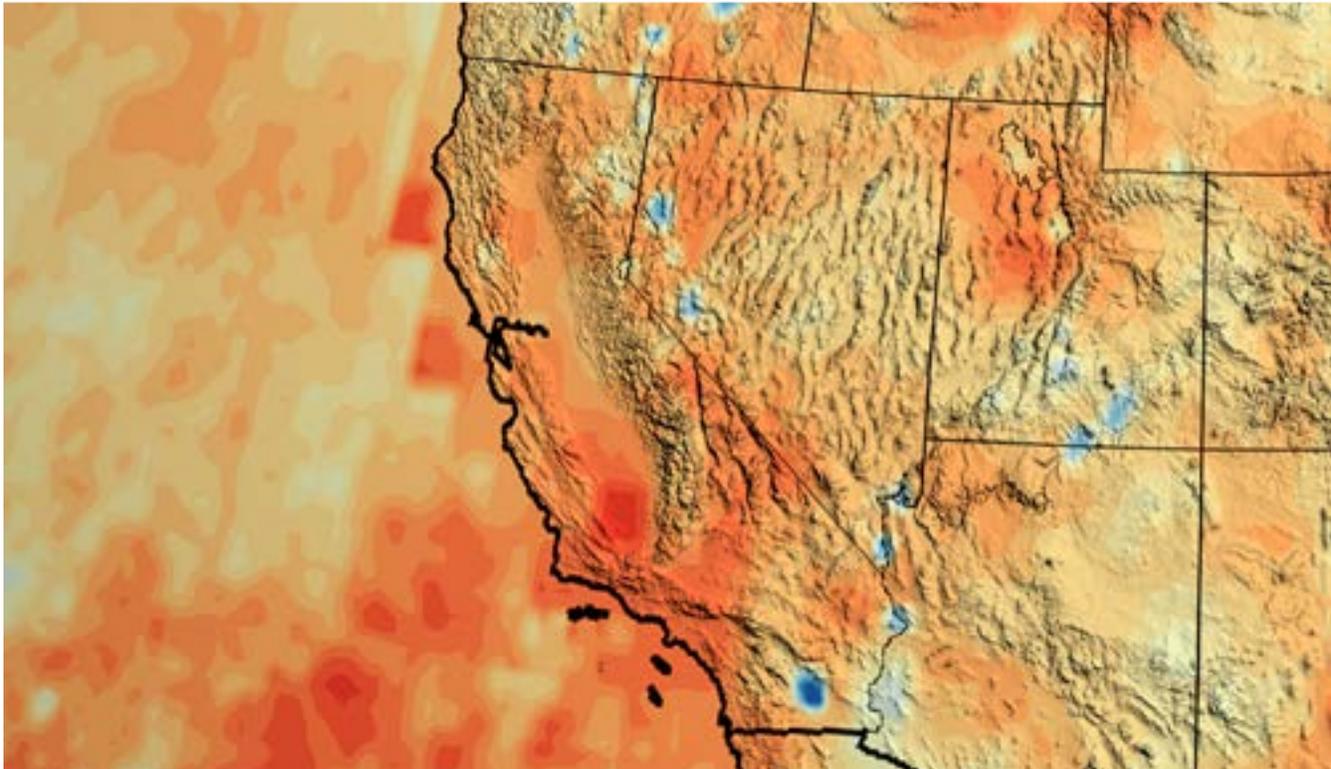




The Smilodon

The Newsletter of the Southern California Academy of Sciences
November 15, 2015

CALIFORNIA'S "RAIN DEBT" EQUAL TO AVERAGE YEAR OF PRECIPITATION



California's accumulated precipitation "deficit" from 2012 to 2014 shown as a percent change from the 17-year average based on TRMM multi-satellite observations. Credit: NASA/Goddard Scientific Visualization Studio

A NASA study has concluded California accumulated a debt of about 20 inches of precipitation between 2012 and 2015—the average amount expected to fall in the state in a single year. The deficit was driven primarily by a lack of air currents moving inland from the Pacific Ocean that are rich in water vapor.

In an average year, 20 to 50 percent of California's precipitation comes from relatively few, but extreme events called atmospheric rivers that move from over the Pacific Ocean to the California coast.

"When they say that an atmospheric river makes landfall, it's almost like a hurricane, without the winds. They cause extreme precipitation," said study lead author Andrey Savtchenko at NASA's Goddard Space Flight Center in Greenbelt, Maryland. Savtchenko and his colleagues examined data from 17 years of satellite observations and 36 years of combined observations and model data to understand how precipitation has varied in California since 1979. The results were published Thursday in *Journal of Geophysical Research – Atmospheres*, a journal of the American Geophysical Union.

The state as a whole can expect an average of about 20 inches of precipitation each year, with regional differences. But, the total amount can vary as much as 30 percent from year to year, according to the study. In non-drought periods, wet years often alternate with dry years to balance out in the short term. However, from 2012 to 2014, California accumulated a deficit of almost 13 inches, and the 2014-2015 wet season increased the debt another seven inches, for a total 20 inches accumulated deficit during the course of three dry years.

The majority of that precipitation loss is attributed to a high-pressure system in the atmosphere over the eastern Pacific Ocean that interfered with the formation of atmospheric rivers between 2011 and August 2015, when the high-pressure system began to dissipate.

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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 6 November 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* 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 three years. I now report to you in my final year as president.

Our 2016 Annual Meeting will be held May 6 and 7 at the University of Southern California (USC) (please visit <http://scas.nhm.org/annual-meeting/> for details). Our plenary speakers for the Annual Meeting are already set—Dr. Larry Allen from CSU Northridge will be the speaker on Friday, May 6, and Dr. Virginia Naples from Northern Illinois University will be the speaker on Saturday, May 7. There will be multiple symposia on both days. As of now we have two symposia confirmed for Friday (Research at USC Wrigley Institute and Parasitology) and one confirmed for Saturday (Marine Mammals). Contributed paper talks will also occur on both days. The evening poster session will be on Friday from 5-7pm. Also, our Junior Academy students participating in the Research Training Program (RTP) will present their posters on Saturday. And, in addition, we will have special events to celebrate our 125th anniversary, so expect this to be a special and fantastic meeting. Save the date!

I would like to thank the following people for their outstanding efforts during our 2015 Annual Meeting at Loyola Marymount University—John Dorsey as Local Committee Chairperson, April Sandifer, David Ginsburg, Lisa Collins, Shelly Moore, Ann Dalkey, all the symposium organizers, the SCAS Board of Directors, and Gloria Takahashi for leading the Junior Academy. Attendance at the 2015 meeting was exceptional—more than 250 people registered. More

than 75 oral presentations were given, along with 41 poster presentations and 20 oral presentations by Junior Academy students. Awards were given for best student presentations and posters, and five graduate student research grants were given. Special thanks to major financial sponsors, Los Angeles Center for Urban Resilience (CUREs) and MBC Applied Environmental Sciences. I would also like to extend a special word of thanks to our outstanding plenary speakers, Dr. Bill Lynn from LMU (CUREs), and Dr. Murray Dailey.

Congratulations and welcome to our newly elected Board members, Kristy Forsgren from CSU Fullerton and Karina Johnston of The Bay Foundation. The following Board members have agreed to continue to serve as officers; myself as President, David Ginsburg as Vice President, Edith Read as Recording Secretary, Ann Dalkey as Treasurer and Corresponding Secretary, Daniel Pondella and Larry Allen as Editors of *The Bulletin*, Brad Blood as Editor of *The Smilodon*, and Shelly Moore as Webmaster.

If you have scientific papers to publish, please remember that our Academy Bulletin is open to papers in any field of science with relevance to southern California, particularly from SCAS members. The Academy publishes papers by members without page charges, so please consider submitting your manuscripts.

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, past and present, for your support of the Academy. Please visit our website <http://scas.nhm.org> for all information pertaining to SCAS.

Please encourage your colleagues and students to attend the annual meeting! I hope to see you there.

Thank you!

Julianne Kalman Passarelli, President



AFTER HISTORIC FLOODING, DEATH VALLEY GEARS UP FOR 'A LONG, HARD RECOVERY'

by Louis Sabagun, *Los Angeles Times* (originally published in the *LA Times* (online version) 11/5/15, 5:05 pm)

It's not unusual for thunderstorms to drench Death Valley this time of year, but this October was different.

The northern section of the park was hammered by back-to-back storms, followed by a powerful weather system that dropped nearly 3 inches of rain in five hours, triggering a 1,000-year flood event that battered historic structures, chewed through roadways and altered the rugged landscape with layers of mud and rocks.

It was the wettest October on record in the area, which normally receives about 4 inches of rain a year.

Hardest hit was one of the park's best-known tourist stops, the area surrounding Scotty's Castle, a rambling medieval-style villa erected in steep and narrow Grapevine Canyon in the 1920s.

The floodwaters in Grapevine Canyon flowed at an estimated rate of about 93,000 cubic feet a second, 10 times that of a 100-year flood, official said. Damage estimates are in the tens of millions of dollars. Death Valley District Ranger Paul Forward was among three staffers and two dozen visitors temporarily stranded by the torrent.

"It started with heavy hail," he recalled. "Three hours later, the dry wash was transformed into floodwaters 100 feet wide with 20-foot waves. The air was filled with the sounds of massive boulders grinding against each other as they rolled down the canyon."

Now, park Supt. Mike Reynolds said, "we're gearing up for a long, hard recovery."

This week, federal appraisers fanned out to take a full accounting of the destruction as utility crews continued the massive job of hauling away mountains of muck from roads, utility easements and the Scotty's Castle area, which is visited annually by 120,000 people and generates about \$550,000 in fees a year.

The villa suffered relatively minor damage. But the adjacent visitors center, bookstore and administrative offices were swamped with mud up to 4 feet deep. Some exterior walls are listing under the pressure of debris piled as high as door handles. An outdoor swimming pool, which was never completed in the 1920s, for the first time is filled with water, albeit muddy.

Flooding destroyed the area's water treatment facility and sewage system, swept away miles of fencing and reduced 24 power poles to splintered stumps. Just north of Scotty's Castle, a 100-yard-long section of a newly paved two-lane road designed to withstand severe flooding was lifted up by roiling water, then slammed down on a nearby boulder field.

Dana Dierkes, a National Park Service spokeswoman, shook her head in amazement as she strode across the dislocated asphalt that had bubbled and warped around the rocks beneath it. "It reminds me of the surreal imagery of melting objects in Salvador Dali's paintings," Dierkes said.

More than 100 people from 22 national parks and National Park Service support services have been deployed to help stabilize infrastructure, salvage furnishings and office equipment, and restore public access in the Scotty's Castle area.

By Wednesday, 70% of the roads closed because of flooding in October had reopened, along with a majority of attractions in the 3.3-million acre park, which draws about 1 million visitors a year.

Grapevine Canyon and Scotty's Castle, however, are closed indefinitely, officials said.

Lucy Craft, 27, an interpretive guide at Scotty's Castle, has been shoveling mud out of historic buildings she normally leads tours in. It's strenuous and seemingly endless labor, but Craft paced herself by heaving mud into wheelbarrows to the rhythm of a mantra: "Out of sight, out of mind."

"What happened here makes me sad," Craft said. "But we're incredibly grateful that no one was hurt."

The National Weather Service said October's storms were not related to El Niño weather patterns. Instead, they were spawned by moist air that frequently drifts across Southern California

in August, September and October. Energized by the heat of the desert, the moisture condenses into massive thunderheads that dump large volumes of water in a brief period of time.

"With El Niño approaching, it is possible that more flooding could occur in the park this winter and spring," Dierkes said.

The good news: More thunderstorms could transform this unforgiving desert of splintery rock towers, dunes and scruffy mountains into panoramic displays of spring wildflowers.

That's because heavy rains dissolve the waxy protective coatings of millions of seeds that have lain dormant for years in terrain where the temperature can soar to 200 degrees. More flowers will mean more pollinators and birds that feast on them. More seeds will mean more rodents for hungry birds of prey, coyotes, foxes and snakes.

"It's the paradox of existence in the hottest, driest and lowest place in the United States," said Linda Slater, a spokeswoman for Death Valley. "Everywhere you look are barren lands carved by torrential rains and flash-flooding, and wildlife taking advantage of the wet weather. "If trends continue, there will be a ton of wildflowers here in 2016."

Next year is the National Park Service's centennial.



A 100-yard-long section of newly paved Highway 267 in Grapevine Canyon, a two-lane road designed to withstand severe flooding, was lifted up by roiling water and then slammed down on boulders in Death Valley National Park. (Brian van der Brug / *Los Angeles Times*)

CALIFORNIA'S RAIN DEBT, CONTINUED...

Atmospheric rivers occur all over the world. They are narrow, concentrated tendrils of water vapor that travel through the atmosphere similar to, and sometimes with, the winds of a jet stream. Like a jet stream, they typically travel from west to east. Those destined for California originate over the tropical Pacific, where warm ocean water contributes a lot of moisture into the air via evaporation. The moisture-rich atmospheric rivers, informally known as the Pineapple Express, then break northward toward North America.

Earlier this year, a NASA research aircraft participated in the CalWater 2015 field campaign to improve understanding of when and how atmospheric rivers reach California. Some of the water vapor rains out over the ocean, but the show really begins when an atmospheric river reaches land. Two reached California around December 1 and 10, 2014, and brought more

than three inches of rain, according to NASA's Tropical Rainfall Measuring Mission (TRMM)'s multi-satellite dataset. Inland terrain, particularly mountains, force the moist air to higher altitudes where lower pressure causes it to expand and cool. The cooler air condenses the concentrated pool of water vapor into torrential rains, or snowfall as happens over the Sierra Nevada Mountains, where water is stored in the snowpack until the spring melt just before the growing season.

The current drought isn't the first for California. Savtchenko and his colleagues recreated a climate record for 1979 to the present using the Modern-Era Retrospective Analysis for Research and Applications, or MERRA. Their efforts show that a 27.5 inch deficit of rain and snow occurred in the state between 1986 and 1994.

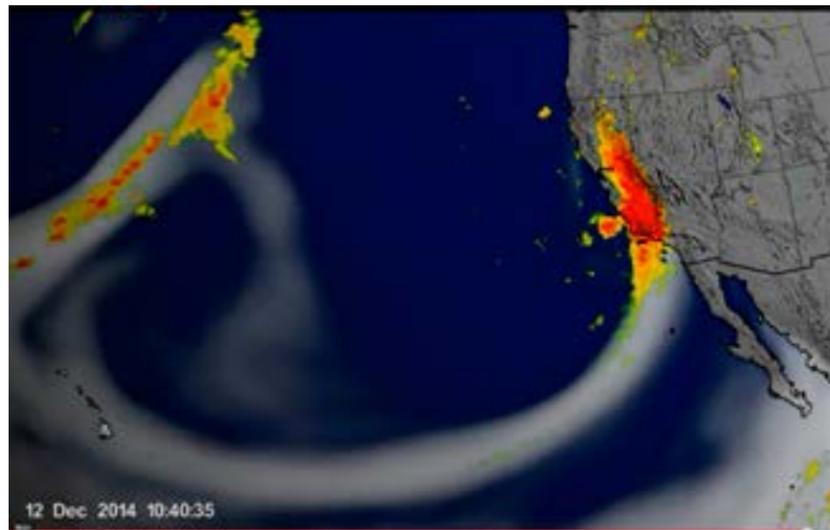
"Drought has happened here before. It will happen again, and some research groups have presented evidence it will happen more frequently as the planet warms," Savtchenko said. "But, even if the climate doesn't change, are our demands for fresh water sustainable?"

The current drought has been notably severe because, since the late 1980s, California's population, industry and agriculture have experienced tremendous growth, with a correlating growth in their demand for water. Human consumption has depleted California's

reservoirs and groundwater reserves, as shown by data from NASA's Gravity Recovery and Climate Experiment (GRACE) mission, leading to mandatory water rationing.

"The history of the American West is written in great decade-long droughts followed by multi-year wet periods," said climatologist Bill Patzert at NASA's Jet Propulsion Laboratory in Pasadena, California. He was not involved in the research. "Savtchenko and his team have shown how variable California rainfall is."

According to Patzert, this study added nuance to how scientists may interpret the atmospheric conditions that cause atmospheric rivers and an El Niño's capacity to bust the drought. Since March, rising sea surface temperatures in the central equatorial Pacific have indicated the formation of El Niño conditions. El Niño conditions are often associated with higher rainfall in the western United States, but it's not guaranteed. Savtchenko and his colleagues show that El



The atmospheric river that drenched California in December 2014 is shown in this data visualization: water vapor (white) and precipitation (red to yellow). Credits: NASA/Goddard Scientific Visualization Studio

Niño contributes only six percent to California's precipitation variability and is one factor among other, more random effects that influence how much rainfall the state receives. While it's more likely El Niño increases precipitation in California, it's still possible it will have no, or even a drying, effect. A strong El Niño that lasts through the rainy months, from November to March, is more likely

to increase the amount of rain that reaches California, and Savtchenko noted the current El Niño is strengthening.

The National Oceanic and Atmospheric Administration (NOAA), which monitors El Niño events, ranks the 2015 event as the third strongest in the past 65 years for May and June. Still, it will likely take several years of higher than normal rain and snowfall to recover from the current drought.

"If this El Niño holds through winter, California's chances to recoup some of the precipitation increase. Unfortunately, so do the chances of floods and landslides," Savtchenko said. "Most likely the effects would be felt in late 2015-2016."

For more information about NASA's Precipitation Measurement missions, visit: <http://pmm.nasa.gov>

STRONG EL NIÑO SETS STAGE FOR 2015/2016 WINTER WEATHER

Article courtesy of the National Oceanic and Atmospheric Administration (Oct. 15, 2015 at www.noaa.gov)

Forecasters at NOAA's Climate Prediction Center issued the U.S. Winter Outlook today favoring cooler and wetter weather in Southern Tier states with above-average temperatures most likely in the West and across the Northern Tier. This year's El Niño, among the strongest on record, is expected to influence weather and climate patterns this winter by impacting the position of the Pacific jet stream.

"A strong El Niño is in place and should exert a strong influence over our weather this winter," said Mike Halpert, deputy director, NOAA's Climate Prediction Center. "While temperature and precipitation impacts associated with El Niño are favored, El Niño is not the only player. Cold-air outbreaks and snow storms will likely occur at times this winter. However, the frequency, number and intensity of these events cannot be predicted on a seasonal timescale."

Other factors that often play a role in the winter weather include the Arctic Oscillation, which influences the number of arctic air masses that penetrate into the South and nor'easters on the East Coast, and the Madden-Julian Oscillation, which can impact the number of heavy rain storms in the Pacific Northwest.

The 2015 U.S. Winter Outlook (December through February) is as follows:

Precipitation:

- Wetter-than-average conditions most likely in the Southern Tier of the United States, from central and southern California, across Texas, to Florida, and up the East Coast to southern New England. Above-average precipitation is also favored in southeastern Alaska.
- Drier-than-average conditions most likely for Hawaii, central and western Alaska, parts of the Pacific Northwest and northern Rockies, and for areas near the Great Lakes and Ohio Valley.

Temperature:

- Above-average temperatures are favored across much of the West and the northern half of the contiguous United States. Temperatures are also

favored to be above-average in Alaska and much of Hawaii. Below-average temperatures are most likely in the southern Plains and Southeast.

Drought:

- The U.S. Drought Outlook shows some improvement is likely in central and southern California by the end of January, but not drought removal. Additional statewide relief is possible during February and March. Drought removal is likely across large parts of the Southwest, while improvement or removal is also likely in the southern Plains. However, drought is likely to persist in the Pacific Northwest and northern Rockies, with drought development likely in Hawaii, parts of the northern Plains and in the northern Great Lakes region.

While it is good news that drought improvement is predicted for California, one season of above-average rain and snow is unlikely to remove four years of drought," said Halpert. "California would need close to twice its normal rainfall to get out of drought and that's unlikely."

This seasonal outlook does not project where and when snowstorms may hit or provide total seasonal snowfall accumulations. Snow forecasts are dependent upon the strength and track of winter storms, which are generally not predictable more than a week in advance.

NOAA produces seasonal outlooks to help communities prepare for what's likely to come in the next few months and minimize weather's impacts on lives and livelihoods. Empowering people with actionable forecasts and winter weather tips is key to NOAA's effort to build a Weather-Ready Nation. For additional information, visit www.noaa.gov.



Precipitation - U.S. Winter Outlook: 2015-2016 (Credit: NOAA)

SCJAS: A YEAR GONE BY

by Vick Liu, RTP Researcher

Vick Liu is a senior at Flintridge Preparatory School.

Albert Einstein once said "The only source of knowledge is experience." It's hard to understand the process of photosynthesis or asexual reproduction by listening to a teacher or reading a textbook; it's even harder to understand these abstract concepts on your own. As Einstein so correctly stated, the only way to truly learn something is to experience it firsthand. As a participant in the SCJAS Research Training Program (RTP), I was able to experience for myself what science is about, namely, experimentation.

Not many high schools require or even allow students to do research on their own. The opportunity even to do your own research is something that is, surprisingly, not taught in school. However, SCJAS was very helpful from the first meeting onward. As an RTP participant, I learned how to conduct my own research in a professional manner. By encouraging students to pursue individual projects, SCJAS taught me how to turn a goal into reality. It taught me the steps to follow from finding a mentor to executing the experiment plan. By supporting me along the way, the RTP program helped me learn the scientific method in a systematic manner. The first thing I needed to do was establish a goal. Next, I needed to find a mentor (SCJAS taught me how to do that as well and even offers to connect students with mentors). Then I had to perform some experiments.

In addition to helping me frame and conduct my research, SCJAS helped me improve my presenting skills and public speaking skills. During the Annual Meeting, I presented my project to several of my fellow RTP participants whilst learning about the projects they were undertaking. The meeting was conducted in a manner that allowed all of the participants could discuss the projects as scholars have for time immemorial. By having so many peers review the projects, the participants could collectively analyze projects and talk about ways to make changes or improvements.

I also enjoyed the different academic locations (Loyola Marymount University, UC Irvine, etc) that hosted meetings of the RTP participants. By moving to different locations, each meeting was like an adventure. There was always somewhere new to explore and a different scientist to learn from. Each of our hosts was gracious enough to give participants a tour of the facilities and I, for one, was very interested in what each had to offer. It helped broaden my horizon of science. The varying locations also allowed us to get a glimpse of what a real scientific working space looks like—we were able to get a taste of all the different opportunities science can offer after college.

Overall, the SCJAS RTP was a program that I very much enjoyed. I found it to be one of the most valuable programs available to me as a high school student—it allowed me to do real research in a manner that is equivalent to research performed in college. It taught me the ins and outs of writing a journal paper as well as the proper manner to present a project to fellow scientists.

My project developed a fully-integrated microfluidic chip device to automatically separate human blood cells and perform cell morphology studies. The device was designed based on acoustic microstreaming and hydrodynamic separation principles to separate red blood cells (RBCs) from white blood cells (WBCs). The device was fabricated using soft lithography technology and consists of polydimethylsiloxane (PDMS) microchannels with widths of 10-30 μm . It also contains pockets that store air bubbles. The air bubbles generate acoustic microstreaming forces which function as a micropump to move fluid in the microchannel. It was found that acoustic microstreaming achieved highly efficient blood cell separation (89% rate), similar to that of conventional centrifugation techniques. By utilizing different physical properties of blood cells in addition to the effects of acoustic microstreaming and hydrodynamic channels, the device successfully separated RBCs from WBCs based on their size difference, mass, and inertia, in addition to performing blood cell morphology analysis to identify various blood cells including RBCs (e.g., sickle cells), and WBCs (lymphocytes, neutrophils, eosinophil).

Most recently, using the technology described above, I developed a handheld iPhone based analyzer to analyze the blood cell morphology and cell counts from human blood. This analyzer consists of an iPhone-based handheld microscope (both 30x and 100x) and an acoustic enhanced blood smear microfluidic device to concentrate and separate WBCs from RBCs. The microfluidic device was designed based on microvortex technology and fabricated using soft lithography technology; it includes pockets that store air bubbles to generate microvortex forces, which serve a method of separating and concentrating blood cells in the microchannel. In addition, automatic cell image processing methods were developed on ImageJ and Cell Profiler programs, both with the ability to recognize and count RBC, although WBC differentiation needs further development. The handheld hematology analyzer was created using cheap, easy-to-find materials. The total cost of the analyzer is \$9-\$29 (excluding the cost of the cell phone).

This device has a potential to change how blood tests are performed, and could save tens of thousands of lives in developing countries that need simple and inexpensive devices for blood tests to diagnose diseases such as malaria.

The research I performed at the SCJAS's RTP program turned into a science fair project. I won the 1st place award in the category of Animal Biology at the 2014 LA County Science Fair, the Sweepstakes Award in senior division at the 2015 LA County Science Fair, the 1st place award in the category of Mammalian Biology at the 2014 California State Science Fair, and the 3rd place Grand Award in the category of Materials and Bioengineering at the 2014 and 2015 Intel International Science and Engineering Fairs.



Vick Liu pictured at Iris Diagnostics. Photo taken by Vick's mentor, Dr. Robin Liu.

2015 SCAS GRANT AWARD WINNERS

Molly Burdick-Whipp, California State University, Long Beach

Understanding fish habitat in a tidally restricted urban lagoon.

Nick Jensen, Claremont Graduate University/Rancho Santa Ana Botanic Garden

Southern California *Streptanthus* as a model system for understanding historical biogeography and regional patterns of edaphic specialization.

Caitlin McGarigal, California State University, Long Beach

Behavioral and physiological effects of angling stress, and post-release mortality, of two important game fish in southern California, kelp bass (*Paralabrax clathratus*) and barred sand bass (*P. nebulifer*).

Magalie Valere-Rivet, Loma Linda University

Lactate production in the hermit crab, *Pagurus samuelis*, subjected to temperature and burial stresses.

Thomas Kroupa, California State University, Long Beach

Thermal defense strategy determines limpet response to acute temperature stress on rocky shores.

2015 SCAS ANNUAL MEETING STUDENT AWARD WINNERS

BEST STUDENT PRESENTATION

Michelle Barton, California State University, Long Beach

Nest site selection of the light-footed ridgway rail (*Rallus longirostris levipes*) in two southern California salt marshes.

BEST STUDENT PRESENTATION - HONORABLE MENTIONS

Stephanie Benseman, California State University, Northridge

Distribution and growth estimates of young-of-the-year of giant sea bass, *Stereolepis gigas*, off southern California.

Christopher DeMarco, California State University, Los Angeles

Conservation of the western gray squirrel in Griffith Park through non-invasive genetic sampling with mtDNA and microsatellite analysis.

Emily Meese, California State University, Long Beach

Spatial distribution, habitat selection, and effects of temperature on resting benthic elasmobranchs at Big Fisherman's Cove, Santa Catalina Island.

Fernando Salgado, California State University, Long Beach

Assessing the functional overlap of ion homeostasis, pH regulation, and survival and infectivity in the human parasite *Toxoplasma gondii*.

BEST STUDENT POSTER

Joshua McKinley, California State University, Fullerton

Feeding behavior of *Anthopleura elegantissima* after low tide exposure.

BEST STUDENT POSTERS - HONORABLE MENTIONS

Alexander Lepicier and Juan Julian (JJ) Baraja, California State University, Dominguez Hills

Do coyotes (*Canis latrans*) residing on the Palos Verdes Peninsula select different prey as a result of residing in a wildland-urban interface?

Arthur Barraza, California State University, Fullerton

The reproductive morphology of male black perch (*Embiotoca jacksoni*).

Morgan Brown, California State University, Long Beach

Relationship of *Sphaeroma quoyanum* to native invertebrate community and sediment dynamics in a southern California salt marsh.

Congratulations to our 2015 SCAS award winners!!
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 SUCCESS STORIES A FAMILY AFFAIR

by Judy Kim, SCAS RTP Researcher

RTP Researcher Benjamin C. Liu, an 8th grader at Dana (Richard Henry) Middle School in Arcadia, took First Place in Applied Mechanics and Structures at the California State Science Fair held last May 25-26. His project sought to develop a novel spiral microchannel device for effective urine particle separation followed by particle morphology analysis. As stated in his abstract, Ben "... successfully developed a spiral microchannel to separate different sizes of urine particles utilizing dean vortices and inertial separation principle. This device addresses the channel clogging issues that the microfilter device I developed last year encountered and significantly improves the separation efficiency. It combines both functions of a traditional centrifuge and microscopic examination into one single lab-on-a-chip device for urinalysis and could potentially revolutionize the field of urinalysis."

In a statement to Gloria Takahashi, head of SCAS' Research Training Program, Ben credits the RTP with providing invaluable support in the progress of his research. "Without the Research Training Program, the results I achieved in my scientific research and competitions/fairs this year would not have been possible... I cannot thank you enough for your continued support." Photos of Ben are provided below. Congratulations, Ben!

NB: Ben's RTP mentor is Dr. Robin Liu. His older brother, Vick, who is also a very successful RTP participant, was awarded First Place in the category of Mammalian Biology at the California State Science Fair for his project in which he developed an iPhone-based application to analyze separate human blood cells and perform cell morphology studies (more detail is provided in Vick's article discussing his work on page 6).



Benjamin Liu, above, with his First Place award medal from the 2015 California State Science Fair. He won in the Applied Mechanics and Structures category for his project "A Novel Spiral Microchannel Device for Urinalysis."



Benjamin Liu, left, with his brother Vick Liu, right, both sporting their respective First Place medals won at the 2015 California State Science Fair.

ANNOUNCING: SCAS' 2016 ANNUAL MEETING May 6 and 7, 2016 University of Southern California

Online registration begins January 1, 2016

We are pleased to announce the plenary speakers for our Annual Meeting:

Friday, May 6: Dr. Larry G. Allen,
California State University, Northridge
Saturday, May 7: Dr. Virginia Naples,
Northern Illinois University

NASA CONTRIBUTES TO FIRST GLOBAL REVIEW OF ARCTIC MARINE MAMMALS

Many human communities want answers about the current status and future of Arctic marine mammals, including scientists who dedicate their lives to study them and indigenous people whose traditional ways of subsistence are intertwined with the fate of species such as ice seals, narwhals, walrus and polar bears.

But there are many unknowns about the current status of 11 species of marine mammals who depend on Arctic sea ice to live, feed and breed, and about how their fragile habitat will evolve in a warming world.

A recently published multinational study attempted to gauge the population trends of Arctic marine mammals and changes in their habitat, identify missing scientific information, and provide recommendations for the conservation of Arctic marine mammals over the next decades.

The Arctic sea ice cover, made of frozen seawater floating on top of the Arctic Ocean and its neighboring seas, naturally grows in the fall and winter and melts during the spring and summer every year. But over the past decades, the melt season has grown longer and the average extent of Arctic sea ice has diminished, changing the game for many Arctic marine mammals – namely beluga, narwhal and bowhead whales; ringed, bearded, spotted, ribbon, harp and hooded seals; walrus; and polar bears.

"This research would not have been possible without support from NASA," said Kristin Laidre, lead author of the new study and a polar scientist with University of Washington in Seattle. "NASA backed us on research related to the biodiversity and ecology of Arctic marine mammals, as well as the development of metrics for the loss of sea ice, their habitat."

Laidre's team used the Arctic sea ice record derived from microwave measurements taken by NASA and Department of Defense satellites. This record began in late 1978, is uninterrupted, and relies on NASA-developed methods for processing the microwave data.

"It's really our best global view of the Arctic sea ice," said Harry Stern, author of the paper with Laidre and a mathematician specializing in sea ice and climate at University of Washington.

Stern divided the Arctic Ocean into 12 regions. Using daily sea ice concentration data from the satellite record, he calculated changes in the dates of the beginning of the melt season in spring and the start of the fall freeze-up from 1979 to 2013. He found that, in all regions but one, the melt season had

grown longer (mostly by 5 to 10 weeks, and by 20 weeks in one region).

"Sea ice is critical for Arctic marine mammals because events such as feeding, giving birth, molting, and resting are closely timed with the availability of their ice platform," Laidre said. "It is especially critical for the ice-dependent species -- seals and polar bears. Ice seals use the sea ice platform to give birth and nurse pups during very specific weeks of the spring, and polar bears use sea ice for feeding, starting in late winter and continuing until the ice breaks up."

Pacific walrus use the floating pack ice both as a platform on which to rest between feeding bouts and as a passive transport around their habitat.

"Loss of sea ice has resulted in walrus hauling out on land in Alaska and Russia in massive numbers – these land haul outs result in trampling of their young," Laidre said. "Also, now walrus must travel a longer way to reach their feeding areas, which is energetically



A pod of narwhals swimming in Admiralty Inlet, Canada in 2005.
Credits: Kristin Laidre / University of Washington

costly."

In the case of Arctic whales, the changes in sea ice might benefit their populations, at least in the short term: the loss and earlier retreat of sea ice opens up new habitats and, in some areas of the Arctic, has also led to an increase in food production and the length of their feeding season.

In the future, Stern said higher-resolution satellite microwave data might come in handy when studying the interactions of Arctic marine mammals with their icy habitat.

"For example, we know that narwhals congregate in specific areas of the Arctic in the wintertime, so maybe a higher spatial resolution in these areas might help us better understand their relationship with the ice," Stern said. "But mainly, just continuing daily coverage is what's important for the long-term monitoring of habitat changes."

This review study was funded by the Greenland Institute of Natural Resources, the Danish Ministry of the Environment and NASA.

Link to the complete study: "Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century" at: <http://onlinelibrary.wiley.com/doi/10.1111/cobi.12474/abstract>

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!

