



The Smilodon

The Newsletter of the Southern California Academy of Sciences
May 16, 2016



A light-footed Ridgway's Rail forages at Bolsa Chica State Beach (photo: D. Zembal).

MEMBER RESEARCH SPOTLIGHT: LIGHT-FOOTED RIDGWAY'S RAIL

This is the first in an occasional series for The Smilodon. Our membership is rife with passionate, committed scientists who are conducting timely and topical research projects. We would like to offer this space as a place to share the results of those efforts. This inaugural Research Spotlight features the work of Michelle Barton--her research into the light-footed Ridgway's rail was conducted as part of her M.S. thesis at California State University, Long Beach. More information about Michelle and her research can be found following the article.

by Michelle Barton

The light-footed Ridgway's rail (*Rallus obsoletus levipes*, formerly light-footed clapper rail), is an endangered sub-species of Ridgway's rail endemic to southern California. Survival of the light-footed Ridgway's rail depends on marsh conservation and restoration efforts to supply suitable nesting habitat. Previous research indicates that Ridgway's Rails preferentially nest in low marsh areas with tall, dense Pacific cordgrass (*Spartina foliosa*). Generally, Ridgway's rails use dead *S. foliosa* stems to construct platform incubation nests. Over the platform, thick, woven canopies of intertwined *S. foliosa* stems are built to shield nests from aerial predators. Nests, which are secured to *S. foliosa* stems, are buoyant and are able to float, much like a floating dock, as tides ebb and flow. While canopy architecture (e.g. height and density) is clearly important in nest site selection, additional microhabitat (e.g. vegetation and food availability) and landscape-level parameters (e.g. shape, composition, and spatial configuration) may contribute to the selection process. To better identify the habitat features that predict reproductive success, nest searches were conducted in Upper Newport Bay (UNB) during the 2014 breeding season. Microhabitat and landscape-level metrics were assessed for nest and non-nest (control) sites.

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PRESIDENT'S CORNER...

SCAS is celebrating 125 years!

For over a hundred years, the Southern California Academy of Sciences has been an important part of the scientific community of southern California. On November 6, 1891, a group of people interested in science gathered in Los Angeles to organize an association to promote all types of natural history. By the end of the year, the purpose of the Southern California Academy of Sciences was delineated "...to secure a more frequent interchange of thoughts and opinions among those who devote themselves to Scientific and Natural History studies; to elicit and diffuse a taste for such studies where it is yet unformed; and to afford increased facilities for its extension where it already exists."

One hundred and twenty-five years later I believe the Academy is doing just that. We strive to promote fellowship among scientists and those interested in science. This is our mission statement! We contribute to scientific literature through publication of pertinent manuscripts in the Bulletin of the Southern California Academy of Sciences and we encourage and promote scholarship among young scientists. I am proud to have been a member of SCAS for almost 20 years and am honored to have served as president of the Board of Directors for the last four years. I now report to you in my final letter as president...

Our 2016 Annual Meeting was held May 6 and 7 at the University of Southern California (USC) <http://scas.nhm.org/annual-meeting/>. Dr. Larry Allen from CSU Northridge was our plenary speaker on Friday May 6 and Dr. Virginia Naples from Northern Illinois University was our plenary speaker on Saturday May 7. Multiple symposia were held both days—Friday: 50 years of research at the USC Wrigley Institute, Parasitology, and Climate Policy; Saturday: Marine Mammals. Contributed paper talks took place on both days, and an evening poster session was held on Friday from 5-7pm. Also, our Junior Academy students in the Research Training Program (RTP) presented on Saturday. A large portion of this newsletter is dedicated to articles written by RTP participants, describing their process and journey—take a look!

The 2017 Annual Meeting will be at California State University, Northridge. Please encourage your colleagues and students to attend!

Please visit our website <http://scas.nhm.org> for all information pertaining to SCAS. On our website you can register for the annual meeting, renew your membership, apply for grants, and submit a manuscript to the Bulletin. The Academy Bulletin is open to high quality papers on research worldwide, particularly from SCAS members. Our website is hosted under the Natural History Museum of Los Angeles County and we are grateful to the Museum and hope to continue our long-standing relationship. I would like to thank our Board of Directors webmaster Shelly Moore for making our website so amazing!

As the President of the SCAS Board of Directors, and on behalf of the Board, I would like to take this opportunity to thank all of the members for your support of the Academy. I would also like to thank the following people for their outstanding efforts preparing for our 2016 Annual Meeting at USC — David Ginsburg as Local Committee Chairperson, Lisa Collins, Shelly Moore, Ann Dalkey, all the symposium organizers, the SCAS Board of Directors, and Gloria Takahashi for leading the Junior Academy.

Congratulations and welcome to our newly appointed Board member, Shana Goffredi from Occidental College. The following Board members have agreed to serve as officers beginning the 2016-2017 term; David Ginsburg as President, Edith Read as Recording Secretary, Kristy Forsgren as Corresponding Secretary, Daniel Pondella and Larry Allen as Editors of the Bulletin, Brad Blood as Editor of the Smilodon, and Shelly Moore as Webmaster.

I would like to thank Ann Dalkey for her seven years of service on the Board as both Treasurer and Corresponding Secretary. Since 2009, her hard work to organize the treasury has really helped SCAS grow as an institution. She will be missed!

So, with my final words as president, I would like you to know how much I have enjoyed being president of SCAS! The last four years have been a great learning experience for me, and I am grateful for the opportunity. I love this society, and will continue to serve on the Board. I also plan to continue to attend the annual meetings and will participate as much as possible. I hope I have served you well!

Thank you,
Julianne Kalman Passarelli, President

BOARD OF DIRECTORS PROFILE: MEET ANN DALKEY

by Julianne Kalman Passarelli, PhD

This is the first in an occasional series profiling members of the SCAS Board whose service directly contributes to the growth of the Academy.

I met Ann in 1998 during the Bight'98 trawl surveys aboard the City of Los Angeles R/V La Mer. I was a young graduate student at California State University, Long Beach at the time, and knew nothing about boat etiquette, collecting and identifying fishes, or field research in general. I was lucky that Ann was on the crew. She took me under her wing, treated me with respect, and taught me the ins and outs of working on a boat. I will never forget how supportive she was and how she helped me with my research. Thank you Ann!

Ann earned a Bachelor of Science in Marine Biology and Master of Science in Biology from California State University, Long Beach. Currently, she is a Stewardship Associate for the Palos Verdes Peninsula Land Conservancy. She oversees monitoring and research activities of the organization that includes applied, educational, and academic studies that will promote better understanding of the natural processes within the preserve. Before coming to the Conservancy, she worked as a marine biologist from 1984 to 2006 for the City of Los Angeles' Environmental Monitoring Division and from 1974 to 1984 for the Orange County Sanitation District. She was an officer of the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) from 1982 to 2002.

Ann has been a member of SCAS since the mid-1970's. She has participated in many annual meetings and has been on the Board of Directors since 2009. She took on the role of treasurer and corresponding secretary shortly after joining the Board. Her contribution to SCAS has been extremely generous with her consistently balancing the books, printing name badges, preparing acknowledgement

letters, and processing memberships. She has helped brand SCAS as a current, modern society with an extremely professional look. I know the SCAS Board of Directors is extremely grateful for her contributions.

Ann also coauthored the guidebook *Native Wildflowers of the Palos Verdes Peninsula*. The goal of this book was to create a user-friendly guidebook so that people with no botanical knowledge can easily identify a plant while hiking on the Palos Verdes Peninsula. This beautiful guidebook features 270 full color photographs of 81 native plant species and 9 invasive plants. It is an outstanding and user-friendly guide that I have on my shelf!

I would like to thank Ann for her seven years of service on the SCAS Board as both Treasurer and Corresponding Secretary. Ann is retiring from the Board this May and plans to spend more time hiking in the mountains with her husband



Above: Ann Dalkey, pausing during a hike on the Palos Verdes Peninsula.
Right: Ann at the welcome table for a SCAS event.



Berry, photographing flowers and butterflies, and enjoying retirement. Since 2009, her hard work to organize the treasury has really helped SCAS grow as an institution. She will be missed!

MEMBER RESEARCH SPOTLIGHT, CONTINUED...

Interestingly, only 25 percent of nests were found in *S. foliosa*. The majority of nests (57 percent) were found in patches of *Scirpus robustus*, a freshwater reed that is generally taller than *S. foliosa* and grows at the upper extent of the marsh plain. This finding was particularly intriguing as *S. robustus* habitat is less abundant than *S. foliosa* at UNB, comprising 8 percent versus 24 percent of the searched area. A Habitat Suitability Index (HSI), calculated by dividing used habitat by available habitat, was calculated to quantify preference and/or avoidance for available habitat types. The HSI for *S. robustus* habitat was 5.61, while that of *S. foliosa* was lower, 2.57, indicating stronger selection for *S. robustus* habitat. Based on these findings, it is hypothesized that constructing nests in *S. robustus* stands has considerable benefits.

In addition to having significantly taller vegetation, nest sites in *S. robustus* were found at higher elevations when compared to those in *S. foliosa*. At the time of maximum inundation, the tallest vegetation (i.e. the highest point a nest is able to travel before being lost to the tides) at *S. foliosa* nest sites was 16 cm under water, while the tallest vegetation at *S. robustus* sites was 72 cm above water. So, *S. robustus* could provide nests a greater degree of protection from tidal inundation.

Although the relative quality of *S. robustus* nesting habitat appears to be high, further research is needed to quantify the consequences. As Ridgway's Rails are

territorial and maintain year-round home ranges, rails that nest in *S. robustus* may need to invest additional energy to defend their home ranges. Further, as *S. robustus* stands are found close to the road, nests may experience a greater degree of predation from terrestrial predators like raccoons.

The high incidence of nest sites in *S. robustus* seen in this study does not necessarily suggest decreased reliance on *S. foliosa*, the bird's ecological affiliate, as rails still showed a preference for *S. foliosa* habitat (HSI = 2.57), rather it points to the fact that the species can adapt and thrive in alternative vegetation types. So, not only does this suggest that

nest site selection of the light-footed Ridgway's rail may be more plastic than previously assumed, but it also speaks to the resiliency and adaptability of the species.



Above: *S. foliosa*.
Right: *S. robustus*
(Photos: M. Barton)



About the author: Michelle Barton recently graduated from California State University, Long Beach, where she conducted research related to conservation biology and wildlife management. This research was part of her M.S. thesis in the Department of Biology. Michelle's advisor, Dr. Christine Whitcraft, runs the Wetland Ecology lab at CSULB. She was further assisted by Dick Zembal, a regional expert on the light-footed Ridgway's rail. He researched nest-site selection in the 1980s, but wanted to get an updated idea of what is influencing nest-site selection. Michelle successfully defended her thesis in April 2016, and is now working for Caltrans as an Environmental Planner.

NOTHING COULD BE FINER THAN BIOENGINEERING IN CAROLINA

by Samson Karben, RTP Researcher '15 and '16

When I first participated in the SCAS Junior Academy Research Training Program's session on how to create a scientific research poster, back in November 2014, I didn't realize I'd be putting the advice to work so soon.

My topic within the RTP program these past two years has been the advantages of non-invasive health monitoring of lizards in naturalistic environments. Since I've mostly been working with the Savannah Monitor -- tracking its unusual cardiac and respiratory properties -- I've called my hardware device "The Monitor Monitor."

Due to the great experience I've had working on my RTP project, I've been inspired to pursue further advanced studies in biological engineering. While researching the field further, I came across a web page promoting the Institute of Biological Engineering's annual conference (www.ibe.org).

Even though the conference was obviously geared towards college and graduate students, they were open to submissions from high school students, so I sent a copy over of the abstract for the RTP paper I've been working on this school year, and was very excited to learn a few months later that it was accepted.

The early-April conference was in Greenville, South Carolina, and brought in scholars from across the United States and Canada, and a few from overseas. The lectures covered a wide range of topics, from fuel-producing algae to virus-fighting bacteria to wearable biosensors. There was even a fascinating and practical session about how to avoid getting duped by fake scientific journals, which attempt to bilk researchers

into paying fake journal submission fees. Some of these scams even create detailed websites showcasing (unauthorized) full lists of editors and papers from the field... so be careful!

The morning of the Poster Session, I participated in a "speed networking" session. For eight minutes, I sat across from a random student or professor and exchanged thoughts about our respective research interests, sometimes even

exchanging business cards as well. Then the moderator would ring a bell (well, it was actually a bell-sounding app on his phone -- this was an engineering conference, after all), and everyone would move on to a new partner.

The highlight of the conference was indeed the poster session. What a great way to get feedback on your research! Professors and students would drift past my poster, ask questions, and occasionally taking pictures. I hope to incorporate some of the comments I had received into additional data gathering and analysis approaches this coming summer.

Thank you, SCAS and the RTP Program, for launching me into such great learning environments!

Samson Karben is a senior at YULA Boys High School in Los Angeles.



The author before his presentation poster at the Institute of Biological Engineering's annual conference in Greenville, NC.

RTP EXPERIENCE FROM TWO PERSPECTIVES

by Jae Marie Tabuada, RTP Researcher

I am a student at the California Academy of Mathematics and Sciences in Carson, California. I've completed my RTP in the Finkel laboratory at the University of Southern California conducting an experiment that validates my mentor's, Dr. Namita Shroff, research. My mentor completed research on



Author and RTP Researcher Jae Marie Tabuada.

the bacterium *S. oneidenisis* and the role of flavins on the bacterium's ability to complete extracellular electron transfer. She observed that using the bacterial flavin exporter (bfe) mutant in the same experiment caused the interstitial felt effect to be delayed by one day. My experiment was to complete gene complementation to reinsert the bfe gene into a bfe mutant to check if the delayed interstitial felt effect is removed. Although I was unable to complete the experiment due to difficulties with the plasmid we used, I learned a lot about the scientific process and about how to conduct myself in a laboratory setting. This opportunity helped me to understand the ethics of science firsthand and to apply everything I learned in class.

Working alongside Dr. Shroff taught me much more than studying a textbook ever would and I am grateful for the opportunity to work in a research laboratory. I understand that everything I've done during my time in the RTP will remain in the past, but everything I learned will be taken with me. Lastly, I am proud to say that I will be taking my gained experience and knowledge to the University of California Berkeley in the fall of 2016.

by Dr. Namita Schroff, RTP Mentor

I received my PhD in Applied and Environmental Microbiology from the University of Wisconsin--Milwaukee in 2012. After a post--doctoral fellowship in Protein Biochemistry at the University of Pennsylvania, I joined the Finkel group in 2014 to study survival techniques adopted by bacteria used as catalysts in electricity generating microbial fuel cells. The Finkel laboratory research largely revolves around investigating bacterial survival and evolution in long--term cultures. We utilize a range of techniques for the same, that include growth, genetic and omic approaches. Jae Marie Tabuada approached us in September 2015 to enlist as a research understudy. She was very excited to learn about electricity generating microbes; her project involved building one of the jigsaw pieces of the puzzle that I am working on. It was a pleasure being her mentor; she is intelligent, enthusiastic, and always eager to learn new concepts and techniques. Jae will make a great scientist, and we look forward to reading her research publications.

We are very proud of her on being accepted at UC Berkeley and wish her the very best in all her future endeavors.



Pictured are members of the Finkel lab at the Molecular Genetics of Bacteria and Phages conference in 2015. L to R-- Christina Ferraro, Nicole Ratib, Namita Shroff, Lacey Westphal, and Steven Finkel.

For more information about the RTP program, or if you have (or know) a student who might be interested in participating, please contact RTP Program Coordinator Gloria Takahashi at myopick@aol.com.

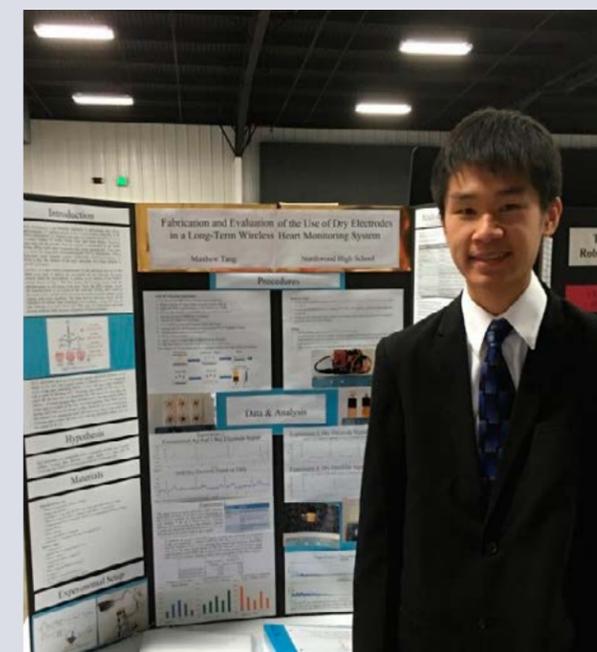
RTP STUDENT DEVELOPS "DRY-ELECTRODE" HEART MONITOR

by Matthew Tang, SCAS RTP Researcher

This is my first year as a RTP student and the experience has been much more than I expected. My adventure at UCI Khine Lab began with safety training, reading scientific papers, learning to use expensive equipment and eventually evolved to my project entitled, "Fabrication and evaluation of the use of dry electrodes in a long-term wireless heart monitoring system." As heart disease is a leading cause of deaths in the United States, there is a need for long-term cardiac monitoring to help prevent or treat cases which be easily detected if patients are having ECG measurements continuously. In fact, my grandmother who has arrhythmia recently had a stroke and could have benefited from such a monitoring device.

Wet electrodes have been the industry standard because they conform well to the skin which creates a better area of contact at the skin-electrode interface. These water-based gel electrodes work reliably during short tests at the doctor's office but are not suitable for continuous heart rate monitoring since they can cause skin irritation and experience signal degradation as the gel dries out over time. Dry electrodes do not require any gel which makes them a better choice for long-term wear. In this project, I have fabricated dry gold electrodes which are flexible and easy to use. My project comprised three parts, the fabrication process, the hardware experimental setup and the software data analysis and processing. Using an Arduino microcontroller and Matlab processing, I was able to acquire the expected PQRST waveform in a typical ECG with the Au dry PDMS based electrodes I fabricated in the lab. Though these electrodes are more susceptible to noise and will not likely replace the wet electrodes for short-term use, they are potentially a viable alternative for long-term wear.

From the challenge of finding a mentor who has time and space for a high school student to writing my first journal paper, the RTP meetings have been full of invaluable advice. The research I conducted was also easily presentable for various science fairs as shown in the picture. Besides the actual research itself, I have enjoyed conversations with my mentor and other graduate students in the lab as well as getting to fellow RTP students at the meetings, making RTP one of the richest experiences of my high school years thus far.



Author Chris Tang stands before his poster presenting his "dry-electrode" research. Chris is a sophomore at Northwood High School.

CAFFEINE IN OTC DRUGS

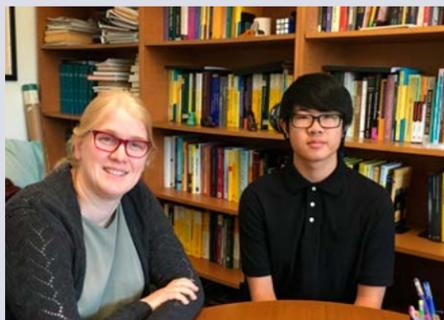
by Jessica Nunez, SCAS RTP Researcher

My name is Jessica Nunez, and I am a junior at Academy of the Canyons. I found out about the opportunity to conduct research after attending the National History Museum in April 2015. Because my school is close to College of the Canyons, I was able to easily find a chemistry professor that would serve as my mentor. My research was conducted on the basis of analyzing the amount of caffeine in over the counter drugs and coffee. The examination was done in a span of six months at College of the Canyons, Valencia Campus with the help of Dr. Flynn and Maya Galloway. Learning about organic chemistry through an experiment that allowed me to enrich my understanding in organic chemistry was extremely rewarding. In the future, I hope to continue with my analysis on medicinal drugs and develop a new idea that pertains to the cardiovascular system. I enjoy the fact that I am able to explore various areas of research through different lenses.

MY EXPERIENCE WITH SCAS' RTP

by Christopher Wong, SCAS RTP Researcher

I've always loved math. The logic and relationships represented by numbers has always intrigued me. I once told my mom enthusiastically that I thought I had discovered a new mathematical theorem—I was seven at the time. My mom laughed it off, but she knew I was really interested in the subject. In middle school, I would take any chance I could get to learn more math subjects. In eighth grade, I started participating in a team research program involving simulations in robotic programming. Prior to becoming a qualified researcher in that program, I was required to take college-level math in set and group theory. The knowledge gained from those topics was then used in learning C programming. But even with that great experience, my curiosity was not sated—I still wondered what other mathematical subjects I might have the chance to learn.



Christopher Wong, right, with his mentor, Dr. Gizem Karaali.

Towards the end of my freshman year in high school, my counselor introduced me to the Research Training Program (RTP) at the Southern California Academy of Sciences (SCAS). She thought that it would be a great opportunity for me to further explore my interest in science while learning from and being inspired by other high-school researchers. I applied for and was accepted to the RTP for the 2015/2016 school year (my sophomore year). Then the next big question came: in what field of science should I do my SCAS research? Very quickly, I steered to mathematics. I understood at the time that it was not a common subject, as majority of RTP students do their research on biological or engineering-related topics. I was also worried that the RTP staff and peers would not be interested in pure or abstract mathematics. But in the end, I knew I had to do this for myself. I could even take this opportunity to remind everyone how pure mathematics is the foundation of many branches of science.

My search for a mentor went very smoothly. Even the math professors who turned down my mentorship requests were very helpful in referring me to their peers. In the end I was grateful to obtain the mentorship of Dr. Gizem Karaali, a math professor at Pomona College in Claremont.

We started our project by exploring various math topics. One big difference between conducting research in mathematics and conducting research in biology is that no lab is needed. I

spent a lot of time reading published literature on many math topics, and with Dr. Karaali's guidance, started making connections between them. After spending the first few months reviewing math literature describing symmetry, groups, and matrices, we decided to select the correspondence of totally positive matrices and planar networks as a research topic.

One might ask why these two topics are important. The logic of total positive matrices can be found applied in discrete mathematics (the study of math structure which is important in developing computer algorithms), probability, stochastic processes (logic applied in stock market, currency exchange rate, and medical data such as EKG and blood pressure), and representation theory (studies in abstract linear algebra and vector space). A simple example of planar network application would be wiring for utilities services like electricity and gas such that no cable or piping crossed one another, or the algorithm used in mapping a driving route between two locations.

Research into these fields could take years—I would say the paper that I finished for the May SCAS meeting can definitely be continued into a next phase, such as expanding the investigation to include group and advanced matrix theory. Therefore, my paper for this year is just the beginning—there is no ending in the mathematic world!

I would not have been able to complete my first year of RTP without the mentorship and guidance from Dr. Karaali. I am grateful for her generous support; even when she was busy teaching and traveling for conferences, she still always had time for me. I also thank the support provided by the SCAS board and Mrs. Takahashi. Over the course of the program, RTP students met three separate times at Loyola Marymount University, Cabrillo Marine Aquarium and UC Irvine, respectively, where we attended presentations organized by Mrs. Takahashi on how to write and present a scientific paper, learn about research ethics, and even learn about other research topics from other high school students. I still remember that in our first meeting at Loyola Marymount we listened to the student delegates to the American Junior Academy of Science and other former RTP students discuss their research topics and experiences. It was inspiring to hear their individual stories and the obstacles that they had to overcome while making their projects successful.

A year ago I was like many high school students that had never heard of the RTP. This is an extraordinary program that provides students who are interested in all disciplines of science the opportunity to conduct research under a mentor. I think we RTP alums have an obligation to help promote this great program to other students.

RTP STUDENT DEVELOPS “DRY-ELECTRODE” HEART MONITOR

by Michelle Xu, SCAS RTP Researcher

I have always been very interested in different biochemistry topics, especially proteins. Proteins are essential to living organisms and perform a variety of different tasks. Each protein has its own unique structure that is important in its function.

I chose to do my research this year on protein folding. Specifically, my project develops a new protein energy function based on the Ising model that can solve both the native folded and the misfolded protein conformations through energy minimization. The protein structure was then simulated and solved using a swarm intelligence method called Ant Colony Optimization. This project can be used to explain why certain fusion inhibitors like T20 for the HIV-1 protein gp41 have weaker potencies than other fusion inhibitors. It was revealed that for a particular inhibitor which exhibits a weaker potency than others, the global minimum of the folding energy was found at the misfolded conformation, rather than the native conformation. This discovery would contribute to drug design efficiency for the HIV-1 fusion inhibitor, as well as other anti-virus drug designs in general.

It was a great experience being a part of SCAS this year. As part of its Research Training Program, I attended

the different training meetings to find ways to improve my project. Through SCAS, I met a lot of new people and learned about the different research projects my peers were doing. The SCAS meetings were all held at research buildings, and it was nice getting a tour of all the research facilities.



Author Michelle Xu, left, with her mentor, Professor Stephen White, of the UC Irvine Dept. of Physiology and Biophysics.

The 2017 Annual Meeting will be at California State University, Northridge. Please encourage your colleagues and students to attend!



THE LAST WORD

In an effort to regularize the publication of this organ, the editorial board of the Smilodon (in consultation with the SCAS Board of Directors) have decided to revise the aforementioned publication's production schedule. Going forward, the Smilodon will be published twice annually:

April 15 and November 15

To facilitate this schedule, the following deadlines for receipt of articles/input/photographs/etc. will be adhered to.

Deadlines for April 15 (Spring) issue:

Receipt of articles/input:	March 15
Draft Smilodon to Board for review:	April 1
Board comments on Draft Smilodon to editor:	April 8
Smilodon distributed to membership:	April 15

Deadlines for November 15 (Autumn) issue:

Receipt of articles/input:	October 15
Draft Smilodon to Board for review:	November 1
Board comments on Draft Smilodon to editor:	November 8
Smilodon distributed to membership:	November 15

If you have any questions or concerns about this schedule, or better yet, if you have content to provide (this can be an abstract of a paper or presentation you are working on, an idea you want to share or receive feedback on, an essay on a field experience that was singular and noteworthy, a particularly good photo you want to share...), please contact sgraff@psomas.com or bblood@psomas.com. Thank you!

