2014 Annual Report to the Research Associates of PLNU

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Greetings from Dr. Rick Bravo ‘79, the Chair of Research Associates

It is a privilege to bring my first report to the fine members of the Research Associates of PLNU. These are historic times for the science departments at the college, as preparations are made to move into the new science facility. It has personally been exciting to see what generations before us have advocated and planned for, finally coming to fruition. I'm grateful for the future opportunities to help young promising scientists and health professionals change the world.

From a small handful of young students doing research in the chemistry department 50 years ago, PLNU has grown to its current state of offering more than 70 science majors superb, career-launching summer research opportunities with our outstanding faculty and alumni. For many of us, these were seminal experiences that effectively touched our lives and helped propel our careers. I know that we all feel gratitude.

It has never been more important that we continue to support the current and future science students at PLNU. Your help and financial support is really needed. You can honor the heritage you have been blessed with by your generous gifts to help keep these programs going.

PLNU continues to boast amazing outcomes. For a college of our size, we have a remarkable number of graduates that ascend to post baccalaureate degrees. Many of that number are now in academia, continuing the PLNU legacy. We can boast of medical, dental and pharmacy school admit rates that are over 90 percent. The NSF has just granted $576,000 to help PLNU educate STEM majors for the next five years. We have 184 students currently declared as pre-health profession students. In short, the college’s science programs have advanced dramatically from their Pasadena days. In fact, PLNU is now known as a premier undergraduate science school in Christian college circles nationally. Not bad eh?

On a personal note, as I continue to work with the excellent faculty and staff at PLNU, Drs. Mike McConnell and Ken Martin as well as the outstanding folks in the Alumni Office and University Advancement, I am reminded of why we do so well.....we are blessed with the highest quality people who have dedicated their lives to Christian higher education. I want to thank them for their dedication in fostering RA as a premier alumni-science organization with the goal and mission of advancing our students and empowering their future careers through solid scientific research experiences rarely available to undergraduates at other institutions.

I thank you for your continued support and affirmation of this ongoing effort. May God bless you and the fine science family at PLNU.

Rick Bravo, '79

New Faculty Member, Kristopher J. Koudelka, Joins the Biology Department

I am ecstatic to be joining the PLNU biology faculty, and I am honored to have been chosen to contribute to their long-standing history of excellent education, research, and spiritual growth. I am a native of Door County, Wisconsin (the peninsula that juts into Lake Michigan). I completed a B.A. in biology, with a minor in chemistry, at the University of Wisconsin-River Falls. I then earned my Ph.D. in biology at The Scripps Research Institute where I studied the natural mammalian uptake of a plant-based viral nanoparticle. I was then fortunate enough to be a JUST post-doctoral fellow where I spent half of my time researching the use of bacteriophage lambda as a drug delivery device in the School of Pharmacy and Pharmaceutical Science at UCSD; and the other half of my time teaching in the chemistry department at USD. Most recently, I was at Carthage College, a primarily undergraduate institution in Kenosha, WI, where I spent four years teaching and guiding undergraduate research in both the departments of chemistry and biology. I love mentoring at the undergraduate level, both in the classroom and the lab, and I could not be more excited to be here!

I met my wonderful wife, Missy – also a native Wisconsinite, in Scotland during an undergraduate study abroad program. We have two outstandingly fun kids: our daughter Kylie is five, and our son Mason is three. It has been wonderful to rejoin our favorite parish in San Diego, and we cheer for the Chargers as long as they are not playing the Packers. You are also likely to catch us running a half marathon or two.

At PLNU my research projects center on the chemical modification and *in vitro* evaluation of plant and bacteria viruses for use as drug delivery and imaging vehicles for the early detection and treatment of disease. Most of our work centers on cancer; however, we are also interested in the native uptake of these foreign viruses in mammalian systems. This work not only enables better drug or imaging agent design, but also may help in the treatment of closely related human pathogens and help undercover viral evolutionary pathways.

Thank you for all of your wonderful support!

New Faculty Member, Ariane L. Jansma, Joins the Chemistry Department

I am very excited to be a part of this dynamic department at PLNU. I am a native of San Diego and attended Pepperdine University where I received a BS in Chemistry and a BA in Spanish. After graduation, I returned to San Diego where I spent several years working in the biotech industry. I spent a year at DuPont Pharmaceuticals and two years at the Genomics Institute of the Novartis Research Foundation (GNF), using NMR spectroscopy for structural elucidation of small molecules in support of medical chemistry. During this time I also completed my MS degree in Analytical Chemistry at San Diego State University. After quite of bit of prayer and consideration I decided to pursue a PhD in Biochemistry at the University of California, San Diego, which involved a considerable change in field and required me to basically begin my education from the ground up. This proved to be a wonderful experience and I decided biochemistry was my passion. After UCSD, I did my postdoctoral research under Peter Wright at the Scripps Research Institute (TSRI) in La Jolla where I used NMR to study structural and functional relationships between viral proteins and human cellular targets.

I have been so blessed to join the faculty at PLNU after completing my postdoctoral research. My lab at PLNU continues my interests in both structural biology and virology, focusing on the study of proteins from the Dengue virus and Tick Borne Encephalitis virus with human host PDZ domain targets. We continue to collaborate with TSRI and have had some wonderful opportunities to use their NMR facilities.

My husband Dave and I met at UCSD and we celebrated our 10th wedding anniversary this year. We have a 4-year-old son named Rylan who is the constant joy of our lives. As a family we attend church at the Torrey Pines Christian Church and are active members of our community in University City. We are all very excited to be a part of the PLNU family and look forward to being here for many years to come.

Pre-Health Professional Program – 2014 – by Sara Choung

The pre-health professions program at PLNU has grown dramatically over the years; there are currently 184 students who are declared as pre-health professions students. We have had a number of meetings and various speakers during the spring and fall of 2014. This information and more can be found on our PLNU pre-health website and PLNU pre-health advising Facebook page.
http://www.pointloma.edu/experience/academics/schools-departments/department-chemistry/pre-health-program
https://www.facebook.com/PLNUPreHealthAdvising

27 students participated in the "sophomore" pre-health interviews and 28 students were involved in the "junior" pre-health interviews that were conducted by the health professions advisory committee in the spring of 2014. The current members of the health professions advisory committee are Ryan Botts (Mathematics), Sara Choung (Chemistry), Greg Crow (Mathematics), Michael Dorrell (Biology), Jamie Gates (Sociology), Katherine Maloney (Chemistry), Ken Martin (Chemistry), April Maskiewicz (Biology), Kendra Oakes Mueller (Psychology), Dawne Page (Biology), Marc Perry (Chemistry), Matthieu Rouffet (Chemistry) and Paul Schmelzenbach (Physics).

The Point Loma Pre-Health Student Association was launched in the fall of 2011. The current executive council includes Paul Thompson (president), Alec Johnson (VP allopathic medicine), Claire Van Hoorebeke (VP dentistry), Kresta Tabaranza (VP optometry), Ally Weiler (VP osteopathic medicine), Natasha Medici (VP veterinary medicine), Nolan Andres (secretary/treasurer), and Elise Herrscher/Michelle Stone (communications director). They have successfully planned and coordinated events including a movie viewing and panel discussion about vaccinations, student mentoring program, and pre-veterinary medicine informational meeting.

We are very proud of our graduates who began their studies at various health professions programs in the fall of 2014. 25 of the 33 applicants were accepted during the 2014 application cycle. The following students entered allopathic medical school: Jonathan Barboza ('11) at University of California San Diego, Taylor Davis ('14) at University of California Irvine, Austin Fares ('13) at Creighton University, Dawn Goral ('14) at University of Colorado Denver, Tori Haase ('13) at Loma Linda University, Kinzi Halle ('13) at Tufts University, Sean Heavey ('13) at Boston University, Michal Hoenecke ('14) at Oakland University, Dani Matonis ('13) at Boston University, Bryan Mueller ('14) at Uniformed Services University of the Health Sciences, Jack Rusing ('13) at University of Arizona Tucson, Danielle (Hassler) Shepherd ('10) at University of Washington, and Emi Soiland ('13) at St. George's University. The following students started osteopathic medical school: Colton Erskine ('13) at Midwestern University Arizona, Michael Geiger ('12) at AT Still University, Tania Gutierrez ('11) at Western University of Health Sciences, Tania Montenegro ('14) at Marian University, Kyle Russell ('13) at Rocky Vista University, and Jack Thompson ('13) at Rocky Vista University. Tyler Sanders ('14), Danielle Shipowick ('13), and Luke Vickers ('12) all began their studies in dental school……Tyler at University of Southern California, Danielle at Loma Linda University, and Luke at University of California, Los Angeles. Christina Issa ('14) started optometry school at Southern California College of Optometry. Carolyn (Houser) Rogers ('14) entered veterinary school at Colorado State University. We wish them all the very best as they pursue careers in the health professions.

Graduate School Acceptances – 2014 by Michael McConnell

Several alumni of the PLNU biology and chemistry departments received good news in response to their graduate school application work in 2014. Those entering PhD programs included: Brooke Apffel '14, Tim Borgogna '14, Joanna Borgogna '14 and Devin Sharpe '14. Brooke is studying biology at the University of Idaho, Tim and Joanna are both studying biology at Montana State University and Devin is studying biochemistry at the University of Maryland. Alumni starting Pharmacy Doctorate programs in 2014 are Hsi-Chun J. Hsu '13 and Allison E. Zakaroff '13. Hsi-Chun is studying at Butler University (Indianapolis, IN) and Allison is studying at Loma Linda University. Finally, Lauren Stewart '14 started a MS program in biology at Cal State San Marcos. This fine group of seven alums represents one of the largest Point Loma contingents to enter graduate school in a single year in quite some time and we are very proud of them.

2014 Science Honor's Weekend Report by Dawne Page

A total of 35 high school students attended the PLNU Science Honor's Weekend of 2014, with a potential declared major of Biology, Chemistry, Biology-Chemistry, or Environmental Science. All of these students had SAT/ACT scores high enough to merit at least a $12,000 scholarship from PLNU. Of these 35 students, 11 enrolled at PLNU, and all but two have remained a science major. One of these students is receiving tuition remission and the others are receiving a total of $122,000 per year in scholarship support from PLNU. Due to the lower yield of students who were recruited to PLNU this year and to the recent scholarship grant from NSF, we are discussing possible changes in the SHW recruiting strategy.

2014 Tri Beta News by Mike Dorrell

Tri-beta continues to actively participate in/support several science outreach programs. In addition a student led seminar was recently created to inform younger students of the research opportunities available here at PLNU. This seminar series aims bring in local scientific entrepreneurs to give talks on scientific careers beyond normal medical school and graduate school. Students are often unsure of the various opportunities that exist for young scientists with a bachelor's in biology, chemistry, or bio-chem. This seminar series should help open the eyes of students to the many opportunities that exist, provide inspirational stories of success from Christian scientists who have succeeded in business, and help provide important connections for students wishing to pursue careers in the local biotech. industry. This culminated in an innovation workshop where students brought novel ideas for solutions to many of the worlds problems. Students from a wide range of disciplines (about 50% were science students) worked with over 30 local biotech CEOs to practice refining these ideas in a group workshop setting designed to show how science and business can work together to help bring ideas to reality. The workshop was a major success for our students, and allowed local CEOs to see the quality of our students and education at PLNU. Finally, Tri-beta continues to provide a social network for biology students, with an annual Christmas party at Dr. Dorrell's house and various other social and outreach events throughout the year.

2014 Biology Summer Research Program

Back Row (left to right): Erin Smith, Stefanie Watson, Ashley Barnett, Paul Thompson, Shane Hunt, Esme Zediker, Taylor Virtue, Gabe Villegas, Nolan Andres, Josh Snyder. ***Next Row (left to right)***: LeAnne Elizondo, Alex Wicklund, Dan Elson, Joelle, Peter Shim, Lyndsey Aponik, Amelia Schricker, Jessica Fowler, Carol Williams. ***Next Row (Left to right***): Todd Anzelon, Chloe Soremekun, Ryan Echols, Nathan Keys, Torrey Halbert, Alec Johnson, Dylan Poorboy, Kate Draeger, Cierra Virtue, Joy Walters. ***Front Row: Standing (left to right):*** Chip LaChat, Hannah Quinn, Kirsten Garbe, Melody Bellora, Adam Donason, Ravi Smith, Kelly Davidson, Madison Ulrich, Sarah Levesque. ***Front Row: Sitting (left to right):*** Dr. Walter Cho, Dr. Mike Mooring, Dr. Ryan Botts, Dr. Robert Elson, Dr. Bob Wiese, Dr. Mike Dorrell, Dr. Dawne Page, Dr. Dave Cummings, Kerri Sevenbergen, Dr. Michael McConnell. ***Not pictured***: Dr. Brad Carter, Dr. John Rogers, Natalie Bain, Megan Barber, Eli Besser, Julia Giacopuzzi, Nicole Rowley.

Students (Graduate) Directed by Dianne Anderson

Susan Phelps (Aliso Viejo, CA), **Jessica Pimental** (San Diego, CA) and **Matthew Nasont** (Covina, CA)

Susan, Jessica (now graduated) and **Matthew** worked with me on the development and classroom field testing of biology concept cartoons on the topics of natural selection and cell division for use in middle school and high school classrooms. Concept cartoons are single-panel images that present a situation with four different characters explaining the phenomenon. One character's answer is scientifically correct, while the others express incorrect ideas commonly held by students. Previous work indicates that the cartoons are beneficial for promoting both small-group and whole-class discussion of concepts that lead to improved learning.

Student Directed by Brad Carter '82

Natalie Bain (Reno, NV) and **Nicole Rowley** (Napa, CA).

Natalie and **Nicole** worked with Dr. Brad Carter at the Alvin and Lois Lapidus Cancer Institute at Sinai Hospital in Baltimore, continuing with the work that **Maritza Vick** had started the summer before. They studied a hormone called human chorionic gonadotropin (HCG), using MTT and TUNEL assays to see if it could increase the apoptotic index of three different breast cancer cell lines (SK-BR3, T47D, and MDA-MB-231). Nicole also

attempted using RNA interference in SK-BR3 cells, to knock-down the membrane receptor (LCR) that is believed to be involved with HCG binding and signaling. In addition, they designed and implemented two clinical studies and performed one of them in collaboration with a musical therapist and patients in the chemotherapy infusion center. Natalie also helped an oncologist write an abstract for a paper that is to be submitted for peer review.

Students Directed by Walter Cho

Nolan Andres (Rancho Cucamonga, CA)**, Shane Hunt** (San Clemente, CA)**, Maddie Ulrich** (Cave Creek, AZ) and **Stefanie Watson** (Woodinville, WA)

Shane Hunt and **Stefanie Watson** joined me on a research expedition to study the Kermadec Trench, a deep-sea trench located in the South Pacific, stretching between New Zealand and Samoa. We joined an international team of scientists aboard the oceanographic research vessel *R/V Thomas G. Thompson* to explore and study the Kermadec Trench, one of the deepest trenches in the world, stretching to more than 10,000 meters below the sea surface. We used a variety of instruments including deep-sea landers, elevator platforms, and the hybrid remotely operated vehicle (HROV) *Nereus*, a unique robot and one of the few capable of operating at such great depths. We spent about 5 weeks at sea exploring different stations along the axis of the trench and at multiple depths collecting imagery data and discreet samples of the trench fauna. Shane and Stefanie played key roles in organizing the metadata of many of the different instruments used, standing watches during HROV dives, processing biological and sediment samples in the shipboard labs, and prepping the instruments and sampling equipment. This was in addition to completing classwork remotely for some of their classes during the cruise.

We then joined my other two students **Nolan Andres** and **Maddie Ulrich** in the lab at PLNU. All four students worked together on multiple projects focused on the study of the biodiversity, biogeography, and population connectivity of marine communities. We continued our study of the population genetic structure of brittle stars in the Gulf of Mexico. Having amplified the 16S mitochondrial marker of most of our brittle star samples from the Gulf of Mexico, we focused on amplifying the COI mitochondrial marker, a mitochondrial gene that is more variable than the 16S mitochondrial marker. Surprisingly, we found that although the 16S marker indicated that one species of brittle star was *Ophiocreas spinulosus*, the COI marker indicated that the sequence divergence was greater than the 3% typically delineating different species in echinoderms. We will continue to pursue this and hope to complete a series of population genetic analyses once both molecular markers have been amplified for all specimens. Lindsay Powell, a former research student, presented some of our results at the 39th West Coast Biological Sciences Undergraduate Research Conference.

The students also designed their own investigation of potential cryptic speciation in *Astroceras elegans*, a brittle star associated with corals found in New Zealand waters. Although described as a single species, *A. elegans* has two distinct morphotypes that appear quite distinct. The students were investigating whether the two distinct morphotypes are in fact genetically the same species or if there is indication of isolation and potential speciation. The students designed their own research project to answer this question including consideration of multiple factors such as geographic distribution, host-associate symbiotic relationships, and bathymetric range. We received specimens from collaborators at the National Institute of Water and Atmospheric Research (NIWA) in New Zealand and have made progress in extracting DNA from these specimens and amplifying multiple molecular markers to investigate the phylogenetic relationships between the 2 morphotypes.

Shane Hunt also focused on analyzing the imagery of deep-sea coral communities in the Gulf of Mexico. We identified multiple deep-sea communities imaged at multiple time points over 2-3 years. Shane used image analysis software to study how these coral communities change over time.

Students Directed by David Cummings and Ryan Botts

CC Virtue (Johannesberg, South Africa**), Kelly Davidson** (Rancho Santa Fe, CA**), Chip LaChat (**Fallbrook, CA**), Ryan Echols** (Arroyo Grande, CA) **J.J. Paul** (San Diego, CA) and **Joy Walters** (Oceanside, CA)

In the summer of 2014, the combined labs of Dave Cummings and Ryan Botts (MICS) was made up of nine individuals: Dave Cummings, Ryan Botts, Carly Boyd, JJ Paul, CC Virtue, Kelly Davidson, Chip LaChat, Joy Walters, and Ryan Echols. Additionally, we collaborated closely with the labs of Drs. Celeste Brown and Eva Top at the University of Idaho. We focused our efforts on the genetics and expression of several new environmental plasmids, pieces of DNA that can be shared among species of bacteria, that encode resistance to antibiotics. This work is currently funded by a grant from the National Institutes of Health.

Students Directed by Mike Dorrell

Ashley Barnett (Visalia, CA), **Daniel Elson** (San Diego, CA)**, Alec Johnson (**Gilbert, AZ**), Paul Thompson** (Gold Canyon, AZ)**, Gabe Villegas** (Orange, CA) and **Mariah Webb** (Big Bear City, CA)

Ashley and **Mariah** studied the potential role of NAAA (n-acylethanolamine acid amidase) in degrading the fatty acid amide, eurichamide. This fatty acid was found to highly regulate the retinal vasculature, and dysregulation of the levels of eurichamide leads to abnormal and disorganized retinal vasculature associated with retinal disease and degeneration. Eurichamide is generated by the enzyme PAM, or peptidylglycine alpha-amidating monooxygenase. Injecting PAM into the mouse retinal vasculature results in increased levels of eurichamide, which in turn results in downstream activation of angiogenin and other poro-angiogenic factors. However, the method of degrading eurichamide, and thus regulating its levels from becoming too high, is currently unknown. NAAA is known to degrade fatty acid amides similar to eurichamide and therefore was a potential candidate to be a key regulator of eurichamide activity in the regulation of retinal vascularization. Ashley and Mariah performed key experiments analyzing the retinas from NAAA knockout mice to determine if NAAA dysregulation led to upregulation of eurichamide and subsequent excess retinal vascularization. These studies are key to understanding the normal regulation of the retinal vasculature and identifying potential treatment modalities for numerous retinal diseases that involve abnormal vascularization. Ashley has since been hired by a local research institute (LMRI) studying retinal vascular disease.

Paul and **Alec** continued studies identifying anti-angiogenic compounds (compounds that block blood vessel growth) that demonstrate synergistic activity in combination. In addition to continuing these studies in our chick chorio-allantoic model, Paul and Alec set up a new model system using cultured Human Umbilical Vein Endothelial Cells (HUVECs). This new model system is cheaper and faster, and should facilitate more rapid screening of combinations of approved or nearly approved therapies that can be used to treat glioblastoma brain tumors. As tumors grow, they require a new vasculature to be established within the tumor to supply the rapidly dividing cells. If this new vasculature can be blocked, the tumor will starve and be unable to grow. However, due to compensatory mechanisms, blocking a single angiogenic factor has been unsuccessful in clinical practice. Our lab has previously shown that by blocking multiple pathways at once with synergistic combinations, this compensatory mechanism can be overcome. Identifying compounds that are already approved by the FDA for clinical use that demonstrate similar synergistic activity in combination, will allow physicians to combine the right therapies.

Daniel and **Gabe** continued work identifying ways to target chemotherapies to tumors in order to limit the devastating side effects normally associated with chemotherapy and to optimize the amounts of toxic drug that can be delivered directly to the tumor. We have identified markers that are specific for glioblastoma tumors and are currently working on using antibody derived pro-drug (ADEP) therapy to target drugs to the tumor. In ADEP therapy, a pro-drug activating enzyme will be linked to an antibody targeting the tumor-specific antigen. Since the antibody will only bind to the antigen on the tumor, the enzyme will be localized specifically to the tumor site. This will allow high levels of a non-toxic pro-drug to be delivered systemically. The enzyme can cleave the pro-drug, making it active. Since the enzyme is localized solely to the tumor, the active, toxic version of the drug will only be generated in the vicinity of the tumor. Daniel and Gabe worked on identifying pro-drug and enzyme combinations to test on animal models of glioblastoma. Daniel continued to work on synthesizing the pro-drug and linking the enzyme to the antibody during an honor's project this year.

Students Directed by Mike Dorrell in collaboration with Faculty at The Scripps Research Institute (La Jolla, CA)

Lyndsey Aponik (Newhall, CA), **Eli Besser** (San Diego, CA) and **Amelia Schricker** (El Cajon, CA)

Eli worked in the Nemerow laboratory at TSRI, studying the use of adenovirus for viral based gene therapy applications. He helped grow the viruses and manipulate the cell surface proteins which allow the adenovirus particles to be targeted to specific cell types in the body.

Lyndsey and Amelia worked in the laboratory of Dr. Martin Friedlander, studying the mechanism by which microRNAs and metabolites regulate angiogenesis in the retina. These studies have ramifications on ocular diseases, the vast majority of which involve abnormal angiogenesis.

Students Directed by Robert Elson

Melody Bellora (San Diego, CA**), Adam Donason (**Murrieta, CA**) and Ravi Smith (**Berthoud, CO**)**

In summer 2014, we continued and brought near to completion our study of the metamorphic development of serotonin-containing neurons in a mealworm beetle. This involves raising the insects and tracking their development through metamorphosis; removing and fixing the central nervous system, using antibodies to detect the presence of serotonin within identifiable neurons, and visualizing the results using confocal microscopy. If things go to plan in the coming summer (2015), this work should be ready for publication. We gratefully acknowledge the support of Research Associates.

Graduate Students Directed by April Maskiewicz

Elizabeth Ferguson, (San Diego, CA) and **Marin Silva** (San Diego, CA).

Elizabeth defended her thesis in August, 2014. The title of her thesis is "*An Exploration of Graphing Software Program Selection and Relative Proficiency Among Undergraduate Biology Students"*. **Marin** collected data for her thesis. Her current project title is "*Student Understanding Using Data Rich Problem Tasks: Keystone Species and Causal Relationships".*

Students Directed by Michael McConnell

Todd Anzelon (La Crescenta, CA**), Kirsten Garbe (**Ventura, CA**), Nathan Keys** (Rancho Cucamonga, CA), **Hannah Quinn** (San Diego, CA) and **Chloe Soremekun** (Cypress, CA).

A distinguishing feature of all Gram negative bacteria is the presence of lipopolysaccharide (LPS) on the cell surface. LPS is a structurally complex molecule consisting of: 1) lipid A, which anchors the molecule in the outer membrane; 2) R-core, an oligosaccharide attached to lipid A that contains unusual sugars and most of the charged groups of the LPS molecule; and 3) O-polysaccharide (O-PS), a hydrophilic polymer generated from 3-6 sugar repeat units that becomes attached to the outer tip of the R-core and which projects outward into the cell's aqueous environment. Lipid A (aka endotoxin) is considered the most dangerous part of LPS from a medical standpoint, but the O-PS is also of great significance to human health, in that it is the part of the LPS molecule with which our immune system initially interacts, as it attempts to defend us from infections by Gram-negative bacteria such as *E. coli* and Salmonella.

The members of the McConnell research group continue to study Group E1 Salmonella O-PS biosynthesis and the mechanisms whereby viruses such as Epsilon 15 and g341 are able to interfere with, and thereby modify the structure of, this O-PS. Although the structure of *S. anatum* O-PS was the first to be determined long ago (1960s) by researchers working at MIT, the enzymes involved in its synthesis still remain largely uncharacterized. A big step towards eventual characterization of the O-PS biosynthetic machinery is now possible, thanks in large part to a gene knockout procedure developed by Barry Wanner and Kirill Datsenko at Purdue University (*PNAS* 97, 6640-6645, 2000). To date, McConnell lab researchers have managed to "knock out" 24 bacterial and phage genes, most of them involved in either O-PS biosynthesis or conversion. Most of our efforts during the summer of 2014 were directed towards cloning many of these same genes onto a low copy number plasmid called pPR637, so that they can be introduced in a controlled fashion into Salmonella bacteria by electroporation. Our hope is that by analyzing the phenotypes of both the deletion mutants as well as transformed strains that carry single genes introduced via plasmids, we will be able to develop a better understanding of O-PS assembly in Salmonella bacteria and the mechanisms whereby phages modify this assembly process.

Students Directed by Mike Mooring and Involved in Costa Rica Research

Dylan Poorboy (Hayden, ID), **Carol Williams** (La Mesa, CA) and **Jessica Fowler** (Salinas, CA)

"Elusive Mammals of the Talamanca Cordillera and Osa Peninsula, Costa Rica"

The Talamanca mountain range is inhabited by populations of elusive mammalian predators and their prey (e.g., jaguar, tapir), but hunting activities are escalating, national parks are short-staffed and poorly funded, and few if any surveys have been conducted in this vast region. In collaboration with local partners, we have monitored a network of camera traps since 2010 to discover the status of the large mammals in these cloud forest communities.

We returned to Costa Rica for our fifth year of Neotropical mammal research with an all-new student team. In fact, "new" was the hallmark this year. Although we continued to monitor and maintain our existing camera trap network with local partners in the Talamanca mountain range, we also initiated a new project involving a new

technique at a new study site with new collaborators and co-workers. Through the enthusiastic support of Dr. Martin Main ("Marty") of the University of Florida, we obtained a large supply of experimental "hair snares", which are traps designed to collect samples of hair from mammals that are attracted to rub against the snare. The design we used consisted of a rubberized backing supporting an array of aluminum bristles from a pet grooming brush, with a strap to attach the arrangement to a tree (Fig 1a). The back of the snare retained clear plastic tubes containing sponges (Fig. 1b) impregnated with a scent attractant (Calvin Klein 'Obsession for Men') applied to stimulate passing animals to rub against the snare and thus leave their hair in the bristles. The goal is to collect hair follicles from which DNA can be extracted for genetic analysis to identify species and individuals, and to characterize the genetics of the population. Our plan was to test the new hair snare design so as to evaluate the feasibility of expanding its use throughout our network in order to obtain genetic data as well as photographs.

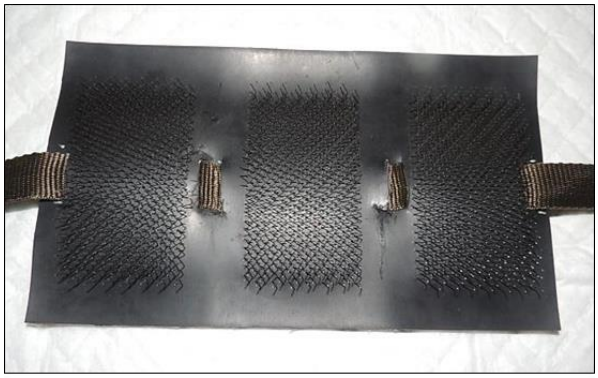


Figure 1a. Top of hair snare

Figure 1 b. Back of hair snare

Our team tested the new hair snare design in two ways: (1) We conducted experimental trials with ocelot and jaguar at the San Diego Zoo and Safari Park, and (2) we field tested the snares at Osa Conservation, a private reserve in the Osa Peninsula of Costa Rica. At the San Diego Zoo, both jaguar (Fig. 2) and ocelot made use of the hair snares, which were paired with a motion sensor camera, and we recovered hair follicles from which we performed morphometric analysis to confirm species identity.

Figure 3. Research team at Osa. From left: Dylan, Carol, Jessica, Mike and Timmy Mooring

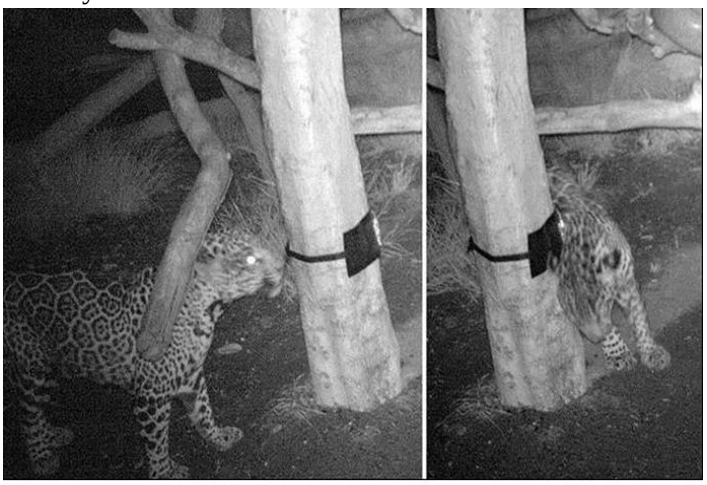


Figure 2. Jaguar 'Nindirwe' investigating hair snare

At Osa Conservation (Fig. 3), we collaborated with Dr. Leslie Hay of Northwest Nazarene University and her students, who were conducting a parallel camera trap study in the reserve. We deployed 31 stations in which we paired a hair snare and a motion sensor camera trap to test the hair snares. Unfortunately, although we sighted puma, ocelot, and oncilla on our cameras (and jaguar was recorded nearby), we did not recover any hairs because none of the animals rubbed against the snares. Subsequently, we deployed the hair snares on our Savegre Valley cameras for several months. After failing to stimulate felids to rub against the snares, we tested a combination of catnip and Obsession to stimulate the cats to rub against the bristles. Although coyote were excited to use the hair

snares, we have yet to see the felids use them. We are still hopeful of discovering the "secret formula" that will enable the hair snares to be a useful complement to our camera trap study.

Upon our return from the Osa Peninsula, we visited our different study sites to visit with local partners, replace non-functional cameras, bring supplies, and deploy cameras in new locations. At Chirripó National Park, we worked with park staff to give a series of community presentations to the newly developed community associations that are working to promote conservation and ecotourism in the San Jeronimo and San Gerardo de Rivas communities located along the periphery of the park. Many of the park porters belong to the association and will be helping us to monitor the cameras located in remote locations of the park. We introduced the community to our project, showed them the animals we have documented, and provided training in camera monitoring.

At Tapantí National Park, we hiked with park staff to deploy new cameras on a remote trail that has been little used and occasionally washed out with heavy rains. Although it was a grueling hike, we are now looking forward to documenting new populations of wildlife in this remote region of the park. At the Alexander Skutch Biological Corridor, we worked with local project coordinator Luis Angel Rojas, to conduct interviews with local residents who are knowledgeable about the wildlife present in the area. We were interested in collecting information on the presence of the threatened Neotropical river otters, or nutria. The persons we interviewed were all agriculture workers that observe wildlife while working or fishing. We discovered that all interviewees had seen river otter many times in the past year on four rivers: Rio Peñas Blancas, Rio Peñas Blanquita, Rio Caliente, and Quebrada Chonchos. All of these individuals also indicated that they had seen or heard coyote on a regular basis. Apparently, the coyotes arrived in the area around 10 years ago and their population has been steadily increasing over time. These coyotes are found in the farmland and open spaces but not in the mountains. It is believed that the coyotes arrived around the time white-tailed deer numbers started to increase. We will continue to monitor the coyotes as they may act as native invaders that might compete with the small and medium felid predators already present in the forest ecosystem.

As usual, we divided our time between hiking rugged mountain trails, processing and managing the photos back at camp, and travelling throughout the region to monitor the camera traps and coordinate with our many collaborators. This is a modest means of empowering local communities to conduct their own citizen science and promote community-based conservation. We continue to add to our unique dataset that we hope to publish in the near future. Of course, the team also relaxed in between field work, enjoyed great Tico cooking, and had regular Bible studies in this valley without a church. We thank the Lord for the many opportunities to do good work!

Students Directed by Dawne Page

Kate Draeger (Colorado Springs, CO**), Torrey Halbert (**Glendora, CA**), Joshua Snyder (**Jackson, CA**)** and **Taylor Virtue (**Johannesburg, South Africa**).**

The zebrafish is a promising vertebrate model for the examination of immunity and disease. Compared to rodents, the advantages of zebrafish include their small size, rapid external development, embryonic transparency, high fecundity, low cost of maintenance, a completed genome project, and a high efficiency of producing transgenic animals. Importantly for immunological studies, zebrafish possess all of the blood cell lineages of mammals. Moreover, several transgenic reporter lines have been created to fluorescently label and subsequently track specific populations of blood cells. By combining fluorescent transgenesis with advanced imaging techniques, zebrafish offer unique advantages over other vertebrate models for visualizing the behavior of hematopoietic cells in living animals.

My students and I are specifically exploring B cell development and maturation in zebrafish. B cells secrete antibodies that bind to pathogens and mark them for destruction. Analysis of the DNA sequence of zebrafish predicts that they have two populations of B cells: one that expresses IgM and another that expresses a unique isotype, IgZ, which has been found in other fish, but not in amphibians, birds, reptiles or mammals. Since fish are the most ancient vertebrates with an adaptive immune system, analysis of these B cell populations in zebrafish should produce insights into the evolutionary development of adaptive immunity. Thus, in collaboration with David Traver (UCSD) and Brad Magor (University of Alberta, Canada), we have made transgenic lines in which these B cell populations are marked with fluorescent proteins. In this way, we can both track and manipulate these populations in order to understand how and where the B cells develop in zebrafish and how and where they respond to pathogens.

Kate, Torrey, Joshua and Taylor worked on three projects together: 1) They assessed the immune response in various transgenic zebrafish reporter lines. They tracked the expansion and retraction of IgM+ B cells, IgZ+ B cells, plasma B cells, and activated T cells in response to various types of antigens. 2) They performed qPCR analysis on lymphoid populations that were sorted from the inoculated zebrafish. 3) They examined recovery of IgM+ and IgZ+ B cells after sub-lethal irradiation.

Student Directed by John Rogers '84

Julia Giacopuzi (Cedar Glen, CA)

Julia worked with Dr. John Rogers as a clinical technician for the "Eric Paredes Save a Life Foundation" in San Diego. She performed free cardiac screenings in various local high schools, administering EKGs and recording the results for future reference by physicians.

Students Directed by Bob Wiese '82

Megan Barber (Bothell, WA), **Sarah Levesque (**Oceanside, CA), **Peter Shim** (San Diego, CA), **Erin Smith** (Carlsbad, CA), **Alexander Wicklund** (Bend, OR) and **Esme Zediker** (Los Angeles, CA)

Erin and **Esme** evaluated, catalogued and updated the health and status of the Safari Park conifer and Baja plant collection**. Peter** developed a husbandry manual for the southwestern pond turtle. **Alexander, Sarah** and **Megan** studied the male hierarchy of western lowland gorillas and tufted capuchins through behavioral observations.

2014 Chemistry Summer Research Program

Back row (left to right): Kerry Alcorn, Dr. Matthieu Rouffet, Grant Abass, Joey Montemurro, Juan Carlos Perez, Ryan Robinson, William Schumacher, Kyle Dornhofer, Dr. Laurance Beauvais, Dr. Marc Perry, Dr. Dale Shellhamer, Soni Kay. ***Middle Row (left to right)***: Dr. Ariane Jansma, Natasha Medici, Brittany Thomas, Sara Elwin, Jasmine Myles, Connor Voss, Maddie Mathews, Kelsey Alexander, Christine Licata, Dr. Tracey Schalnat. ***Front Row (left to right)***: Jordan Reader, Jordan Thompson, Matthew Steinhaus, Brent Chicoine. ***Not pictured***: Dr. Ken Martin, Dr. Katherine Maloney.

Students Directed by Laurance Beauvais

Brent Chicoine (Manteca, CA), **Maddie Mathews** (Goleta, CA) and **William Schumacher** (Santee, CA)

My research group focuses on the preparation of new functional solids termed metal-organic frameworks. **Brent** and **Madeleine** investigated the preparation of solids containing SALEN-type ligands. This summer, we will be studying the metal complexes of the solids and investigating their ability to function as oxidation catalysts. In a joint project with Marc Perry, **William** has focused on preparing solids containing N-heterocyclic carbine ligands. This summer, he will study the formation of metal complexes with these solids and their catalytic properties.

Students Directed by Ariane Jansma

Natasha Medici (Boulder, CO) and **Brittany Thomas (**Tahoe, NV**)**

In collaboration with Peter Wright's lab at The Scripps Research Institute, Natasha and Brittany were able to use state of the art 600 MHz and 800 MHz NMR spectrometers to investigate the intermolecular interactions between the oncogenic protein E7 from high risk Human Papillomavirus (HPV) and the TAZ2 domain of the cellular transcription factor CREB Binding Protein (CBP). As part of this project, they used bacteria to recombinantly express and purify both E7 and TAZ2 as well as implement casein II kinase to perform *in vitro* phosphorylation of the E7 peptide. Using a combination of isotope labeling strategies, combined with filtered NOE NMR experiments, they identified specific residues involved in the interface of the complex formed between E7 and TAZ2. We will be finishing this work during the summer of 2015 and hope to include it as part of a publication in a high impact journal.

Students Directed by Katherine Maloney

Jordan Reader (Springville, CA) and **Matthew Steinhaus** (Huntington Beach, CA)

Jordan and **Matt** continued their work on a collaborative project with researchers at the University of California, Riverside. This summer, they developed a significantly more efficient procedure for isolating the natural product, radicinin, from fungal fermentation broths. They also prepared semisynthetic radicinin derivatives with increased water solubility, including a sulfate ester and sodium salt.

Students Directed by Marc Perry

Jasmine Myles (La Mesa, CA), , **Kyle Dornhoffer** (Clovis, CA), **Joey Montemurro** (Glenview, IL) and **Juan Carlos Perez** (Santee, CA)

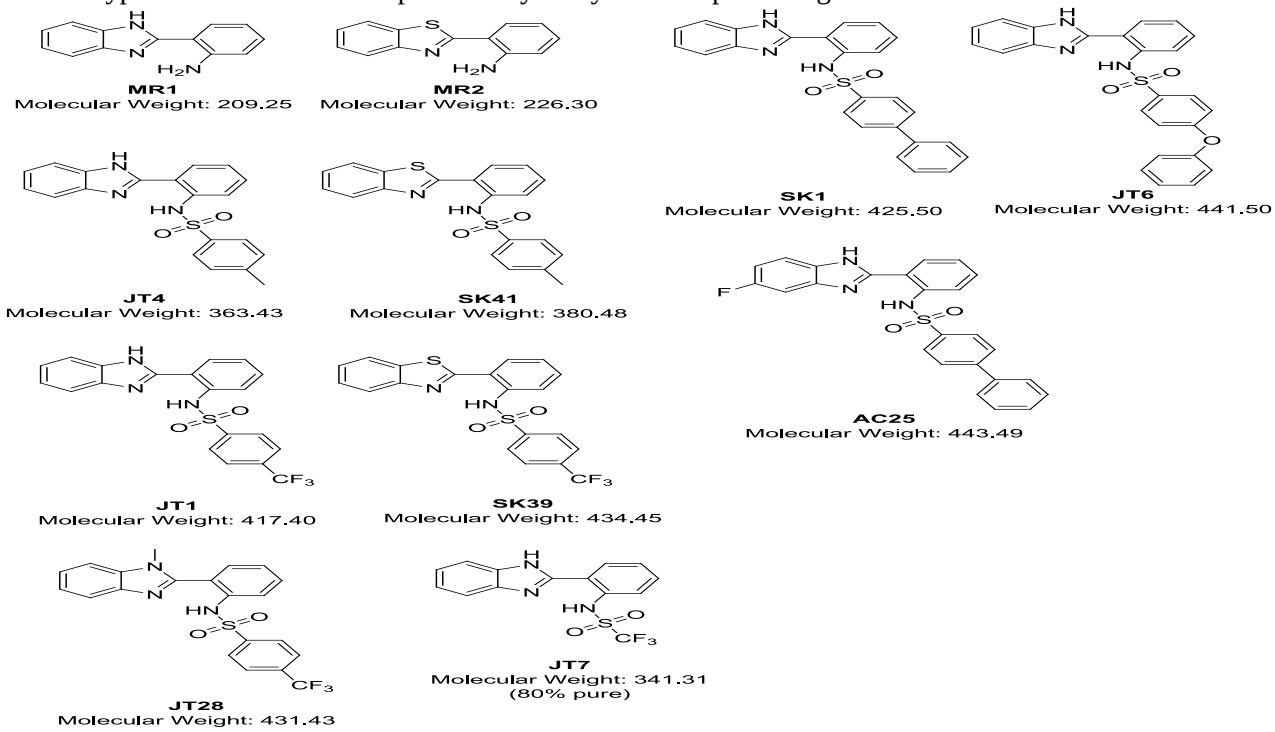
Jasmine worked to develop a Cobalt-catalyzed method for the cross-coupling of alkyl Grignard reagents with aryl bromides. The use of N-heterocyclic carbene ligands and 1,4-dioxane as an additive results in a method equivalent or better than other known methods. Evidence suggests that diorganomagnesium species are involved in the catalytic cycle. **Kyle** worked on the use of isonitrile ligands in the iron-catalyzed cross-coupling of N-aryl chlorides with secondary alkyl Grignard reagents. He specifically worked on electron deficient N-aryl chlorides. **Joey w**orked on a new synthetic procedure for the synthesis of unsymmetrical imidazolium salts which are precursors to N-heterocyclic carbenes. Once synthesized, these will be important to test the steric and electronic properties of the N-heterocyclic carbenes that optimize catalysis. This should allow for the rational design of a very effective ligand. **Carlos** worked with Kyle on the use of isonitrile ligands in the iron-catalyzed cross-coupling of N-aryl chlorides with secondary alkyl Grignard reagents. He specifically worked on electron rich N-aryl chlorides.

Students Directed by Matthieu Rouffet

Jordan Thompson (Medford, OR)**, Catherine Soni Kay** (Lincoln, NE), **Grant Abass** (Murrieta , CA), **Connor Voss** (Riverside, CA) and **Nicholas Wu** (San Diego, CA; a volunteer High school student).

Connor, Grant, Jordan, Soni and **Nicholas** have investigated the synthesis of several Anthrax Lethal Factor inhibitors using a 2-phenylbenzimidazole sulfonamide backbone. While we spent most of our summer synthesizing derivatives of our lead molecule, we have also performed enzymatic assays in partnership with UCSD in order to get *in vitro* IC50 data against lethal factor. More than 25 new inhibitors were synthesized, characterized by NMR and Mass spectroscopy and tested against Lethal Factor. Our ongoing collaboration with the SSGCID (The Seattle Structural Genomics Center for Infectious Disease) has not yet yielded any crystal

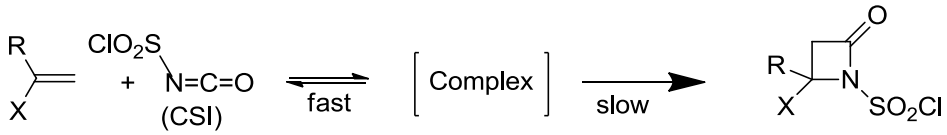
structures, but we remain hopeful. We have started a new collaboration with Dr. Tim Hagen form Northern Illinois University and the SSGCID to target a new metalloenzyme involved in bacterial growth. Our goal is to develop a novel type of antibiotic and the preliminary assay data are promising.



Students Directed by Dale Shellhamer

Kelsey L. Alexander (Placentia, CA), **Sarah L. Elwin** (El Cajon, CA), **Christine J. Licata** (Orange, CA) and **Ryan D. Robinson** (Spring, TX)

Reaction of chlorosulfonyl isocyanate (CSI) with alkenes gives N-chlorosulfonyl-β- lactams that are readily reduced to β-lactams. β-Lactams are useful for the preparation of compounds that function as antibiotics, cholesterol-lowering drugs, and synthons for the preparation of various other molecules. Many drugs and agricultural compounds coming to market have a fluorine atom in the molecule that greatly improves the efficacy of the product. Presently there are no antibiotics in the literature that have a fluorine atom on the β-lactam ring. Fluorine is strongly electron-withdrawing and it reduces the reactivity of the fluoroalkene with CSI.



R= Alkyl or Aryl
X = H or F

Kelsey, Sarah, Christine and **Ryan** completed our study on improving the synthetic utility of this "sluggish electrophile" (CSI) with unreactive alkenes. They found that the efficiency of these reactions is greatly improved at temperatures where the pre-equilibrium favors a complex between CSI and the alkenes. This study was recently accepted for publication in the journal *Synthesis.*

2014 Student Seminar and Poster Presentations (asterisks denote students)

Students Sponsored by Walter Cho

Lindsay Powell*, Nolan Andres*, and Emily French* (Walter Cho). "The genetic connectivity of populations of the brittle star *Ophiocreas spinulosus* in the Gulf of Mexico". Presented as a seminar by Lindsay Powell at the 39th Annual West Coast Biological Sciences Undergraduate Research Conference, Azusa Pacific University, Azusa, CA (April 12, 2014)

Students Sponsored by Dave Cummings and Ryan Botts

Borgogna*, T. R., J.-L. Borgogna*, J. A. Mielke, C. J. Brown, E. M. Top, R. T. Botts, and D. E. Cummings. 2014. "Abundance and diversity of CTX-M extended-spectrum β-lactamases in urban wetlands and associated waste water treatment plants". General Meeting of the American Society for Microbiology, Boston, MA. (poster)

Frye*, William, Ryan Botts, and David Cummings. 2014. "Aminoglycoside resistance plasmids in *Pseudomonas* species isolated from the Tijuana River Estuary". Presented as a seminar by William Frye at the 39th Annual West Coast Biological Sciences Undergraduate Research Conference, Azusa Pacific University, Azusa, CA (April 12, 2014)

Borgogna*, Timothy, Joanna-Lynn Borgogna*, Matthieu Rouffet, Ryan Botts, and David Cummings. 2014. "Detection and Quantification of CTX-M Extended-Spectrum β-lactamases in Urban Wetlands and Associated Waste Water Treatment Plants". Presented as a seminar by Timothy Borgogna at the 39th Annual West Coast Biological Sciences Undergraduate Research Conference, Azusa Pacific University, Azusa, CA (April 12, 2014)

Borgogna*, Joanna-Lynn, Timothy Borgogna*, Lori Carter, Ryan Botts, and David Cummings. 2014. Diversity, abundance, and persistence of antibiotic resistance genes in urban wetlands in San Diego County. Presented as a poster by Joanna Borgogna at the 39th Annual West Coast Biological Sciences Undergraduate Research Conference, Azusa Pacific University, Azusa, CA (April 12, 2014)

Collins*, Brooke, Lori Carter, Ryan Botts, and David Cummings. 2014. The identification and annotation of novel plasmids carrying drug resistance from urban wetlands. presented at the 2014 Honors Scholar Conference at Point Loma Nazarene University, San Diego, CA (April 12, 2014).

Students Sponsored by Mike Dorrell

Barnett, Ashley*, Webb, Mariah*, Peter Westenskow and Michael I. Dorrell. "Towards Identification of the Regulating Factor of the Retinal Vascularization Factor, Eurichamide." Presented as a poster by Ashley Barnett and Mariah Webb at the 39th Annual West Coast Biological Sciences Undergraduate Research Conference, Azusa Pacific University, Azusa, CA (April 12, 2014)

Students Sponsored by Katherine Maloney

Davis, Taylor*, Oscar Alvarado*, Brent Chicoine*, Bethany Okada *, Kim Quach*, Charlie Brayton*, Katherine N. Maloney, and Catherine S. McFadden. "Analysis of secondary metabolites from cryptic species of *Sarcophyton glaucum* suggests a genetic explanation for previously observed variation," presented by Taylor Davis and Oscar Alavardo at the 247th American Chemical Society National Meeting, in Dallas, Texas, March 16, 2014.

Student Sponsored by Michael McConnell

Hannah Quinn* and Michael McConnell (2014). "Evidence for Two O-Polysaccharide Polymerase Enzymes in *Salmonella enterica*, Serovar Strasbourg", Seminar presentation by Hannah Quinn at the 2014 UCSD Summer Undergraduate Research Conference, University of California San Diego, San Diego, CA (August 14, 2014).

Hannah Quinn* and Michael McConnell (2014). "Evidence for Two O-Polysaccharide Polymerase Enzymes in *Salmonella enterica*, Serovar Strasbourg", Seminar presentation by Hannah Quinn at the 2014 Southern California Conferences for Undergraduate Research (SCCUR), Fullerton State University (November 22, 2014).

Student Sponsored by Mike Mooring

Eduardo Alvarez*. "Integrating occupancy modeling and interview data to predict presence of jaguars (*Panthera onca*) and other large mammals in Tapanti National Park, Costa Rica", presented at the 2014 Honors Scholar Conference at Point Loma Nazarene University, San Diego, CA (April 12, 2014).

Students Sponsored by Dawne Page

Megan Calzia*, Jordan Crampton*, Joshua Snyder* and Dawne M. Page. "Study of lymphoid cells and the adaptive immune response using transgenic zebrafish." Presented as a poster at the 39th Annual West Coast Biological Sciences Undergraduate Research Conference, Azusa Pacific University, Azusa, CA (April 12, 2014)

Students Sponsored by Marc Perry

Sanders*, Tyler M. and Perry, Marc C. "Cobalt-Catalyzed hydroarylation of alkenes," presented by Tyler Sanders at the 247th ACS National Meeting, Dallas, TX, March 16-20, 2014.

Student Sponsored by Dale Shellhamer

Smith,* L. B. and Shellhamer, D. F. " Study on the synthetic utility of chlorosulfonyl isocyanate(CSI) reactions with alkenes: Optimizing pre-equilibrium Phenomena by varying temperature," Presented by Lincoln Smith at the 247th National meeting of the American Chemical Society in Dallas, TX, March 16, 2014.

2014 Faculty Seminar/Poster Presentations

Dave Cummings

Cummings, D. E. 2014. "Environmental reservoirs of drug-resistant bacteria". San Diego Zoo Institute for Conservation Research, San Diego, CA. (invited speaker)

Mike Dorrell

Dorrell, Michael I. "The role of DEGS1 in Macular Telangiectasia and Other Ocular Degenerative Diseases". Presented to the LMRI Consortium in San Diego, CA. (March, 2014).

Dorrell, Michael I. "Identification of Genetic Loci and Potential Genes Associated with Macular Telangiectasia". Presented to the MacTel symposia in New York City. (June, 2014).

Dorrell, Michael I. "In Vivo Electroporation of DEGS1 and DEGS1 inhibitors Does Not Result in Neuronal Degeneration". Presented to the LMesRI Consortium in San Diego, CA. (December 2014).

April Maskiewicz

White, J.* and Maskiewicz, A. "Ecospheres! Engaging Students in Energy and Matter Dynamics in Ecosystems". Presented by Josh White at the National Science Teachers Association annual conference – Long Beach, CA. Nov, 2014.

2014 Book and Journal Article Publications (asterisks denote student coauthors)

Robert Elson

Marin B, Pinto RD, Elson RC and Colli E (2014) "Noise, transient dynamics, and the generation of realistic interspike interval variation in square-wave burster neurons". ***Physical Review E*** 90: 042718.

Ariane Jansma

"The High-Risk HPV16 E7 Oncoprotein Mediates Interaction between the Transcriptional Coactivator CBP and the Retinoblastoma Protein pRb", Ariane L. Jansma, Maria A. Martinez-Yamout, Rong Liao, Peiqing Sun, H. Jane Dyson and Peter E. Wright, ***Journal of Molecular Biology***, 2014, 426(24), 4030-4048

Ken Martin

"Effect of 1-Chloropentane on the Energy of Transfer from Naphthalene to 2,6-Dimethylnaphthalene on α-Alumina During Temperature Programmed Desorption", Melissa A. Shew, Rachel J. DeHoog, K.A. Martin, A.M. Nishimura, ***Journal of Undergraduate Chemistry Research***, 2014, 13(3), 45-49.

"Effect of Water on the Laser Induced Excimer Fluorescence Decay of 2-Methylnaphthalene and Naphthalene on α-Alumina During Temperature Programmed Desorption", Melissa A. Shew, Rachel J. DeHoog, K.A. Martin, A.M. Nishimura, ***Journal of Undergraduate Chemistry Research***, 2014, 13(2), 34-39.

April Maskiewicz

White, J.* and Maskiewicz, A. (2014). "Understanding Cellular Respiration in terms of Matter and Energy within Ecosystems." ***American Biology Teacher***, 76(6), 408-414.

Mike Mooring

Li, Z., Beauchamp, G., and Mooring, M.S., 2014. "Relaxed selection for tick-defense grooming in Père David's deer?". ***Biological Conservation*** 178: 12–18.

Mooring, M.S. and Penedo, M.C.T., 2014. "Behavioral versus genetic measures of fitness in bison bulls (*Bison bison*)". ***Journal of Mammalogy*** 95: 913-924.

Research Grants Awarded (or pending)

David Cummings

National Institutes of Health (NIH). "Capture and Characterization of Self-Transmissible Plasmids from Urban Wetlands Encoding Clinically Relevant Antibiotic Resistance Genes." 5/2013 – 4/2016, $237,790. D. E. Cummings, R. T. Botts, and E. M. Top. May 2013-April 2016

Katherine Maloney (PI), and **Co-PIs Dawne Page, Paul Schmelzenback (Physics), Lori Carter (MICS)** and **Maria Zack (MICS)**

"Scholarships to Support STEM majors and Computational Sciences Minors," $576,750, April 2015 – March, 2020, National Science Foundation.

Overview: We propose to build on our STEM community by providing scholarships to academically talented and financially needy STEM students interested in careers and graduate education that combine a STEM discipline with computational science (STEM-CS). The PLNU Computational Science minor was established in 2011 to allow Mathematics or Computer Science students to gain limited knowledge in Biology, Chemistry or Physics to be able to help scientists with their computational needs; and to expose Biology, Chemistry or Physics majors to computational techniques they can use in their field. This popular minor provides a natural cohort of academically-talented STEM students that take classes together and share a common interest. We propose to use this cohort to accomplish the objectives of our S-STEM project:

1) Provide scholarships of $10,000 per year for four years to 14 academically-talented and financially needy students who major in a STEM discipline and minor in Computational Science (S-STEM-CS Scholars). Two cohorts of 7 students will be funded over a five-year period.
2) Increase the number of students with high levels of financial need (>$10,000) in our STEM programs.
3) Improve the retention of students with high financial need (often from under-represented groups and first-generation college students) in our STEM programs.
4) Use existing and new student support structures to ensure success for the students in our cohort at PLNU and beyond.

We anticipate that the S-STEM-CS scholarship will facilitate student enrollment and retention at PLNU as STEM majors by reducing or eliminating two major burdens: student loans and the requirement for students to work 15 hours/week or more while in college. By meeting most or all of these students' financial need and giving them academic and career service support, we hope to graduate them into the STEM workforce or into STEM graduate education.

April Maskiewicz

Co-PI on National Science Foundation RCN-UBE titled: "*Faculty Development Network for Undergraduate Biology"*. Principal Investigator D. Allen, with Co-PIs A. Maskiewicz, K. Sirum, G. Uno & S. Elrod. NSF DBI#1346570, $498,753.00. 2014-2019.

Mike Mooring

1. Zoological Society of San Diego (2014): "Jaguar and other predators of the Talamanca Cordillera, Costa Rica"; $10,000
2. RASP (2014): "GPS and Camera Traps to Study the Large Mammals of the Talamanca Mountains, Costa Rica"; $2000

Matthieu Rouffett

Research Corporation for Advancement of Research (2014-2015). Development of novel Anthrax Lethal Factor inhibitors. ($55,000).

Dale Shellhamer

National Science Foundation-Research at Undergraduate Institutions (NSF-RUI) "Electrophilic Addition of Chlorosulfonyl Isocyanate and Other Electrophiles to Unreactive Fluoro- and Hydrocarbon Alkenes" $ 134,374. (pending).

Other Professional Activities by Faculty Members

Walter Cho

In April and May of 2014, I joined an international group of scientists on the NSF-funded HADES-K research expedition to explore and study the hadal environment (deep-sea trenches, depths of 6,000-11,000 m), specifically the Kermadec Trench in the South Pacific. We used cutting-edge technology to explore these areas, including the Hybrid Remotely Operated Vehicle (HROV) *Nereus*. HROV *Nereus* is a robot that can be controlled from the ship to explore and sample the deep-sea trench environment and it can also operate as an Autonomous Underwater Vehicle (AUV). Unfortunately, HROV *Nereus* was lost at sea due to what was thought to be a pressure housing failure that caused a catastrophic implosion as a result of the great pressure at 10,000 meter depths. Despite this loss, we obtained important samples to help us further our understanding of hadal ecosystems, which are some of the most poorly studied systems on Earth. This expedition was also a unique opportunity for two of my undergraduate research students who accompanied me as they gained excellent field research experience.

David Cummings

In January 2014 I began writing a weekly blog, exploring the connections between faith and the nature, especially as it is understood through outdoor activities like hiking, fishing, camping, etc. In June, the blog was relocated to WordPress at walkwiththerock.wordpress.com.

In March 2014, I taught for one week at SNU's Quetzal Education and Research Center in San Gerardo de Dota, Costa Rica.

Mike Dorrell

1. Off-campus research internships: The number of highly qualified candidates for summer research at PLNU continues to grow, so efforts are being made to help students not chosen for the PLNU program find internship and summer research opportunities elsewhere. For the summer of 2014, Dr. Dorrell helped students find internship positions in the laboratories of Drs. Glen Nemerow and Martin Friedlander at the Scripps Research Institute.

2. Director of research at LMRI: For the past 15 months (from June 2013 through August 2014), I was tasked with helping to start, and then lead, a brand new research institute in La Jolla. This new institute, the Lowy Medical Research Institute (LMRI; www.LMRI.net), was established through the philanthropic donations of the Lowy family for the study of the degenerative eye disease Macular Telangiectasia (MacTel) and other related ocular disorders. Based on my previous work with the MacTel group during my post-doctoral fellowship, which provided the basis for the current clinical trial for MacTel treatment, the group asked if I would help guide the new research institute. For the first few months, I was involved in designing the lab, getting the lab up and

running, and hiring scientists to work in the lab. Then, as the institute got working, I helped guide research involving genomic studies to identify gene candidates that may be associated with this disease, set up numerous assays to study the disease, and coordinated extramural research with several labs around the world who have expertise related to aspects of the disease. I currently spend one day per week at LMRI to continue guiding and consulting with this institution and its scientists.
3. Manuscript reviewer for *Investigative Opthalmology, Visual Science (IOVS)*, *Proceedings of the library of science one (PloS One)*, and *Nature Medicine*.

Ariane Jansma
Throughout this year, I coordinated the purchase, installation and set-up of our high field 400 MHz NMR system. Now that this system is installed and running, I will be in charge of routine maintenance and troubleshooting in support of the Chemistry Department

Katherine Maloney
Reviewer for *Journal of Natural Products;* Member of the American Chemical Society (Division of Organic Chemistry Executive Committee; Chair of Membership Subcommittee); American Society of Pharmacognosy

April Maskiewicz
Administrator of "University NOW". University NOW is a program for under-represented juniors in high school to (a) envision themselves as college students, and (b) successfully complete a university-level integrated biology/writing course. The students come to PLNU three days per week in the afternoon and take a specially designed college level interdisciplinary course in Human Biology & Bioethics (Bio 101) and Writing 99 that extends over two semesters. This year (2014-15) we had 17 students from the AVID program at Point Loma High School attending UNOW.

Dale Shellhamer
Reviewed an article for the Journal of Fluorine Chemistry.

West Coast Biological Sciences Undergraduate Research Conference by Michael McConnell

Research Associates annually helps sponsor PLNU's involvement in the West Coast Biological Sciences Undergraduate Research Conference (WCBSURC). In fact, largely because of Research Associates support, PLNU has now been represented at 33 consecutive WCBSUR Conferences and 36 out of 40, altogether. The 39th Annual WCBSUR Conference was hosted by Azusa Pacific University on April 12, 2014. PLNU sent 19 participants to this Conference (4 faculty and 15 students) and most of the students presented either a poster or a seminar that day (see section entitled "**2014 Student Seminar and Poster Presentations**" for details).

PLNU also continues to be very active as a hosting institution for the WCBSURC. The 40th WCBSURC took place on the PLNU campus on April 25, 2015 and PLNU will also host the 41st Annual WCBSURC on April 9, 2016 (this will be PLNU's 10th time as host institution). Suffice it to say that these hosting efforts raise PLNU's profile in a very positive way. Publicity for the 40th Annual WCBSURC was sent to 15,350 biology and biochemistry faculty at 667 institutions nationwide. The response was outstanding, as a total of 462 attendees representing 67 institutions in 14 states were in attendance, eclipsing the previous high attendance mark for a WCBSUR Conference (the 38th Annual WCBSURC hosted by PLNU in 2013) by about 5%. Alum Weston Bennett '14 captured the day for us on film (http://www.westonbennettphotography.com/wcbsurc). More details regarding the 40th WCBSURC can be obtained at: http://www.pointloma.edu/experience/academics/schools-departments/department-biology/science-education-programs/wcbsurc.

Abundant anecdotal evidence suggests that the major publicity efforts that are made when PLNU hosts the WCBSURC help our students when they apply for acceptance into graduate and professional school programs. Thanks to steady support from Research Associates, PLNU will continue to be a major player in the WCBSUR Conference for many years to come.

Reports on the Annual Meetings of Research Associates by Michael McConnell

Spring Board Meeting (May 9, 2014):

The Board of Directors of Research Associates met for its annual spring dinner meeting on May 9, 2014. The meeting was called to order at 4pm by Board Chair, Brad Oliver ('77). Other Board Members present included Esther Allen ('55), Ron Clagett ('95), Thomas Fitzpatrick ('01), Stuart Graham ('85), Doreene Hyatt ('89), Art Nicolet ('65), Laura Nist ('91) and Jeff Youngren ('05). Also present were Biology and Chemistry Department Faculty Representatives Michael McConnell and Ken Martin, as well as guests Joe Watkins (VP of External Relations), Sheryl Smee (Executive Director of Alumni Relations), Marc Perry (Chemistry Department) and Dave Cummings (Biology Department). Several other Board members participated in the business part of the meeting via telephone; namely, Kelly Gallego ('94), Adam Kanalakan ('04), Nathan Kemalyan ('83), Matt MacGinnis ('05) and Ben Powers ('98).

Ken Martin presented updates on the RA General Fund and annual budget and final decisions were made regarding Endowed Scholarship recipients as well as the juniors who would be awarded the 2014 Molecular Science Awards at the Annual Breakfast in November (these Award decisions were based primarily upon votes cast by the outgoing senior Class of 2014).

Joe Watkins, PLNU's VP of External Relations, gave a presentation on the current status of fund raising for the new Science Complex project. The official Ground Breaking Ceremony had taken place the day before (May 8, 2014) with several RA Board members in attendance and the excitement level was high. Joe announced that although most of the funding had been procured, there was still a strong need to engage more biology and chemistry alumni in the campaign in order to help bridge the remaining 3.69M funding gap (**editor's note: this gap has since shrunk to 2.67M**). Executive Director of Alumni Relations Sheryl Smee also spoke about the fund raising effort to date and how to further increase participation in the Campaign by science and math alumni.

There was discussion about board leadership as well as possible nominees to replace the eight Board Members whose terms would be ending in November, 2014. Rene Bravo agreed to take on the role of Chair effective in January, 2015, and hence, will continue on the Board for an additional two years. Esther Allen, Brad Carter, Brad Oliver and Jeff Youngren also expressed their willingness to continue serving for an additional year in order to help see the Science Campaign through to its conclusion. The Board approved inviting Karisa Archer ('10) to become a new Board member, effective at the November, 2014 Board meeting

Discussion continued over dinner and included an overview of programs supported in 2013-14 by Research Associates, including: 1) the 2014 Science Honors Weekend, 2) the 2014 Summer Research Programs in Biology and Chemistry; and 3) participation by PLNU faculty and students in the American Chemical Society's National Meeting as well as the 39th Annual West Coast Biological Sciences Undergraduate Research Conference, which had been hosted by Azusa Pacific University April 12, 2014.

Annual RA Breakfast and Fall Board Meeting (November 22, 2014):

The Research Associates Annual Breakfast and Fall Board Meeting both took place in First Church's Ellipse Chapel on the Saturday of Homecoming Weekend (November 22, 2014). Well over one hundred persons were in attendance (___ graduating seniors, plus ___ alumni and faculty) and as they enjoyed breakfast, they were able to view a power point presentation that described the 2014 summer research program in great detail. It was a busy morning that in addition to a delicious breakfast, included: 1) introductions of graduating seniors and new faculty members Ariane Jansma and Kris Koudelka by Department Chairs, Sara Choung and Dawne Page; 2) introduction of RA Board Members by Board Chair, Brad Oliver'77; 3) introduction of returning alumni by Dale Shellhamer; 4) recognition of Endowed Scholarship and Molecular Science Award recipients by Brad Oliver; 5) an update by President Brower on the progress being made in funding the new Science Complex, and 6) an appeal by Kirk Milhoan('86) and Rick Bravo('79) for alumni to consider purchasing hoods for the new Science Building.

The major theme of the Breakfast was to honor recently retired Professor Emeritus of Biology, Dr. Darrel Falk for his 25 years of service to PLNU. Alumni Jennifer Cato('94) and Evelin Butler('99) both spoke on Dr. Falk's behalf and a portion of a letter from Becky Miller('95) was also read, after which Dr. Falk spoke for a few minutes about his time at PLNU and what the experience had meant to both him and his family. This part of the program ended with a beautifully delivered, impromptu tribute to Dr. Falk by University Provost, Dr. Kerry Fulcher.

Ken Martin completed the morning by speaking about the importance of Research Associates to the PLNU science program, then closed with prayer, followed by an invitation to all guests to stay on after the Breakfast for a "Mix and Mingle" event in the Patio Area next to the Ellipse.

The Fall Board Meeting took place in the Strawn Conference Room. Chair Brad Oliver('77) called the meeting to order at 10:45am and other members present included Esther Allen('55), Karisa Archer('10), Rick Bravo('79), Ron Clagett('92), Stuart Graham('85), Adam Kanallakan('04), Matt MacGinnis('05), Laura Nist('91) and Randall Skidgel('74). Board members Doreene Hyatt('89), Brad Carter('82), Mark Jameson('92), Nathan Kemalyan('83) and Art Nicolet('65) all participated in the meeting from long distance via telephone. Also present were Faculty Representative Ken Martin, Joe Watkins (VP of External Relations), Dan DeSeagher (Regional Development Director) and Marc Perry (PLNU Chemistry Department).

After brief introductions, the Board received reports on several topics, including: 1) a printed update on the pre-professional program that had been prepared by Sara Choung; 2) a final summary by Ken Martin of the 7/1/13 to 6/31/14 fiscal year plus updates on the funding levels for both the RA General Fund and the RA Endowed Scholarship Fund for 2014-2015 at the midway point; 3) discussion of possible nominees for the Board to replace outgoing Board Members Mark Jameson, Jack Owens and Ben Powers, whose terms were to end on December 31, 2014 (both Mark and Jack indicated a willingness to continue serving on the Board for a 5th year, so only Ben Powers needs to be replaced). The remainder of the meeting time was given over to Joe Watkins and Dan DeSaegher, who first reported on the present status of the Campaign for the Sciences, then led the Board in a discussion about possible approaches for completing the funding effort.

2014 Molecular Science Award Recipients

***Left to Right**:* Christine Licata, Kelsey Alexander, Kyle Dornhofer, Paul Thompson, Kirsten Garbe, Hannah Quinn and Brad Oliver (Chair of Research Associates).

2014 Endowed Scholarship Recipients

Left to Right: William Schumacher, Catherine Kay, Kelsey Alexander, Torrey Halbert, Kate Draeger, Natasha Medici and Brad Oliver (Chair of Research Associates). ***Not Pictured:*** Grant Abass, Dylan Poorboy, Ryan Robinson and Brittany Thomas.

FINANCIAL REPORT (Fiscal Year 2013-2014)

I. ENDOWED SCHOLARSHIP FUND

Description: This fund was created by the action of the RA Board in 1988 to fund scholarships for deserving students in the Biology and/or Chemistry departments. Contributions were solicited from RA member over several years until the fund reached the level of $100,000 in 1995, at which point scholarships began to be awarded. The fund value grows as the result of interest earnings and ongoing contributions by members that are specifically designated for this purpose. Earnings from two years past are used to determine the amount of scholarship money available for dispersal on an annual basis (e.g., the amount of scholarship money awarded for the 2014-15 academic year were determined by the fund value as of July 1, 2013*). Scholarship awardees are recommended in the spring and approved at the May meeting of the board of directors of Research Associates. Overall GPA and the recommendation of science faculty are criteria for these awards. Scholarships can also be awarded out of this fund as a recruiting incentive for incoming freshmen if monies are available and with the RA faculty advisors' recommendation.

**** this method of calculation was officially established by the Board of Research Associates in May 2007***

ENDOWED SCHOLARSHIP FUND (ESF)	Amount
Fund as of July 1, 2002	$129,866
Fund as of July 1, 2003	$122,367
Fund as of July 1, 2004	$145,833
Fund as of July 1, 2005	$151,675
Fund as of July 1, 2006	$170,008
Fund as of July 1, 2007	$192,396
Fund as of July 1, 2008	$180,587
Fund as of July 1, 2009	$143,109
Fund as of July 1, 2010	$162,428
Fund as of July 1, 2011	$183,354
Fund as of July 1, 2012	$186,123

Fund as of July 1, 2013	$191,172
Fund as of July 1, 2014	$205,252

II. RESEARCH ASSOCIATES GENERAL FUND

Description: Funded by annual membership gifts and used to support the ongoing needs of the summer research programs in the Biology and Chemistry departments. These funds also help support recruiting efforts and sending students to professional conferences where they can present the findings of their research. Funds are divided evenly between the two departments.

July 1, 2013 – June 30, 2014	Income	Expenses	Balance
Balance on Hand July 1, 2013			**$325**
Total Gifts (donors plus Advancement Office Support)	$42,090		
Other Income (interest)			
Transfer to RA Scholarship Fund			
Summer Research Support (2013+ Leftover2012 Expenses)		$28,000	
Scholarships (9 Molecular Science Awards @ $475 each)		$4,275	
Recruiting (Science Honors Weekend)		$2,300	
Conferences		$1,389	
Annual Report (Printing & Postage for 1000 mailings)		$4,548	
Fund Raising		$753	
Breakfast Meeting	$966	$1700	
Misc.		$961	
SUM	**$43,056**	**$43,598**	
Balance on Hand June 30, 2014			**-$217**

CURRENT YEAR'S BUDGET (Fiscal Year 2014-2015)

July 1, 2014 to June 30, 2015

INCOME	**Initial Target $40,000**	**Revised Target $43,000**	**Given to Date* $19,297**
EXPENDITURES	**BUDGET**	**FORECAST**	**SPENT**
Recruitment of Students, and Public Relations w/ Medical and Graduate Schools	**$2,000**	**$2,000**	**$2,000**
Outstanding Molecular Science Awards (6 x $550)	**$3,300**	**$3,300**	**$3,300**
Summer Research Program	**$28,000**	**$28,000**	**$28,000**
Research Conference Expenses	**$2,000**	**$2,000**	**$2,000**
Annual Report, Directory, and Mailings	**$3,000**	**$4,500**	**0**
Annual Board Meetings, and Misc	**$1,700**	**$3,000**	**$2,580**
TOTAL	**$40,000**	**$42,800**	**$37,880**

***From July 1, 2014 through June 4, 2015, a total of $19,297 had been given by 47 donors to various RA funds. Institutional Advancement has contributed another $22,500 in order to encourage support for the Science Complex Building Campaign by the Research Associates membership.**