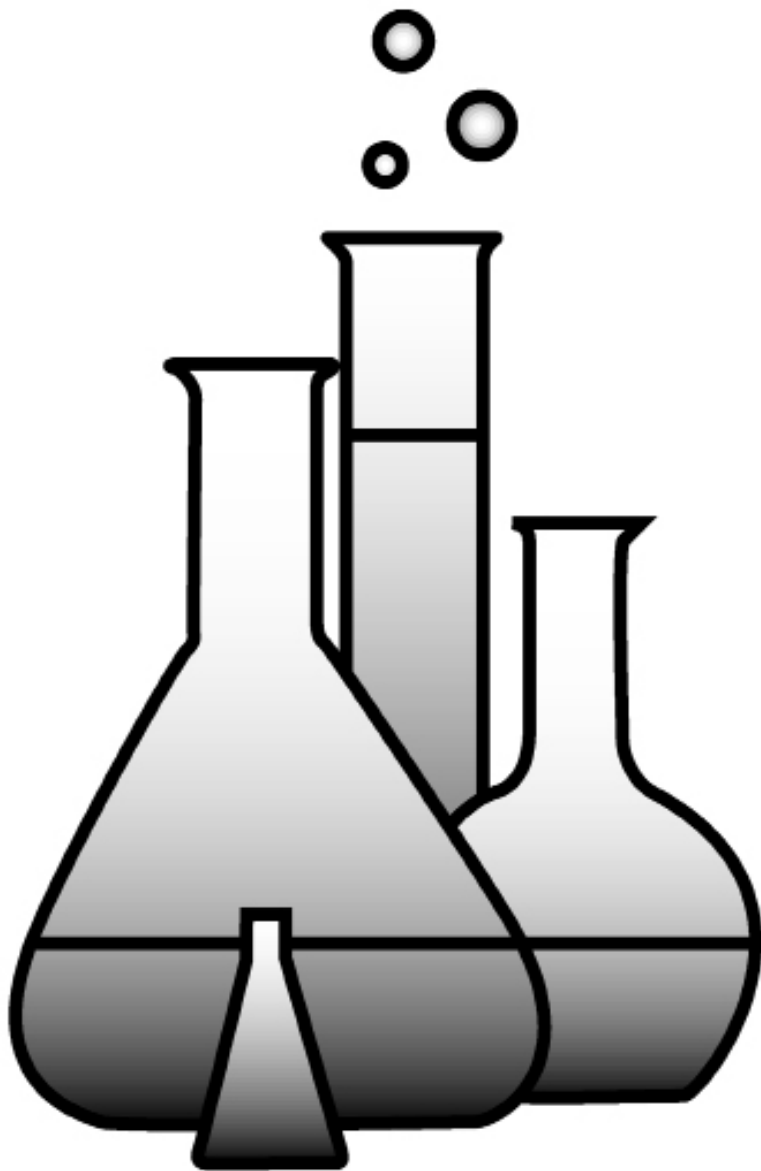


POINT LOMA NAZARENE UNIVERSITY

Research Associates



ANNUAL REPORT

2010

2010 ANNUAL REPORT TO THE RESEARCH ASSOCIATES OF PLNU

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Greetings from Dr. Jeff Conner, the Chair of Research Associates



I hope this greeting finds you well in 2011 and hope that last year was rewarding and fulfilling. As I look toward my second year as Research Associates chair, I am encouraged by the university's commitment to support and expand the science departments.

During Homecoming last November, we enjoyed a well-attended breakfast. It was certainly encouraging to meet with fellow alumni and interact with students and hear about research being conducted at Point Loma. A special congratulations to Dr. McConnell, who received an Alumni of Point Loma award during Homecoming – certainly well deserved and long overdue.

The commitment of our faculty at Point Loma remains exceptional and continues to be inspiring. I am grateful to Ken Martin and Michael McConnell for their exemplary service as faculty representatives to Research Associates.

Since the inception of Research Associates, the faithful giving of many alumni has augmented the endeavors of the science faculty to produce valuable research experience for numerous students. The value of scientific inquiry, instilled in all of us, is profound. The numerous faculty and their expansive research efforts remains fertile ground for student opportunities.

Research Associates will play a pivotal role in aiding the continued success of the science departments. As the University looks towards successful development of a new science building, the active participation of alumni will be necessary. Prior to the initiation of a formal capital campaign, the university is endeavoring to secure a substantial lead gift. It will be important for the science alumni to show interest and commitment to assist in this enormous undertaking. I urge you to pray for the provision of the necessary commitment to initiate the campaign. I also urge you to help in expanding the depth and breadth of participation in Research Associates.

Thank you for your continued support of Research Associates,

Jeff Conner

New Faculty Members Join the Biology and Chemistry Departments

Mike Dorrell, Assistant Professor, Department of Biology

I was raised all across the world, literally. My father was a Quaker minister so we moved to a new church throughout the United States every four years. I even spent three years in Africa (from age 6 to 9) where my parents were missionaries in Kenya and Uganda, helping to restore the churches, schools, and hospitals after the dictator Idi Amin had destroyed the country. I was always very interested in science; an interest that manifested in undergraduate degrees in chemistry and mathematics and a Ph.D. in biomedical research from The Scripps Research Institute (TSRI) in La Jolla.



For most of the past decade, I have been preparing myself for a career as a professor of biology at a small university. The idea that I could combine things that I love to do – learn biology, perform biological research, and teach – as a vocation still amazes me. Now that my vocational ‘calling’ has been achieved, I could not be happier than I am here at Point Loma Nazarene University. I have always been fond of the small, liberal arts education system. During my own undergraduate experience at Simpson College in Iowa, another small liberal arts institution, I realized how important the development of a real relationship with my professors was to my own success, both at the undergraduate level and in my career beyond. Through the liberal arts education, I was also taught to think rather than memorize, a developed talent that has proven to be critical for successful research in the sciences. All of these benefits of a smaller institution are epitomized at PLNU. I have been welcomed with open arms by both my colleagues and the students. The professors’ genuine care for their students, for each other, and for the program, along with their love and faith in Christ, is immediately obvious. PLNU’s commitment to modeling character and molding good citizens is only possible when faculty have huge hearts and make an effort that goes beyond educating young minds. The fact that such an impressive combination of education and character comes complete with a high quality undergraduate research program is nothing less than remarkable. I know I am blessed to be here amongst friends at PLNU, doing what I love with others who share the same values, both for Christ and for teaching as a vocation. I will continue to do my best to keep up the tradition of education, student care, and research that has been developed here over so many years.

My research interests are a continuation of my work performed as a graduate student and a post-doctoral fellow at TSRI where I studied the growth of blood vessels in development and disease. At PLNU, my lab investigates the natural development of the retinal vasculature using a zebrafish model. This has important implications on both development and degenerative eye diseases since the vast majority of diseases contributing to vision loss have associated, abnormal vascular growth of the retina. I also study tumor vascularization using a novel chick embryogenesis model. Using this model, we can study the mechanisms by which tumors induce vascular growth and develop new methods by which tumor vascularization can be blocked, thus starving the tumor and preventing growth and metastasis. We are currently testing various

combinations of currently approved angiostatics to determine which combinations demonstrate synergistic activity in the hope of providing some new insight for treatment of glioblastoma brain cancers. I continue to maintain adjunct faculty status at TSRI, which will allow my students and me to use the cutting-edge facilities available there as needed. Through these studies, I hope to make a difference in medicine (no matter how small) and provide a program where motivated students can learn how to set up, perform, and analyze cutting-edge research.

Marc C. Perry, Assistant Professor, Department of Chemistry

I did both my B.S. and Ph.D. in chemistry at New Mexico State University. Of course, something else wonderful happened during that time in that I met my wife Christina, and we were married. After receiving my Ph.D., I went to Texas A & M University where I took a postdoctoral position for two and a half years. I also had the privilege of lecturing there for a year in the organic chemistry sequence. I then took a tenure-track position at the University of Alaska Anchorage. It was an undergraduate institution, and I taught and performed research there for seven years. During that time, I taught a number of courses including Survey of Chemistry, General Chemistry I and II, Organic Chemistry I and II, and the associated labs. Finally, I took a position this last fall at PLNU. I believe that God has called me here, and I certainly feel blessed to be at such a wonderful place. In the fall I taught Organic Chemistry I (CHE295) and labs, and I am currently teaching General Chemistry II and lab.



Throughout my career, my research interests have been in the area of organometallic chemistry and catalysis. As a graduate student, I developed a number of rhenium-catalyzed heteroatom transfer reactions. Some examples of these reactions included sulfide, phosphine, and alcohol oxidation reactions using sulfoxides as oxidants. In my postdoctoral position, my main research interests were in the area of iridium-catalyzed asymmetric hydrogenations of unfunctionalized alkenes. In my position at UAA, I began work in the area of iron-catalyzed cross-coupling reactions involving alkyl Grignard reagents. I found that pi-acid ligands facilitated the reaction and allowed the use of secondary alkyl Grignard reagents. The two ligand classes that I investigated included isonitriles and N-heterocyclic carbenes.

My plans for research at PLNU are to continue in the iron-catalyzed cross-coupling of alkyl Grignards. To begin with, I will continue to look at the use of N-heterocyclic carbenes as ligands in the cross-coupling of unactivated aryl chlorides. It will take some time to optimize these reactions, particularly for the secondary alkyl Grignards. I will also try to gain a better mechanistic understanding of these reactions. This work is very amenable to the use of undergraduates, and I am very excited to participate in the summer research program.

SAAC NEWS

By Sara Choung

The American Chemical Society (ACS) Student Chapter at Point Loma Nazarene University (Chemistry Club) has continued to be active throughout the school year

with a variety of activities including fundraisers, social activities, graduate school information sessions, national scientific meeting, and outreach events. Outreach to students in the community has included 1) classroom demonstrations for Wilson Middle School eighth grade students, 2) a PLNU campus visit by Tri-City Christian High School students, and 3) ChemExpo in Balboa Park, which is sponsored by the San Diego Chapter of the ACS. Fifteen students attended the National ACS meeting in San Francisco, California, in March 2010. Ten of them presented research posters and the club presented a poster including the club's activities. The club co-hosted (with Tri-Beta) three graduate school information sessions during the fall of 2010 that included seminars by PLNU professors and alumni currently in different graduate programs. The club officers for the 2010-2011 academic year are Mark Boerneke (president), Troy Kurz (vice president), Seth Simonds (secretary), David Vandebroek (treasurer), and Summer Bunting/Carli Coco (publicity/public relations). The club once again received an Honorable Mention Chapter Award from the American Chemical Society for its 2009-2010 activities. The award was presented at the spring ACS meeting in Anaheim in March 2011. The club has helped foster deeper relationships and a sense of community between our students and has helped students get more involved with the chemistry department.

Pre-Health Professional Program

Currently, our records indicate that 14 of the 17 2009 grads who applied and 11 of the 16 2010 grads who applied have been accepted into health professional schools. In addition, several alums from earlier years were accepted into programs during 2010. Those enrolling in medical school at Loma Linda during the fall of 2010 include Karissa Archer ('10), David Pratt ('10), Torrey Parry ('08), and Josh Western ('10). Adam Sweeney ('10) began his studies at the University of Washington School of Medicine, and Matt Herrick ('07) is now studying medicine at the University of Texas. Seth Bricel ('10), Vanessa Franz ('10), and Jonathan Laroya ('09) all received good news this year and will be enrolling at USC, University of Vermont and UC San Diego medical schools, respectively, beginning this fall. Andrew Bernhard ('10) and Connie Irwin ('10) both began their dental school studies in 2010; Drew at Creighton University and Connie at the University of Washington. Peter Ivey ('10) was recently accepted into UCSF Dental and will start there in the fall of 2011. Amber Kerk ('10) is studying veterinary medicine at Purdue University, and Cassie Wilcox ('10) recently received news of her acceptance into the Veterinary School at the University of Tennessee. Jessica Chen ('10) was accepted into UC San Francisco's pharmacy doctorate program and will begin studies there this fall.

Kimberly Lew ('08) has enrolled in the physician assistant program at Western University School of Health Sciences in Pomona, Grace Faucette ('07) will begin studying occupational therapy at Idaho State University this fall, and Ashley Voss ('10) is enrolled in the DOM program at the Arizona College of Osteopathic Medicine.

We are proud of these graduates and wish them the very best as they join the more than 400 PLNU alumni who have successfully pursued careers in the health science professions.

Graduate School Acceptances

by Michael McConnell

Several alumni of the PLNU biology and chemistry departments received good news in response to their graduate school application work this year. Garret Lemons ('08) is now working on an M.S. degree in ecology at San Diego State University. Natasha (Jundt) Gebhart ('10) and Anthony Montano ('10) are both pursuing Ph.D. degrees in molecular biology; Natasha is at Indiana University while Anthony is studying at UC Irvine. Those who began working in chemistry Ph.D. programs this year include Nicole Freyschlag ('10) at Tufts University, Julianne Thomsen ('10) at Yale University, and Justin Bordley ('10) at Georgia Tech University.

This fine group of alums represents one of the largest Point Loma single year contingents to enter graduate school in quite some time and we are very proud of them.

2010 Biology Summer Research Program



First row: Dr. Mike Dorrell, Dr. Robert Elson, Pieter Baker, Troy Kurz, Brad Jacobsen, Stephen Bravo, Natasha Jundt, Doug Zuill, Caleb Bryce, Alyssa Scott, Daniel Virden, Jared Yee, Dr. Michael McConnell. **Second row:** Bobby Perry, Quinn Yost, Chris Evans, Dr. April Maskiewicz, Kelsey Luoma, Kerri Sevenbergen, Kelly Pfeil, Karissa Vaillancourt, Megan Edgbert, Jenna Lavenuta, Amy Woods, Sarah Schale, Trisha Stull. **Third row:** Dr. Mike Mooring, Dr. David Cummings, Jake Tremblay, Andrew Montano, Hannah Green, LeAnne Elizondo, Danielle Matonis, Marie Holman, Kayla Kendric, Angelica Barr, Dr. Dawne Page, Dr. Bob Wiese, Dr. Darrel Falk. **Not pictured:** Will Taylor.

Students Directed by David Cummings

Pieter Baker (Escondido, CA), **Jenna Lavenuta** (Escondido, CA), **Kelly Pfeil** (Bend, OR) and **Doug Zuill** (Poway, CA)

In the Cummings lab, we are trying to understand the role of urban storm water runoff in the spread of antibiotic-resistant bacteria and antibiotic resistance genes in natural environments. In 2011, we focused our efforts in two related areas: (1) detecting plasmid-mediated quinolone resistance genes in Tijuana Estuary and Famosa Slough, and (2) sequencing fragments of the multidrug-resistance plasmid pLNU.11 from the Tijuana Estuary.

Students Directed by Mike Dorrell

Stephen Bravo (San Luis Obispo, CA), **Troy Kurtz** (Chino, CA) and **Jacob Tremblay** (Poway, CA)

All three students continued the work initiated by Stephen the year before in which the chick chorio-allantoic membrane (CAM) model is used to study the effects of various angiostatic therapies on tumor vascularization and growth. The goal of this project is to find novel combinations of currently approved, or nearly approved, angiostatics that result in synergistic activity. The students made significant progress by determining dosing efficacies for several monotherapies. By doing this, we learned the maximum dose of each angiostatic that had minimal effects as monotherapies. This next summer we plan to combine these angiostatics at these doses to determine which combinations result in significant, synergistic angiostatic activity.

In addition, Troy and Jacob, with help from Stephen, worked at developing a retinal vascular development model in zebrafish. Zebrafish rearing techniques were perfected and several timepoints during zebrafish development were cataloged for future use in determining the course of retinal vascularization. The overall purpose of this project is to understand the course of normal developmental angiogenesis of zebrafish retinas, for future study of normal development and retinal vascular disease.

Students Directed by Robert Elson

Karissa Vaillancourt (La Mesa, CA) and **Amy Woods** (Rancho San Diego, CA)

We are studying the roles of key neurohormones and neuromodulators in the control of arousal and vegetative functions in developing larvae of model insect species – to answer basic questions in neural development and for insight into the control of important pests. In the summer research program of 2010, we continued to make progress in two projects:

1. The development of neurons expressing octopamine – the invertebrate equivalent of norepinephrine. This project uses the tobacco hornworm moth, *Manduca sexta* (an important research model). Octopaminergic neurons control central and peripheral arousal, and octopamine and its receptors are targets or models for insecticide design. Hence, it is important to know how the neurons capable of synthesizing this neurotransmitter develop within the central nervous system from the caterpillar through metamorphosis to the adult.

We have used a sulfide-silver histochemical technique to stain for the presence of the copper-containing enzyme, tyramine-beta-hydroxylase, which synthesizes octopamine. We pursued the development of neurons expressing this enzyme from early larval stages through the pupa and into the early adult. It is my hope to develop a specific antibody against the enzyme: to this end, during the previous academic year I mentored an undergraduate who did bioinformatic analysis of the probable structure of tyramine-beta-hydroxylase and its possible immunogenic sites. We are also trying to use immunocytochemistry to confirm the presence of octopamine in our newly discovered neurons.

2. The development of neurons expressing the transmitter serotonin. This project forms part of a larger research effort studying the neural control of the hindgut (the organ of waste elimination and urine processing) in the large mealworm, *Zophobas morio*, a close relative of commercially important pests of stored grains and flours. This organ is controlled by the terminal abdominal

ganglion of the nerve cord. In the larva, the ganglion possesses four serotonin-containing neurons that innervate the hindgut. Using antibodies specific for serotonin, we have followed the development of these and other serotonergic neurons in this important nerve center.

This project is proving to be very successful. We've found that the number of serotonin-expressing motor neurons and interneurons changes during the metamorphosis of the insect, some coming online later in development while other neurons that previously expressed serotonin either die or stop making the transmitter. This presents a fascinating opportunity to study the development of serotonin expression in specific neurons. We intend to do parallel studies using antibodies raised against the enzymes involved in serotonin synthesis. I thank Research Associates for their generous support. It enables me to pursue research questions of both basic and applied importance, and to train undergraduates in scientific methodology and techniques of microdissection, immunocytochemistry, and histology.

Students Directed by April Maskiewicz

Halsie Donaldson (Redlands, CA) and **Hannah Kelley** (Sacramento, CA)

Hannah and Halsie are analyzing freshman biology majors' responses to a pre/post ecology diagnostic question cluster that measures students' principled-reasoning. They are determining if, after a specially designed active-learning intervention, students began to reason at multiple scales (organismal, cellular, and molecular) and apply principles such as conservation of matter and energy to explaining ecological phenomena. Upon completion of coding the pre- and post-tests using a validated coding scheme, they will statistically analyze the results.

Students Directed by Michael McConnell

Megan Edgbert (Petaluma, CA), **Natasha Jundt** (Fresno, CA), **Danielle Matonis** (Poway, CA) and **Andrew Montano** (Oceanside, 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 a 3-6 sugar repeat unit that is attached to the outer tip of the R-core and which projects outward into the cell's aqueous environment. Although lipid A (aka endotoxin) is the most dangerous part of LPS from a medical standpoint, the O-polysaccharide is also of significance to human health, in that it is the part of the LPS molecule with which our immune system initially interacts during an infection by Gram-negative bacteria.

The members of the McConnell research group continue to study Group E1 Salmonella O-polysaccharide structure and biosynthesis and the mechanisms whereby viruses such as Epsilon 15 and c341 are able to 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 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 *rfbD*, respectively. Their work was possible because the J. Craig Venter Institute had recently published a partial genomic sequence for *Salmonella weltevraden*, another Group E1 organism so closely-related to *S. anatum* that its gene sequences can be used successfully for the design of knockout PCR primers that are effective against *S. anatum*.

By the end of the 2010 summer research program, five more *S. anatum* genes involved in O-polysaccharide biosynthesis had been knocked out; namely, *rfaL*, *Orf9.6*, *Orf17.4* and two phage E15 genes (21 and 22) whose protein products modify the host cell O-polysaccharide structure. The impact of each gene's loss on O-polysaccharide structure was characterized using a variety of experimental approaches. By far our most surprising discovery, to date, is that the product of *S. anatum* gene *Orf9.6* is an O-polysaccharide polymerase that can apparently synthesize either alpha-glycosidically-linked or beta-glycosidically linked O-polysaccharide polymers, depending upon whether the mannosyl-rhamnosyl-galactose repeat unit substrate provided to it does, or does not, contain O6-acetyl groups on the galactose residues. We have experiments in mind for the summer 2011 research program that should enable us to further refine this model.

The results we have been obtaining lately are often surprising and occasionally, downright baffling! We are resilient and determined, though; hopefully, we will eventually come to understand the process of O-polysaccharide biosynthesis in Group E1 *Salmonella* bacteria to a substantial degree.

Students Directed by Mike Mooring and Involved in Costa Rica Research
Caleb Bryce (Wells, ME), **Bobby Perry** (San Diego, CA), **Will Taylor** (San Diego, CA) and **Jared Yee** (Redlands, CA)

“Pilot study of elusive mammals in a Costa Rican cloud forest”

Tropical montane cloud forests are extremely species-rich but among the most endangered and little studied ecosystems in the world. The montane oak forests of the Talamanca mountain range of Costa Rica serve as important habitat by connecting populations of large mammals at lower elevations along both the Atlantic and Pacific sides of the mountains. The Rio Savegre Valley is located in the Talamanca mountain range and is part of the buffer zone for the largest contiguous region of protected montane forest in Costa Rica. Long-term, large-scale species monitoring is required to assess the current status and trends of mammal populations in these oak cloud forests. Because large mammals are most likely to suffer from alterations to the local landscape from land use, hunting, or climate change, these populations serve as a barometer for the overall health of cloud forest ecosystems.

During summer 2010, we conducted a pilot study to monitor mammal population trends in the upper watershed of the Rio Savegre Valley. Based out of the QERC field station in San Gerardo de Dota, we employed a suite of non-invasive techniques to survey the elusive mammals, including trail surveys of tracks and scat, phototrapping with motion-sensor cameras, and recording vocalizations with acoustical recorders. In addition, we conducted a series of interviews with long-time community residents to construct an historical narrative of mammal population trends over the past 50 years since the valley was settled.

Based on tracks and photographs, we established the presence of all the large predators (coyote, ocelot, puma, jaguar) and their prey species (raccoon, peccary, paca, tapir). The discovery of a black jaguar was particularly exciting, as jaguar had not been sighted in the valley for more than 40 years. This discovery indicates periodic use of the valley by this rare feline. Combining trail observations with historical trends from interviews, we found that coyotes were the most commonly observed predator in the valley, with all informants reporting either seeing or hearing coyotes on a regular basis. Although puma observations were less frequent, their consistent presence on the trails was indicated by tracks and photos. Ocelot and paca were photographed in the lower valley, where they appear to be rarer than coyotes and pumas. Finally, we discovered the presence of a tapir in the lower valley where this species had not previously been reported, possibly due to dispersal from an expanding population at higher elevations.

These findings indicate that mammals are using the valley as a corridor between elevational zones, providing important evidence against a government proposal to build five hydroelectric dams along the 40-km river that would destroy habitat connectivity for jaguars and other charismatic predators. We are now working in partnership with local collaborators to expand this community-based conservation initiative. As we returned to San Diego, it was clear that God has opened a door very wide for the continuation of the mammal study. Not only have we confirmed the presence of several predator species in the valley (even the rare and elusive jaguar), but also we have been able to enlist an unusual level of community support for an ongoing study. With the help of community members, it has been decided that QERC will continue to monitor a baseline network of cameras that will give us a full year of photo trap data before we return again next summer. In addition to our goal of acquiring 20 more cameras to expand the trail network currently being monitored, we have also identified several new side projects that will add new depth to the mammal study. Among other things, we would like to start a comparative study at the Cerro de las Vueltas Biological Reserve, a pristine subalpine (paramo) reserve a short distance from San Geraldo where we have already found signs of puma, coyote, and tapir. If all goes well, we hope to enlist the collaboration of local mammalogists at the UNA (National University) in order to acquire additional funding and perhaps expand the project into the Amistad Peace Park corridor to the east of the Savegre Valley.

Students Directed by Mike Mooring and Involved in Bison GIS Analysis
Caleb Bryce (Wells, ME), **Bobby Perry** (San Diego, CA) and **Will Taylor** (San Diego, CA).

“Analysis of GIS Data on Bison Space Use at Fort Niobrara, Nebraska”

American bison are the largest land mammals in North America, with males and females weighing up to 1200-2000 lbs, respectively. Historical herds on the Great Plains migrated hundreds of miles a year in search of good forage until they were reduced from an estimated 30 million to a few hundred in the 19th century. The efforts of early conservationists saved bison from extinction by placing conservation herds in protected areas, such as national wildlife refuges and parks. Today, the 20,000 bison in conservation herds are typically housed on small refuges, of which Fort Niobrara National Wildlife Refuge (approx. 20,000 acres) is representative. Because conservation herds are typically housed on refuges that are considerably smaller than their historical range, knowledge of their habitat

selection and movement patterns is important for wise management of both bison and the overall ecosystem.

We studied the space use of bison (*Bison bison*) at Fort Niobrara National Wildlife Refuge during June-August of 2008-2009, where approximately 400 head of bison (adults and calves) are rotated through grazing units during the summer months. Data were collected from June 9-August 7 of 2008, and from June 19-August 8 of 2009. We utilized a Trimble Yuma ruggedized tablet PC with GPS in combination with a Trupulse laser rangefinder/compass with Bluetooth connection to the tablet PC. The Trimble and Trupulse recorded the outer boundaries of each group using off-set mapping techniques, which were subsequently converted into polygons. At the same time, data on herd size, composition, and activity budgets were entered into attribute tables embedded in the polygons. The herd polygons and attribute data were then used to build an ArcMap geodatabase. We subsequently performed spatial analysis using the sophisticated analytical tools found in the Spatial Analyst Extension for ArcMap 9.3 and the Animal Movement Extension for ArcView 3.3. Excel and SPSS were then used to statistically explore associations between bison group size and activity with unit size, elevation, soil type weather, gates, and soil type.

During the three weeks prior to our summer research team's departure for Costa Rica, my students worked to finish off the GIS analysis that we have been doing during the school term for the past 2 years (2008-2010). Our findings included the following: (1) The longer the bison herd was in a unit, the larger the percent of the unit that was grazed, indicating that bison generally utilized most parts of the units. (2) Some parts of the unit did appear to be avoided, however, especially the choppy hills. (3) Weather influenced activity budgets, with bison feeding less on hot and windy days. (4) Bison at higher elevations spent less time feeding and more time standing and lying down on hot, windy days, supporting the thermoregulatory model. (5) Soil type did not appear to influence habitat selection by bison. (6) Bull groups spent more time lying down compared with cow groups. (7) Bison tended to gravitate towards the gates, especially during the rut. Furthermore, they tended to be closer to the gate that they would eventually pass through, and farther from the gate they had already entered the unit by. These results indicate that bison have a mental map of the "migration" route they will follow through the units during the summer. The resulting product was a 26-page report that was sent on to the Fort Niobrara refuge office to assist them with ongoing vegetation surveys and review of management policy.

Students Directed by Dawne Page

Bradley Jacobsen (Indio, CA), **Kayla Kendrick** (El Cajon, CA), **Sarah Schale** (Bakersfield, CA) and **Alyssa Scott** (Chula Vista, CA)

I spent 2008-09 on sabbatical in Dr. David Traver's lab at UCSD in order to transition my research on the immune system to using zebrafish as a primary animal model. 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 and Brad Magor (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.

David Pratt (Class of 2010) and **Kayla Kendrick** made some of the DNA constructs that were injected into Zebrafish embryos to make the transgenic lines. **Alyssa Scott** assessed the expression of B cell-specific genes in various zebrafish organs by quantitative PCR. **Brad Jacobsen** and **Sarah Schale** assessed the B cell proliferative response in immunized fish.

Students Directed by Bob Wiese '82

Trisha Stull (Cherry Valley, CA) and **Daniel Virden** (Reynoldsburg, OH)

Trisha Stull and Daniel Virden's primary project was studying the space use and species interactions of various monkey exhibits throughout the San Diego Zoo. They observed 11 exhibits throughout the zoo, for 20 hours each at various times throughout the day. The purpose of this project was to determine how exhibits were being utilized by the monkeys and if any changes would improve the spatial use of the exhibits. They also looked at which combinations of monkey species were the most favorable, both in terms of the monkeys' well-being and public interest. In a separate assignment, they observed specifically the male DeBrazza guenon to determine why he was losing his hair. Trisha and Daniel also worked on a small project in which they transferred breeding records of the San Diego Zoo's koala program and analyzed them to determine if kinship between koalas was related to mating success. This was to supplement the zoo's continuing research on koala mate choice.

Angelica Barr (Hemet, CA)

Angelica's primary study focused on behavioral observations of Southern Pacific Pond Turtles (*Actinemys marmorata pallida*) at the San Diego Zoo. The Southern Pacific Pond Turtle historically was a common resident along the rivers of California, but with a 95 percent loss of riparian forests and the channelizing of most of California's rivers, it has declined toward endangered status. Our program for this species includes breeding, head starting hatchlings and eventual release of sub adults back into the wild. Angelica collected daily observation data from the turtles held in our large Pacific Pond Turtle exhibit at the San Diego Zoo. The sustainability of this species at our facility requires successful breeding and rearing new generations and the behavioral data will help us better understand this

species' biology. Additionally these data will help us assess the overall design of the exhibit and will provide insight into the spatial requirements of these aquatic turtles and will be useful when designing future aquatic reptile enclosures. The information gathered from Angelica's project will be shared with our program colleagues as we strive toward successfully sustaining the Pacific Pond Turtle in the Southwest. Angelica also learned various hands-on husbandry techniques as she assisted the Herpetology Department with daily husbandry routines including the maintenance of reptile eggs and the care and feeding of various species of reptiles.

Hannah Green (El Cajon, CA)

Hannah studied the new elephant herd forming at the San Diego Zoo. In 2009, the San Diego Zoo opened its new Elephant Odyssey exhibit for our herd of eight Asian and one African elephants. This new herd is composed of three elephants from the zoo, four elephants from the San Diego Zoo Safari Park, and two elephants from a private facility. Hannah's research focused on gaining a better understanding of the new relationships that are forming between the elephants as they are introduced to each other. Time budgets for interactions between elephant pairs were developed and compared. She also looked at use of the new exhibit to learn how the elephants are using the different exhibit features (e.g., food type and feeder preference) and established time budgets for how each elephant spent their day. This information is critical to providing the best possible care for the elephants in their new home.

2010 Chemistry Summer Research Program



Front row (left to right): Mark Boerneke, Luke Vickers, David Vandebroek. **Middle row (left to right):** Kelli Hickie, Renae Minnema, Summer Bunting. **Back row (left to right):** Angel Fontilela, Dr. David Lingner, Ryne Holmberg, Parker Horn, Dr. Dale Shellhamer, Dr. Victor Heasley. **Not pictured:** Dr. Ken Martin, Michael Douglas and Seth Simonds

Students Directed by Sara Choung

Justin Bordley (Modesto, CA) and **Julie Thomsen** (Colton, CA)

During the spring of 2010, both Julie and Justin completed honors projects that

had been initiated the summer before. Julie's project title was, "The Effect of Nitrogen Compounds on Iron(III) Molybdate Catalysts" and Justin's work was entitled, "Studies of the Partial Oxidation of Ethanol and Methanol over an Iron Molybdate Catalyst and the Effect of Sulfur Compounds." We collaborated with Dr. Chelsey Baertsch's research group in the Chemical Engineering Department at Purdue University on a project that addresses the need for selective ethanol microensors with applications including analysis of renewable liquid fuels and pollution monitoring of exhaust gases from automotive and refining applications. Julie and Justin used our catalytic reactor at PLNU to study the partial oxidation of ethanol and methanol over an iron molybdate ($\text{Fe}_2(\text{MoO}_4)_3$) catalyst. Iron molybdate catalysts are selective for the partial oxidation of ethanol to acetaldehyde and methanol to formaldehyde. They also investigated the effects of pyridine, a nitrogen containing compound, and thiophene, a sulfur containing compound, on the partial oxidation of ethanol. Both were found to decrease the rate of partial oxidation of ethanol. Julie is currently in her first year at Yale University pursuing a Ph.D. in chemistry and Justin started the Ph.D. program in the chemistry department at Georgia Institute of Technology.

Students Directed By Victor Heasley

Mark Boerneke (Oceanside, CA)

"Reaction of Styrene with Monobromamine, NH_2Br ."

Mark, along with Dr. David Lingner, studied the reaction of styrene with NH_2Br , synthesized recently for the first time at PLNU at drinking water compatible conditions, in aqueous conditions and pH 8-10, which gave the following products: bromohydrin, dibromide, styrene oxide (trace), phenacyl bromide, and bromoform. Hydrobromite ion (OBr^-) at these pH values is not the reactant since it gave styrene oxide as the major product. Since NH_2Br , but not NH_2Cl , reacts with styrene, an ionic mechanism is suspected for NH_2Br . We have proposed an ion-radical mechanism for the reaction of NH_2Cl with various unsaturated hydrocarbons.

Ryne Holmberg (San Diego, CA)

"Investigation of the Reactivity of Both Chlorines in NHCl_2 "

Ryne's project was to determine whether both chlorines in the NHCl_2 molecule are chlorinating agents; after the loss of one of the chlorines in NHCl_2 , the remaining fragment might disintegrate. Ryne's investigation involved the study of the reaction of a ten-fold excess of resorcinol (1,3-dihydroxybenzene) with NHCl_2 and determining the amount of mono- and dichlororesorcinol produced. The preliminary data, which point toward a 1:1 molar stoichiometry between NHCl_2 and the chlororesorcinol products, suggest that only one of the two chlorines is reactive.

Renae Minnema (Visalia, CA)

"Studies on the Stability of Hypochlorous Acid, HOCl , in MeOH /Ether and Its Reaction with 1,4,6-Trichlororesorcinol (TCR) and Pentachlororesorcinol (PCR)."

Renae determined that the lifetime of HOCl in MeOH /Ether at room temperature was about 20 minutes, and after this time the solution became increasingly yellow, probably due to the formation of chlorine. HOCl , in contrast

to NH_2Cl and NHCl_2 , did not open the ring of PCR in MeOH, instead adding the substituents of Cl, OCH₃ across the double bond. TCR and HOCl gave PCR and the product from PCR (Cl, OCH₃ addition).

Student Directed by Ken Martin

Michael Douglas (Elk Grove CA)

Michael joined us in 2010 as we continued our investigations of solid state phase transitions in substituted naphthalenes. In Michael's project, we focused most of our attention on methyl substituted naphthalenes and their interactions with separately deposited adlayers of nonradiative molecules like octane and decalin. 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. When irradiated with UV light, these naphthalene compounds form excimers (excited state dimers) under such conditions. By monitoring the fluorescence emission, we are able to observe the transitions from one stable excimeric form to another as a function of temperature. We also detected the effects of mixing as we impart thermal energy to the bilayer system. After computer analysis, these observations give insight into the physical transformations that occur in the elementary process of desorption from an inert surface or mixed crystal. The studies have been written up and will be published in the near future. The work was conducted at Westmont College under the joint direction of Ken Martin and Allan Nishimura (the Kathleen Smith Professor of Chemistry, Westmont College). As usual Michael and Dr. Martin spent 10 weeks of their summer in Santa Barbara working on this research project.

Seth Simonds (Chandler AZ)

Seth also joined the research team in 2010 as we looked for evidence of resonance energy transfer between naphthalene as a donor, and molecules such as phenanthrene as an acceptor. Bilayers of donor and acceptor molecules were deposited from vapor in an ultra high vacuum (UHV) chamber onto a cryogenically cooled Al_2O_3 (0001) crystal. The sample was irradiated with UV light so that the emission spectra could be observed and monitored. The adlayer molecules mixed as the sample was steadily heated, imparting thermal energy to the molecules of the system. Resonance energy transfer was apparent when the molecules mixed and came within the critical energy transfer distance. Resonance energy transfer was also observed between layers of dichlorobenzene and fluorenone using the same technique. The studies have been written up and will be published in the near future. The work was conducted at Westmont College under the joint direction of Ken Martin and Allan Nishimura (the Kathleen Smith Professor of Chemistry, Westmont College). As usual Seth and Dr Martin spent ten weeks of their summer in Santa Barbara working on this research project.

Students Directed by Dale Shellhamer

Kelli Hickle (Gilbert, AZ), **Parker Horn** (Vista, CA) and **David Vandebroek** (Oceanside, CA)

Kelli, Parker and David spent the summer measuring rate constants for reaction

of chlorosulfonyl isocyanate with monofluoroalkenes. Plotting the logarithm of their measured rate constants versus calculated vertical ionization potentials gives a linear plot. Several fluoroalkenes fell off the linear line due to steric effects. Fluoroalkenes with very low ionization potentials are also below the line, which we interpreted as a change in mechanism from a concerted to a stepwise pathway. Quantum chemical calculations, however, suggest that these electron-rich low ionization potential fluoroalkenes are still reacting by a one-step concerted process. We now suspect that these electron-rich fluoroalkenes fall off the line on the linear plot because they form a pre-equilibrium complex before the rate determining step. Data supporting formation of a complex are from the activation parameters and UV-Vis studies with these electron-rich alkenes.

Summer Bunting (Whaleyville, MD)

The percent yield for reaction of chlorosulfonyl isocyanate (CSI) with unreactive alkenes is moderate to low. Summer is using our new microwave reactor to increase the efficiency of CSI reactions with unreactive hydrocarbon and fluorocarbon alkenes. She found that reaction times are shorter and product yields are increased with the use of a microwave reactor.

2010 Student Seminar and Poster Presentations

Students Sponsored by Sara Choung

1. Justin A. Bordley, Julianne M. Thomsen, Joseph E. Gatt, Chelsey D. Baertsch, and Sara Yu Choung, presented at 2010 Spring Meeting of American Chemical Society, San Francisco, CA (3/10). "Studies of the Partial Oxidation of Ethanol and Methanol over an Iron Molybdate Catalyst and the Effect of Sulfur Compounds."

2. Julianne M. Thomsen, Justin A. Bordley, Joseph E. Gatt, Chelsey D. Baertsch, and Sara Yu Choung, presented at 2010 Spring Meeting of American Chemical Society, San Francisco, CA (3/10). "Effect of Methanol and Nitrogen Containing Compounds on the Activity, Selectivity and Stability of Fe₂(MoO₄)₃ Catalysts in the Partial Oxidation of Ethanol."

3. Mark Boerneke, Justin Bordley, Summer Bunting, Vanessa Franz, Nicole Freyschlag, Danielle Hassler, Amber Kerk, Anthony Montano, Kristen Moser, Seth Simonds, Ricardo Solano, Adam Sweeney, Julie Thomsen, Jacob Thorpe, David Vandenbroek, Sara Yu Choung and Gary L. N. Smith, presented at the 139th Annual Meeting of the American Chemical Society, San Francisco, CA (3/10). "Sharing Chemistry with Students in the Greater San Diego Area."

Students Sponsored by David Cummings

Archer, Karisa F., David J. Arriola, Pieter A. Baker, Jonathan B. Laroya, Cody R. Ryan, Kelsey R. Unruh, Kelly L. Pfeil and David E. Cummings. "Spread of drug-resistance genes in a sewage-impacted coastal wetland." Presented by **Karisa Archer** and **Jonathan Laroya** at the 35th Annual West Coast Biological Sciences Undergraduate Research Conference, Santa Clara, CA, April 2010.

Student Sponsored by Mike Dorrell

Stephen Bravo and Michael Dorrell. "Development of a novel model for testing combination anti-angiogenic therapies for cancer treatment". Presented by **Stephen Bravo** at the 35th annual WCBSURC, Santa Clara, CA, April 2010.

Students Sponsored by Victor Heasley

1. "Studies on the Synthesis of Monobromamine and Selected Reactions," Adam R. Sweeney and Victor L. Heasley. Presented by Adam Sweeney at the 239th Annual Meeting of the American Chemical Society, San Francisco, March 2010.
2. "Investigation of the Products and the Reaction of Pentachlororesorcinol, a Model Humic Acid, with Hypochlorous Acid," Amber R.E. Kerk* and Victor L. Heasley. Presented by **Amber Kerk** at the 239th Annual Meeting of the American Chemical Society, San Francisco, March 2010.

Student Sponsored by Ken Martin

1. W.A. Hale (1), **N.C. Freyschlag** (2), K.A. Martin (2), and A.M. Nishimura (1) "Evidence for Quenching of Methylanthralene Fluorescence by Cyclopentanone on Al_2O_3 ". 57th Annual Western Spectroscopy Association Conference at Asilomar Conference Center, Pacific Grove, CA, Jan. 2010. (1) Department of Chemistry, Westmont College. (2) Department of Chemistry, Point Loma Nazarene University
2. C.L. Binkley (1), **N.C. Freyschlag** (2), M.L. Gross (1), W.A. Hale (1), T.C. Judkins (1), K.A. Martin (2), and A.M. Nishimura (1) "Disubstitutional Effect on Naphthalene Fluorophores on Al_2O_3 ". 57th Annual Western Spectroscopy Association Conference at Asilomar Conference Center, Pacific Grove, CA, Jan. 2010. (1) Department of Chemistry, Westmont College. (2) Department of Chemistry, Point Loma Nazarene University

Students Sponsored by Michael McConnell

Hall, Courtney, Anthony Montano, Natasha Jundt, Jessica Chen, Robert Thayer and Michael McConnell (2010) "Studies on the mechanism of lipopolysaccharide biosynthesis in Group E1 Salmonellae bacteria", Presented by **Courtney Hall** and **Anthony Montano** at the Thirty-Fifth Annual West Coast Biological Sciences Undergraduate Research Conference, Santa Clara University, CA (April 24, 2010).

Students Sponsored by Mike Mooring

William Taylor, Caleb Bryce, Kathryn Thompson, Robert Perry, Christian Sanders, and Mike Mooring. "Bison space use: influence of weather, sex, and topography", presented by **William Taylor** and **Caleb Bryce** at the 35th Annual West Coast Biological Sciences Undergraduate Research Conference, Santa Clara University, CA (April 24, 2010).

Students Sponsored by Dale Shellhamer

1. Hassler, Danielle M. and Shellhamer, Dale F. "Addition of electrophiles to some monosubstituted fluoroalkenes," presented by **Danielle Hassler** at the 239th Annual Meeting of the American Chemical Society, San Francisco, CA (March 21, 2010).
2. Thorpe, Jacob J. and Shellhamer, Dale F. "Reaction of chlorine and bromine with 4-methoxy-1,1,2-trifluorobut-1-ene," presented by **Jacob Thorpe** at the 239th Annual Meeting of the American Chemical Society, San Francisco, CA (March 21, 2010).
3. Vandenbroek, David J.; Hickle, Kelli R. and Shellhamer, Dale F. "Studies on the reaction kinetics of chlorosulfonyl isocyanate with monofluoro substituted

alkenes," presented by **David Vandebroek** at the 239th Annual Meeting of the American Chemical Society, San Francisco, CA (March 21, 2010).

Faculty Seminar/Poster Presentations

David Cummings

Cummings, David E., Karisa F. Archer, David J. Arriola, Pieter A. Baker, K. Grace Faucett, Jonathan B. Laroya, Kelly L. Pfeil, Cody R. Ryan, Kelsey R. U. Ryan and Douglas E. Zuill. "Plasmid-mediated quinolone resistance (PMQR) genes in a sewage-impacted coastal wetland." Presented by **David E. Cummings** (and students) at the General Meeting of the American Society for Microbiology, San Diego, CA, May 2011.

Mike Dorrell

Michael I. Dorrell, Stephen Bravo. "Effects of non-vascular cells on endothelial cells during retinal angiogenesis". Presented by **Michael Dorrell** at the Gordon Research Conference; Endothelial cell phenotypes in health and disease. Biddeford, Maine, August 2010.

Victor Heasley

1. "Chlorination of Drinking Water with the Chloramines: Possible Contaminant Formation During Reaction of Dienes and Chloramines," **Victor L. Heasley**, Jeffery L. Boerneke, Amber R. E. Kerk, and Renae A. Minnema. Presented by Victor L. Heasley at the 4th International Congress of Chemistry and Environment, January 22, 2010, at Ubonratchathani, Thailand.
2. "Synthesis of Monobromamine, NH_2Br , and Its Reactions with Organic Compounds," Victor L. Heasley*, Mark A. Boerneke, David W. Lingner, Adam R. Sweeney and Renae A. Minnema. Presented by **Victor L. Heasley** at the 11th EuAsC2S Chemistry Conference, Dead Sea, Jordan (October 7, 2010).

April Maskiewicz

1. Coffey, J.E. & Maskiewicz, A.C. (2010, Dec). "The Dynamics of Progress: A case study of elementary teachers' engagement in science". Poster presented by **April Maskiewicz** at: DRK-12 PI meeting - Washington, D.C., December 2-4, 2010.
2. Maskiewicz, A., Griscom, H. & Welch, N. (2010, August). "Using active-learning strategies to address student misunderstandings of global climate change". Presentation by **April Maskiewicz** in Symposium titled: "Where's the Carbon? - Increasing Public Understanding of Global Warming with Improved College Science Education" at the Ecological Society of America's 95th Annual Conference – Pittsburgh, Pennsylvania.

Dawne Page

Dawne M. Page, David N. Pratt*, Noemi Delgado*, Alyssa R. Scott*, Bradley H. Jacobsen*, David L. Stachura+, Brad G. Magor#, and David Traver+. Dept. of Biology, Point Loma Nazarene University, San Diego, CA. #Dept. of Biological Sciences, University of Alberta, Edmonton, Canada. +Dept. of Cellular and Molecular Medicine, UCSD, La Jolla, CA. "Creation of IgM:GFP Zebrafish Reporter Lines." Presented by **Dawne Page** at the 2010 Zebrafish Meeting, Madison, WI, 6/2010.

Dale Shellhamer

Shellhamer, Dale F.; Bunting*, Summer A.; Hickle*, Kelli R.; Horn*, Parker C.; Vandenbroek*, David J. and Boatz, Jerry A. "Kinetics and studies on the reaction of chlorosfonyl isocyanate with monofluoroalkenes," presented by **Dale Shellhamer** at the 20th Winter Fluorine Conference at St. Petersburg Beach, January 10, 2011.

Book and Journal Article Publications (asterisks denote student coauthors)

David Cummings

1. Magnuson, T. S., M. W. Swenson, A. J. Paszczynski, L. A. Deobald, D. Kerk, and D. E. Cummings. "Proteogenomic and functional analysis of chromate reduction in *Acidiphilium cryptum* JF-5, an Fe(III)-respiring acidophile." 2010, *BioMetals*, vol 23, pp. 1129-1138.

2. Cummings, D. E., A. E. Zimmerman*, K. R. Unruh*, and S. Spring*. Influence of microbially reducible Fe(III) on the bacterial community structure of estuarine surface sediments. 2010, *Geomicrobiology Journal*, vol. 27, pp. 292-302.

Victor Heasley

Victor L. Heasley, Kristin M. Mitrovich*, Lisa C. Sator*, Audra M. Fisher*, Amber R.E. Kerk* and Dale F. Shellhamer, "Synthesis of a New Humic Acid Model, 2,3,6,6-Tetrachloro-2-methylcyclohex-4-ene-1,3-dione, and Investigation of Its Reactions with Monochloramine in Ether and In Methanol," *Research Journal of Chemistry and Environment* (December 2010).

Ken Martin

1. Michael S. Douglas‡*, Laura M. Selby*, K.A. Martin‡ and A.M. Nishimurat "Perturbation in the Formation of Excimers in Methylanththalenes on Al₂O₃ (0001)" *J. of Undergraduate Chemistry Research*, **2010**, 9(4), 117

2. Christine L. Binkley*, Nicole C. Freyschlag‡*, Melissa L. Gross*, Wendi A. Hale*, Taylor C. Judkins*, K.A. Martin‡ and A.M. Nishimurat "Energy Transfer in Mixed Excimers and Exciplexes on a Dielectric Surface" *J. of Undergraduate Chemistry Research*, **2010**, 9(4), 122

3. Laura M. Selby*, Michael S. Douglas‡*, K.A. Martin‡ and A.M. Nishimurat "1-Methylanththalene Excimers on a Dielectric Surface" *J. of Undergraduate Chemistry Research*, **2010**, 9(4), 128

April Maskiewicz:

1. Maskiewicz, A. & Winters, V. (2010). Interpreting elementary science teacher responsiveness through epistemological framing. In Gomez, K., Lyons, L., & Radinsky, J. (Eds.) *Learning in the Disciplines: Proceedings of the 9th International Conference of the Learning Sciences* (ICLS 2010) - Volume 1, Full Papers. International Society of the Learning Sciences: Chicago IL.

2. Alvarado, M.* & Maskiewicz, A. (In press). *Teaching High School Physiology Using a Popular TV Medical Drama*. The American Biology Teacher.

Michael McConnell

Los, Marcin, John Kuzio, Michael McConnell, Andrew Kropinski, Grzegorz Wegrzyn and Gail Christie (2010). Lysogenic conversion of bacteria of importance to the food industry, pp 157-198. In Parviz Sabour and Mansel Griffiths (ed.), *Bacteriophages in the control of food- and waterborne pathogens*, ASM Press, Washington, D.C.

Dale Shellhamer

1. Shellhamer, Dale F., Davenport*, Kevyn J., Hassler*, Danielle M., Hickle*, Kelli R., Thorpe*, Jacob J., Vandebroek*, David J., Heasley, Victor L., Boatz, Jerry A., Reingold, Arnold L. and Moore, Curtis E. "Reaction of chlorosulfonyl isocyanate with fluorosubstituted alkenes: Evidence for a concerted pathway," 2010, *Journal of Organic Chemistry*, 75, 7913.

2. Shellhamer, Dale F., Davenport*, Kevyn J., Jones*, Rachel N., Thorpe*, Jacob J., Weiss*, Ryan J., and Heasley, Victor L. "Reaction of halogens and interhalogens with 1,1,2-trifluorobut-1-en-4-ol and 3-butene-1-ol: A study on the rearrangement of trifluorosubstituted 3-membered halonium ions," *Trends in Organic Chemistry* 14, 73-77 (2010).

Research Grants Awarded (or in progress)

David Cummings

1. NOAA California Sea Grant Program. "Transferrable antibiotic resistance plasmids in urban coastal wetlands." \$10,000. 2011. D. E. Cummings and E. M. Top.

2. PLNU Research and Special Projects (RASP). "Measuring the concentration of antibiotic resistance genes in polluted wetlands." \$1,126. 2011. D. E. Cummings.

3. PLNU Wesleyan Center for 21st Century Studies. "Effects of tropical deforestation on Norops lizard behavior." \$2,000. David E. Cummings and Peter Gilson*.

April Maskiewicz

1. "Learning Progressions for Scientific Inquiry: A Model in the Context of Energy," NSF - 5 PI's, \$2.9 million, (San Diego State University, University of Maryland, Point Loma Nazarene University), National Science Foundation, January 1, 2009 – August 31, 2011.

2. "Identifying differences in discourse and teaching about matter and energy in biology, chemistry, and physics courses, and the challenges this poses for learners of biology". IBP (Introductory Biology Project) 4 PI's (University of Colorado, Hampshire College, University of North Dakota, Point Loma Nazarene University). Introductory Biology Project Catalytic Mini Grant, \$2000, August 1, 2010 – July 31, 2011.

Michael McConnell

"Identification of Major and Minor Protein Components Contained Within the Virion Structure of the Salmonella-Specific Bacteriophage, Epsilon 15", PLNU Alumni Association Faculty Grant, \$2000, 2010-2011

Mike Mooring

“Using acoustical recording units to survey elusive mammals in a tropical montane cloud forest”, PLNU Alumni Association Faculty Grant, \$2000, 2010-2011

“Elusive mammals of the Savegre Valley tropical montane cloud forest, Costa Rica”, Zoological Society of San Diego (2010): \$10,000

Dawne Page

The National Science Foundation proposal “B cell development and activation in zebrafish” has been granted as a 4-year project for \$466,000. This is a joint effort between PLNU & UCSD with Dawne Page of PLNU as PI and David Traver of UCSD as co-PI.

Dale Shellhamer

National Science Foundation (NSF-RUI) Research Grant, “ Electrophilic Reaction of Fluorosubstituted Alkenes with Chlorosulfonyl Isocyanate and some other Electrophiles”. \$134,277 (May 1, 2010 through April 30, 2013).

Other Professional Activities by the Faculty

David Cummings

Refereed two articles for *Environmental Science and Technology* and one for *Journal of Hazardous Waste Management*

Mike Dorrell

1. Refereed four articles for *Investigative Ophthalmology and Visual Science* (IOVS), one for *Nature Methods* and two for *Retina*.
2. Tri-beta faculty advisor; 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.
3. Off-campus research internships; Dr. Dorrell is also active in helping students find internship and summer research opportunities off-campus as the number of highly qualified candidates for research continues to grow.

Mike Mooring

Refereed one article for *Journal of Mammalogy*, one article for *Animal Behaviour*, one article for *Journal of Animal Ecology* and one article for *ISRN Zoology*

Dale Shellhamer

1. Served on a review panel for Major Research Instrumentation funding at the National Science Foundation in Arlington, VA, July 12-14, 2010.
2. Reviewed a research proposal from the University of Southern Illinois for the National Science Foundation, February 2010.
3. Refereed one article for *The Journal of Fluorine Chemistry* and one article for *The Journal of Organic Chemistry*.

Annual West Coast Biological Sciences Undergraduate Research Conference

by Michael McConnell

The 35th Annual WCBSUR Conference was hosted by the founding institution, Santa Clara University, on April 24, 2010. Among those representing Point Loma at this event were faculty members David Cummings, Mike Dorrell, Mike Mooring and Michael McConnell. A total of 11 students participated; namely, Karisa Archer, Steve Bravo, Caleb Bryce, Megan Edgbert, Courtney Hall, Jonathan Laroya, Anthony Montano, Robert Perry, Tricia Norkunas, Sarah Schale and Will Taylor. Altogether, Point Loma students presented four posters and one seminar at the conference. All of these presentations are described in more detail elsewhere in this report. Since the WCBSUR Conference was founded by Santa Clara University in 1976, a total of 143 institutions from 25 states have sent participants. PLNU has been represented at the WCBSUR Conference for 28 years in succession and 30 times, altogether. The PLNU Biology Department has hosted the WCBSUR Conference seven times (1992, 1996, 2000, 2004, 2006, 2008 and 2009), which is second only to Santa Clara University. Other host institutions have included Colorado College, Loyola Marymount University, Occidental College, the University of San Francisco and the University of California at Irvine. In 2011, Pacific Lutheran University (Tacoma, WA) will join the group of host institutions as the conference takes place for the first time in the Pacific Northwest.

PLNU's involvement in the WCBSUR Conference raises the profile of the science program in a very effective way. For the most recent conference hosted by PLNU in 2009, publicity was sent directly to over 12,000 biology and biochemistry faculty at 620 institutions throughout the United States. There is abundant anecdotal evidence indicating that such publicity directly benefits PLNU students when they apply for acceptance into graduate and professional school programs. With steady support from Research Associates, PLNU will continue to be a major player in this outstanding conference for many years to come.

Following the 2011 WCBSUR Conference at Pacific Lutheran University, Loyola Marymount will host in 2012, after which PLNU will host the WCBSUR Conference for the eighth time in April 2013.

CA Science Project (website: <http://csmc.ucop.edu/csp/seasand/>)

SEASAND, the Science Education Association of San Diego, is a site of the statewide CA Subject Matter Project in Science. This is a joint project between UCSD and PLNU, and our goals are: 1) to provide opportunities for teachers to enhance their science content knowledge and pedagogical skills, 2) to support professional communities for science teachers, and 3) to develop formal partnerships with schools and districts to improve student learning. To accomplish these goals, we offer summer institutes for secondary science teachers. In summer 2010, we offered a 24-hour institute on climate change. The institute was taught by Dr. Paul Schmelzenbach (PLNU Physics Dept.) along with Dr. Heidi Woelbern (adjunct professor PLNU Biology Dept.) and Dr. Stephanie Rico (a San Diego high school science teacher). We initiated an online teacher network community to foster a yearlong exchange of ideas by the participants of our summer institute, specifically on the topic of climate change (<http://education.sdsc.edu/csp/>). This work is supported by a No Child Left Behind grant from the State of CA.

Report on the Annual Meetings of Research Associates

by Michael McConnell

Spring Board Meeting:

The Board of Directors of Research Associates met for its annual spring dinner meeting on May 14, 2010. Members present included Board Chair Jeff Conner '84, Jeff Gardner '92, Keith Kortman '77 and Brad Oliver '77. Also present were faculty representatives Ken Martin and Michael McConnell, as well as three guests; namely, Joe Watkins (VP of External Relations), Sheryl Smee (Director of Alumni Relations) and Mike Mooring (professor of biology). There were reports on the various programs supported by Research Associates during 2009-10, including participation by students in science conferences, the annual Science Honors Weekend and the summer research programs in biology and chemistry. Final decisions were made regarding the juniors who would be awarded Molecular Science Awards at the Annual Breakfast in November, based upon voting by the outgoing seniors of the Class of 2010. Joe Watkins gave the board an update on fund-raising for the science complex. Sheryl Smee gave a final report on the highly successful "Celebration of Math and the Sciences" event that had taken place during Homecoming Weekend (November 2009).

During dinner, the board put together a slate of nominees to be considered by the general RA membership for election to the board (normally this nominating slate is prepared in November but there had been no November 2009 board meeting because of the Celebration of Math and the Sciences event).

Annual Breakfast and Fall Board Meeting:

The Research Associates Annual Breakfast and the Fall Board Meeting both took place on Saturday, November 20, 2010. The attendance at the breakfast was 86 (38 students and 48 alumni). RA board members who were present that morning included Chair Jeff Conner '84, Esther Allen '55, Rick Bravo '79, Jeff Gardner '92, Mark Jameson '92, Keith Kortman '77, Kirk Milhoan '86, Jack Owens '88, Harold Wadley '66 and Jeff Youngren '04. The activities at the breakfast included introduction of graduating seniors by department chairs and introduction of all biology and chemistry summer undergraduate researchers by their various faculty research advisors. Jeff Conner introduced the RA board members, and then Vic Heasley and Dale Shellhamer introduced all of the other alumni who were in attendance. The culminating events of the breakfast were the keynote address by Chair Jeff Conner, followed by announcement of the winners of the Molecular Science Awards (see photograph below).

The Fall Board Meeting followed immediately after the breakfast. Following introductions, there was a report on the pre-professional program, a final report on the 7/1/09 to 6/31/10 fiscal year, and updates on the funding levels of both the RA General Fund and the RA Endowed Scholarship Fund for 2010-2011 at the midway point. The meeting finished with an update by Joe Watkins on the status of the science complex fund-raising effort.

RA board members whose terms of service were completed in November 2010 were David Luttrull and James Mellert. We are very grateful to these alumni for their excellent work and service to Research Associates.

2010 Molecular Science Award Recipients



Left to right: Brad Jacobsen, Ricardo Solano, Caleb Bryce, David Vandenbroek, Stephen Bravo, Kelli Hickle, Renae Minnema, Mark Boerneke, Dr. Jeff Conner

Financial Report (Fiscal Year 2009-2010)

Endowed Scholarship Fund

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. The ESF provides scholarships from the investment earnings of the previous fiscal year. In 2005, the board voted to designate 25 percent of all unspecified gifts to the ESF, in order to assure its steady growth. No scholarships were awarded for the 2009-10 academic year.

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

Research Associates General Fund

The General Fund is sustained by annual membership gifts and is used primarily to support the ongoing needs of the summer research programs in the biology and chemistry departments, with available money divided equally between the two departments. This fund also helps pay for recruiting efforts and for sending our students to professional conferences where they can present the findings of their research.

Research Associates General Fund – Final Budget Details

July 1, 2009 – June 30, 2010	Income	Expenses Balance	Balance
Balance on hand as of July 1, 2009			\$29,368
Total Gifts (from 70 donors) \$23,975	\$23,975		
Other Income (interest)			
Transfer to RA Scholarship Fund (25% of Total Gifts)			
Summer Research Support (2010)		\$26,490	
Scholarships (8 Molecular Science Awards)		\$4,000	
Recruiting (Science Honors Weekend)		\$2,100	
Conferences (Biology Only, Chemistry Self-Funded)		\$1,500	
Annual Report (Printing & Postage)		\$2,298	
Fund Raising		\$565	
Homecoming Breakfast Meeting	\$1,010	\$1,643	
Misc.		\$801	
SUM	\$24,985	\$39,397	
Balance on hand as of June 30, 2010			\$14,956

Current Research Associates General Fund Budget

July 1, 2010 to June 30, 2011

Income

Gift Target \$38,000 (Gifts to date \$27,283)*

Expenditures	Budgeted	Expended*
Recruitment of Students and Public Relations w/ Medical and Graduate Schools	\$2,500	\$2,400
Outstanding Molecular Science Awards (8 at \$500)	\$4,000	\$3,850
Summer Research Program	\$25,000	\$26,000
Research Conference Expenses	\$3,000	\$1,700
Annual Report, Directory, and Mailings	\$2,000	\$323
Annual Meetings and Other	\$1,500	\$1,052
TOTAL	\$38,000	\$35,375

*As of 3/31/2011