

RESEARCH ASSOCIATES

Annual Report 2013

POINT LOMA NAZARENE UNIVERSITY



POINT LOMA
NAZARENE UNIVERSITY

Research Associates
3900 Lomaland Drive, San Diego, California 92106
Phone (619) 849-2304 Fax (619) 849-2598
mmcconne@pointloma.edu
www.pointloma.edu

forward



Recycled

2013 ANNUAL REPORT TO THE RESEARCH ASSOCIATES OF PLNU

Contents

Greeting from Mr. Brad Oliver, the Chair of Research Associates	1
New Faculty Member, Brandon Sawyer, Joins the Biology Department	2
New Faculty Member, Laurance Beauvais, Joins the Chemistry Department.....	3
Pre-Health Professional Program - 2013	4
Graduate School Acceptances - 2013	5
Science Honors Weekend 2013 Report	5
News from ACS Student Chapter	5
News from Tri Beta.....	6
2013 Summer Research Programs in Biology and Chemistry.....	6-19
Student Seminar and Poster Presentations.....	20-22
Faculty Seminar and Poster Presentations	22-23
2013 Book and Journal Article Publications	23-24
Research Grants Awarded (or in progress)	24-25
Other Professional Activities by the Faculty	25-26
Annual West Coast Biological Sciences Undergraduate Research Conference.....	26-27
Report on the Annual Meetings of Research Associates	27-28
2013 Molecular Science Award Winners.....	29
2013 Endowed Scholarship Winners	29
Financial Report (FY 2012-2013).....	30-31

Greetings from Brad Oliver, '77, Chair of Research Associates



It has been a year of good information, so let's get to it.

- 1. IT'S HAPPENING**, the new science building is finally going to be built. Funding and plans are underway. We need to get the last 4 million dollars, but the board of trustees of the university and Dr. Brower are fully behind this science project. I continue to be amazed by the quality of the science program we have at PLNU. This says a lot about the science faculty and their patience, ability, resourcefulness, perseverance, tenacity, and loyalty. We really do need this new science building.
2. The Research Associates (RA) Annual Breakfast on Homecoming Saturday had a happy problem this year. We had to move to a larger venue, the Ellipse at First Church. This year was one of the largest gatherings that the breakfast has fielded. A highlight was having Dr. Randy Skidgel speak to us....he had received an Alumnus Award in chapel the day before. He aimed his words towards the students, showing them that there were many opportunities for scientists and science students: in other words, MD, RN, and PhD are not the only letters you may have after your name. Scholarships were also awarded, and Dr. Brower gave a state of the science building project presentation.
3. The RA Board met after the breakfast and we had the largest turnout I can remember. I thank all those that spent the time and energy to come. We had a 1st here, too. Art Nicolet and Jeff Youngren arranged to have the board meeting made available by teleconferencing to those who could not make it to SD, so Nathan Kemalyan and Brad Carter were able to listen in and take part from Oregon and Maryland, respectively. Nathan Kemalyan also presented some good goals for RA in a follow up email message he sent to the board (see below). Thank you Art and Jeff for arranging this.
I have to remind myself that the primary goals of Research Associates are to support summer undergraduate research and to provide scholarships for science majors. I have to do this because in the past I felt that we had to push for the science building. The science building is now going to happen, so I don't have to obsess over it anymore. Currently, RA has an annual budget of around \$40,000 and most of this money goes to fund student summer research. The Endowed Scholarship fund is approaching \$200,000 now and several scholarships from its earnings are being given to students each year. Nathan Kemalyan proposed that we should work to raise the annual giving to the General Fund up to \$100,000 per year and to double the size of the Endowed Scholarship fund to \$400,000. I concur....think of what could be done both in the research and student scholarship areas if we could achieve these goals. Please consider, pray, and think about this.

Last year I pledged \$10,000 for the new science building. At the time I did not know where the money was going to come from. I can save up smaller amounts, but that was an amount I couldn't "work" into the budget. Six weeks after I wrote my greeting for the Annual Report, the money was there. I am thankful that I was

challenged to make that pledge and it was a joy to send it in. I do not know what I will do for the current year, but it will be something; maybe a number I cannot even imagine yet. I know that many of you are unable to make a large donation, but I do hope that you will give whatever you can to the science building and to RA.

Jeff Youngren and I started a bidding war to see who could be the first to put the wrecking ball into Boney Hall. We will take all bidders into this "demolition ministry". The bid is \$1,000, step up. BONEY HALL IS GOING DOWN!

New Faculty Member, Brandon Sawyer, Joins the Biology Department



As a proud PLNU alumnus and former visiting professor, I truly consider it an honor to now be a faculty member in both the Biology and Kinesiology Departments. I graduated from PLNU in 2003 with a degree in athletic training. The year after graduating college I spent an exciting year working as an athletic trainer for the San Diego Chargers. My wife and I married in June of 2004, then headed east so that I could study Exercise Physiology at the University of Virginia. After completing my master's in 2006, I spent a year teaching at Fresno State University while also working as an athletic trainer for local high schools and a semi-professional arena-football team. From 2007 – 2010 I worked at PLNU as a visiting professor in Kinesiology as well as serving as the head athletic trainer.

After 3 years of service at PLNU it became evident to me that I should pursue my PhD and move into full-time academic work. Therefore, between 2010 and 2013 I worked on my PhD in Exercise Physiology and Nutrition at Arizona State University. My dissertation research involved an 8-week exercise intervention study, in which I compared the effects of continuous vigorous exercise training with those of high-intensity interval training in obese sedentary adults. We evaluated many cardiovascular disease and Type 2 diabetes risk factors including: endothelial function, 24-hour blood glucose, 24-hour blood pressure, blood lipids, measures of oxidative stress and antioxidant capacity, cell-adhesion molecules, and inflammatory biomarkers. My research experience throughout my studies has focused on the determinants of maximal exercise (maximal oxygen consumption, critical power, and running economy) and the effects of exercise on cardiovascular disease risk factors. I was part of a very productive laboratory during my doctoral work, as evidenced by the 25 poster presentations, 4 first author publications, 1 review article and 1 book chapter I was able to be a part of during that time. My research at PLNU will begin in the summer of 2014 and will be focused on evaluating the effects of different forms of exercise on cardiovascular health in healthy, diseased, and at risk populations.

I am so blessed and honored to work in both the Kinesiology and the Biology Departments at PLNU. I am a passionate educator and I feel extremely lucky to have the opportunity to teach college students about the amazing human body. My wife, Monique Sawyer, is a Psychiatric Nurse Practitioner at Sharp Mesa Vista Hospital in San Diego and she runs an intensive-outpatient program for suicidal and at risk teens. We have two amazing boys, Soren (5) and Christian (8 months).

New Faculty Member, Laurance Beauvais, Joins the Chemistry Department



I'm excited to join the chemistry program and to help continue the long tradition of excellence in undergraduate research at Point Loma Nazarene University! I was born in Houston, TX, and obtained my B.S. in Chemistry from the University of Houston. During my time there, I worked on the synthesis and characterization of high-temperature superconductors, and developed an interest in inorganic and solid state chemistry. Focusing on those topics, I pursued a PhD at UC Berkeley. While at Berkeley, I worked on a range of projects including atom-at-a-time experiments with transactinides, actinide solid state chemistry, and metal-organic frameworks. I became interested in rational synthetic techniques for the design of heterogeneous catalysts, and decided that I needed to learn more about catalysis. Following this dream, I moved to MIT as a postdoctoral fellow, where I studied the mechanism of the enzyme system methane monooxygenase. Finally, after all of these studies, I accepted a tenure-track position at San Diego State University. My research group focused on the synthesis of heterogeneous catalysts inspired by metalloenzymes. In particular, we prepared mimics of lignin peroxidase and studied them with respect to lignin degradation into higher value products. During my time at SDSU, I successfully mentored one PhD student, two MS. students, and seven undergraduates. We published one paper in *Dalton Transactions* and have three manuscripts that are either submitted or in preparation.

At SDSU, I was teaching general chemistry to a lecture hall holding 500 students at a time. I became disenchanted with such a depersonalized environment and was happy to move to a smaller, Christian liberal arts setting where teaching is valued in addition to research.

I met my wife, Miriam Bennett, in graduate school at Berkeley and we were married the summer after she received her PhD. I had drifted away from Christ through my undergraduate years, and she was instrumental in bringing me back to the Light. We have two daughters, Lily and Chloe, who we look forward to putting to work in the lab. I am glad to be working at a place where I can integrate my faith and work, and find strength with fellow believers.

At PLNU, my research projects with students will focus on the preparation of functional materials, especially heterogeneous catalysts. I am working with other members of the department to find collaborative projects that will increase the odds of receiving grants and optimizing student experiences. Students in my lab will receive experience with the synthesis of inorganic compounds and their characterization by various spectroscopic techniques. I was able to bring most of my equipment, including an inert atmosphere glovebox, thermogravimetric analyzer, and UV/vis/NIR spectrometer, from SDSU, so we are well equipped to perform this research. We will be utilizing instruments at SDSU, UCSD, and USD to perform powder and single crystal X-ray diffraction and gas sorption experiments.

Pre-Health Professional Program - 2013

By Sara Choung

The pre-health professions program at PLNU has grown over the years and there are currently 199 students who are declared as pre-health professions students. We had a number of meetings with various speakers during the spring and fall of 2013. This information and more can be found on both our PLNU pre-health website and on the PLNU pre-health advising Facebook page.

<http://www.pointloma.edu/experience/academics/schools-departments/department-chemistry/pre-health-program>
<https://www.facebook.com/PLNUPreHealthAdvising>

During the spring of 2013, 32 students participated in the “sophomore” pre-health interviews and another 28 students were involved in the “junior” pre-health interviews that were conducted by the health professions advisory committee. The current faculty members of the health professions advisory committee are Ryan Botts (Mathematics), Sara Choung (Chemistry), Max Butterfield (Psychology), Catherine Crockett (Mathematics), David Cummings (Biology), Rebecca Flietstra (Biology), Katherine Maloney (Chemistry), Ken Martin (Chemistry), April Maskiewicz (Biology), Kevin Modesto (Social Work), Kendra Oakes Mueller (Psychology), Marc Perry (Chemistry), Matthieu Rouffet (Chemistry), Paul Schmelzenbach (Physics), and Jonathan Trinidad (Sociology).

The Point Loma Pre-Health Student Association was launched in the fall of 2011. The 2013 executive council includes Jordan Crampton (president), Levi Williamson (VP allopathic medicine), Tyler Sanders (VP dentistry), Olivia Honda (VP optometry), Chip LaChat (VP osteopathic medicine), Carolyn Houser (VP veterinary medicine), Nolan Andres (secretary/treasurer) and Paul Thompson (communications director). They have successfully planned and coordinated several meetings and volunteer opportunities.

We are very proud of our graduates who began their studies at various health professions programs in the fall of 2013. 20 of our 25 applicants were accepted during the 2013 application cycle. The following students entered allopathic medical school: Josh Blessing ('13) at Creighton University, Stephen Bravo ('11) at Loma Linda University, Renee Crawford ('13) at University of Louisville, Alex Eller ('13) at Loma Linda University, Amy Henninger ('12) at St. George's University, Kayla Kendric ('12) at Creighton University, Troy Kurz ('12) at Creighton University, Breeelan Matranga ('13) at Creighton University, Tim Merino ('07) at Meharry Medical College, Christina (Sing) Pedro ('05) at Indiana University, and Josh Wathen ('13) at Loma Linda University. Kelly (Pfeil) Mullen ('11) enrolled in osteopathic medical school at Marian University. Mat Delgadillo ('13), Bianca Esparza ('12), Alexis Hernandez ('13), Caitlyn McGue ('13), and Justin Weststeyn ('13) started dental school; Mat and Bianca at Loma Linda University, Alexis at University of the Pacific, Caitlyn at University California San Francisco, and Justin at University of Missouri Kansas City. Jaqui Anderson ('12) began her studies in optometry school at Southern California College of Optometry. Justin Hsu ('13) and Allison Zakaroff ('13) both started pharmacy school; Justin at Butler University and Allison at Loma Linda University. We wish them all the very best as they pursue careers in the health professions.

Graduate School Acceptances - 2013

by Michael McConnell

Several alumni of the PLNU biology and chemistry departments received good news in response to their graduate school application work in 2013. Those entering PhD programs included: James Bonner ('13), Bradly Baer ('13), Amber Gillett ('13), Jacob Milligan ('13) and Andrew Montano ('12). James is studying bioanalytical chemistry at UC Riverside, Bradly is enrolled in the organic chemistry program at Vanderbilt University, Amber is studying inorganic chemistry at UC Irvine, Jacob is studying organic chemistry at UC Irvine, and Andrew is studying molecular biology at Baylor University. We also learned that Maureen (Nikki) Beckley ('08) started a MS program in immunology at the University of the West of England, located in Bristol, United Kingdom, in 2013. This fine group of six 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.

Science Honor's Weekend 2013 Report

A total of 37 high school students attended the PLNU Science Honor's Weekend of February, 2013, 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 37 students, 21 enrolled at PLNU, and all but one has remained a science major. These students are receiving a total of \$290,000 in scholarship support from PLNU.

2013 ACS Student Chapter News

By Sara Choung and Matthieu Rouffet

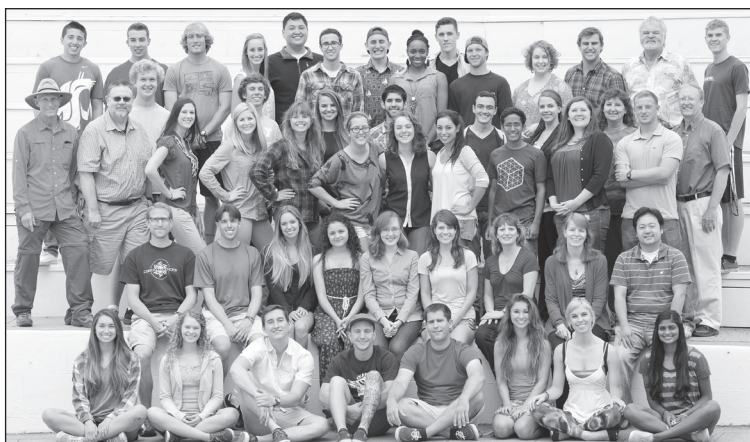
The American Chemical Society Student Chapter at Point Loma Nazarene University (Chemistry Club) has continued to be active throughout the year with a variety of activities including fundraisers, social activities, graduate school and research information sessions, national scientific meeting, and outreach events. Outreach to students in the community included classroom demonstrations for eighth grade students at Wilson Middle School in City Heights. Nine students attended the 245th American Chemical Society National Meeting in New Orleans, Louisiana in April 2013. All of them presented research posters and the club presented a poster about its activities. The club has also hosted various parties throughout the year including an ice cream social, end-of-the-school-year party, and Cider celebration party. The club officers for the 2013-2014 academic year are Taylor Davis (president), Alex Carlson (vice president), Oscar Alvarado (secretary), Tyler Sanders (treasurer), and Soni Kay (publicity/public relations). We are very excited that Dr. Matthieu Rouffet is now the faculty advisor of the club, after he and Dr. Sara Choung were co-advisors. The chemistry club has helped foster deeper relationships and a sense of community between our students and helped students get more involved with the Chemistry department.

2013 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 created to inform younger students of the research opportunities available here at PLNU. This past year, Tri-beta initiated a seminar series to 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. Finally, Tri-beta continues to provide a social network for biology students, with an annual Christmas party at Dr. Dorrell's house and a spring party at Dr. McConnell's, along with various smaller gatherings on campus throughout the year.

2013 Biology Summer Research Program



Front Row(left to right): Michal Hoenecke , Joy Walters, Jordan Crampton, Jonathan (JP) Piazza, Josh Snyder, Holly Keating, Joelle Soch, Preethika Venugopal. **Second Row:** Dr. Dave Cummings, Dr. Mike Dorrell, Mary Ella Wood, Tania Montenegro, Hannah Quinn, Joanna Borgogna (Fregoso), Prof. Kerri Sevenbergen, Dr. Dawne Page, Dr. Walter Cho. **Third Row:** Dr. Mike Mooring, Dr. Rob Elson, William Schumacher, Dawn Goral, Brooke Apffel (Collins), Grant Abass, Blair Riddle, Megan Calzia, Jill Mason, Nathan Keys, Kirsten Garbe, Maika Adair, Adam Donason, Ravi Smith, Megan Barber, Lindsay Powell, Mrs. LeAnne Elizondo, George Moorehead, Dr. Bob Wiese. **Back Row:** Michael Guerrero, Paul Thompson, William Frye, Ashley Barnett, Eduardo (Po) Alvarez, Zack Sedillo, Nolan Andres, Chloe Soremekun, Paul Malherbe, Tim Borgogna, Emily (Mere) French, Alex Wicklund, Dr. Michael McConnell, Mitchell Prins. **Not Shown:** Dr. Brad Carter, Ryan Echols, Carolyn Houser, Dr. John Rogers, Maritza Vick, Mariah Webb.

Students (Graduate) Directed by Dianne Anderson

Patricia Evans (San Diego, CA), **Casey Vogel** (Solana Beach, CA), **Susan Phelps** (Aliso Viejo, CA), **Jessica Pimental** (San Diego, CA), **Matthew Nasont** (Covina, CA) and **Paul Ruiz** (San Diego, CA)

The Conceptual Inventory of Natural Selection was originally designed for use with college and advanced high school students. **Pattie** worked with me to create a new version valid for use with middle school students. The revision included simplification of sentence structure as well as the use of more basic vocabulary without changing the biological meaning of the questions or answers. Pattie interviewed students to determine how well they understood the questions, and also collected and analyzed classroom data from more than 200 students. We submitted a related manuscript to The American Biology Teacher, and are currently working on requested revisions before resubmission for publication. The test now allows teachers and researchers to assess the understanding of this central biological concept in students from middle school through college.

Casey investigated the relationship between middle school students' understanding of scaling (ability to estimate the relative size of microscopic objects such as atoms, cells, and molecules) and the students' abilities to explain the process of protein synthesis. Her work involved both interviews with students, as well as the collection of classroom data generated by several class sections of students. Casey's research demonstrated that instruction in scaling is correlated with increased student understanding of the relationship between atoms and cells as well as the process of protein synthesis. A related manuscript is currently under preparation for submission to the American Biology Teacher.

Susan, Jessica, Matthew, and Paul are working 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

Maritza Vick (Arroyo Grande, CA) worked with Dr. Brad Carter, M.D., Director of the Alvin and Lois Lapidus Cancer Institute at Sinai Hospital in Baltimore, Maryland. Mitzy studied a hormone called human chorionic gonadotropin (HCG), testing to see if it could increase the apoptotic index of three different breast cancer cell lines. (SK-BR3, T47D, and MDA-MB-231.)

Students Directed by Walter Cho

Nolan Andres (Rancho Cucamonga, CA), **Emily Mere French** (Oro Valley, AZ) and **Lindsay Powell** (Vista, CA)

Research in the Cho lab focuses on the study of the biodiversity, biogeography, and population connectivity of marine communities. We are studying patterns of the distribution of marine fauna and investigating the different biotic and abiotic factors that may be responsible for creating and maintaining such patterns. We are currently focusing on the invertebrate associates of deep-sea corals using a variety of molecular and ecological tools to study the ecology of these communities.

All three students worked together collecting data for multiple projects during summer, 2013. We studied patterns of population connectivity based on the species composition of deep-sea coral communities in the Gulf of Mexico. Collectively, Mere, Lindsay, and Nolan reviewed 229 hours of underwater video footage collected with the ROV Jason II during the LOPHELIA II research cruise in 2010. They sampled 1,547 images representing 207 distinct coral communities from across the Gulf of Mexico covering a depth range of 250-2,400 m. Mere was primarily focused on analyzing this coral community data collected from the video and discovered statistically significant patterns in the distribution of these coral communities. She found distinct assemblages of invertebrate coral associates structured by depth, local and broad geography, and coral morphology. She also characterized significant differences in the diversity of the invertebrates associated with deep-sea corals based on geography and depth. In addition, Mere was able to review previously collected images from the LOPHELIA II research cruise in 2009 and was able to find 7 coral communities imaged and observed during both cruises. This overlap in coverage allows us to compare the exact same coral communities from both before and after the BP Deepwater Horizon oil spill that occurred in 2010 and characterize any changes that may have resulted from the oil spill.

We also studied patterns of population connectivity using molecular tools. All three students worked together on both a molecular systematic and population genetic study of brittle star species associated with deep-sea corals in the Gulf of Mexico. Nolan, Lindsay, and Mere extracted DNA from preserved samples of brittle stars collected from the Gulf of Mexico over multiple research cruises and sequenced the mitochondrial 16S gene from 98 individuals and the mitochondrial COI gene from 84 individuals. Lindsay studied the genetic diversity of coral-associated brittle stars in the Gulf of Mexico using the mitochondrial 16S gene and through a series of phylogenetic analyses, found 6 potential species and further evidence of cryptic speciation previously documented in brittle stars. Further studies using different molecular markers may help to further characterize the evolutionary relationships that exist between these different brittle star species. Nolan focused on studying the gene flow of one particular species of brittle star, *Asteroschema* sp. 1, using both the 16S and COI mitochondrial genetic markers. Using a variety of phylogenetic and population genetic analyses he found evidence of high levels of gene flow connecting the populations of this species in the Gulf of Mexico. However, some analyses also showed slight genetic structure within local geographical scales (on the scale of kilometers versus hundreds of kilometers) and also possible isolation by distance, indicating that populations of this particular species may be dispersing according to a stepping stone model of dispersal. In future studies, we hope to clarify these results by increasing the sample sizes representing the different populations, increasing the geographical resolution in defining populations, and also using more sensitive molecular markers. Lindsay is continuing her work on these projects in the Spring 2014 semester.

Students Directed by David Cummings

Kristen Petersen (San Diego, CA), **Tim Borgogna** (San Diego, CA), **Brooke (Collins) Apfel** (Escondido, CA), **Michal Hoenecke** (Huntington Beach, CA), **Ryan Echols** (Arroyo Grande, CA), **Will Frye** (Clovis, CA), and **Joy Walters** (Oceanside, CA)

In the summer of 2013, the Cummings lab collaborated closely with Dr. Ryan Botts in PLNU's MICS Department and with Dr. Eva Top at the University

of Idaho to study the release of antibiotic resistance plasmids from the watershed into the Tijuana River Estuary through storm water. These plasmids are responsible for making bacteria resistant to the drugs we typically use to combat them and represent a significant public health threat. Seven students worked full-time on this project in the summer of 2013: **Kristen Petersen, Tim Borgogna, Brooke (Collins) Apfel, Michal Hoenecke, Ryan Echols, Will Frye, and Joy Walters**. An eighth student, **Joanna (Fregoso) Borgogna**, while officially working in Dr. Rob Elson's lab, worked on this project part time on evenings and weekends. Four of these students continued their work as honors projects: Tim and Joanna Borgogna, Kristen Petersen, and Will Frye. As part of the training, Drs. Cummings and Botts travelled with Tim and Joanna Borgogna to the University of Idaho for a week of training. In 2013, we made considerable progress in our attempts to understand the pool of resistance genes mingling with the native bacteria of the Tijuana River Estuary.

Students Directed by Mike Dorrell

Zachary Sedillo (Capistrano Beach, CA), **Dawn Goral** (Redlands, CA), **Paul Thompson** (Gold Canyon, AZ), **Ashley Barnett** (Visalia, CA) and **Grant Abass** (Murrieta, CA).

Zachary Sedillo, Dawn Goral, Paul Thompson, Grant Abass and Ashley Barnett all worked together on three main projects in the Dorrell lab. The students continued to systematically test different combinations of angiostatics using the chick chorioallantoic membrane (CAM) model in order to identify novel combinations that confer synergistic activity when used in combination. These drug combinations will be useful to block blood vessel growth (angiogenesis) into glioblastoma tumors, thus "starving" the tumor and preventing tumor growth in a manner that isn't accompanied by the side effects associated with classical chemotherapy. **Jack Rusing** (Prescott, AZ) continued this work during the academic year as part of an Honors Project with **Zachary Sedillo**, as they worked to identify antibodies that target tumor associated macrophages (TAMS). TAMS are immune cells that have potential to eliminate foreign, contaminating cells, or dead or unhealthy cells. However, these cells have essentially been hijacked by the tumor microenvironment and activated towards tissue growth and tumor-promoting, rather than tumor-eliminating, activities. If cell-surface markers that are specific to the TAMS can be identified, then antibodies against these markers can be used to mediate ADEP (antibody dependent enzyme pro-drug) therapy, whereby enzymes that activate a pro-drug to an active drug version can be delivered specifically to the tumor using TAM-specific antibodies. This would allow the pro-drug (non-active version) to be administered systemically, while the active chemotherapy version of the drug would only be established by the enzymes localized to the tumor. Students preliminarily identified two markers of interest that will be further studied towards this goal. Finally, students also began studying the chemical mechanism by which the tumor microenvironment activates TAMS towards a tumor promoting (rather than tumor eliminating) status. Better understanding of this mechanism can lead towards better control of the tumor microenvironment and better prognosis for patients.

Students Directed by Mike Dorrell in collaboration with faculty at The Scripps Research Institute (La Jolla, Calif.)

Carolyn Houser (Litchfield Park, AZ) worked in the Nemerow laboratory at TSRI, studying the use of adenovirus for viral based gene therapy applications. Carolyn 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.

Mariah Webb (Big Bear City, CA) 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. As their Honor's Project, Mariah and Ashely Barnett continued to work together on this project during the 2013-14 academic year.

Students Directed by Robert Elson

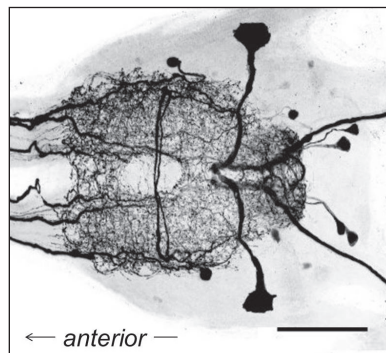
Adam Donason (Murrieta, CA), **Joanna L. Fregoso** (Chula Vista, CA), **Ravi J. Smith** (Berthoud, CO), and **Joelle R. Soch** (Nevada City, CA)

During post-embryonic, metamorphic development of the mealworm, *Zophobas morio* (Coleoptera: Tenebrioninae; a basal order of holometabolous insects), the pattern of motor and interneurons expressing serotonin-like immunoreactivity (SLI) changes within the terminal abdominal ganglion, a neural center involved in the control of digestive and reproductive organs.

In this accessible model system, **Joanna, Ravi, and Joelle** collaborated with Rob Elson in tracking the normal time-course of changes in SLI and its sensitivity to exogenous doses of the pesticide pyriproxyfen, a juvenile hormone analog (JHA).

We were able to build on the previous summer's work to show that developmental changes in the number and types of neurons expressing SLI begin in the prepupal phase of the last larval instar and are largely complete late in the pupal stage (when the adult is ready to emerge). The number and type of neurons developing or losing the serotonin phenotype is now established. With the addition of some further repetitions and some control experiments, this story should soon be ready for publication. Some of these neuronal changes are affected by manipulation of developmental hormones, and this remains an area for future research. Adam's project was complementary. Working in the same system, he revealed dopamine expression.

The picture shows a typical confocal image of neurons, stained by immunocytochemistry for the presence of the neurotransmitter serotonin, in the terminal abdominal ganglion of the beetle, Zophobas. Scale bar: 50 micrometers. Unipolar cell bodies of neurons occupy places at the edge of the ganglion; each sends a single process into the ganglionic core, where it produces a characteristic branching pattern of dendrites; each then sends an axon running out of the ganglion in a particular nerve.



Students Directed by April Maskiewicz

Kelsey Alexander (Placentia, CA) September 2012 through May 2013, **Josh White** (Graduate Student, January 2013 through October 2013) and **Elizabeth Ferguson** (Graduate Student, January 2013 to present).

Conducting and Qualitatively Analyzing Student Responses to Ecology Diagnostic Question Clusters.

Kelsey collected and analyzed data to validate a diagnostic question cluster that measures students' principled-reasoning in ecology. This project is a collaborative project with the University of Michigan. Kelsey conducted 10 one-on-one interviews with freshman to senior level students, transcribed much of the interview data, and then analyzed the findings.

Josh applied a design-based research approach to create and implement a data-rich problem (DRP) task intended to improve student achievement in understanding cellular respiration at the ecosystem level; an identified area of difficulty and an area of focus in the Next Generation Science Standards covering Matter and Energy in Organisms and Ecosystems in High School Life Science. Results suggest that students from the experimental class showed significant quantitative gains on posttest items focused on cellular respiration; whereas students from the control class showed no significant quantitative gains in performance on cellular respiration items.

Liz evaluated undergraduate biology students' understanding and use of a computer-based graphing tool commonly found in science industries (SigmaPlot) and compared it to students' use of and preference for Excel. She wants to determine if students are more likely to choose a professional computer-based program in place of a rudimentary graphing program when asked to graph data.

Students Directed by Michael McConnell

Maika Adair (San Diego, CA), **Kirsten Garbe** (Ventura, CA), **Sean Heavey** (San Diego, CA), **Nathan Keys** (Rancho Cucamonga, CA), **Jill Mason** (Bakersfield, CA), **Hannah Quinn** (San Diego, CA) and **William Schumacher** (Santee, 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, 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-polysaccharide 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-polysaccharide 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-polysaccharide. Although the structure of *S. anatum* O-polysaccharide was 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 this biosynthetic machinery was taken in the summer of 2009 when PLNU students Courtney Hall ('10) and Anthony Montano ('10) both successfully used the gene knockout procedure developed by Barry Wanner and Kirill Datsenko at Purdue University (PNAS 97, 6640-6645, 2000) to knock out *Salmonella anatum* genes *res1* and *rfaD*, respectively. Their success was possible in part because the J. Craig Venter Institute had recently published a partial genomic sequence for *Salmonella weltevreden*, another Group E1 organism so closely-related to *S. anatum* that its gene sequences can be used to design knockout PCR primers that are effective against *S. anatum* genes. Since those early successes four summers ago, McConnell researchers have managed to "knock out" 21 additional bacterial or phage genes involved in O-polysaccharide biosynthesis/conversion; namely, *Salmonella anatum* genes *rfaL*, *rfaK*, *rfaB*, *rfaG*, *Orf9.6*, *Orf17.4*, *wbaO*, *wbaN*, *wbaP*, *manC* and *hsdR* (*hsdR* codes for the major restriction endonuclease of *S. anatum* and its successful removal by deletion mutagenesis means that we now have an *S. anatum* strain that is easier to manipulate through the addition of exogenous DNA molecules); *Salmonella strasbourg* genes *Tyv* and *ddhB*; *Salmonella typhimurium* gene *ddhB*; phage E15 genes *21*, *22*, *28* and *46*, and finally, phage g341c genes *15*, *16* and *23*. The role normally played by each deleted gene's protein product with regard to O-polysaccharide biosynthesis is determined by using a variety of experimental approaches to characterize the mutated bacterium's phenotype, including its phage sensitivity pattern (measured both by plaque formation and by adsorption of purified, radioactive phage particles), its ability to remain suspended in liquid medium at low temperatures (i.e. cold solubility), its reactivity in ELISA assays involving antibodies directed against different types of O-PS structures, and the mobility pattern generated by its purified LPS molecules during polyacrylamide gel electrophoresis. So far, most of the deletion mutants have displayed phenotypes that were in line with our expectations, but there have also been major surprises along the way, including some that have yet to be explained. We remain resilient and determined, though, and hopefully, we will one day have a clear understanding, not only of the normal process of O-polysaccharide biosynthesis in Group E1 *Salmonella* bacteria, but also, of the ways in which various phages are able to modify that process, resulting in the production of novel O-polysaccharide structures.

Students Directed by Mike Mooring and Involved in Costa Rica Research

Jonathan Piazza (New Egypt, NJ), **Eduardo Alvarez** (Ivanhoe, CA), **Mitchell Prins** (Calimesa, CA), **Michael Guerrero** (Los Angeles, CA) and **Paul Malherbe** (Temecula, CA)

"Mammalian Predators and Prey of the Talamanca Cordillera, Costa Rica" The Talamanca mountain range is the largest block of protected montane forest in Costa Rica and is inhabited by populations of elusive mammalian predators (e.g., jaguar, puma, oncilla) and their prey (e.g., Baird's tapir, brocket deer, collared peccary). Illegal hunting activities in this region are escalating, putting at risk many of these large mammals. Few mammal surveys have been conducted in this vast region, creating a significant gap in our understanding of montane populations. In particular, there is an urgent need to assess the altitudinal distribution, relative abundance, and activity budgets of the large, charismatic mammals in the high

elevation cloud forest zone. Starting in 2010, we initiated the first long-term camera trap surveys of mammals in several key areas, including 3 national parks, 5 private reserves, and 3 buffer zones. In collaboration with local partners, we monitor a network of about 80 motion sensor 'camera traps', with scent stations erected at all camera stations to encourage animals to investigate and thus obtain higher quality photos. The camera trap surveys are augmented by fecal genetic analysis of scat collected from the trails and identified to species by the Conservation Genetics Lab at the University of Costa Rica and the American Museum of Natural History using mtDNA markers. With these tools, we are starting to unravel the conservation status of the large mammals of this Neotropical cloud forest ecosystem.

We have now conducted four years of Neotropical mammal research, based at Southern Nazarene University's QERC field station in the upper Savegre River watershed. During this past year of 2013, we continued to expand our camera trap network, relocated many cameras to more remote locations, expanded our relationships with local collaborators, and introduced a new technique for surveying large mammal diversity with an interview project. New camera trap arrays were deployed in two private wildlife reserves in the buffer zone along the northern border of Tapanti National Park: La Marta Wildlife Refuge and El Copal Reserve in Pejibaye. These cameras have already returned valuable information on the presence of ocelote, puma, and jaguar in this region close to human communities. Some camera stations originally deployed along gravel roads in the park were relocated to the more remote Esperanza Transect Trail, and this has resulted in new sightings of tapir and puma. In Chirripó National Park, we relocated over half of the cameras to more remote locations along the El Uran alternative route and the southern border of the park near San Jerónimo, resulting in our first photo of jaguar in the park. Our team partnered with Tapanti National Park and Panthera to conduct an interview project aimed at amassing additional data on jaguar and other wildlife by enlisting the knowledge of local residents of Pejibaye, including hunters. These data are currently being examined using occupancy analysis for an Honors project by Eduardo Alvarez, paving the way for future interview projects. Finally, we conducted community meetings in Pejibaye, Savegre Valley, and Quizarrá in the Alexander Skutch Biological Corridor (ASBC) to present our survey results. Despite the vandalism of several of our cameras and ongoing illegal hunting activities in ASBC, community members were galvanized to take conservation action when we presented our findings showing the large mammal species now present (e.g., puma, ocelot) in their back yard.

The team spent countless hours hiking rugged mountain trails under physically demanding conditions, and upon returning to the field station spent many more hours processing and entering photos into our Camera Base database software. As always, we travelled long distances in order to access our camera traps and to meet and coordinate with our many collaborators. This is in keeping with our goal of empowering local conservationists to conduct their own citizen science and thus promote community-based conservation programs. We do this while continuing to collect a unique dataset that will contribute to Neotropical ecology and conservation science. In addition to our intense work schedule, the team also relaxed, worked out, played soccer, ate great meals, and met for worship and study of God's Word on Sundays. As always, we desire for this work to benefit the animals, ecosystems, and people of Costa Rica, and to give glory and honor to the Lord Jesus.

Students Directed by Dawne Page

Megan Calzia (Burney, CA), **Jordan Crampton** (Bullhead City, AZ), **Joshua Snyder** (Jackson, CA), **Tania Montenegro** (San Diego, CA) and **Mary Ella Wood** (San Diego, CA)

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.

Jordan Crampton, Joshua Snyder, Tania Montenegro, and Mary Ella Wood 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. **Megan Calzia** examined recovery of B cell populations after sub-lethal irradiation. **Jordan Crampton** is using a PCR-based assay to detect early DNA rearrangement of the immunoglobulin genes in developing B cells as a Senior Honor's Project.

Student Directed by John Rogers '84

Blair Riddle (Spokane, WA) 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

Holly Keating (Oceanside, CA), **George Moorehead** (San Diego, CA), **Preethika Venugopal** (Cerritos, CA), **Alexander Wicklund** (Bend, OR) and **Megan Barber** (Bothell, WA)

Holly Keating assisted the Curator of Reptiles in the data entry and analysis of more than 6,500 historical specimen records. These paper records contained a wealth of information about the first reptile and amphibian specimens collected and displayed at the San Diego Zoo during the first half of the 20th Century. This

important data on acquisition, disposition, feeding and breeding history, interesting morphology, and longevity, however could not be analyzed until it was entered into an appropriate data management system. A poster was created that focused on early amphibians, marine reptile specimens the Zoo attempted to keep, disposition history and collections where specimens were deposited after the SDZ, the first captive breeding, and the very first reptiles that came to the Zoo in 1926. These historical records had been left untouched for many years, and it was important to organize and present this early history as the San Diego Zoo approaches its centennial year in 2016.

George Moorehead worked closely with Greg Vicino, the Animal Welfare Manager at the San Diego Zoo, to study and possibly eliminate a stereotypic pacing behavior exhibited by a geriatric Manchurian brown bear named Blackie. The project had three overarching goals. (1) Determine the reason/motivation behind the stereotypic behavior. (2) Acquire baseline data of all the behaviors exhibited by the bear during the "pacing season" as a reference to test the effectiveness of future enrichment programs. (3) Test the efficacy of an automated feeder at increasing the time Blackie spends foraging and possibly mitigating his stereotypic pacing.

The pacing exhibited by this bear only happens a couple months out of the year and these times correlate with brown bear mating season. Pending fecal tests, which may show an increase in testosterone in correlation to the beginning of pacing season, it was concluded the stereotypic pacing is due to mating urges. The theory is that, because a male brown bear in the wild would spend time during the breeding season searching out female bears, the pacing is how he exhibits those natural instincts in a zoo environment.

An automated feeder was used as an enrichment device with the hopes of extending the amount of time Blackie spends foraging (a natural and very common bear behavior) and possibly decreasing the time spent pacing. A test using the feeder to quantify the possible increase in time spent foraging showed a fivefold increase during times using the feeder. This shows the use of an automated feeder (that can be set to dispense food at preset or random times) can have a dramatic effect on the amount of time a bear spends actively searching out and ingesting food, and it shows promise of being a new tool for the keepers to utilize in order to elicit natural bear behaviors.

Preethika Venugopal studied the spatial utilization of their exhibit by rainbow lorikeets at the San Diego Zoo Safari Park to determine how to create an exhibit that ensures the maximum time for each guest-lorikeet interaction. One goal of the exhibit is to ensure guests enjoy their experience enough to come back and visit the exhibit each time. This study produced data showing which areas of the exhibit are used most and which areas are used the least. Preethika's research was performed using time sheets. She recorded the natural behavior of the rainbow lorikeets, sampling fifteen minutes out of every hour in the day for each bird. This allowed us to determine that trees are used the most and for the longest periods of time, with mesh, railing and guests coming in 2nd, 3rd and 4th, respectively. In addition, Preethika conducted a hand-washing study in the lorikeet exhibit, comparing it with studies done at the Petting Kraal and Lemur Walk. These three exhibits together recognized areas of different extremes in terms of the animal-guest physical interaction. With this information, she was able to prove that any animal-related disease most likely did not originate from any of these exhibits because of good hand hygiene practices that are promoted by the Safari Park.

Alex Wicklund and Megan Barber studied the male hierarchy of western lowland gorillas (*Gorilla gorilla gorilla*) and tufted capuchins (*Cebus apella apella*) through behavioral observations. Through the capuchin observations, they saw a clear correlation between rank and the amount of time spent with females. There were also higher patterns of aggression between the highest and lowest ranking males. In the gorilla troops, they looked at the overall behavior of each male in the zoo's population. These behaviors included: where in the exhibit they spent their time, how they spent their time, and with whom they spent their time. They were also looking at a silverback's (Paul Donn) behavior before and after the removal of a female (Azizi) from the zoo's "breeding troop." There were also observations of an introduction of a silverback male (Maka) with his younger brother (Ekuba) to see how they behave while spending time together.

2012 Chemistry Summer Research Program



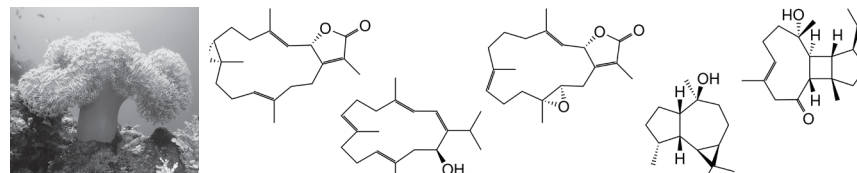
Front row (left to right): Jordan Thompson, Brent Chicoine, Tyler Sanders, Jordan Reader, Oscar Alvarado. **Middle Row (left to right):** Dr. Marc Perry, Soni Kay, Dr. Katherine Maloney, Dr. Dale Shellhamer, Taylor Davis, Dr. Tracey Schalnatt, Jasmine Myles, Christine Licata, Kelsey Alexander. **Back row (left to right):** Kerry Alcorn, Dr. Vic Heasley, Joey Montemurro, Kyle Dornhofer, Lincoln Smith, Alex Carlson, Ryan Robinson, Matthew Steinhaus, Dr. Matthieu Rouffet. **Not Pictured:** Dr. Ken Martin and Marcus Anthony.

Students Directed by Katherine Maloney

Oscar Alvarado (Norwalk, CA), **Brent Chicoine** (Manteca, CA), **Taylor Davis** (Castlerock, CO), **Jordan Reader** (Springville, CA), and **Matthew Steinhaus** (Huntington Beach, CA)

Brent joined **Oscar** and **Taylor** in their project examining secondary metabolite profiles of soft corals belonging to the genus *Sarcophyton*. This summer their focus shifted from extractions and chemical profiles of individual corals, to the isolation of major metabolites in last summer's extracts using high-performance liquid chromatography (HPLC). Chemical structures of these major metabolites were

determined using liquid chromatography-mass spectrometry (LCMS) and both 1- and 2-dimensional nuclear magnetic resonance (NMR) spectroscopy.



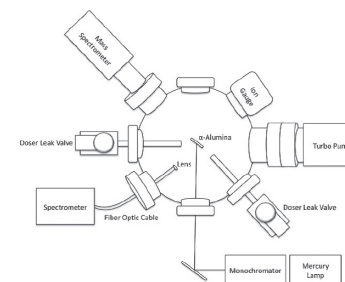
Left: A colony of *Sarcophyton glaucum* photographed on the reef in Palau. Right: Representative molecules from *Sarcophyton*.

Jordan and **Matt** worked on a collaborative project with researchers at the University of California, Riverside. This summer, they optimized an isolation procedure for the fungal natural product radicinin, and tested the radicinin for the ability to protect grapevines from Pierce's Disease in greenhouse studies.

Student Directed by Ken Martin

Marcus Anthony (Lake Oswego, OR)

Marcus joined the group this year as we continued our investigations of solid state phase transitions in naphthalene and substituted naphthalenes. Marcus's project involved measuring the laser induced fluorescence (LIF) decay times for naphthalene, 1-, and 2-substituted naphthalenes as they interact with each other and with separately deposited adlayers of various alcohols. Fluorescence decay times in the order of 3×10^{-7} s to 3×10^{-8} s were measured in order to gain insight into the various solid state phase transitions these materials undergo as the temperature is increased to the point of causing the molecules to desorb from the surface. As in past years, the substituted naphthalene compounds were deposited as thin films, in some cases only a few hundred monolayers thick, on a cryogenically cooled Al_2O_3 (0001) crystal, in an ultra high vacuum (UHV) chamber (see figure below). When irradiated with UV or Nd:YAG laser light, these naphthalene compounds form excimers (excited state dimers). By monitoring the fluorescence emission and the LIF decay lifetimes, we are able to observe the changing interactions between the naphthalene compounds and the various types of aliphatic alcohols. As the temperature was increased, an irreversible transition from one stable excimeric form to another was observed. These transitions are reversible in neat naphthalene samples. After computer analysis, these observations give insight into the physical transformations that occur in the elementary processes that take place as crystals undergo phase transitions prior to desorption from an inert surface. The studies have been written up and are now published as articles in peer reviewed journals. The work was conducted at Westmont College under the joint direction of Ken Martin and Dr. Allan Nishimura. As usual, Marcus and Dr. Martin spent ten weeks of their summer in Santa Barbara working on this research project.



Students Directed by Marc Perry

Jasmine Myles (La Mesa, CA), **Tyler Sanders** (Gardner, CO), **Kyle Dornhoffer** (Clovis, CA) and **Joey Montemurro** (Glenview, IL)

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.

Tyler worked on the development of a new method for the direct cross-coupling of alkenes and aryl bromides. This is the first example of this type of reaction. So far, cobalt complexes in the presence of N-heterocyclic carbenes turn out to be the most effective catalysts for this system.

Kyle worked on some exploratory reactions using iron salts as precatalysts. He also did some mechanistic work to help elucidate the oxidation state of iron within the catalytic cycle during the iron-catalyzed cross-coupling of alkyl Grignard reagents with aryl chlorides.

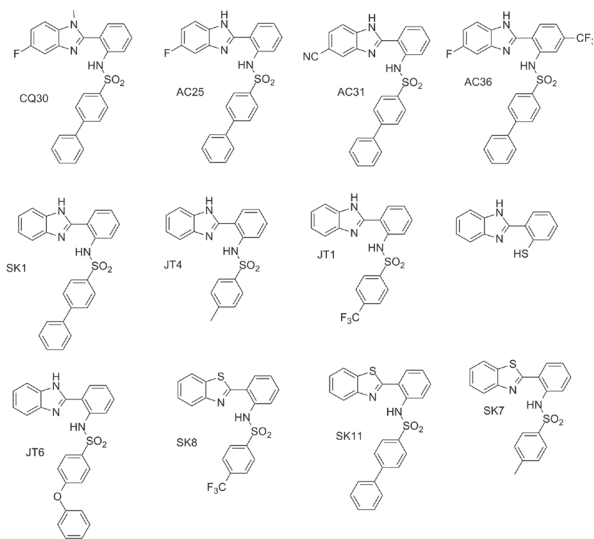
Joey worked on a new synthetic procedure for the synthesis of unsymmetrical imidazolium salts which are precursors to N-heterocyclic carbenes. Once synthesized, these will be important to test the steric and electronic properties of the N-heterocyclic carbenes that optimize catalysis. This should allow for the rational design of a very effective ligand.

Students Directed by Matthieu Rouffet

Alexander Carlson (Ione, OR), **Colton Quick** (Carlsbad, CA), **Jordan Thompson** (Medford, OR), **Soni Kay** (Lincoln, NE) and **Nicholas Wu** (San Diego, CA) (volunteer, High school student)

Alexander, Colton, 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 obtain *in vitro* IC₅₀ data against lethal factor. More than 15 new inhibitors were synthesized, characterized by NMR and Mass spectroscopy and tested against Lethal Factor. Finally, we have established a collaboration with the SSGCID (The Seattle



Structural Genomics Center for Infectious Disease) where our newly synthesized molecules are going to be co-crystallized within Lethal factor thus allowing us to rationally design more potent and selective inhibitors in the future.

Students Directed by Dale Shellhamer

Kelsey L. Alexander (Placentia, CA), **Christine J. Licata** (Orange, CA), **Lincoln B. Smith** (San Diego, CA) and **Ryan D. Robinson** (Spring, TX)

Chlorosulfonyl Isocyanate (CSI) is an unreactive reagent, but it works well as an electrophile for the synthesis of *beta*-lactams with electron-rich alkenes. CSI reacts poorly, or it does not react with electron-deficient alkenes or monofluoroalkenes.

Kelsey studied the use of catalysts to assist this sluggish electrophile (CSI) with electron-deficient alkenes. Significant improvement was found for the reaction of electron-deficient alkenes and CSI using L-Proline-*tert*-butyl ester as catalyst and with carbene catalysts like 1,3-Bis(2,4,6-trimethylphenyl)-1,3-dihydro-2H-imidazol-2-ylidene. The synthetic utility was further enhanced by lowering the temperature between 0^o to + 10^oC depending on the solvent.

Christine studied the reaction of *para*-toluenesulfonyl isocyanate with alkenes in several solvents. *para*-Toluenesulfonyl isocyanate is less reactive with alkenes than CSI. With an alkene like methylenecyclohexane the yield of *beta*-lactam product was maximized (90 - 95 %) between temperatures of 50^o - 70^oC. The efficiency of the reaction was not improved at lower temperatures as we found for the reactions with CSI. However, very electron-rich alkenes like dihydro-2H-pyran gave the best results (80 - 85%) at lower temperatures between 0^o to -20^oC, depending on the solvent.

Lincoln studied the reaction of CSI with alkenes that are reported to give poor results like electron-deficient hydrocarbon alkenes and monofluoroalkenes. He found that reactions of CSI with unreactive hydrocarbon alkenes give the best results between 0 to + 15^oC, depending on the solvent. Monofluoroalkenes like *alpha*-fluorostyrene give the best results at a reaction temperature of - 15^oC.

Kelsey, Christine and Lincoln's results confirm our earlier findings that some isocyanates form a complex before the kinetic slow step of the reaction. This complex is in equilibrium with the reagents and lowering the temperature drives the equilibrium toward the complex. Reacting from the complex rather than the isolated reagents gives a much improved outcome. This find opens the reactions of isocyanates to a wider range of alkenes previously thought not to be reactive with these reagents. Isocyanate reactions with alkenes give *beta*-lactam products that are a class of antibiotics, and there is recent evidence for *beta*-lactams to have cholesterol lowering properties.

Oxidative electron-transfer reactions using Ruthenium, methyl viologen and visible light for initiation of cyclization and Diels-Alder reactions has been reported in the literature. Our previous work showed that CSI forms radical cation intermediates with hydrocarbon alkenes and some monofluoroalkenes through oxidative electron-transfer. **Ryan** is studying the synthetic utility of using CSI as an oxidative electron-transfer reagent. The goal is to utilize CSI and eliminate the need for Ruthenium, methyl viologen and visible light to initiate oxidative electron-transfer reactions such as Diels-Alder and other cyclization reactions.

2013 Student Seminar and Poster Presentations (asterisks denote students)

Students Sponsored by Sara Choung

Amber Gillett*, Caitlyn McGue*, Joshua Blessing*, Jacob Milligan*, Allison Zakaroff*, Junior Cajbon*, Justin Hsu* (Sara Choung, and Matthieu Rouffet). "PLNU chemistry club develops enthusiasm for chemistry in the greater San Diego area." Presented at the 245th American Chemical Society National Meeting, New Orleans, LA (4/13).

Students Sponsored by Mike Dorrell

1. Dawn Goral*, Jack Thompson*, Jack Rusing*, Zack Sedillo*, Troy Kurz* and Jake Trembley* (Mike Dorrell) "The Anti-Tumor Effects of Angiostatic Combination Therapy on Glioblastoma/Gliosarcoma". Presented as a seminar by Jack Thompson at the 38th Annual West Coast Biological Sciences Undergraduate Research Conference, Point Loma Nazarene University, San Diego, CA (April 20, 2013)
2. Zachary Sedillo* and Jack Rusing* (Mike Dorrell), "Two Model for Targeting Tumor Cells Through Specific Macrophages for Possible Applications". Presented as a poster by Zachary Sedillo and Jack Rusing at the 38th Annual West Coast Biological Sciences Undergraduate Research Conference, Point Loma Nazarene University, San Diego, CA (April 20, 2013)

Students Sponsored by Rob Elson

1. Barr, Angelica M.*, Weston Bennett*, Joanna L. Fregoso*, and Robert C Elson. "Metamorphic changes in number and type of serotonergic neurons in the terminal abdominal ganglion of a mealworm beetle," poster presented by Angelica Barr, Weston Bennett, and Joanna Fregoso at 38th annual West Coast Biological Sciences Undergraduate Research Conference, Point Loma Nazarene University, San Diego; April 20, 2013.
2. Elson, Robert C., Angelica Barr*, Weston Bennett*, Joanna Fregoso*, Ravi Smith*, Joelle Soch*, and Daniella Wolf*. "Postembryonic development of serotonergic neurons in a tenebrionid beetle: time-course and hormonal dependence," poster presented by Robert Elson and Joelle Soch at the Annual meeting of the Society for Neuroscience, San Diego; Nov. 10, 2013, 2013.

Students Sponsored by Katherine Maloney

Davis, Taylor*, Oscar Alvarado*, Bethany Okada*, Kim Quach*, Vincent Shieh*, Charlie Brayton*, Katherine N. Maloney, and Catherine S. McFadden. "Analysis of secondary metabolite chemistry among the soft coral *Sarcophyton* species *glaucom*, *gemmatum*, and *trocheliophorum*," presented by Taylor Davis at the 38th Annual West Coast Biological Sciences Undergraduate Research Conference, Point Loma Nazarene University, San Diego, CA (April 20, 2013)

Students Sponsored by Ken Martin

Hannah Ryan*, Shanan Lau*, Marcus Baer*, K.A. Martin, and A.M. Nishimura "Laser Induced Fluorescence of Mixed Excimers on Alumina", 60th Annual Western Spectroscopy Association Conference at Asilomar Conference Center, Pacific Grove, CA, Jan. 2013.

Students Sponsored by Michael McConnell

Sean Heavey*, Andrew Montano*, Megan Evilsizor*, Natasha Gebhart*, Danielle Matonis*, Hannah Quinn* and Maika Adair* (Michael McConnell). "Identification of genes coding for two cell surface converting enzymes of the Group E1 Salmonella-Specific Bacteriophage, Epsilon 15", seminar presented by Sean Heavey at the 38th Annual West Coast Biological Sciences Undergraduate Research Conference, Point Loma Nazarene University, San Diego, CA (April 20, 2013)

Students Sponsored by Mike Mooring

1. Ryan Dahl*, Jonathan Piazza*, Austin Fares*, Eduardo Alvarez*, and Mike Mooring. "Invasion of a Costa Rican montane cloud forest by coyote". presented by Ryan Dahl and Jonathan Piazza at the 38th Annual West Coast Biological Sciences Undergraduate Research Conference, Point Loma Nazarene University, San Diego, CA (April 20, 2013)
2. Eduardo Alvarez*, Austin Fares*, Ryan Dahl*, Jonathan Piazza*, and Mike Mooring. "Species richness, diversity, and relative abundance of large mammals in protected areas and buffer zones of the Talamanca Cordillera, Costa Rica", presented by Eduardo Alvarez at the 38th Annual West Coast Biological Sciences Undergraduate Research Conference, Point Loma Nazarene University, San Diego, CA (April 20, 2013)

Students Sponsored by Dawne Page

1. Caitlyn McGue*, Tania Montenegro*, Sarah E. Schale*, Bradley H. Jacobsen*, David N. Pratt*, Noemi Delgado*, Alyssa R. Doty*, Brad G. Magor, David Traver, Dawne M. Page. "The use of transgenic zebrafish to monitor the B cell immune response." Presented by Caitlyn McGue at the 38th Annual West Coast Biological Sciences Undergraduate Research Conference, Point Loma Nazarene University, San Diego, CA (April 20, 2013)
2. Kanako Lewis, Dawne M. Page, Valerie Wittamer, Julien Y. Bertrand, David Traver. "Characterization of zebrafish dendritic cells and B cells using novel transgenic reporters." 4th North American Comparative Immunology Workshop, Santa Barbara, CA, 2013.

Students Sponsored by Marc Perry

1. Gillett, Amber N* ; Perry, Marc C. "The Role of diorganomagnesium species in the iron-catalyzed Kumada coupling of alkyl Grignard reagents," presented by Amber Gillett at the 245th ACS National Meeting, New Orleans, LA, April 7-11, 2013.
2. Bonner, James G. * ; Perry, Marc C. "Methylmagnesium bromide as a probe for the active oxidation state of iron in Kumada couplings of alkyl Grignard reagents," presented by James Bonner at the 245th ACS National Meeting, New Orleans, LA, April 7-11, 2013.
3. Kleinsasser, Jack F. * ; Weststeyn, Justin T. * ; Perry, Marc C. "Formaldehyde free procedure for the synthesis of bulky N-arylimidazoles," presented by Jack Kleinsasser and Justin Weststeyn at the 245th ACS National Meeting, New Orleans, LA, April 7-11, 2013.

Student Sponsored by Matthieu Rouffet

Alexander Carlson*, Colton Quick* and Matthieu Rouffet "Synthesis of anthrax lethal factor inhibitors using a novel potent and selective zinc binding group," presented by Alexander Carlson at the 245th American Chemical Society meeting in New Orleans, April 8th 2013.

Students Sponsored by Dale Shellhamer

Milligan,* Jacob C., Shipowick,* Danielle E. and Shellhamer, Dale F. "Synthetic Utility of Chlorosulfonyl Isocyanate (CSI) at Lower Temperatures" Presented by Jacob Milligan and Danielle Shipowick at the 245th National Meeting of the American Chemical Society in New Orleans, LA., April 2013.

2013 Faculty Seminar/Poster Presentations

Dianne Anderson

1. Korb, Michele, Anderson, Dianne, Hagedorn, Eric, Jensen, Megan & Silbergliitt, Matt. "A life science concept inventory on genetics/molecular biology for middle school learners: Assessment development informs teacher pedagogy". Paper presented by M. Korb, D. Anderson, and M. Jensen at the annual meeting of the American Educational Research Association, San Francisco, CA, April 2013.
2. Evans, Patricia* & Anderson, Dianne. "The Conceptual Inventory of Natural Selection a decade later: Development and pilot testing of a middle school version leads to a revised college/high school version". Paper presented by D. Anderson at the annual meeting of the National Association for Research in Science Teaching, Rio Grande, Puerto Rico, April, 2013.

Rob Elson

Elson, Robert C. "Metamorphosis of serotonin-containing neurons in the nervous system of a pest insect: a report on original research made possible by sabbatical leave (fall 2012) and RASP grant support," seminar presented by Robert Elson at PLNU faculty scholarship day, San Diego; Aug. 26, 2013.

April Maskiewicz

1. Maskiewicz, April. (2013, August). "Applying Education Theory to Conduct Ecology Education Research: What does that mean?" Presentation in Symposium entitled: "Using Education Theory: Learning From the Past to Shape the Future of Ecology Teaching" at the Ecological Society of America's 98th Annual Conference – Minneapolis, MN.
2. D'Avanzo, C. & Maskiewicz, A. (2013, August). "How to Use Teaching Issues and Experiments in Ecology (TIEE) in Your Teaching and to Publish in TIEE." Organized Workshop presented at the Ecological Society of America's 98th Annual Conference – Minneapolis, MN.
3. Maskiewicz, A. (2013, April). "Navigating the Challenges of Teaching Responsively: An Insider's Perspective". Paper presented at National Association of Research in Science Teaching - San Juan, Puerto Rico.

Dale Shellhamer

Shellhamer, Dale F. "Kinetic studies on the reaction of Chlorosulfonyl Isocyanate with hydrocarbon alkenes and monofluoroalkenes: Evidence for a single electron-transfer (SET) intermediate and a pre-equilibrium complex on the reaction pathway" Presented at San Diego State University, San Diego, CA. April 19, 2013.

2013 Book and Journal Article Publications (asterisks denote student coauthors)

Walter Cho

Thresher R., F. Althaus, J. Adkins, K. Gowlett-Holmes, P. Alderslade, J. Dowdney, W. Cho, A. Gagnon, D. Staples, F. McEnnulty, and A. Williams. 2014. "Strong Depth-Related Zonation of Megabenthos on a Rocky Continental Margin (~700–4000 m) off Southern Tasmania, Australia." *PLoS ONE* 9(1), e85872. doi:10.1371/journal.pone.0085872

Mike Dorrell

Dorrell M.I., M. Marcacci*, S. Bravo*, T. Kurz*, J. Tremblay* and J.C. Rusing*. "Ex Ovo Model for Directly Visualizing Chick Embryo Development". November/December 2012. *The American Biology Teacher*. Vol. 94(9). Pp. 628-634.

Vic Heasley

Heasley V.L.,* Lingner D.W., Boerneke* J.L., Boerneke* M.A., Hsu* H., Minnema* R.A., Moulton* C.A. and Sweeney* A.R. "Studies on the syntheses of monobromamine NH₂Br and dibromamine NHBBr₂ in various solvents", *Research Journal of Chemistry and Environment*, 2013, 17(6), 48-51

Ken Martin

1. Garbe, Nicole K., Marcus B. Anthony*, K.A. Martin, and A.M. Nishimura "Effect of Simple Aliphatic Alcohol Thin Films on the Laser Induced Excimer Fluorescence Decay of Naphthalene on α -Alumina During Temperature Programmed Desorption", *Advances in Applied Physics*, 2013, Vol. 1, no. 4, 127-138, HIKARI Ltd.
2. Driver, Brandon D., Nicole K. Garbe, Marcus B. Anthony*, K.A. Martin, and A.M. Nishimura. "Effect of cis- and trans-decalin on the Laser Induced Fluorescence Decay of 2-Methylnaphthalene on α -Alumina During Temperature Programmed Desorption", *Journal of Undergraduate Chemistry Research*, 2013, 12, 61-64.
3. Anthony*, Marcus B., Brandon D. Driver, Nicole K. Grabe, K.A. Martin, and A.M. Nishimura. "Effect of Simple Aliphatic Alcohols on the Laser Induced Fluorescence Decay of 2-Methylnaphthalene on α -Alumina During Temperature Programmed Desorption", *Journal of Undergraduate Chemistry Research*, 2013, 12, 51-55.
4. Gardner, Samantha R., Laura M. Selby, Rachel K. Teranishi, Michael S. Douglas*, Seth W. Simonds*, K.A. Martin and A.M. Nishimura "Temperature dependent excimer luminescence of naphthalenes on α -alumina"., *Journal of Luminescence*, 134(2013) 657-664

5. Baer*, Bradly B., Shanan Lau, Hannah E. Ryan, K.A. Martin, A.M. Nishimura "Laser-Induced Fluorescence Decay of 2-Methyl-, 2-Methoxy-, and 2-Ethyl-naphthalene on α -Alumina during Temperature Programmed Desorption", *Journal of Spectroscopy*, (2013) 959126
6. Baer*, Bradly, K.A. Martin and A.M. Nishimura "Fluorescence Quenching by Resonant Energy Transfer", *The Chemical Educator*, 2013, 18, 1-3
7. Ryan, Hannah E., Shanan Lau, Bradly B. Baer*, K.A. Martin and A.M. Nishimura "Laser induced fluorescence resonance energy transfer of 9,10-dihydrophenanthrene and 9-fluorenone on alumina during temperature programmed desorption", *Journal of Undergraduate Chemistry Research*, 2012, 11(4), 116-118.
8. Ryan, Hannah E., Shanan Lau, Bradly B. Baer*, K.A. Martin and A.M. Nishimura, "Laser induced fluorescence decay of 1-methyl-, 1-methoxy- and 1-ethyl-naphthalene on alumina during temperature programmed desorption", *Journal of Undergraduate Chemistry Research*, 2012, 11(4), 107-111.

April Maskiewicz

Maskiewicz, A. & Lineback, J. (2013). "Misconceptions are so yesterday". *CBE-Life Sciences Education*, 12(3), 352–356.

Michael McConnell

Guichard*, J.A., Middleton*, P.C. and McConnell, M.R. (2013) Genetic analysis of structural proteins in the adsorption apparatus of bacteriophage epsilon 15. *World Journal of Virology* 12; 2(4): 152-159; doi:10.5501/wjv.v2.i4.152

Dawne Page

Dawne M. Page, Valerie Wittamer, Julien Y. Bertrand, David N. Pratt*, Noemi Delgado*, Sarah E. Schale*, Caitlyn McGue*, Bradley H. Jacobsen*, Alyssa Doty*, Yvonne Pao, Hongbo Yang, Neil C. Chi, Brad G. Magor and David Traver. "An Evolutionarily Conserved Program of B Cell Development and Activation in Zebrafish." *Blood* 122:e1-e11 (2013).

Dale Shellhamer

Shellhamer, Dale F., Summer A. Bunting*, Kelli R. Hickle*, Parker C. Horn*, Jacob C. Milligan*, Danielle E. Shipowick*, Lincoln B. Smith*, David J. Vandenbroek*, Marc C. Perry, and Jerry A Boatz[†], "Kinetic Studies on the Reaction of Chlorosulfonyl Isocyanate with Monofluoroalkenes: Experimental Evidence for Both Stepwise and Concerted Mechanisms and a Pre-equilibrium Complex on the Reaction Pathway", *Journal of Organic Chemistry*, 2013, 78, 246-252

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

University of California Pierce's Disease Research Grant, collaborator with PI Philippe Rolshausen, University of California, Riverside). "Field and greenhouse evaluations of grapevine fungal endophytes and fungal natural products antagonistic to *Xylella fastidiosa* for control of Pierce's Disease". \$162,086 2012-2014

Mike Mooring

1. Zoological Society of San Diego (2013): "Jaguar and other predators of the Talamanca Cordillera, Costa Rica"; \$10,000
2. RASP (2013): "Mammalian predators and prey of the Talamanca Cordillera Cloud Forest"; \$2000
3. PLNU Alumni Grant (2013): "Mammalian predators and prey of the Talamanca Cordillera, Costa Rica" (\$2,000)

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

Manuscript reviewer for two journals: *Deep-sea Research Part I* and *Symbiosis*.

Mike Dorrell

1. **Off-campus research internships:** The number of highly qualified candidates for summer research at PLNU continues to grow, so Dr. Dorrell helps students not chosen for the PLNU program find internship and summer research opportunities off-campus. For the summer of 2014, Dr. Dorrell has helped students find internship positions in the laboratories of Drs. Nemerow and Friedlander at the Scripps Research Institute.
2. **Director of research at LMRI:** Dr. Dorrell took a one-year sabbatical from PLNU during 2013-14 in order to serve as the first director of the newly formed Lowy Medical Research Institute (LMRI) in La Jolla. The LMRI studies an orphan degenerative eye disease called Macular Telangiectasia (MacTel) and the primary goal of the Institute is to use information garnered during the past decade to determine a path forward whereby the cause of MacTel can be identified and treatments more specific to this disease can be found. Studies on MacTel at LMRI will likely have important implications for understanding other degenerative eye diseases as well, including Age Related Macular Degeneration and Diabetic Retinopathy. Dr. Dorrell's duties as director have included: 1) working to establish the research program at LMRI; 2) generating testable hypotheses regarding the cause of MacTel, and 3) establishing streamlined experimental protocols by which to test these hypotheses.
3. **Manuscript reviewer for *Investigative Ophthalmology*, *Visual Science (IOVS)*, *Proceedings of the library of science one (PloS One)*, and *Nature Medicine*.**

April Maskiewicz

Administrator of “University NOW”, a program to help high school juniors from under-represented groups envision themselves as college students by successfully completing a university-level integrated biology/writing course. The students come to PLNU three days a week 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 (2013-14) we have 24 students from the AVID program at Point Loma High School attending UNOW.

Katherine Maloney

1. Reviewer for *Journal of Natural Products* and *Marine Drugs*
2. Member-at-Large, Executive Committee of the American Chemical Society Division of Organic Chemistry

Michael McConnell

Reviewer for *World Journal of Gastroenterology*, Baisheng Publishing, China (two articles)

Dale Shellhamer

Recipient of the Outstanding Achievement Award, Sigma Xi, April 2013.

West Coast Biological Sciences Undergraduate Research Conference

by Michael McConnell

Research Associates helps sponsor PLNU’s strong involvement in the West Coast Biological Sciences Undergraduate Research Conference (WCBSURC), an event that raises the profile of our science program in a very effective way throughout the nation. The 38th Annual Conference was hosted by PLNU on April 20, 2013 and in preparation for that event, publicity was sent directly to ~13,400 biology and biochemistry faculty at 650 institutions throughout the United States. The response was outstanding as a total of 433 attendees representing 65 institutions in 17 states were in attendance, eclipsing the previous high attendance mark for a WCBSUR Conference by over 20%. It was somewhat nerve-racking when our keynote speaker, Nobel Laureate Roger Tsien of UCSD, became seriously ill three weeks before Conference day and had to cancel; fortunately for us, though, the star post-doc working in Dr. Tsien’s lab at the time was one of our own, Dr. Evan Miller (PLNU Class of ‘04). Evan stepped in for Dr. Tsien and did a marvelous job as our keynote speaker (shortly thereafter, Evan accepted his first academic position at UC Berkeley, where he is now Assistant Professor of Chemistry and Molecular/Cellular Biology. The highlights of the Conference were beautifully photographed for us by RA Board member Jeff Youngren, and several of Jeff’s photos can be accessed at the Conference website (<http://www.pointloma.edu/experience/academics/schools-departments/department-biology/science-education-programs/wcbsurc>).

Azusa Pacific University hosted the WCBSURC for the first time on April 12, 2014, and there will be more information about Point Loma’s participation in that Conference in the upcoming 2014 RA Annual Report. PLNU will host the 40th Annual WCBSURC on April 25, 2015 and we’re excited to announce that one of

the world’s most famous molecular biologists, Dr. Leroy Hood, will be our keynote speaker (<https://www.systemsbiology.org/leroy-hood>). We intend to publicize the Conference to a minimum of 14,000 biology and biochemistry faculty at institutions located throughout the United States and Canada and our goal will be to bring at least 500 participants onto the campus, representing institutions from at least 20 states.

Abundant anecdotal evidence indicates that this widespread, positive publicity indirectly benefits PLNU 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.

Report on the Annual Meetings of Research Associates

by Michael McConnell

Spring Board Meeting (May 3, 2013):

The Board of Directors of Research Associates met for its annual spring dinner meeting on May 3, 2013. Those present were Chair, Brad Oliver, Board members Esther Allen, Rick Bravo, Ron Clagett, Thomas Fitzpatrick, Stuart Graham, Art Nicolet and Jeff Youngren. Faculty Representatives Michael McConnell and Ken Martin, and guests Joe Watkins (VP of External Relations) and Sheryl Smee (Director of Alumni Relations) were also present. 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 2013 Molecular Science Awards at the Annual Breakfast in November (these Awards are based upon votes cast by the outgoing senior Class). There was discussion regarding the future leadership of Research Associates; Board Chairs normally serve a two year term, but Brad Oliver indicated that he was willing to continue in the position beyond his two year term with the Board’s approval. It was moved (Bravo), seconded (Graham) and unanimously approved that Brad’s term as Chair be extended for a third year (through December 31, 2014). Art Nicolet made a presentation regarding ways to improve communication within the RA membership and to promote a higher level of funding for the RA General Fund, so that the undergraduate research program can be sustained and further strengthened. Joe Watkins gave the Board a very upbeat report regarding the new Science Complex. There were several important developments during the first four months of 2013, the result being that in May, 2013, funding has been secured for approximately two-thirds of the cost of the new science building, with only about 8.3 million still needing to be raised (**editor’s note: another 4 million has been raised since then and the balance is now down to ~ 4 million**).

Over dinner, Board members discussed the Science Complex funding effort and perused written reports dealing with: 1) the results of the Science Honors Weekend recruiting effort; 2) the upcoming 2013 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 38th Annual West Coast Biological Sciences Undergraduate Research Conference, which had been hosted by PLNU on April 20, 2013.

Annual RA Breakfast and Fall Board Meeting (November 23, 2013):

The Research Associates Annual Breakfast and Fall Board Meeting both took place on the Saturday of Homecoming Weekend (November 23, 2013). This year the Breakfast was held in First Church's Ellipse Chapel, which overlooks the Lomaland Drive campus entrance and affords a gorgeous view of the San Diego skyline. This venue worked out so nicely that the Ellipse has already been reserved for the 2014 Annual RA Breakfast. Well over one hundred persons were in attendance (28 graduating seniors, plus 85 alumni and faculty) and as they enjoyed breakfast, they were able to view a power point presentation that described the 2013 summer research program in great detail. Following breakfast, the program activities included: 1) introduction of RA Board Members by Board Chair, Mr. Brad Oliver'77; 2) introduction of returning alumni by Dale Shellhamer; 3) introduction of graduating seniors by David Cummings; 4) a keynote address by Randall Skidgel regarding current career options currently available for science graduates; 5) recognition of Endowed Scholarship and Molecular Science Award recipients by Brad Oliver; 6) a report by President Brower on the progress being made in funding the new Science Complex; and finally, 7) a brief summary by Ken Martin of the importance of Research Associates in sustaining and improving PLNU's science program.

The Fall Board Meeting followed immediately after the Breakfast. Members present included Board Chair Brad Oliver'77, Esther Allen'55, Rick Bravo'79, Ron Clagett'92, Kelly Gallego'94, Stuart Graham'85, Doreene Hyatt'89, Adam Kanallakan'04, Matt MacGinnis'05, Art Nicolet'65, Laura Nist'91, Jack Owens'88, Randall Skidgel'74, WilliamWork'90 and Jeff Youngren'06. Board members Brad Carter'82 and Nathan Kemalyan'83 also participated in the meeting by long distance telephone from Maryland and Oregon, respectively. The other meeting participants were Faculty Representatives Ken Martin and Michael McConnell, Joe Watkins (VP of External Relations) and Marc Perry (PLNU Chemistry Department faculty member).

After brief introductions, the Board received reports on several topics, including: 1) an update on the pre-professional program; 2) a final summary for the 7/1/12 to 6/31/13 fiscal year plus updates on the funding levels for both the RA General Fund and the RA Endowed Scholarship Fund for 2013-2014 at the midway point; and 3) discussion of possible nominees for the Smoot Award. The remainder of the meeting involved a very upbeat presentation by Joe Watkins (VP of External Relations) on new developments in the effort to fund the new Science Complex...considerable discussion followed Joe's report.

2013 Molecular Science Award Recipients



Front Row (left to right): Oscar Alvarado, Taylor Davis, Lindsay Powell, Timothy Borgogna, Eduardo Alvarez, **Back Row:** Brad Oliver (Chair of Research Associates), Alexander Carlson, Mitchell Prins

2013 Endowed Scholarship Recipients



Front Row (left to right): Oscar Alvarado, Tyler Sanders, Taylor Davis, Catherine Kay, Kelsey Alexander, **Back Row:** Lincoln Smith, Brad Oliver (Chair of Research Associates), Kyle Dornhofer

FINANCIAL REPORT (Fiscal Year 2012-13)

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 2013-14 academic year were determined by the fund value as of July 1, 2012^{*}). 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 of July 1, 2013	191,172

II. RESEARCH ASSOCIATES GENERAL FUND

The General Fund is supported by membership gifts and used primarily to support the ongoing needs of the summer research programs in the biology and chemistry departments. These funds also help support recruiting efforts and the participation of students in professional conferences where they can present the findings of their research. Funds are divided evenly between the two departments.

RESEARCH ASSOCIATES FINANCIAL REPORT 2012-13

July 1, 2012 – June 30, 2013	Income	Expenses	Balance
Balance as of July 1, 2012			\$4,161
Total Gifts (87 donors)	\$39,820		
Other Income (interest)			
Transfer to RA Scholarship Fund			
Summer Research Support (2013+ Leftover 2012 Expenses)		\$29,550	
Scholarships (8 Molecular Science Awards \$500 each)		\$4,000	
Recruiting (Science Honors Weekend)		\$2,600	
Conferences		\$2,500	
Annual Report (Printing & Postage)		\$2,533	
Fund Raising		\$914	
Breakfast Meeting		\$961	
Misc.		\$598	
SUM	\$39,820	\$43,656	
Balance as of July 1, 2013			\$325

CURRENT RESEARCH ASSOCIATES GENERAL FUND BUDGET

July 1, 2013 - June 30, 2014

Income

Gift Target \$40,000 (Received as of May 9, 2014: \$25,375)

Expenditures	Budgeted	Forecasted	Expended*
Recruitment of Students and Public Relations w/ Medical and Graduate Schools	\$2,800	\$2,300	\$2,300
Outstanding Molecular Science Awards (9 at \$475)	\$4,200	\$4,275	\$4,275
Summer Research Program	\$28,000	\$28,000	\$28,000
Research Conference Expenses	\$2,000	\$1,000	\$500
Annual Report, Directory, and Mailings	\$2,400	\$2,400	
Annual Board Meetings and Miscellaneous	\$1,500	\$2,200	\$2,080
TOTAL		\$40,900	\$40,175