SoCal
SETAC News

Society of Environmental Toxicology and Chemistry
Southern California Chapter

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FEATURE ARTICLE

Lab rats from the sea: How new technology is transforming sea urchin research

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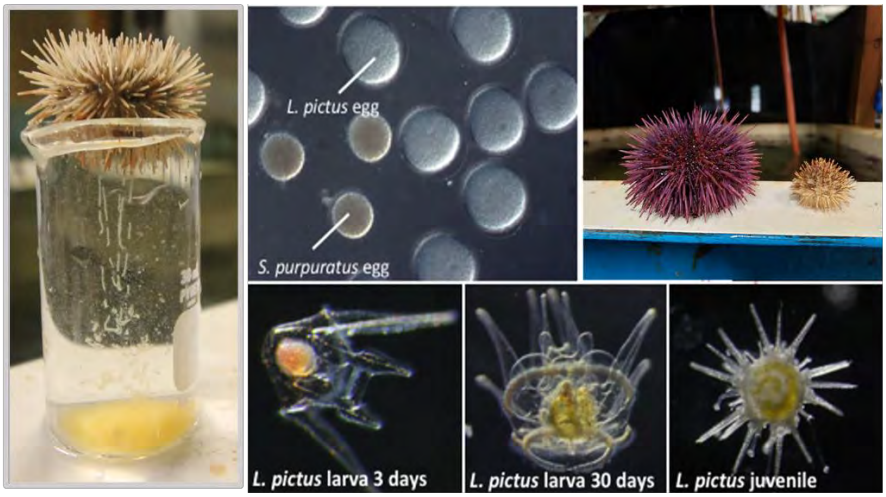
Many of the members of SoCal SETAC study the impact of man-made chemicals and environmental disturbances on the marine environment. These studies rely on marine animal models for which there are straightforward and reproducible bioassays. However, for many of these animals there can be limited genetic or biochemical information with which to link observed effects to specific cellular pathways. A marine bioassay model that is exceptional in this regard is the sea urchin. As standard animals in EPA bioassays (Shipp et al., 2019; US EPA 2002; 2009 missing), and also favorites in developmental biology (Mcclay, 2011), there is a long history of using sea urchin gametes and embryos as marine models.

Sea urchins have a number of advantages as marine models. A single female can produce 5 million eggs in a single spawn, making it easy to collect enough material for experiments. The embryos develop synchronously in nothing more than sea water. In addition, the sea urchin developmental program is very well understood at the cellular and molecular levels, making it possible to easily screen for relevant developmental defects (phenotypic and molecular). Finally, sea urchins also have optically clear eggs which provides excellent material for live-imaging.

Among the handful of sea urchin species currently used for molecular and ecological research, most work has been done on the purple sea urchin, *Strongylocentrotus purpuratus*. This was one of the first marine animals to have a fully sequenced genome (Sea Urchin



Lytechinus pictus eggs are larger and more transparent than *Stronglyocentrotus eggs* (top left), yet their adults are smaller (top right) and easier to culture. Bottom row: *L. pictus* larvae, and metamorphosed juvenile cultured in the Hamdoun lab. Photos by Hamdoun Lab Graduate Student, Katherine Nesbit.

President's Corner

Chris Stransky, Wood E&I

Though it hasn't really felt like summer yet with all this drizzle at the coast, I'll take it over crowds at the beach any day. This picture here with my cool hat is actually in December on Catalina – we're so fortunate here in SoCal.

What a fantastic meeting we had at Scripps Institution of Oceanography (SIO), and a record-breaking event too with more attendees and presentations than ever. A huge thanks to Keith Maruya (our Past President), for selecting the location and leading the charge, and all the amazing behind the scenes support from the Board and Officers to make it so successful. A huge thanks to our sponsors and all of you that attended and presented as well – the quality of presentations and degree of interaction and enthusiasm was so inspiring and rewarding to see. Please see the summary by Keith (pg. 3) in this newsletter with more details (cont. pg. 3)

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FEATURE ARTICLE (continued)

Genome Sequencing Consortium et al., 2006) – making it the "lab rat" of sea urchins. With the of genome editing techniques such as Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)/Cas9, it has become possible to manipulate the genome of this and other urchins. Indeed, genome editing is a central tool for experimental investigation of causal relationships between genes, phenotypes and evolution.

However, these recent techniques have also brought to light some of the disadvantages of *S. purpuratus* as a marine model. Namely these urchins reproduce slowly, and their "egg-to-egg" time is very long (>2 years). In addition, the adults are large (on average 8 centimeters), requiring large culturing space. To begin to address this issue a multidisciplinary research team at Scripps Institution of Oceanography (SIO), led by faculty members Amro Hamdoun and Deirdre Lyons, is developing a new sea urchin model - the painted sea urchin *Lytechinus pictus*. In contrast to the purple urchin, *L. pictus* has a short generation time (~4 months) (Hinegardner, 1969); adults are on average 2 centimeters, the embryos develop on the benchtop with no special chilling requirements, and the eggs and embryos are even more optically clear than those of *S. purpuratus* (Nesbit et al., 2019).

Collaborative urchin team Drs. Amro Hamdoun and Deirdre Lyons. Marine Biology Research Division, Scripps Institution of Oceanography. UC San Diego

One of the first steps being pursued by the group is *de novo* whole genome sequencing of the *L. pictus*, with a draft genome already completed and slated for publication next year. This was enabled by the drastic cost reduction of next generation sequencing, and the ability to combine longer and shorter reads to overcome high polymorphism that is common in urchins. In parallel the groups are also optimizing the larval culturing and developing new methods to insert reporters into the genome of *L. pictus* embryos. This leverages the CRISPR which works by targeting the enzymatic activity of a DNA cleaving enzyme to the specific region of the genome chosen for editing (Jinek et al., 2012). The cuts produced by this enzyme (Cas9) can be directed to repair the genome by homology directed repair (HDR), which uses the homology between a foreign sequence and the sequence of the cleaved region, to "fuse" a transgene into the urchin genome.

One of the primary applications of these manipulations, is the production of animals expressing fluorescent reporters useful for live cell imaging. Reporter lines of urchins are applicable to a wide variety of studies ranging from the tracking of cell fate and function in development, to the characterization of cell response to environmental change. Indeed, this project is opening the door to new types of toxicology experiments that were not previously possible in marine "models". For instance, one of the loci being targeted for knock in by the Hamdoun lab is the metallothionein gene (Cserjesi et al., 1997) which is upregulated in response to metal exposure. The animals with fluorescent reporters inserted at these loci could be used as early warning indicators of contaminants, since they would glow more brightly if the sea water is contaminated with metals. In another application the group is aiming to make animals with engineered protein reporters for flame retardants (Schrankel et al., 2019).

This marine cell biology work at SIO is likely to also help lead to new discoveries about the functioning of cells and embryos. Indeed, the study of marine animals has already paid huge dividends in biomedical and environmental research. The formation of many critical fields in modern sciences were enhanced by studies of marine animals, ranging from cellular immunology, neurobiology behavioral biology, and embryology. In f act, many Nobel Prize-winning findings were dependent on seminal discoveries made using marine animals - including nerve action potential; learning and memory; regulation of cell division and GFP. These are likely to be just the "tip of the iceberg" of what can be learned.

For more details on sea urchin research see:

Cserjesi, P., Fang, H. and Brandhorst, B. P. (1997). Metallothionein gene expression in embryos of the sea urchin Lytechinus pictus. *Mol Reprod Dev* 47, 39–46.

Hinegardner, R. T. (1969). Growth and development of the laboratory cultured sea urchin. *Biol Bull*.

Jinek, M., Chylinski, K., Fonfara, I., Hauer, M., Doudna, J. A. and Charpentier, E. (2012). A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity. *Science* 337, 816–821.

Mcclay, D. R. (2011). Evolutionary crossroads in developmental biology: sea urchins. *Development* 138, 2639–2648.

Nesbit, K. T., Fleming, T., Batzel, G., Pouv, A., Rosenblatt, H. D., Pace, D. A., Hamdoun, A. and Lyons, D. C. (2019). *The painted sea urchin, Lytechinus pictus, as a genetically-enabled developmental model*. 1st ed. Elsevier.

Schrankel, C. S., Gökirmak, T., Lee, C.-W., Chang, G. and Hamdoun, A. (2019). Generation, expression and utilization of single-domain antibodies for in vivo protein localization and manipulation in sea urchin embryos. In *Echinoderms, Part B*, pp. 353–376. Elsevier.

Sea Urchin Genome Sequencing Consortium, (2006). The genome of the sea urchin Strongylocentrotus purpuratus. *Science* 314, 941–952.

Shipp, L. E., Hill, R. Z. and Hamdoun, A. (2019). *A teaching laboratory on the activation of xenobiotic transporters at fertilization of sea urchins*. In *Echinoderms Part A*. pp.429-446. Elsevier.

U.S. EPA. (2002). Short-term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. In Saltwater chronic methods manual (3rd ed.). Cincinnati, OH: Office of Water EPA-821-R-02-014.

PRESIDENT'S CORNER (continued)

and kudos to all the individuals for all their hard work.

So for those into a little trivia, here's a few interesting fun facts about Scripps – you all know how I like fun facts…

- SIO is America's oldest and the world's largest academic ocean, atmosphere, and earth science institution; founded in 1903 and joined the University of California in 1912. Staff numbers approximately 1,600, including about 100 faculty, more than 400 other scientists, 245+ graduate students and nearly 700 volunteers at the university and associated Birch Aquarium.
- SIO is a world leader on climate change research, earthquakes and other natural disasters, drug-resistant diseases, water shortages, saving marine life, energy alternatives, and pollution, among others. Research projects have occurred in more than 65 countries. Check out the article in this newsletter by SIO scientist and Board member Dr. Amro Hamdoun for deeper insight into some of the exciting research at SIO.

- SIO has a fleet of research vessels including one of the oldest active and most unique ships in the world – the Floating Instrument Platform or FLIP commissioned in 1962, now 57 years old!. FLIP was built by the Navy to create a stable platform to conduct research for submarine technology. When vertical, 300 ft of the ship is below the surface with 55 ft above resulting in incredible stability with movement of only 3 inches up and down in 30 ft seas! The vessel, of course was built so the crew can live and operate both horizontally and vertically which can pose some interesting challenges as you might imagine. SIO's newest ship is the Sally Ride, a 238 ft. state of the art research ship commissioned in 2016. In 1983, Sally Ride became the first American woman to fly in space, completing two missions in the Space Shuttle.

So quickly this will be my final Pres. Corner article as our Board transitions in July. However, I will fortunately have the pleasure of staying very active as Past President this next year with responsibility of our next annual meeting. It will certainly be tough to top this years, but that said I expect we will see the same level of excellence and participation no matter where we end up (somewhere north of San Diego). Erika Holland, our VP, will soon take the reins and will be an exceptional leader. I can't say enough how rewarding and enjoyable it has been working together with our awesome Officers (Keith, Erika, Misty, Alvina, Joe, Violet, and Denise), Board (Nick, Wendy, Jun, Scott, Karin, Mary, Amro, Nicol, and Dimitri), and numerous volunteers. Seeing and interacting with the membership and many new faces is so rewarding. Rotating off the Board this year will be Wendy, Scott, and Nick – thank you so much all for your support and contributions over the past 2 years – we'll miss you. Nick however is not going too far as he graciously accepted a unanimous nomination, among Officers, to become our next VP – thank you Nick! He will be great and with Erika will continue to have exceptional support.

So, for those of you looking to become more involved we will have 3 new postions to fulfill (1 private, 1 public, and 1 student) - please see the announcement herein by Misty and Alvina. I should also point out for those interested that all positions have expectations to contribute – that's what keeps the ball rolling and interest and engagement up for everyone. Plus, the greater the contribution, the greater the success of the Chapter and personal reward too.

I am extremely proud to say that I have had the great pleasure of being a member and participating with our SoCal SETAC Chapter for over 25 years now, attending our very first "pre-Chapter" conference on Ecological Risk Assessment held in San Diego in 1993. So many of my professional connections, relationships, and many of the good friends that I have developed over my career are a direct result of this involvement with our Chapter. This would never have happened if it wasn't for all of those energetic folks past and present. OK, just a little more fun fact history – our very first "official" SoCal SETAC annual meeting was held in Irvine in 1994, making this year at SIO our 25th. However, the Chapter itself wasn't officially recognized until 1995. That makes this coming year in 2020 a big celebration of our 25th as a Chapter – what a milestone!

A concluding thank you all, particularly those of you who have come out to join our meetings and outreach events. I must also take the opportunity to thank our Chapter sponsors who give us the flexibility to plan the best events possible and support our students: ABC Labs, Aquatic Biosystems, Anchor QEA, Enthalpy, Geosyntec, LimnoTech, Pacific EcoRisk, Physis, Pi Environmental, Vista Labs, Weck Labs, and Wood E&I, and new in 2019 Coastal Environments.

It really is easy to see why our community is among the best, if not the best regional Chapter around. In large part because of our success I have been asked to serve on the North America Chapters Committee so we can mentor and share our tips with others. It really comes down to you all so I urge every one of you to get more active in our local Chapter or at the National level whether it's applying to be on the Board or volunteering to help with our many events.

Have a wonderful summer and I look forward to working with you in the coming year. *Chris*

MEET THE BOARD

Nick Hayman

Nick Exploring the tidepools in San Diego

I am currently serving as a board member for SoCal SETAC and I am honored to be your incoming vice-president. During my membership over the last five years, I have met so many of my favorite people and have enjoyed learning about all the cool work being done in Southern California!

Like any good marine biologist, I grew up in two landlocked states: Idaho and Utah. I was lucky enough to spend my (admittedly terrestrial) childhood in national parks and my teenage years exploring the wilderness of Idaho, where I fed my love of the natural world and discovered my passion to protect its resources. When I finally did reach the coast—first, for my undergraduate work at the Oregon Institute of Marine Biology at the University of Oregon - I knew I'd never leave the ocean again.

After graduating from University of Oregon with a degree in marine biology, I immediately moved to San Diego, with my wife Zoë and my dog Seeley, for my Master's program at San Diego State University in Dr. Brian Hentschel's lab. There, I got my first real taste for ecotoxicology. Dr. Hentschel was working on an interesting predator-prey interaction between the California killifish and a spionid worm and I decided to incorporate sublethal exposure to chlorpyrifos to the system as my colleague, and ecotoxicology mentor, Violet Renick had been showing some intriguing effects of chlorpyrifos on killifish behavior. Due to that project, I came to my first SoCal SETAC meeting in 2014 and the rest is history!

After obtaining my Master's in 2015, I realized that academia was not for me. I had always had a desire to work for the government, as both of my parents worked for federal agencies and instilled the value of public service in me. What I did not expect to find was a part-time, contractor aquatic toxicologist position at the Naval Information Warfare Center (NIWC) Pacific (formerly Space and Naval Warfare Systems Center (SPAWAR) Pacific), a Navy lab. However, after a couple of months of working there, I knew that it was the place for me and I did everything I could to maintain my contract. Then, in one of the rare moments between hiring freezes, I was able to secure a civilian position, which I have held since 2017.

Nick, his wife Zoë and their dog Seeley enjoying Point White on Bainbridge Island, WA

At NIWC Pacific, I work as part of a team in the bioassay lab (including SoCal SETAC members Gunther Rosen and Molly Colvin). As NIWC Pacific is a research and development lab, we help the Navy meet its environmental

MEET THE BOARD - Nick Hayman (continued)

stewardship goals while still maintaining its mission critical capabilities. This has allowed me to work on many cool projects, including assessing the toxicity risk of biofuels, demonstration of passive sampling technologies, monitoring sediment using in-situ bioassay devices (SEA Rings) developed at NIWC Pacific, and developing alternative pulsed exposure methods to make WET testing of episodic discharges, such as stormwater, more environmentally relevant, just to name a few. Working at NIWC is a great mix between the applied research needed by any public agency and the opportunity to be creative and develop novel techniques to meet those needs specific for the Navy. I am constantly working outside of my comfort zone, giving me the opportunity to learn and study things I could have only imagined having the opportunity to otherwise. This makes it both a challenging and fun place to work!

Nick, our new Vice President, already taking a leadership role at this year's annual meeting

STUDENT CORNER

Annual Meeting Student Presentation Awards

By *Nicol Parker*

At this year's annual meeting we had one or our largest turnouts yet, which included great participation from the students involved in the chapter. In addition to residents of SoCal, we were excited to welcome members from the Desert Southwest SETAC chapter including several student presenters. The students gave outstanding platform and poster presentations and here we highlight this year's presentation awardees.

Best Graduate Student Presentation

Margaret Slack, *M.S. Candidate San Diego State University, Environmental Health, May 2020 and B.S. Boston College, 2015, B.S. in Biology 2015.*

Current Research: My current research focuses on wildlife toxicology – we're studying organic pollutants in the critically endangered California condor and their marine mammal prey. In particular, we're assessing endocrine-disrupting halogenated organic compounds that could be causing eggshell thinning in coastal populations of condors, a phenomena that is largely absent in inland groups. We hypothesize that this disparity may be due to the differing diet of the two groups because inland condors feed on livestock and hunted carrion while coastal condors feed on marine mammals, which are huge sinks for those lipophilic organic pollutants. When dead marine mammals wash ashore, their blubber houses high levels of these endocrine-disrupting compounds that get consumed by the condors and eventually cause reproductive stress.

We're able to assess the contaminant levels in condors and marine mammals using non-targeted chemical analysis through the utilization of two-dimensional gas chromatography coupled to time-of-flight mass spectrometry (GCxGC/TOF-MS). This method allows us to see a broad range of contaminants in our biologic samples. Once we've identified most of these compounds, we can work with our research collaborators at the San Diego Zoo to test the endocrine-disrupting potential of several compounds using cloned condor estrogen receptors. This will help us to discern which compounds are causing the most reproductive toxicity to the condors.

Future Research Interests: I'm really interested in the world of microplastics, particularly understanding which chemicals are leaching from the breakdown and entering into the ocean environment, as well as assessing the health impacts that micro- and nanoplastics might have as they move through the bodies of marine organisms. It's such a prominent and ubiquitous issue, but also one that society can influence.

Previous Research: I've been lucky to work a lot of seasonal jobs before entering into graduate school. I worked at the Alaska SeaLife Center in Seward, Alaska for a little less than a year, helping with both fieldwork and laboratory work that ranged from attempting to reintroduce the endangered Steller's eider into the tundra environment to assessing genetic damage caused by crude oil in mussels. After that, I moved to Hawaii as a research assistant on a project recording seed dispersal by native and non-native birds to understand the changing ecosystem. And right before I entered into graduate school, I spent a year at the Shaw Institute in Maine studying microplastic uptake by blue mussels and worked on a pilot study that tried to examine the potential of microplastics translocating across the gut tissue and into the kidney and livers of whales and dolphins.

How did you become interested in your research? Despite growing up in landlocked Pennsylvania, I've always had a love for ocean and coastal ecosystems. They're some of the most vulnerable environments on the earth, so understanding them enough to protect them is a driving force for me. The field of toxicology is a discipline that allows for interactions between many different stakeholders, such that policies can be direct results of the research. To me, that's an important part of science; not to just understand our environment for the sake of knowledge, but to do so in order to promote conservation.

Hobbies/Activities Outside of Research: I love anything outdoors! If I'm spending my free time hiking, trail running, snorkeling, looking for whales, or even just picnicking by the ocean, I'm the happiest I can be. But if I can't be outside, I love to wake up with a cup of coffee and paint, watch re-runs of *Parks and Recreation*, or cheer for the Steelers during the fall.

Best Graduate Student Poster

Joseph Belsky, *M.S. University of Arkansas, Dec. 2018 and B.S. Cornell University, Hotel Management, 2010*

Current Research: The focus of my current research has been the toxicology of formulated pesticide mixtures (that contain multiple active ingredients, each with a different mode of action) to *Apis* and non-*Apis* bee species. Research questions assess synergisms in the toxic impact to bees that arise from exposure to different pesticide chemistries that are premixed into a single pesticide product, as well as differences in the response of honey bees versus other bee species to pesticides in field-realistic scenarios. Pesticide exposure is measured by contact, oral or combined contact + oral exposure, while pesticide toxicity is quantified as acute, chronic or sub-lethal, depending on the specific experiment.

Implications from my research include a.) analysis of multiple active ingredient pesticides for synergisms in their toxicity to bees arising from their combination, b.) usage of formulated pesticides dissolved into distilled water as opposed to technical grade pesticides dissolved into acetone, c.) assessment of mortality at the extended screening of 96-hours post treatment, d.) whole bee bodily pesticide contact exposure, e.) assessment of residual pesticide toxicity to honey bees, and f.) direct comparison of premixed pesticide toxicity to both *Apis* and non-*Apis* bee species. These implications contribute towards enhancing current regulatory protocols for assessing the toxicity of pesticides to bees.

Future Research Interests: Investigation of the molecular and biochemical basis for pesticide toxicity to *Apis* and non-*Apis* bee species. I am specifically interested in isolating functions of specific detoxification enzymes responsible for the ability of bees to withstand and hence be resistant to certain pesticide chemistries. Elucidating differences in these enzymes and their expression in different bee species is of great interest.

Previous Research: Toxicity of different pesticide chemistries (including those designed for agricultural settings as well as those designed as home products) to different non-*Apis* bee species. Specific focus has been placed on blue orchard bees, *Osmia lignaria* and alfalfa leafcutter bees, *Megachile rotundata*. Some of these experiments have also investigated the toxicity of premixed pesticides (containing multiple active ingredients, each with a different mode of action). I have also contributed to several studies investigating bee species diversity in different geographies and landscape settings.

How did you become interested in your research? After university, I spent a gap year in Argentina where I worked and studied at a language school. During this time, I learned about the importance of agriculture to South America. I was specifically captivated by the impact that insect pests can have on agricultural crop production when they are not controlled to tolerable levels, by an approach termed integrated pest management (IPM). My fascination rapidly grew, so I decided to pursue a career track in entomology. This led me to UC Davis, where I completed the required entomology and life science coursework, enabling me to continue my studies at the University of Arkansas where I completed a MS in entomology. During my time at UC Davis, I observed the work of a bee ecology lab and simultaneously began reading literature investigating causes for widescale bee population declines. These experiences solidified my deep interest in researching bees, and in combination with my original interests in agricultural entomology and integrated pest management, led me to my specific research focus on pesticide toxicology to bees.

Hobbies/Activities Outside of Research Swimming, beekeeping, running, hiking

Undergraduate Best Student Presentation.

Daniel Lucas, *Candidate (2022) for a B.S. in Molecular and Cellular Biology and a B.S. Neuroscience and Cognitive Science, Minoring in Spanish and Anthropology*

Current Research: My current main research interest lies somewhere between environmental pollutant detection in aquatic systems and public health risk assessment. I primarily work in this area in a place one would not think had many aquatic systems, in urban areas of Arizona. My work focuses on detecting and monitoring levels of organic and metal contaminants within fish

that are stocked in artificial lakes and ponds as part of a community fishing program maintained by the fish and game department. While this program was created primarily with the aim of supplying areas for recreational fishing within urban areas, there is a subset of the population in many urban areas which become dependent on the stocked fish as a cheaper food source, as catching their own fish from these ponds is often cheaper than buying them from the store. Therefore, much of my work is to monitor the contaminants that are within these stocked fish and which this vulnerable population is being exposed to through fish consumption. I then use this to determine the potential public health risk to those being exposed.

Future Research Interests: My future research interests include expanding on my current research through identifying when exactly the stocked fish become contaminated. This could either be taking place in the fisheries where they are raised, or the urban ponds they are stocked in. Most people think the fish are safe to eat because, although they can see the water in many of the ponds is far from clean, they reason that the stocked fish are not in the water long enough to become contaminated before they are caught. Therefore, pinpointing when the fish become contaminated between fishery and consumption is critical, and can then form the basis for a plan to combat the issue.

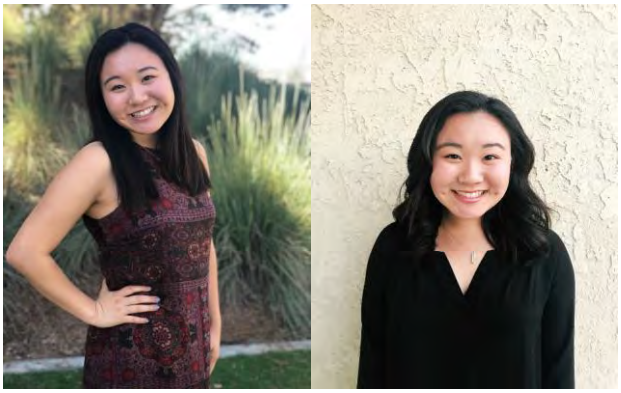
Previous Research: My previous research is slightly all over the place. During my senior year of high school, I worked in a molecular endocrinology lab and evaluated the efficacy of Vitamin D to increase serotonin production in the brain. At this time, I was also involved in another lab working to evaluate the effects mining has on the desert soil microbiome and attempting to identify a microbe that thrives in these environments for the purpose of potential bioremediation purposes. Additionally, I worked in an aquatic toxicology lab processing fish samples both from urban Phoenix and American Samoa, which formed the basis of my current research.

How did you become interested in your research? I became interested in research on somewhat of a whim. I applied to an internship program at the University of Arizona, which places high school students in university labs for a summer. I never thought I would be accepted, but gave it a go anyway. I ended up spending the summer after my junior year of high school working full time at U of A researching precision medicine asthma therapeutics. Once I returned home and started reaching out to professors at Arizona State University with my prior research experience, everything took off from there and I simply couldn't say no to doing research on anything I had the opportunity to.

Hobbies/Activities Outside of Research: Bass guitar, fly fishing, hiking

Undergraduate Best Student Poster

Erica Choe *Candidate (2020) for a B.S. in Biochemistry, Minor in Bioethics Loyola Marymount University*



Erica Choe was also a SoCal SETAC Undergraduate Research Award Recipient. She was featured in our 2019 Winter Newsletter, among other research award recipients. Checkout our winter newsletter for more information on Erica's research interests, accomplishments and hobbies (https://www.socal-setac.org/newsletter-1).

Keep your eyes open!

SoCal SETAC Student Research Awards

Applications open at the end of July, 2019

Funds available for both Graduate and Undergraduate Student Research Projects.

Annual Meeting Recap

By Past President Keith Maruya

The 2019 Annual Meeting of the Southern California Chapter was held on May 6-7 at the Robert Paine Scripps Forum, on the campus of the world-renowned Scripps Institution of Oceanography in La Jolla, CA.

The oceanfront venue, home to ground-breaking oceanographic research since 1903 that is co-located with the campus of the University of California, San Diego, stole the show with coastal vistas and breezes greeting the more than 120 registrants from the region and beyond.

Unique for this year, the SoCal Chapter welcomed members of the South and Southwest, South Central and Pacific Northwest Chapters, along with Susanne Brander and Leah Thornton-Hampton, current members of the North America Board of Directors.

The meeting was kicked off with a special symposium on toxicity testing. Karen Mogus, Deputy Director in the Division of Water Quality at the California Water Resources Control Board, provided the context for the session, with a summary of updated numeric aquatic toxicity objectives proposed for waterbodies statewide. Karen was followed by a series of SoCal Chapter members who provided their take on challenges with troubleshooting, setting site-specific guidelines, capturing pulsed contamination events, and performing toxicity identification evaluations (TIEs).

Day 2 dawned with a second mini symposium titled "Screening for Emerging Contaminants", with Dr. Brander giving a keynote on her application of omics to elucidate multigeneration effects on fish exposed to low levels of endocrine active chemicals. Ms. Thornton Hampton, a PhD student at the University of North Texas and Texas Christian University, followed with a summary of her work on immunotoxicity of PBDEs, and brought the audience up to date on SETAC North America activities. Maggie Slack, a M.S. student at San Diego State, was awarded best graduate student presentation for her talk on non-targeted analysis of contaminants in California condors. Daniel Lucas, a freshman majoring in neurobiology at the University of Arizona, was also recognized for his platform presentation on surveying contaminants in recreationally caught fish in the Phoenix metropolitan area (see Student Corner).

The Monday evening poster social featured 34 presenters, a record for our Chapter Annual Meeting. Diversity was also on tap as attendees from Cal Poly Pomona, Cal State Northridge, Cal State Long Beach, Loyola Marymount, UC Riverside, Arizona State, Oregon State and Scripps presented their work on topics ranging from microplastics and sunscreens, transcriptomics and adverse outcome pathways, to sources of variability in toxicity testing. Awardees for Best Student Presentations went to Joseph Belsky (University of Arkansas) for his work on insecticide toxicity to bees, and Erica Choe Loyola Marymount) for her study on volatilization of PAH from turf pellets (see Student Corner).

Thanks go to countless folks, including 14 sponsoring entities, contributing Chapter Board members, staff and student volunteers, invited speakers, presenting participants, and all those who attended. Special thanks to Dimitri Deheyn for helping secure the one-of-a kind venue, Chris Stransky (Chapter President and meeting Emcee), Nick Hayman (logistics), Violet Renick (website), Joe Freas (finances), Mary Woo and Karin Wisenbaker (student judging) and last but not least, our dedicated and hard-working Co-Secretaries, Misty Mercier and Alvina Mehinto, whose families could not resist joining in the fun. Congrats to Nick Hayman for being nominated and voted in as the next Chapter VP!

In the end, we accommodated 22 platform presentations, more than half of which were given by students, including Nikki Andrzejczyk, winner of the Chapter's 2018 graduate student research grant, and Daniel Lucas, the undergrad from U of A. The remaining talks were presented by folks representing government and academia (7 each) and the private sector (4). Sector representation for poster presenters was strikingly similar and equitable with 18 of the 34 posters given by students (11 graduate, 7 undergraduate), 6 each from academia and industry and 4 given by government employees. The triumvirate that is SETAC is alive and well in SoCal!

Other firsts were had in La Jolla. An impromptu Sunday evening mixer was organized to welcome newcomers to our Chapter. Stephen Clark and Brant Jorgensen from Pacific EcoRisk joined a few SoCal Chapter regulars to meet and chat with Kelly Governar, a SIO graduate student supervised by Prof. Deheyn, and Ms. Thorton Hampton who had traveled in from Texas. Later, Karen Watanabe-Sailor, a Professor at Arizona State who models AOPs for a living, joined in the Cinco de Mayo festivities. In a post-meeting de-brief over margaritas and soft tacos, a handful of Board members took a few minutes to reflect on the past couple of days before throwing out possible venues for 2020. In true SETAC fashion, we can't wait for next year's event!

Celebrating Keith's contribution to SoCal SETAC and passing the torch to our new Past President, Chris Stransky

Thanks for a Great Annual Meeting, Robert Paine Scripps Forum, La Jolla, CA.

CALENDAR OF EVENTS

July 2019

July 7-10
SETAC Australasia 2019 Conference | *Darwin, Australia*

August 2019

August 5-9
National Environmental Monitoring Conference | *Jacksonville, FL*

August 11-16
Ecological Society of America & United States Society for Ecological Economics 2019 Joint Annual Meeting | *Louisville, KY*

August 12-15
SETAC North America Focused Topic Meeting: Environmental Risk Assessment of PFAS | *Durham, NC*

August 18-22
The Surface Water Quality Conference and Expo – Storm Con | *Atlanta, GA*

August 25-30
19th International Symposium on Toxicity Assessment | *Thessaloniki, Greece*

September 2019

September 8-12
International CleanUp Conference 2019: CleanUp 2019 – the 8th International Contaminated Site Remediation Conference incorporating the 2nd International PFAS Conference | *Adelaide, Australia*

September 15-18
SETAC Latin America 13th Biennial Meeting | *Cartagena, Columbia*

September 17-19
GRA's Second Annual Western Groundwater Congress | *Sacramento , CA*

September 21-25
Water Environmental Fender's Annual Technical Exhibition & Conference (WEFTEC) | *Chicago, IL*

September 22-27
SER2019: 8th World Conference on Ecological Restoration | *Cape Town, South Africa*

October 2019

October 7-9
California Stormwater Quality Association's 13th Annual Conference | *Monterey, CA*

October 29-31
Western Dredging Association (WEDA) Pacific Chapter Fall 2019 Conference | *Newport Beach, CA*

November 2019

November 3-7
SETAC North America 40th Annual Meeting | *Toronto, ON, Canada*

November 3-7
Coastal and Estuarine Research Federation (CERF) 25th Biennial Conference| *Mobile, AL*

November 5-7
Esri Ocean and Atmosphere GIS Forum | *Redlands, CA*

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