“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.
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 benefited faculty and students alike. For many years, a room on second floor went relatively unused. For some, you will remember viewing 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. Backl 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 microbiology lab.

- An ultra-low temperature freezer for cell culture storage
- A digital camera microscope attachment
- Two dependable and functional autoclaves
- New furniture was installed, and original art was added to fill the position. Because we now offer cell culture storage

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 throughout her undergraduate years as a Biological Foundations teaching assistant. She was a natural choice when we needed a Biological Foundations teaching assistant. She was a natural choice when we needed one. Haruka is an avid photographer, an experienced SCUBA diver, and an accomplished naturalist. As an Honors 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.

**BIOLGY 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 Angwin and Albion is our campus on the beautiful Mendocino Coast. 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.

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Our next big change is to begin teaching labs. 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.

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I learned about my 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 MUSEAT (Multilineage-differentiating Stress-Enduring Adipose Tissue). I was responsible for gathering previous and current research on this relatively new field and composing 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 Rhie Wellness Clinic under the supervision of Dr. Joan Rhie 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 you prepare 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 “digest” them for pertinent information.

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 a 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 taxonominazional organization of organisms, specifically subspecies of Aphonopelma.

When and where did you do this work? I did this research with Dr. Bryan Nee during Winter and Spring quarters of 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 you prepare 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.

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 landscapes and collected data to better understand the Calistoga popcornflowers. Surveying the location consisted of mapping the field and placing flags in the middle of high concentrations of the Calistoga popcorn flower (Phlox subulata stricta). I counted the number of flowers within a specific distance of each flag. Within each radius, a random flower’s 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 Wytrick.

When and where did you do this work? My research internship began in April 2013 and lasted for two months. The plants occur in 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 problem 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 you prepare 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.

My name is David Kang and I am a Junior Biomatematics 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 gave Pangyulina, 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 effects 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 you prepare 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.
Since 2008 each Biology professor, Dr. Stephen 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.

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 Hawkshill sea turtle and to determine dietary analysis through gastric lavage as well as attach satellite transmitters for home range analysis within a unique environment of mangrove estuaries. Hawkshills, 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. In January 2014 we completed our fourth study 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, 2νTUCB which acts as an anti-inflammatory. Coincidentally, this compound was originally isolated from an insect by another UC Davis entomology professor. 2νTUCB 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 2νTUCB 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 2νTUCB. 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 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 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 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 UC Davis 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 even know exists. 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 these 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 am 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 am still closed labs, which is 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.

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.

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 the reality of my purpose came 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 seemed 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 others and, if possible, make that community some place abroad. I spent hours talking with professors about international work, mingling with our ethically 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!