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One of the new Nikon compound light microscopes installed in the Microbiology lab.

## GREETINGS!

“There is a time for everything, and a season for every activity under the heavens: a time to be born and a time to die, a time to plant and a time to uproot, a time to kill and a time to heal, a time to tear down and a time to build, a time to weep and a time to laugh, a time to mourn and a time to dance, a time to scatter stones and a time to gather them, a time to embrace and a time to refrain from embracing, a time to search and a time to give up, a time to keep and a time to throw away, a time to tear and a time to mend, a time to be silent and a time to speak, a time to love and a time to hate, a time for war and a time for peace.”

—Ecclesiastes 3:1-8 (NIV)

Solomon’s words ring true especially in the wake of the transitions PUC has experienced and the tragedies that our Napa Valley and Northern California communities have endured this past year.

Through it all our campus community has relied on our Creator and each other for continued strength and purpose. Because of God’s love and grace, the future is bright.

The following pages provide the “scoop” about our department but we want to mention a few other items that we think you’ll want to know about.

- Dr. Bob Cushman is not only the new PUC president but he’s also a biologist and geologist! The science faculty are thrilled to have one of our own at the helm.
- The PUC Board decided in early October to not sell any of our land and the conservation easement that protects nearly 900 acres is nearly complete. We couldn’t be happier about these developments.

- Sheldon Schultz, the new Albion manager, and his wife are biologists! They have a passion for science education and a love for the camp.

- You and your family are invited to visit Clark Hall to view our various museum collections. We and our students can also advise and, when possible, visit Northern California schools to enhance or provide biology enrichment. Email [biology@puc.edu](mailto:biology@puc.edu) to learn more and/or to schedule a visit.

“The Lord bless you and keep you; the Lord make His face shine on you and be gracious to you; the Lord turn His face toward you and give you peace.”

—Numbers 6:24-26 (NIV)

## DEPARTMENT HIGHLIGHTS

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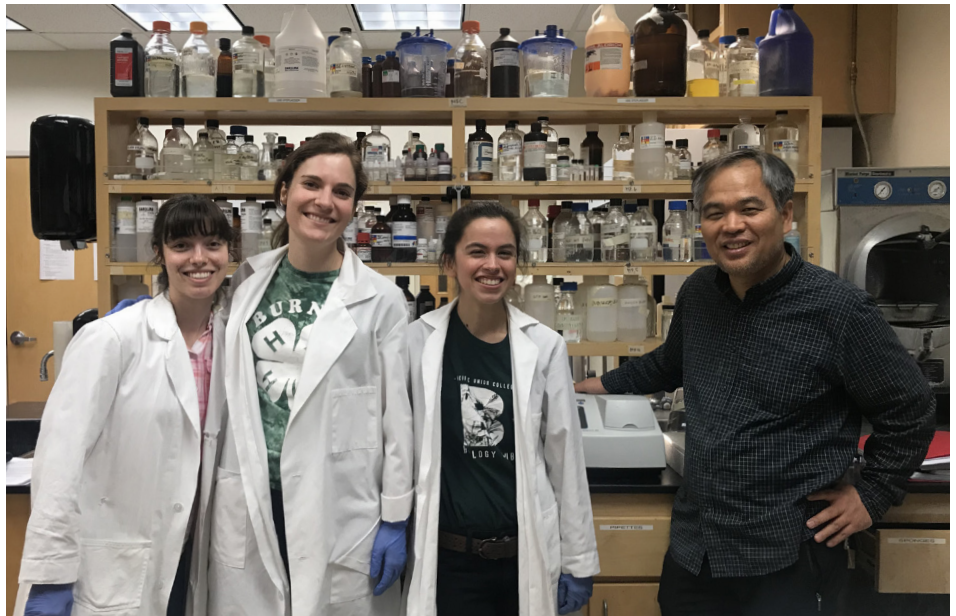
**Thank you!** We have generous supporters whose contributions enable us to do what is needed to provide the excellent education our students deserve. Technology continues to improve our ability to study and understand living things but new lab equipment is expensive. We are incredibly thankful for your donations to make these purchases as we need to.

Following our appeal in 2017, you responded! As a result, we were able to purchase eight new Nikon compound light microscopes and install them into the Microbiology lab just in time for fall 2017. These microscopes are well-constructed with infinitely conjugated objective lenses and LED illumination. Professors and students are very happy with these new microscopes and we look forward to purchasing another eight Nikon microscopes in summer 2018.

With your help, we also purchased four new Fisherbrand dissecting microscopes. These are the first dissecting scopes we've had where the lighting is built into the body. This minor improvement makes a world of difference for the student experience.

Other additions include a new centrifuge to replace one that wore out and a 70" monitor installed in the Microbiology lab used for various classes (e.g., Histology, Microbiology, and Immunology). The department of biology office now has two new bookcases, framed art, and faculty mailboxes that match the décor of previous improvements to the room. Several Scripture quotes now hang throughout Clark Hall intended to encourage students as they face academic and other challenges.

We use donated money to support summer undergraduate research fellowships (SURFs). In fact, donations funded three student research projects in summer 2017 alone! Two of these students conducted marine biology research in Honduras and another conducted rattlesnake research. Support is in the form of a tuition waiver, stipend, and/or travel allowance. Your donations increase the number of students who we can include in this amazing program.



*Students in the 2018 Biotechnology I class with Dr. Backil Sung.*

## NEW BACHELOR'S IN BIOTECHNOLOGY

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A new biotechnology program was launched by our department in fall 2017. Biotechnology I and II are the core courses these majors will take. Dr. Bryan Ness instructs the lectures while Dr. Backil Sung supervises students in the lab. Each biotechnology major will also be required to participate in an internship and enroll in the biotechnology capstone.

Surrounded by world-class biotech firms and wineries, PUC is well-situated for students to learn biotechnology process and techniques and to find prospective jobs in the Bay Area and beyond.

The lab will provide opportunities for students to learn hands-on skills necessary in biotechnology labs and firms. In Biotechnology I lab students practice protein-related skills such as protein identification, localization, and quantifications. Additionally, they will learn how to culture bacteria and worms. Those techniques can be used directly once hired by biotechnology employers. Biotechnology II lab will focus on working with nucleic acids - DNA and RNA.

The curriculum trains a student to use and understand the practices and techniques most commonly encountered in biotechnology-related positions. A student will be qualified to

enter the biotech workforce immediately upon completion of the degree requirements.

The goal of this program is to train students to work as lab technicians in biotechnology research and development and academic settings by emphasizing hands-on experience and expertise. However, the program is also intended to fully prepare students to pursue more advanced M.S. and Ph.D. degrees in biotechnology, thus enabling them to obtain more prestigious positions as administrators, primary investigators, and medical professionals.

## DEPARTMENT NEWS

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We are on Instagram! Find us at [@pucbiology](https://www.instagram.com/pucbiology). Regular posts from campus and elsewhere will keep you up-to-date about what's happening here. Posts are made to inform our current students, prospective students, and alumni. Follow us!

## THE CLASS OF 2017

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2017 was the first year the graduation ceremony was held in Maxwell Commons (the grassy area near the PUC Church and Paulin Hall). It was a day to remember!

We had 17 students (four environmental studies and 13 biology majors) graduate in 2017. This is





*The Class of 2017 (L to R back row): Scott Herbert, Robin Vance, Aimee Wyrick, Floyd Hayes, John Duncan, Bryan Ness, and Backil Sung; (front row) Amber Washington, Amanda Garcia, Charidan Jackson, Iris Lee, Natalie Tran, Abigail Daniliuc, Dustin Zunino, Annika Iftekharuddin, Dylan Turner, Charlene Wang, and Alicia Bedolla. Graduates not pictured: Zachary Asatani, Jason Bajwa, Kevin Choi, Katelynn Curry, Seong Hwang, and Allison Moore.*

the first class we've graduated in which nearly half of the students transferred to PUC in their second or third year of college!

Three of our graduates started dental school and another dental hygiene school in fall 2017. Three other students started medical school in fall 2017 and at least two are on track to begin medical school later this year. Several students immediately entered the workforce and at least two are in graduate programs. This was a banner year as at least 18 PUC graduates were accepted to dental school.

## BIOLOGY LAB COORDINATOR

Meet Amanda Garcia, our new lab coordinator. She graduated in June 2017 with an environmental studies degree. We are so pleased she is working with us now. She is a local—she moved to Angwin with her parents, brother, and sister in 2006 when she was just 13. The biology faculty know her well as she took classes from most of us but some of us have known her since she was just a kid.

She has seamlessly made the transition from student to professional. As you may remember from past newsletter descriptions, the lab coordinator has a diverse and demanding workload. She is handling all of her duties well and always with a smile on her face. She is devoted to making the lab a good experience

for students and TAs alike—she is always available to help or answer a question. We are so blessed to have her as a colleague.

Kevin Jahng, our previous lab coordinator, is well into his first year of dental school at LLU and is doing well. He made some great improvements during his tenure and we miss him!



*Biology lab coordinator Amanda Garcia is pictured here with her niece Caelyn and Daisy Duck at Disneyland.*

## BIOLOGY FACULTY ART ON DISPLAY

Several of the biology faculty are avid photographers. In fact, there are a few who could start a second career as professional photographers! Many of the pictures taken by these faculty are used in lecture presentations but we thought it would be wonderful to have these displayed in a more prominent place. The walls of the second floor of Clark Hall are now filled with large format canvas photographs of birds, insects, plants, mammals, and more. Be sure to stop by when you're here the next time—maybe for Homecoming April 20-22, 2018!

## SAVING LIVES

In early October, the biology faculty, lab coordinator, and several student employees earned CPR/AED certification. Paramedic and PUC alumnus Nathan Garcia taught the group traditional CPR techniques and how to use an automated external defibrillator (AED), a portable device that checks the heart rhythm and can send an electric shock to the heart to try to restore a normal rhythm. An AED device is now installed in Clark Hall and there are quite a few faculty and other employees on site who are trained to use it and to administer CPR.

## GEOGRAPHIC INFORMATION SYSTEMS (GIS)

PUC now offers INFS 240 (Intro to GIS). This course deals with the display, interpretation, analysis, and management of geographic information. This course offers an introduction to methods of portraying, managing, and processing geographic information. Emphasis is placed on the nature of geographic information, data models and structures for geographic information, geographic data input, data manipulation and data storage, and spatial analytic techniques.

In the lectures, the conceptual elements of the above topics are discussed. In the labs, students gain first-hand experience with data input, data management, data analysis, and result presentation in a geographical information system.



*The department of biology faculty and employees earn CPR/AED certification.*

INFS 240 is a new elective option for the environmental studies degree, though we encourage biology majors who have an interest in wildlife, environmental science, and/or public health to take the class.

## THE LASTING IMPACT OF DR. MARGARET R. HUSE

Dr. Margaret R. Huse first taught Human Anatomy at PUC during the summer sessions from 1986-1994, then twice each year from 1996-2000. She also taught Dissection of the Human Body on several occasions; this laboratory-only course ultimately evolved into the more complete course Advanced Human Anatomy. Now taught by Dr. John Duncan, this class continues to be in high demand. Probably close to a thousand students will remember Dr. Huse with deep appreciation for her quality teaching in both classes and labs during her tenure with us.

Soon after her death in 2007, the department of biology became the recipient of a trust titled the Margaret R. Huse, M.D., Research and Education Fund. The money from this trust is designated to fund biology faculty research projects and pay for continuing education opportunities.

The biology faculty remain extremely grateful for research funding provided by Dr. Huse, which has given us unprecedented

opportunities for conducting biological research with students here on the PUC campus and abroad (five different countries and counting). In addition, obtaining funding for short-term research projects from external sources can be a time-consuming and frustrating challenge, so having an internal source of funding is extremely convenient.

What follows is a brief description of the kinds of things the biology faculty have been able to do because of Dr. Huse's generosity. Money from the Margaret Huse fund has been used to purchase equipment and supplies, to pay for analysis of samples/specimens, to cover publication fees, and to pay travel and lodging expenses.

Dr. Floyd Hayes has conducted numerous short and long-term studies. In all cases he has included PUC students. He has studied the waterbirds of Clearlake and *Butorides herons* of Panama. Other bird studies include looking at the impact of humans on resident birds that frequent popular picnic areas in Yosemite National Park and determining the taxonomic status of the Chaco nothura of Paraguay. Dr. Hayes has also conducted marine invertebrate research in Micronesia and Honduras and plans to do similar projects in Fiji. He has published extensively on these various research projects and several of our students are co-authors.

Over the past year, Dr. Scott Herbert has increasingly utilized the Margaret Huse fund. Many aspects of his rattlesnake envenomation research (16 high-end rattlesnake cages, photographic equipment needed to record the snake as it struck the human limb models, and

other materials for that study) are possible because of this fund. The fund has paid for camera equipment that allowed him to better document the past and future field biology expeditions to Alaska. Dr. Herbert uses these many photos in lecture with precise locations and the added personal experience to make a larger impact than would otherwise be possible.

Dr. Backil Sung has established a long-term study on Alzheimer's disease (see more details elsewhere in this newsletter). Initially, time was spent learning how best to grow the study organism (*C. elegans*) and to improve the protocol used to examine the behavioral change difference in the animal groups. More recently he has made some promising discoveries. Our students have been involved with each of these projects. Dr. Sung plans to kick off a study of Lyme disease specifically, how heart arrhythmia, one of main symptoms in the disease, develops.

Prof. Aimee Wyrick and her students are now into a sixth year of studying the rare Calistoga popcorn flower. The species has a distinct distribution pattern not fully explained by observations of superficial processes. Ultimately, local hydrologic patterns and soil content affect this species distribution. Over the past few years, the population distribution and phenology have been thoroughly examined but will now broaden to look at soil and water chemistry. In the next few months, Prof. Wyrick will start a new project to study salamanders present in the back 40.

To be clear, without the support of the late Dr. Huse this research would not have been accomplished. We think that she would be pleased with the many projects done so far, not only because the biology faculty have accomplished exciting and novel research but that many of our students have benefited as well.

## STUDENT INTERNSHIPS AND RESEARCH

### Amber

#### Who are you?

I'm Amber Washington and I'm a senior environmental studies major. I plan to go to graduate school to obtain my master's degree in forensic science.





*Amber Washington completed an internship with the California Native Plant Society.*

### **What did you do?**

I was responsible for researching the different native plant species located in the Skyline Wilderness Park, which is home to the Napa Valley Chapter of the California Native Plant Society (CNPS). Also, as a member of the CNPS (Napa Valley Chapter), I participated in several restoration projects in the Martha Walker Native Habitat Garden in the Skyline Wilderness Park and the annual spring native plant sale.

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

My internship with the California Native Plant Society (Napa Valley Chapter) was for five months in the winter and spring of 2017.

### **What did you learn?**

There are more than 200 California native plants in the Skyline Wilderness Park. These native plants classify as perennial herbs, annual herbs, ferns, grasses, shrubs, vines, and trees. Each plant species have their own unique growing conditions that allow them to thrive, but sometimes their growth can be hindered due to non-native plants invading. That is why restoration projects are beneficial, being they help keep the native plants alive and well while getting rid of those plants that have the potential to destroy them.

### **How did PUC help prepare you for this experience?**

As an environmental studies major, I feel the Intro to Research Methods class prepared me most for collecting accurate information on the native plants of the Skyline Wilderness Park. The Conservation Biology class gave me just the right amount of experience that

allowed me to be of great assistance during the restoration projects of the Martha Walker Native Habitat Garden that I participated in. Previous knowledge of the anatomy of plants from a flowering project that was assigned in the Biological Foundations class also contributed to the success of my internship.

## **Sierra and Antonio**

### **Who are you?**

I'm Sierra Trogon and I graduated PUC with bachelor's in biology in December 2017. I plan to start veterinary school in the next few years.

I'm Antonio Robles and I'm a sophomore biology major. I plan to go on to medical school and specialize in family practice.

### **What did you do?**

We participated in research with Dr. Hayes

studying the symbiotic associations between rock-boring urchins and fish. Most of the work involved natural observations, counting holes with the urchins, and writing down every species seen in the hole. In intervals of 10 minutes, we spotted a fish and counted how many holes with rock-boring urchins they associated with. The study involved studying thousands of sea urchin burrows and tallying the different species seen hiding in their burrows.

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

The research took place over a period of eight days during the summer of 2017 in Roatán, Honduras.

### **What did you learn?**

**Sierra:** During the research project I learned how to identify the various types of sea urchins, fish, and other species encountered in the study. I also learned and realized just how tedious and time consuming it is to obtain accurate and reliable data. It was not as easy as simply counting and tallying the species. There were thousands of sea urchin burrows and each hole had to meet the right criteria in order to count. There were a couple times where I had to start over and redo counts to increase the accuracy and reliability of my data.

**Antonio:** I hadn't realized the fascinating opportunity research can give you to construct interpersonal skills by getting together with students and professors that are interested in finding one new aspect of the behavior of a certain species. Often we would get together to review our data and plan on how to collect more as a group. I learned how working in groups is



*Sierra (2nd from left) and Antonio (2nd from right) and fellow classmates spend time snorkeling in Honduras.*

important in research as well and the importance of communication in the field. In addition, I learned how to record data in the coral reefs and new ways to observe nature with a curious mind.

#### **How did PUC help prepare you for this experience?**

**Sierra:** PUC helped prepare me by teaching me the general biology involving the marine life I encountered. The Intro to Research Methods class also played a major role in preparing me for the research I did. I planned and proposed a research paper that included background information and methods for counting the sea urchin burrows. This significantly increased my understanding of the research that was being done.

**Antonio:** Taking Biological Foundations helped me understand the phyla and characteristics of the species we were observing which led to my understanding of the project better. The Tropical Biology class also made me understand the diversity in the coral reefs, potential harms, taxonomy, and potential dangers. For instance, knowing fire coral could sting me while researching in the shallow rocky areas would definitely have made me uncomfortable; however, having known this before from class led me to become aware of my surroundings and feel comfortable during the research process.

### **Erika**

#### **Who are you?**

I'm Erika Thalman and I'm a senior biology major. I'm planning on going to graduate school to pursue a master's degree in natural resources, marine biology, or biology.

#### **What did you do?**

I helped with cleaning raceway ponds and feeding the fish. I also had the opportunity to work with a variety of people and do other things like water quality testing, weight counts, assisting in fish planting and public education, as well as participate in hand-spawning California golden trout.

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

In the summer of 2017, I volunteered twice a week from mid-July to late-September at the Moccasin Creek Hatchery.

#### **What did you learn?**

I learned how to get more involved in areas I'm interested in. Volunteering at this hatchery taught me many useful skills I can apply not only to future careers, but to my personal life as well. I discovered no matter what field you choose to work in, you always interact with people to some degree. This experience demonstrated how a great team of people work together despite their different personalities and temperaments. The hatchery personnel were so willing to teach me all they could about their work and their mission, and were even kind enough to advise me on how to get my foot in the door with the California Department of Fish and Wildlife (CDFW). Through this I saw how important it is to make connections wherever you go. You never know when they may come in handy.

#### **How did PUC help prepare you for this experience?**

The science courses I have taken at PUC gave me a good foundation for understanding how many of the processes at the hatchery worked. Classes like Ecology, Field Biology, and Biological

Foundations made it easier to understand the different fish behaviors and how to handle the fish. Chemistry was also useful for water testing as well as in choosing medications or anesthetics. Lastly, Genetics contributed to my comprehension of different fish stocks and how the CDFW is able to prevent farmed fish from breeding with wild populations.

### **Mychal Hellie**

#### **Who are you?**

I'm Mychal Hellie and I'm an environmental studies major in my junior year. I plan to get my masters in ecology.

#### **What did you do?**

I helped Dr. Hayes study the grebes on Clear Lake. We studied the distribution of nest locations and the grebes behavior on the nests. My job was to help set up the cameras and survey the nesting locations. I also recorded data from the pictures about how much time each parent spends incubating the eggs.

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

My internship was with the Audubon Society, doing research on Clear Lake during the summer of 2017.

#### **What did you learn?**

There is a lot of work that goes into field research, especially when it involves canoeing at five in the morning, and if you want good data, you need dedication. Studying the grebes out in wild taught me how interesting the natural world around us can be. Going minute by minute though photos of their lives showed me the vast complexity of wildlife and why they are worth studying and preserving.

#### **How did PUC help prepare you for this experience?**

Classes at PUC like Pollution & Environmental Quality helped me understand conditions like eutrophication that affect the ecosystems on Clear Lake. Ecology and Conservation Biology, taught me many field techniques I used in to study and sample the grebe populations.

### **Charidan and Zoe**

#### **Who are you?**

I'm Charidan Jackson, and I'm a first-year master student at California State University, Long Beach. I plan to obtain a graduate degree in biology and work as a forensic scientist.

I'm Zoe Morphis and graduated with a biology major in December 2017. I plan to go to vet school to become a licensed veterinarian.



*Erika (shown here with a fish she caught) spent several months working in a CDFW fish hatchery.*





*Mychal spent hours in a canoe studying grebes during his internship with the Audubon Society.*

#### **What did you do?**

We worked with Dr. Ness to survey the population density of ticks in Angwin and the Albion Field Station. We were responsible for taking collections, logging GPS locations, and recording other physical and biological information about each site. This was the beginning stages of a research project to study the prevalence of Lyme disease in the local tick populations and involved development of

research methods as well as collecting preliminary samples.

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

The research was done during spring and fall quarters of 2017. We focused on collecting in areas of Angwin and Albion frequented by humans such as the back 40 and trails with plant growth on either side.

#### **What did you learn?**

**Charidan:** From our data collection, we learned Angwin is prime habitat for ticks. We saw differences in species, developmental stage, and sex. Collecting ticks was not difficult because they come toward humans and other potential hosts. Ticks are especially active in warmer and slightly moist environments. Although we did not initially aim to collect data specifically on the plant matter ticks were found on, we noticed that more ticks were found on invasive species such as French broom and Himalayan blackberry

**Zoe:** The most valuable thing I learned during this research project was simply about the amount of effort that goes into even a basic research project. Even getting approval for obtaining the necessary supplies was a challenge, not to mention the hard work of trying to collect ticks. It really helped me to appreciate complicated research studies scientists have done to help us learn about the natural world.

#### **How did PUC help prepare you for this experience?**

**Charidan:** Classes such as Conservation Biology and Ecology emphasized the importance of detailed and specific data collection. We applied the quadrat method we learned from those

classes to organize data collection before we started. PUC also offered a one-day seminar on Geographic Information Systems. GIS gave us the tools to map Angwin's trails and plot our points along the trail. Flowering Plants opened my eyes to the different types of plants in various habitats. Without the expertise of that class, I doubt we would have noticed any correlation between invasive plant species and ticks.

**Zoe:** PUC prepared me for this experience by providing me with the basic knowledge necessary to understand the research process. Specifically, taking Intro to Research Methods provided me with a solid background to be able to read and comprehend scientific research articles in order to prepare a feasible plan for our study. I also was grateful for the knowledge I had from Genetics, as it allowed me to understand how sequencing the ticks' DNA to detect Lyme disease would work.

### **Jeff and Brandon**

#### **Who are you?**

I'm Jeff Grabow and I'm a senior biology major. I plan on a career in dentistry.

I'm Brandon Kim and I'm a senior biology/pre-dentistry student. I plan to go to dental school and specialize in oral maxillofacial surgery.

#### **What did you do?**

We participated in ongoing research to identify and count mammals in PUC's back 40 forest. We were responsible for collecting data from motion-capture wildlife cameras, editing out non-data, and entering results into our log. These data include the species name, the time of day that the photo was taken, and the concentration of animals "captured" in a particular habitat.

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

**Jeff:** I've been part of this research project for the past two years.

**Brandon:** My research started in spring of 2017 and continued through winter of 2018. We spend most of our time visiting the cameras in the back 40 and collecting/replacing memory cards. We view and categorize the photos in a Clark Hall classroom.

#### **What did you learn?**

**Jeff:** During this project I learned about the rich abundance of mammals we have in our woods here at PUC, including bobcats, river otters, and bears. I also learned about working with a team to come to the best conclusions when analyzing data.



*Zoe and Charidan (pictured) used a piece of flannel to collect ticks from the outdoors to determine their distribution patterns.*

**Brandon:** There are so many different things I learned from this experience but the most important is to be precise and to pay attention to detail. When looking at thousands of pictures a day, one has to keep a keen eye out for certain things within an image. Similarly, I realized the importance of having good communication skills as well as finding a research partner who you enjoy working alongside. This person is there for you and also makes the research more enjoyable.

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

**Jeff:** My time at PUC taught me to write in an appropriate manner for our research. In addition, Dr. Hayes' passion for animals (especially birds) has contributed to my growing admiration for the nature here on our hill.

**Brandon:** As a biology major, one of the classes that helped me throughout this research project was Intro to Research Methods. This course helped me throughout this research experience as it laid a foundation that enabled me to categorize each animal to their specific subcategories within Excel. It helped me with the end of quarter research paper that we submitted that showed the culmination of our research that quarter. Similarly, taking Ecology helped when it came to understanding the main goal of this project how to assign each animal to its proper group.

## Michelle and Janet

**Who are you?**

I'm Michelle Tang and I'm a senior here at PUC. I'm also a biology major/pre-medicine student, planning on going to medical school.

I'm Janet Tang, a junior biology major hoping to continue on to medical school.

**What did you do?**

**Michelle:** I worked with Dr. Herbert to study the habituating acts of rattlesnakes by calculating venom expenditure and observing measures of defensiveness. My partner and I were in charge of filling the rubber hand gloves with saline, warming it up to about 37 degrees C, and scenting it to match the characteristics of a real hand. I was also responsible for pouring the contents from the glove into a bucket, diluting it, and putting it into individual vials. My partner and I also used the vials of diluted venom to find the concentration of protein in the venom via protein assay.

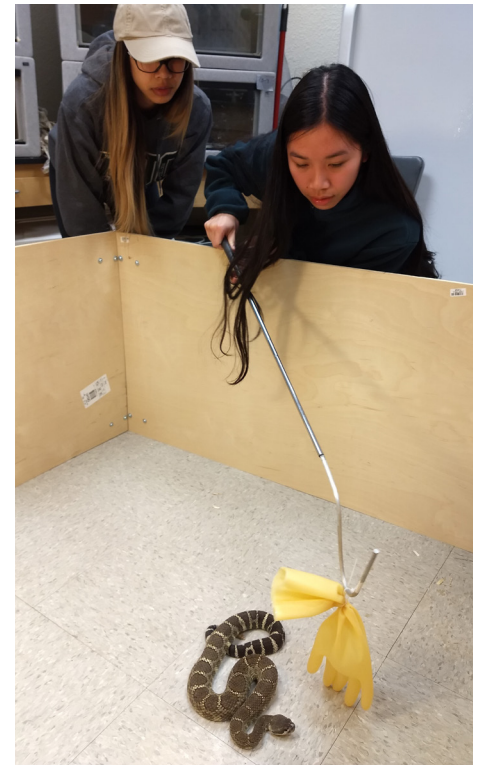
**Janet:** I was responsible for recording the interaction between the snakes and the saline-filled rubber gloves. I followed each snake and made sure to film the potential bite at a specific angle that allowed us to determine the time of strike and more.

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

The research lasted 10 weeks during the summer of 2017 in Clark Hall.

**What did you learn?**

**Michelle:** I learned rattlesnakes are not vicious reptiles that are out there to get you. Each and every rattlesnake had a different temperament and reacted very differently to the actions imposed on them. Some rattlesnakes didn't even strike at the glove when they were seriously provoked. I also learned the importance of teamwork and communication in terms of getting things done correctly and on time.



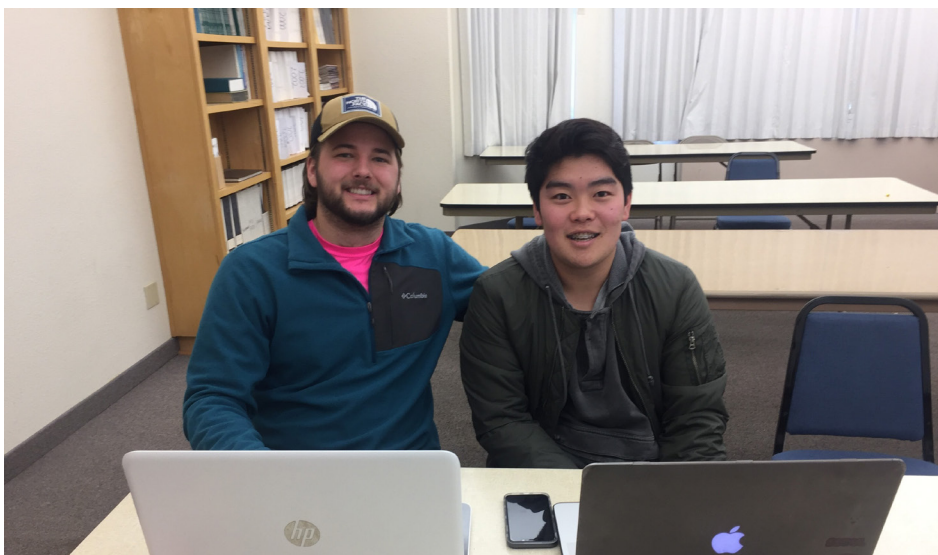
*In this picture, Michelle (left) and Janet are running an experiment in which the rattlesnake strikes a solution-filled glove they will later analyze for venom content.*

**Janet:** Contrary to popular belief, I learned rattlesnakes are kind and gentle creatures. Though they are thought to be aggressive, rattlesnakes do not want to bite humans and only do so when they are harassed or scared.

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

**Michelle:** As a biology student, classes such as Animal Behavior and Intro to Research Methods really gave me the background knowledge that this research required. In Animal Behavior, I learned about habituation and the various types of non-associative and associative learning. Intro to Research Methods allowed me to better understand the steps and processes of research and how it works. Although I haven't taken Immunology yet, I will definitely be prepared to do a protein assay when the time comes.

**Janet:** Because I'm a science major, the science classes I have taken helped prepare me by providing valuable lab experience and knowledge I have utilized during my research. In addition, I have enjoyed getting to learn about various science topics ranging from single-celled organisms to large multicellular creatures.



*Jeff (left) and Brandon reviewed thousands of photographs in order to identify, describe, and quantify the mammals present in the PUC forest.*



## Chelsea

### Who are you?

I'm Chelsea Nicole T. Paclibar and I'm a senior biology major. I plan to go on to dental school at Loma Linda University and specialize in orthodontics.

### What did you do?

I participated in research that studied the relationship between Alzheimer's and overeating. The hypothesis of the study was that overeating causes degeneration of the nervous system. For this study, we grew *C. elegans* into healthy adults and collected their eggs after a few days. The eggs were then divided into six different conditions and a behavioral test was performed on the larvae that hatched. I was responsible for the data collection, which involved taking photos of the petri dishes containing the samples under a microscope, as well as measuring and calculating the length, thickness and volume of each specimen.

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

My research internship started in the fall of 2017 and will continue through spring of 2018. This work is supervised by Dr. Sung.

### What did you learn?

I realized research can be complex. It's overwhelming but also exciting because you

get to discover new things and get to interact with people who you work with to accomplish a common goal that can potentially have a positive impact in the world. I learned working on a research study requires a great deal of patience because data collection and analysis can take a while, thus, often leading to delayed results. I also learned working with other students can greatly enhance efficiency and allow for a better pool of creative ideas to overcome the limitations we might have.

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

I'm a biology major and I've taken many required core classes and electives that gave me the foundational skills and information needed to effectively do research. The Biological Foundations sequence prepared me very well and gave me the background knowledge to analyze data, to use a pipette and microscope, to prepare solutions, and to observe samples. Additionally, my Cellular and Molecular Biology class equipped me with information on the cellular construction and development of the *C. elegans* which allows me to understand and evaluate its responses to the experiments and tests performed.

## LEARN MORE ABOUT THE BIOLOGY FACULTY

Many of you are well-acquainted with the biology faculty but others are not. What follows is a brief update about each one of us. Please visit our department website to view citations, and in some cases read, published research articles by the biology faculty.

### Dr. John Duncan

When most people ask, "What's up?" My typical response is, "Not much." Mostly because: One, I don't take this question as a serious inquiry; two, I do not want to unload on them and give them crippling depression; or three, I do not view my life as terribly interesting. With that being said ...

I traveled with Dr. Hayes and several students to Roatán, Honduras, in summer 2017 for a field biology class. We had a great time counting sea urchins, looking at turtles, and going on two dives. The second dive was to see the feeding of the sharks with dead fish taken out of a bucket; something I had not witnessed before but certainly countered the "feeding frenzy"

idea that sharks go crazy and eat everything in the vicinity.

I traveled with my family to Cozumel at Christmas and dove nearly every day. Diving around the island is never bad. Water temperature was great, visibility was always clear, and we were able to see the "big three" of the island: eagle rays, nurse sharks, and turtles. We swam through a few arches, which was new for us and exciting to swim through the rocks following fish around their schooling areas.

The trip with the family was also great because for the first time both of my children are not living at home. Willy is going to graduate this year after two years attending Monterey Bay Academy near Santa Cruz. Linda, who started at PUC, was accepted to the Coast Guard Academy and has moved to Connecticut to have adventures of her own.

As some of you may know, I sponsor the campus Jujitsu club. I've tried to make sure we have enough activities to do throughout the year with classes twice a week where students can experiment combining their studies in anatomy and physics to create a pleasant sounding thud, as well as several evenings at my house eating and socializing. This year we have been more active than in the past, with frequent opportunities to take a break from the academic load of the quarter.

I feel like some former students will read this and feel like I'm so relaxed I might not be giving current student the same educational experience they had (stress and anguish). Not to worry; the decibels of complaint are still at the same level this year as in years past. The fires of advanced human anatomy are being stoked yet again this spring quarter.

### Dr. Floyd Hayes

In 2017, I enjoyed two overseas trips with students. In early January, I traveled to Amazonian Brazil with five students taking Field Biology: Tropical Biology. It was my fifth trip with students to Amazonian Brazil, but the previous trips were during spring break in March, when the rivers were high during the late season. This time the rivers were much lower, which meant that we saw more sandbars with terns, skimmers, and cormorants resting on them—plus more dolphins swimming in the narrower rivers. Unfortunately, we were unable to find baby caimans, which we enjoyed catching at night during previous trips. The highlight of the trip



Chelsea Paclibar studied the model organism *C. elegans* to better understand the development of Alzheimer's disease.

was watching an Amazon tree boa eating a bat during one of our night hikes in the rainforest.

In August, I traveled with Dr. John Duncan and eight students to the Caribbean island of Roatán in Honduras. Five of the students were taking Field Biology: Tropical Biology and three were participating in a research project on fishes associating with sea urchins. Surprisingly our trip wasn't canceled, because we arrived just six hours after Hurricane Harvey struck the Texas coast and we were at the edge of the storm! Unfortunately, hundreds of flights were canceled after our arrival in Houston, but luckily our flight to Roatán was one of the last to depart Houston, so we got to spend a sunny week exploring the exquisite coral reefs and labyrinth mangrove channels of Roatán instead of being stranded at the airport in Houston. The highlight of the trip was scuba diving with about 10 hungry Caribbean reef sharks.

## Dr. Bryan Ness

I continue to keep up the tradition of the Clark Hall Zoo with snakes, lizards, turtles, tarantulas, hissing cockroaches, and a Guinea pig. Recent additions include a savannah monitor, green and brown anoles, fire belly toads, a milk snake, and a Mexican red-kneed tarantula. Having so many amazing animals handy makes it easy for me to share them with students who come to PUC for the annual Math-Science Workshop, as well as with local grade schools and preschools, and the PUC Church for children's stories and children's church.

Over the last year I've also been working with several students researching the occurrence of deer ticks in the Angwin area, with additional sampling at Albion. Each tick that is collected will be tested for the presence of the bacteria *Borrelia burgdorferi*, which is the cause of Lyme disease. Past surveys have found Napa County to be a hot spot for the disease, so we are hoping to help quantify the risk to humans of contracting it.

In my spare time I enjoy photography, mostly landscape and nature macro photography. Some of my photographs are among those that are displayed on the 2nd floor walls of Clark Hall. I also enjoy music performance and am actively involved with the PUC symphonic wind ensemble and the St. Helena Community band where I play timpani, and various other percussion instruments, as needed. I also play guitar and help lead music for the PUC Church as a part of one of the praise teams and sing 1st tenor in the PUC choir.

This last spring, I was also able to travel to Washington, D.C., and participate in the Science March on Washington on Earth Day. I was part of approximately 100,000 participants, trying to remind our government leaders of the importance of science in making public policy and designing regulations and laws. It was energizing and encouraging to see so many turn out for the event. I plan to participate in future marches and other forms of advocacy to keep the importance of science as a part of good government in the fore.

## Dr. Backil Sung

I collected preliminary but meaningful data from a recent dementia study. Nematode worms, *C. elegans*, experience adverse neurological behaviors when they consume excess food. The animals in over consumption groups significantly failed to respond to a chemoattractant compared to animals in the group fed less and least amounts of food. The overfed animals showed less ability to discriminate the chemoattractant from the control chemical.

Many students are involved in this project and they help by growing worms, performing behavioral tests, analyzing data, and conducting statistical analysis. Currently Chelsea Paclibar, Jalynn Ramirez, Keion Yoo, and Chigozirim Omosor are working on this study.

This study is significant as it is an animal model to investigate food effect on the development of dementia or Alzheimer's disease. So far our findings support the health message of the Adventist church and a study already reported by another scientist who has demonstrated that overeating can cause memory impairment in old age.

I plan to extend this project to a biochemical study to discover why overeating causes this serious brain problem. I'm working on a grant application to continue this work. I expect that this project will reveal to many more the wonderful health message of the Adventist church. We hope to identify a potential mechanism to prevent and treat dementia disease by blocking the pathway that induces the disease.

I also recently collaborated with an international research group and recently published an article that studied how Parkinson's disease can develop by the death of cells in the basal ganglia in the brain. Now another project continues with the international group to study the mechanism of Parkinson's disease.

## Prof. Aimee Wyrick

Even though I'm always busy, I love teaching biology at PUC. It's hard to say what I enjoy most about my job and so I'll just give you a few examples of the many things which make my work life great.

I'm incredibly fortunate to teach a wide diversity of classes, from Geology to Flowering Plants and lots of things in between. I do my best to connect what students learn in the classroom to the outdoors. Each quarter students participate in a service-learning project and/or field trips to local areas of interest. For example, students in Biological Foundations III recently worked on invasive species removal and restoration projects with various groups, including the Bureau of Reclamation at Lake Berryessa. Altogether, students in this and other classes logged over 300 service hours during the 2016-17 school year.

Napa County and Northern California are a mecca of natural places of interest. Most of the outings for my field courses are completed within a 3-4 hour lab session. I'm fortunate to work with a variety of people and organizations to make these field trips possible. For example, Flowering Plants students collect flowers during outings to nearby locations. The 2017 class conducted a "rare plant treasure hunt" with the California Native Plant Society (CNPS) on our own PUC property. The group confirmed the existence of a rare species and identified several new locations where it occurs.

In the last year I helped to develop our new biotechnology degree and helped to revamp the annual Math-Science Workshop programming. I taught Natural History of California from June through August online and then in late August the students and I spent a week at Albion.

The Biology Club has been going strong since it was rekindled in 2007 and I'm proud to be the club sponsor for over 10 years! In early February, we took a group of 24 to Albion for the weekend and enjoyed some of the best weather I've ever experienced. The students participated in the "First Annual Albion Olympics," a combination of individual and team "sports" (e.g., canoe races and a bubblegum blowing contest).

At home I have it pretty good too! My husband and I just celebrated 16 years of marriage. We love living in the Bay Area and enjoy all it has to offer, from great food to outdoor adventures.



## Dr. Robin Vance

I recall coming to PUC and joining the department of biology nearly 17 years ago after teaching at Union College in Lincoln, Neb., for the previous 13 years. My, time does move on. Many of our current students were infants or small children at the time. It has been my privilege to work with many students over these past years and see how God has blessed them in their lives. My hope is the department of biology at PUC will continue to be a place where our students can grow in their relationship with God as they become ever more proficient in learning the wonderful story of the study of living things.

## Dr. Scott Herbert

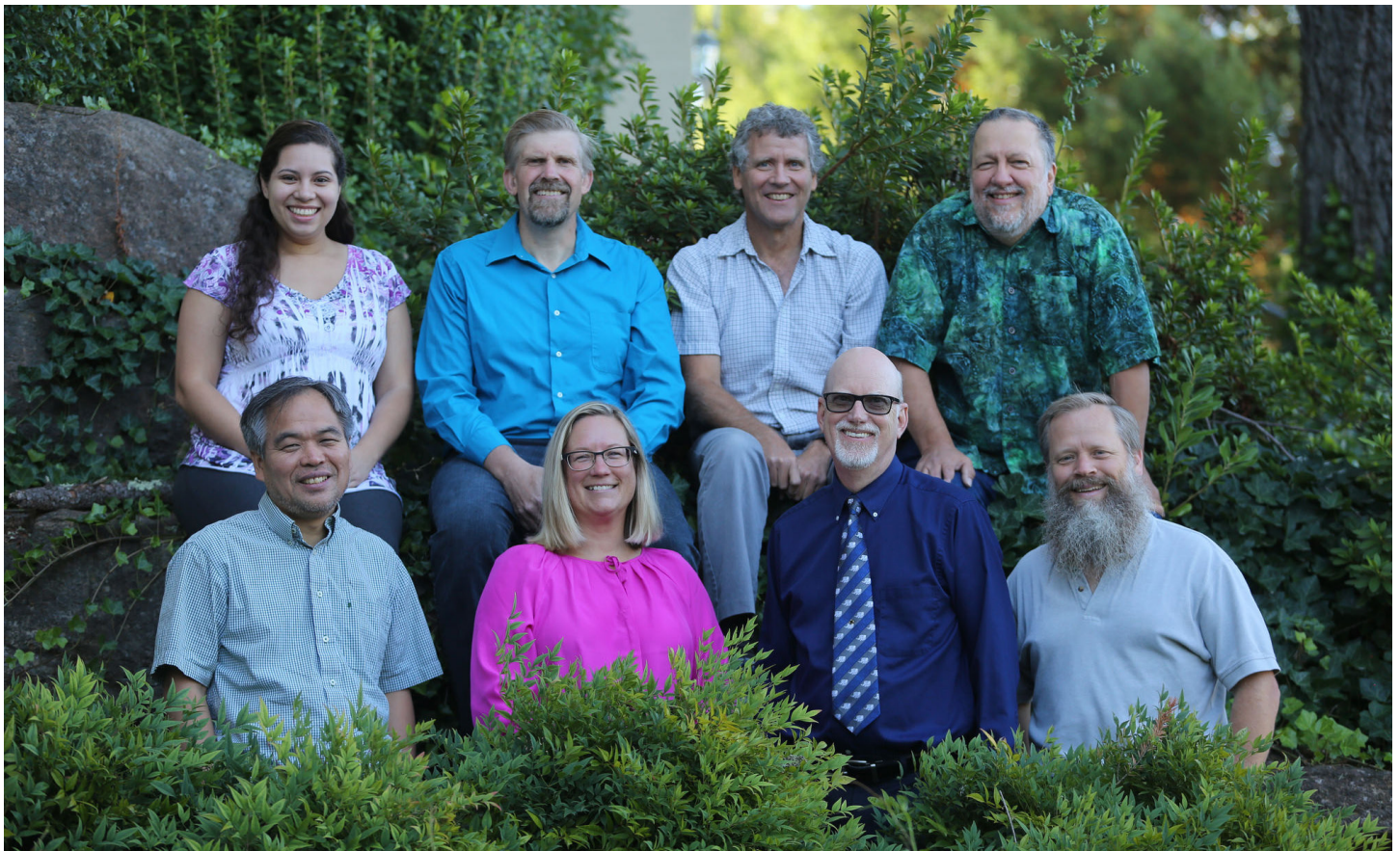
Like most, I found this past year to be a busy one! While having to move to a new house during the school year (always fun!), I was able to participate in some fun activities, like PacificQuest. My focus was on the basics of human anatomy and how it is linked with the microbes that live in or on us! It gave me a chance to work with some bright 6th to 8th graders with an earnest desire to learn.

This past year also saw a further progress in my habituation study. Basically, we (Michelle Tang, Janet Tang, and myself) are trying to determine if a venomous snake like our local northern pacific rattlesnake experience a change in their behavior (i.e., if they change the amount of venom they expend) if they are exposed to the same conditions over time. Specifically, do snakes expend less venom when biting defensively after having to do it on multiple occasions? After some preliminary work, we ran this experiment and we are currently analyzing data to see if we detect a significant effect in preparation for submitting for publication and presentation at scientific meetings.

This is the summer for our Alaska trip as part of our field biology/ecology summer class! It's a wonderful opportunity to illustrate the different biomes and their incredible attendant diversity of life with a level of impact which cannot be achieved any other way. It's an unparalleled opportunity to see whales, sea otters, puffins, glaciers (even ice fields!), grizzly bears, caribou, moose, beavers, and grand vistas that defy adequate description. Besides, it is an absolute blast!

While we are wrapping up the habituation study, I'm looking at some new potential areas for research. One option would be to look at the effects of venom depletion; that is, how often does a snake have to bite (and expend venom) before one sees a drop-off in the amount of venom in successive bites using enzyme linked immunosorbent assays (ELISAs)? Such a study would not only provide some very interesting information about their behavior, but would also afford the opportunity for students to apply skills learned in other classes like biotechnology.

Another potential research option would be to look at the movement behavior of our local rattlesnake. Again, it would give an opportunity to students to experience the integration of some newly available resources, like GIS along with techniques from field biology (e.g., radio telemetry).



*The biology faculty and staff (L to R back row): Amanda Garcia, John Duncan, Floyd Hayes, and Bryan Ness; (front row) Backil Sung, Aimee Wyrick, Robin Vance, and Scott Herbert.*

# DEPARTMENT OF BIOLOGY

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Amanda Garcia (Lab Coordinator)

## NEWSLETTER CREDITS

### EDITOR

Aimee Wyrick-Brownworth

### CONTRIBUTORS

Amber Washington, Sierra Trogon,

Antonio Robles, Erika Thalman, Mychal

Hellie, Charidan Jackson, Zoe Morphis, Jeff

Grabow, Brandon Kim, Michelle Tang, Janet

Tang, Chelsea Paclibar, John Duncan, Scott

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### DEPARTMENT OF BIOLOGY

Pacific Union College

One Angwin Avenue

Angwin, CA 94508

Phone: (707) 965-6635

Fax: (707) 965-7577

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