



“For with You is the fountain of life; In your light we see light.”

Psalm 36:9 NASB

Welcome to another edition of the Pacific Union College Biology Department Newsletter. The verse above is one of many verses in the Bible that uses light as a spiritual reference. As Biologists we know how important light is for living organisms. Think where we would be without photosynthetic organisms converting energy from light to directly or indirectly fuel the majority of living things. Learning how light affects life and how energy flows through different living systems is just one of the many examples of interactions between organisms we study here in the Biology Department. We remain convinced that God is the ultimate source of light, energy, and life both temporal and eternal.

Our students continue to amaze and sometimes confound us as we walk a common path for a time. In the following pages we will bring you updates of student activities. You will see examples of active learning, hard work, and plenty of fun. You will also see evidence of impressive support from you, our alumni. For instance, in the past year our alumni have donated over \$30,000 in direct support to the Biology Department. Thank you so much for your tremendous generosity. We love to hear from you and learn more about what you are doing. Remember that this will always be “your” department. Enjoy the updates you will find in the following pages.

Issue 11 | Winter 2014

Contents

- 2 Department Highlights
- 3 Student Research & Internship Reports
- 6 Updates on Recent Graduates

Department of Biology

Chair
Robin Vance, Ph.D.

Faculty
Robin Vance, Ph.D.; John Duncan, Ph.D.; Floyd Hayes, Ph.D.; Scott Herbert, Ph.D.; Bryan Ness, Ph.D.; Aimee Wyrick-Brownworth, M.Sc.

Laboratory Coordinator
Haruka Ito

Newsletter credits

Editor
Aimee Wyrick

Contributors
Bryan Anamuro, Dustin Baumbach, Natasha Elloway, Zach Gately, Trevor Gomes, Yela Jung, David Kang, Nathan Lee, Angelo Maniego, Allen Moreno, Gibby Muth, Mindy Nelson, Robin Vance, Zoe Thompson, and Aimee Wyrick.

The Biology Newsletter is also posted as an e-newsletter on our department website www.puc.edu/biology. Starting in 2015, future newsletters will be published as an e-version only. We will send email notifications for future publications. Please let us know your email by entering your address at www.puc.edu/biology.

DEPARTMENT HIGHLIGHTS

THANK YOU ALUMNI!

In early 2013 our generous alumni donated over \$20,000 to be used for departmental needs. We are pleased to report that the money has been used wisely and has benefitted faculty and students alike. For many years, a room on second floor went relatively unused. For some, you will remember reviewing histology or flowering plant slides in this room. This past summer, this room was renovated. Curtains were added, new furniture was installed, and original art hung on the walls. This is now a welcoming study space that students really enjoy.

We originally planned to use a large portion of this money to buy a new autoclave for the microbiology lab. However, Dr. Backil Sung determined that the autoclave that had problems could be fixed for a fraction of the cost. So, for just a few thousand dollars, the autoclave is as good as new. With Dr. Sung's help, we also repaired an older (and previously unused) autoclave. The microbiology lab now has two dependable and functional autoclaves for the price of one brand new.

The biology faculty meet regularly in the third floor conference room. Since adding a seventh faculty member we became crowded sitting around our conference table. This past summer, we acquired a larger conference table and matching desk chairs. Meetings are now much more comfortable. The money was also used to provide laptop computers for some faculty and a document camera now installed in the microbiology lab.

Another recent donation of \$10,000 will be used to purchase the following lab and field equipment:

- A digital camera microscope attachment for the microbiology lab
- An ultra-low temperature freezer for cell culture storage
- 3 Iworx physiography neuro amplifiers (used for neurobiology lab)
- 15 high quality binoculars

LAB COORDINATOR

Andrew Yoon, a 2011 PUC graduate in Biology, served as the Biology Department lab coordinator from 2011 to 2013. During Andrew's tenure, two new faculty were hired and he was key to orienting them to the labs. Andrew's expertise in the microbiology lab made him indispensable during a time of transition in the instruction of this class. Over the years, he worked closely with all faculty to ensure that lab classes were organized, TAs were hired and supervised, and that supplies were available as needed. Andrew has now moved on to pursue his graduate goals and he is greatly missed. He was an integral part of our department and he will always have a special place in our hearts.

We are excited to introduce our new Lab Coordinator, Haruka Ito. Haruka graduated with a Biology degree with Honors in June 2013. Haruka has worked with many of our faculty through her undergraduate years as a Biological Foundations teaching assistant. She was a natural choice when we needed to fill the position. Because we now offer summer biology courses, Haruka started work in June 2013. She is an essential part of our Biology team.

Haruka is an avid photographer, an experienced SCUBA diver, and an accomplished naturalist. As an Honors



Haruka Ito, a 2013 biology graduate is the current lab coordinator.

student, she completed a research project that included an "Adventure Guide" to the Angwin and PUC flora and fauna. Haruka's goal in this project was to marry her vast knowledge of the natural history of the area with an educational outreach component. In the preface of this guide she states "My aim is to bring awareness and encourage curiosity about the special set of organisms that we coexist with in Angwin." We are lucky to have her channel her passion and energy for biology to our students and faculty.

BIOLOGY CLUB

In early February, the club co-sponsored an Albion weekend trip with the Chemistry Club. In all, 40 students attended and enjoyed diverse outdoor activities; canoeing the Albion River, watching whales from the Pt. Cabrillo lighthouse, hiking through the Russian Gulch redwoods to see a waterfall, and tide-pooling at Glass Beach.

BIG CHANGES AT ALBION

The Albion Field Station has changed its name to Pacific Union College, Albion Retreat and Learning Center. Most people know what "biological" means but not many know what a "biological field station" is, particularly the current generation of students. In addition, Albion is being used more as a retreat center and outdoor education facility than as a field station by both the college and guests.

The administrative team of PUC has identified Albion as a branch campus of PUC and the goal is to brand the two as such. We want our patrons to know that PUC and Albion are one entity. Even many of our students are not aware of this fact. Pacific Union College is our campus in the hills of Napa Valley and Albion is our campus on the beautiful Mendocino Coast.

Our next big change is to begin teaching classes at Albion. This is not an easy task and takes a lot of coordination. Aimee Wyrick will officially coordinate this activity. Aimee does not let grass grow



Biology club members enjoyed a hike through the redwoods during a recent trip to Albion.



Pictured from L to R: (back row) Darlene Teddy, Aimee Wyrick, Floyd Hayes, Bryan Ness, John Duncan, Robin Vance, Geoffrey Kip, Jose Ramirez, Chris Walters, Steven Frey, Crystal Lauw, Randy Castanaza, and Stephen Moreno; (front row) Gabby Alvero, Emily Assavapitkul, Haruka Ito, Angelo Maniego, and Tony Park. Graduates not pictured: Jose Chavez, Eun Ji Choi, Alice Chun, Richard Kim, Julie Knutson, Allen Moreno, Kevin Park, Shayla Phillips, and Young Shin.



Students enjoy tidepooling at Glass Beach in Fort Bragg.



Geology students at Kehoe Beach Pt. Reyes National Seashore.

under her feet and already has a number of possibilities in the pipeline including her own Biological Foundations summer class spending a week there this coming summer. The goal is to teach one or more general education classes at Albion in a shorter time and at approximately the same cost as on campus.

Aimee is exploring all these possibilities with Nancy Lecourt, Academic Dean, and dreaming big. The summer of 2015 is targeted as the launch date for biology and GE classes at Albion.

RECENT GRADUATES

Twenty-two students graduated in 2013. Three students earned an Environmental Studies degree and 19 earned a Biology degree. In the past decade there have been 202 graduates earning degrees in Biology, Environmental Studies, and Natural Sciences (a discontinued major). The 2013 class has the distinction of being the largest graduating class since 2006 and we are on track to graduate an even larger class in 2014!

The Biology Department annually assesses the departmental student learning

outcomes or "SLOs". A recent assessment of SLO #1 showed that our graduating seniors exceed the set goals to "identify and explain general biological principles." In the future we hope to incorporate an alumni survey to determine the long-term impacts of the education you received as a major in our department. Your feedback will be helpful as we continue to improve our program and keep the curricula relevant.

STUDENT RESEARCH & INTERNSHIP REPORTS

WHO ARE YOU?



A western grebe parent with a chick sitting on its back. Allen Moreno participated in research that studied the nesting behavior of this and another grebe species.

I am Allen Moreno and I graduated in Fall 2013 with a degree in Environmental Studies. I am planning to go to dental school and possibly specialize.

What did you do? I did research on two species of grebe (Clarks and Western) that nest on Clear Lake. My responsibilities were to paddle in a canoe to search for nests at various nesting sites, count the total number of nests, and record any disturbances of the nests, including losses of nests due to wind-generated waves and predation by birds. We also recorded observations of hybridization between the two species.

When and where did you do this work?

The research on breeding grebes is led by Dr. Floyd Hayes. I was involved in July and August of 2013.

What did you learn? I learned about research that helps protect migratory birds, as well as safeguards that are able to be put in place. This research has identified the nesting areas that are most important for grebes and the most prone to damage from natural and human causes.

How did your experience at PUC help you prepare for this experience? A good amount of my classes have focused on ways to limit humanity's environmental footprint on species' that are less capable to withstand dramatic changes in their environments. I would recommend the classes where you can travel to tropical locations to study the local biology and ecology in greater depth, such as Tropical Biology. Overall, my experience at PUC helped me to see the world in a better light.

WHO ARE YOU?



Nathan Lee worked on a research project that studied adipose stem cells.

My name is Nathan Lee and I am currently a senior Biology major. I plan to go to medical school and specialize in general surgery.

What did you do? I participated in a research study involving adipose pluripotent stem cells, also known as MUSE-AT (Multilineage-differentiating Stress-Enduring Adipose Tissue). I was responsible for gathering previous and current research on this relatively new field and compiling the data for the other members of the research team.

When and where did you do this work?

My research internship lasted for a month during the summer of 2013 at the JW Rhee Wellness Clinic under the supervision of Dr. Joon Rhee in Redlands, California.

What did you learn? During my time at the clinic, I was able to observe many of the procedures that involved the removal and storage of adipose tissue. This was further supplemented with the research of different methods for extracting the stem cells from the tissue and subsequent storage of the stem cells. I also learned how the research group functions together and communicates to implement outside data and research into applicable information for their current research project.

How did your experience at PUC help prepare you for this experience? A vast majority of my classes helped prepare me for my research experience. For example, Cellular and Molecular Biology helped me understand many of the underlying mechanisms utilized by the stem cells on a cellular level. Histology taught me how to recognize the tissue and cell types I came across in the research papers. Finally, Intro to Research Methods helped me to find relevant research papers and "dissect" them for pertinent information.

WHO ARE YOU?



Yela Jung and Bryan Anamuro studied the correlation of obesity and Alzheimer's disease using a microscopic roundworm as the study subject.

We are Bryan Anamuro and Yela Jung, senior biology majors.

What did you do? We developed a research design to observe if there is a correlation between an obese state and Alzheimer's symptoms. *Caenorhabditis elegans* (a microscopic roundworm) was our model organism of choice. The experiment used two different types of diets that were both high in protein and lipids. These diets were given in different amounts in order to lead to an obese state, which in turn we expected would produce a significant amount of amyloid β -plaques. These are small oligopeptides that are frequently observed in the brains of patients with Alzheimer's. Later, western-blot and ELISA tests were used to examine the results.

Groups of *C. elegans* were introduced to the nutrient agars for a period of two weeks. Also, behavioral testing was done in order to show if there were Alzheimer's symptoms seen before and after the weight gain. During our eight-week study, we finished and perfected the methods and materials, and started feeding variable amounts of nutrients to the worms.

When and where did you do this work?

We conducted this research during the summer of 2013 with Dr. Backil Sung as our major professor.

What did you learn? This summer was the first time we had conducted research. It was a good experience but frustrating at times due to our lack of knowledge and experience. However, Dr. Sung and a fellow researcher, David Kang, helped us to solve many problems along the way.

WHO ARE YOU?



Natasha Elloway participated in non-invasive genetic research of *Aphonopelma tarantulas*.

My name is Natasha Elloway and I am a senior Biology major here at PUC. I plan to attend dental school next fall.

What did you do? I participated in research that carried out experiments in identifying certain tarantula species of genus *Aphonopelma*. These experiments revolved around DNA barcoding, which looks for DNA identification markers specific to a species. A non-invasive technique was used to extract the DNA from the exuviae, or exoskeleton, of tarantulas. The importance of this research was to understand the taxonomical organization of organisms, specifically subspecies' of *Aphonopelma*.

When and where did you do this work?

I did this research with Dr. Bryan Ness throughout Winter and Spring quarter 2013 at PUC.

What did you learn? I had hands-on experience of learning how to properly use a centrifuge, vortex, PCR (Polymerase Chain Reaction) and gel electrophoresis machine, as well as becoming a little more familiar with tarantulas.

How did your experience at PUC help prepare you for this experience? Most of the lab equipment and techniques used were introduced in a number of courses taken at PUC, including: Biological Foundations, Introduction to Research Methods, Cell & Molecular Biology, and Genetics. Learning about these techniques in these courses made the application less difficult and more enjoyable.

WHO ARE YOU?



Angelo Maniego conducted a field study to document the distribution of a rare plant, the *Calistoga popcorn flower*.

My name is Angelo Maniego, a Biology Major. I graduated in June 2013 and am currently in a post-baccalaureate program at CSU East Bay. I plan on attending dental school.

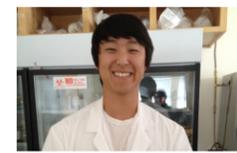
What did you do? I surveyed the landscape and collected data to better understand the *Calistoga popcorn flowers*. Surveying the location consisted of mapping the field and placing flags in the middle of high concentrations of the *Calistoga popcorn flower (Plagiobothrys strictus)*. I counted the number of flowers within a specific distance of each flag. Within each radius, a random flowers' height was measured along with the number of blossoms and buds on the stem of the flowers chosen. The data was then organized and presented to Professor Aimee Wyrick.

When and where did you do this work? My research internship began in April 2013 and lasted for two months. The plants occur on two privately-owned properties in Calistoga, California.

What did you learn? Through this project I have learned the importance of the *Calistoga popcorn flower* and the effects it has on the surrounding environment, as well as the problems it would pose if it were to become extinct. I also learned the importance of being descriptive and precise in recording data.

How did your experience at PUC help prepare you for this experience? I was able to implement what I have learned from classes like Ecology, Flowering Plants, and Intro to Research Methods towards the research. In Ecology we did outdoor experiments for labs that involved measuring and counting trees, similar to the survey I did when counting the flowers. Furthermore, Intro to Research Methods prepared me well to record data and write up results of the study.

WHO ARE YOU?



David Kang studied the development of opioid tolerance in a roundworm (*C. elegans*).

My name is David Kang and I am a Junior Biomathematics major. I plan to become a surgeon one day.

What did you do? I conducted a research study on the buildup of opioid tolerance. I worked with *Caenorhabditis elegans*, a microscopic nematode (roundworm) that lives for about a month. The worms were given Pargyline, an inhibitor that was expected to prolong the start of morphine tolerance or prevent it from starting at all. Different doses of morphine were given over a period of time and I checked the effect of the morphine by using a heated pen to see the reactions of the worms.

When and where did you do this work?

I spent most of the 2013 summer conducting this research under the guidance of Dr. Backil Sung. I will continue the research into the current academic year.

What did you learn? Research is not an easy job. It takes a lot of patience to keep up with all of the work. Reading a large quantity of other research papers and books is a necessity, because to write a credible paper, credible sources must be used and cited.

How did your experience at PUC help prepare you for this experience? Introduction to Research Methods was the most useful class for conducting research, because of the hypothetical research experiment that we had to create. The class taught me that writing a research paper and conducting experiments were not easy and they gave me an idea of what it was going to be like to actually conduct research.

UPDATES ON RECENT GRADUATES

Since 2008 each Biology Newsletter has featured current student internship and research reports. We thought you'd like to know about some of our recent graduates and what they're up to a few years after graduating. The following gives you a glimpse of the great things PUC alums are up to.

DUSTIN BAUMBACH

Environmental Studies B.S. 2012



I spent three months in summer 2013 along the Gulf of Fonseca (Honduras). I was there to determine locations of the

critically endangered eastern Pacific Hawksbill sea turtle and then to determine dietary analysis through gastric lavage as well as attach satellite transmitters for home range analysis within a unique environment of mangrove estuaries. Hawksbills, though once abundant in the area, were hunted to the point of local extinction within the eastern Pacific range, until recently discovered. Unfortunately, I did not encounter any of these critically endangered turtles in the wild during my field excursions. Because of this, my major professor, Dr. Stephen Dunbar and I decided to switch my field site and also slightly that of my research focus.

I will work on the island of Roatán in the Bay Islands of Honduras within the Roatán Marine Park to look at the foraging as well as sex-ratios of the critically endangered Caribbean Hawksbill sea turtle. Their numbers are rising but are still critically endangered. There is little known about the gender ratios (male to females) in this area. Because external male/female determination is impossible, Dr. Dunbar

and I are developing methods to hormonally determine gender through blood sampling. I will be in Honduras this coming summer to collect initial data. Following my field season, I plan to upgrade my graduate studies to a Ph.D.

MINDY NELSON

Biology B.S. 2012



Along with other responsibilities of second year veterinary school at UC Davis, I work with Dr. Alonso Guedes, DVM, MS, Ph.D., a veterinary

anesthesiologist and Assistant Professor of Clinical Surgical and Radiological Sciences. He has developed a novel analgesic, t-TUCB which acts as an anti-inflammatory. Coincidentally, this compound was originally isolated from an insect by another UC Davis entomology professor. t-TUCB has found success in treating laminitis, an inflammation of the hoof that causes great morbidity and mortality in horses. In the fall of this year, we conducted a pilot study on six horses to determine the efficacy of t-TUCB on lameness and pain scores of wrist joints. The research is conducted on horses that are donated to the school's Center for Equine Health to be used for research or teaching purposes.

In January 2014 we completed our fourth and final phase of a pharmacokinetic study with five beagles, also using t-TUCB. This study determines the level of drug that is found in the bloodstream, and also the level of metabolites that should be inhibited by its presence. Beagles are a classic research animal that are raised by breeders specifically for scientific research. Our boys are all about 1 year old and are lucky to be up for adoption now that our study is complete.

The research is actually a very small part of what I do. Most of my non-class time is

spent working as a Large Animal Critical Care Technician at our teaching hospital. The patients I work with are mostly critically ill horses suffering from colic or infectious disease in our ICU and isolation units. I also get to treat baby horses in NICU, which is one of my favorite parts. This summer I will extern at four different clinics in Colorado and Montana. I still have my greyhound and it looks like I'll be getting a new horse soon.

ZACH GATELY

Environmental Studies B.S. 2011



I completed my Masters of Public Health from Loma Linda University in June 2013 and immediately signed up for

mission work. It did not hit me until I woke up from a long nap on my Ethiopian Air flight and five words flashed through my mind: There is no turning back. I was on my way to Béré, Tchad, the near geographic center of Africa, and there was little I could do about it then.

Fast forward five months and that moment of realization seems but a lifetime away. Being thrown head first into an utterly unknown culture presents quite a bit of adventure. A fellow LLU MPH graduate and I have been tasked with managing the public health projects associated with L'Hôpital Adventiste de Béré. Our three main projects include working with Community Health Workers (CHW) and Traditional Birth Attendants (TBA), health education classes in the surrounding villages, and working with malnourished children in the hospital.

I have let experience become my teacher here in Tchad. I blunder through the languages (there are 120 distinct languages in Tchad), I crashed the motorcycle, and I have danced around in the market for a better price. I have learned that when people have a story to tell, it is better to

listen rather than rush them.

Going to Africa was not some last minute idea. Even while studying at PUC, I had the urge to serve my community and, if possible, make that community some place abroad. I spent hours talking with professors about international work, mingling with our ethnically diverse student body, and participating in student-led groups in the community. While a senior, I also interned with Napa County Public Health Department, furthering my interest in public health as well as reinforcing my interest in working in diverse communities.

Though there have been setbacks, challenges, and a few crazies along the way, I know that there is more adventure to come, here in the heart of Africa!

ZOE THOMPSON

Biology B.S. 2011



I am currently a neuroscience Ph.D. candidate at UC Riverside, and am working in an evolutionary physiology/exercise physiology lab.

Our lab focuses on a selective breeding experiment for voluntary wheel-running in mice. Half of the mice are "high-runner" mice (the top runners are chosen to breed in the next generation), and half of the mice are control mice (bred without regard to their wheel-running). This experiment has been ongoing for 20 years now, and the high-runner mice have experienced many changes. When compared to control mice, they are leaner, have a higher maximal oxygen consumption, greater endurance, and run three times as much. There are also many neurobiological changes that have occurred. The high-runner mice have some differences in how their neurotransmitters work (dopamine and serotonin especially), and also have more brain-derived neurotrophic factor (BDNF

- important for growth of new neurons) immediately after running. They also have heavier brains! A study conducted before I started at UCR used magnetic resonance imaging (MRI) to figure out which area of the brain was responsible for this increased mass. Interestingly enough, it wasn't the cerebellum or hippocampus, but the midbrain, an area most people don't know much about. However, the midbrain contains the wiring for both motor and reward pathways - either of which might explain the high-runner behavior. I wanted to know more details about how the midbrain is contributing to this increased mass - are there more neurons in the high-runner mouse midbrain? Are they more densely packed? Which regions within the midbrain seem to have gotten bigger, and can that answer help us explain how the high-runner mice run more? Getting the answers to these questions required a different approach than MRI, as I needed to be able to see individual neurons and count them. I'm using histology (a Nissl stain) to look more closely at the midbrain.

I am really thankful to PUC and especially the Biology Department for preparing me so well for graduate school! I was fortunate to have a chance to TA at PUC which is now a big part of my job (thanks also to the awesome Chemistry department for letting me TA there as well). The personal guidance I received from professors, as well as the broad selection of Biology courses have served me well. Graduate school is difficult but very rewarding, and I would suggest to any current student who is interested that he or she contact their advisor!

TREVOR GOMES

Biology B.S. 2011



After graduating from PUC I moved to southern California to pursue admission

to Loma Linda University's Physical Therapy program. During this time I worked part time and continued cycling several days a week. After attending a training camp in January of 2012 something changed inside me that convinced me to start training for a reason other than just for the love of the sport.

When I was placed on the alternate list for the DPT program I moved back to my hometown in Northern California to work and train. I began racing and the improved results were immediate! I quickly upgraded in category and started racing with stronger riders. Ironically, I was accepted to LLU soon after but after considerable thinking and prayer I ultimately turned down the acceptance and went full steam ahead with cycling. By September 2012 I was a category 2 cyclist. At this point I race in the Pro, 1, 2 field against the best riders in the sport. 2013 was a tough year for racing, but I continue to improve. Although training and racing take a lot of my time I am also the product manager for the cycling company, Williams Cycling, which allows me flexibility to build my work schedule around my training schedule.

My Biology degree isn't completely neglected. Since late 2013 my boss and I have been exploring the possibility of co-founding a beverage company. His strong business background and my biology background allow us the insight to develop several products that we feel may have strong marketability. This is an exciting prospect! For the foreseeable future I will continue to train 5-6 days as I pursue a career as a professional cyclist.



DEPARTMENT NEWSLETTER

BIOLOGY



ADDRESS SERVICE REQUESTED

Department of Biology
Pacific Union College
One Angwin Avenue
Angwin, CA 94508

Phone: (707) 965-6635
Fax: (707) 965-7577

NON-PROFIT ORG.
U.S. POSTAGE
PAID
PERMIT NO. 42
ANGWIN, CA 94508