Chemistry Connections for Community College Students at the University of California, San Diego

4Cs @ UCSD

Summer 2017 Highlights

chemreu.ucsd.edu/

9500 Gilman Drive • La Jolla, CA • 92093-0303
Greetings! We are pleased to share with you the third annual publication of highlights from our 3-year NSF-funded Research Experiences for Undergraduates (REU) program. Our site offers first-year (or the equivalent) students attending the expansive network of two-year colleges within commuting distance of UC San Diego an intensive and integrated early undergraduate research experience in the chemical sciences, at the frontiers of materials synthesis, human health and disease, energy and environmental science. Prior research experience is neither required nor expected. Rather, 4Cs @ UCSD provides students a first opportunity to participate in scientific discovery and knowledge generation, to explore interests, and to develop new skills, understandings, and self-awareness, with the ultimate goal of enabling a successful transition to university and eventually a science-related career.

And now we have completed our final summer cycle for this funding period (2014-17). From June 5-August 11, ten REU Fellows were fully immersed in the laboratories of UC San Diego Chemistry and Biochemistry faculty, working closely with one or more graduate students and postdoctoral fellows to make real and significant contributions to a research project. Professional development and interaction between students and members of the broader research community was promoted through faculty seminars, research skills workshops, outreach activities, and informal events. The 2017 UCSD Summer Research Conference was an occasion for students to share the results of their research and practice oral communication skills. And “local” has its advantages – including extended time for research, training, and mentoring! To this end, funding and enrichment activities continue throughout this next academic year (Fall 2017 - Spring 2018), allowing REU Fellows to build on their 10-week summer apprenticeship.

Herein, we introduce you to our 2017-18 cohort of REU Fellows. The students’ profiles feature their personal reflections and a synopsis of their scholarly work, as captured in the abstracts they submitted to the 2017 UCSD Summer Research Conference. In the latter pages, you'll find an overview of program activities, as well as updates from our REU alumni from 2015-16 and 2016-17.

Thanks to the contributions of many people, 4Cs @ UCSD and its participants have enjoyed a great deal of success, even as we continue to refine programmatic features and cultivate local partnerships. We are grateful to: the UC San Diego Chemistry and Biochemistry faculty and their research team members who have so generously donated resources, expertise, and time to mentoring the REU students; the Chemistry faculty at our local community colleges for their enthusiastic support of student recruitment and retention efforts; the knowledgeable staff from UC San Diego’s Environmental Health and Safety (Dr. Amy Moore), Geisel Library (Teri Vogel), Office of Admissions, Transfer Services (Timothy Borch), and the Birch Aquarium at Scripps (Cari Paulenich), who helped to facilitate our workshops; and Robyn Swanland, for providing administrative assistance. Together we are expanding access to undergraduate research and enabling a more diverse group of students to share in the advancement of science ... benefiting ALL involved!

Your sincerely,

Stacey Brydges (sbyrdges@ucsd.edu) and Haim Weizman (hweizman@ucsd.edu)
Program Co-PIs/Co-Directors of 4Cs @ UCSD (NSF-REU Award# 1359483)
**Alma Anides-Morales**  
San Diego Miramar College

**Career Goals:** To complete a M.S. degree in Environmental Science

**Fun fact:** I ran my first marathon this summer!

Being able to spend my summer conducting research in my area of interest was an invaluable experience that extended beyond any learning in the classroom. I got to participate in the planning and execution of field work research, which meant spending a significant amount of time at the beach! Through my mentor, I learned the importance of careful planning, paying attention to detail, and laboratory skills. The many challenges faced in research taught me the importance of perseverance and being resourceful. I gained many skills and insights through the workshops and seminars. I learned the value in reading scientific literature and how to make the most of it to meet your needs. Community outreach is something near and dear to my heart; having a workshop on science communication to the public got me thinking about what is the most effective way to communicate and include the public in scientific work. I had an opportunity to practice with a group of high school students where I demonstrated some of the basic principles of CAICE. Furthermore, I have learned how to put together a presentation and will have an opportunity to formally present this summer’s work at the Summer Research Conference at UC San Diego. Before this experience, science was fun but intimidating. However, in talking to other professionals and the great group of mentors I have met, I realize science does not require perfection— all is needed is some curiosity, creativity, and discipline.

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**Detecting Enzyme Activity in Coastal Aerosol**

Sea spray aerosol (SSA) composition influences its climate relevant properties. One component of SSA detected in the laboratory is marine microbial enzymes. However, viable enzymes in SSA in the real atmosphere have not been previously reported. Marine bacteria express enzymes to break down organic compounds that can be used for nutritional requirements. The enzymes are found "free" in the seawater and attached to the outer surface of the microbes. The known transfer of bacteria in SSA suggests it should contain viable enzymes. Recent work (Malfatti and Lee, *in prep*) has confirmed in the laboratory the presence of viable enzymes in nascent SSA. This research explores whether viable marine bacterial enzymes exist in the real atmosphere. Here we present the first reported measurements of enzymatic activity in marine aerosol. Aerosols were sampled at the coast and analyzed using the fluorogenic substrates method. Detection of viable enzymes in marine aerosol demonstrates that the chemical machinery with which bacteria shape marine organic material remain viable in the atmosphere, demonstrating a bacterial influence on SSA composition after ejection.
Raina Bautista-Bumbasi
Cuyamaca College

Career Goals: To earn a PharmD and become a nuclear pharmacist

Fun fact: I was deathly afraid of dogs until I was 19. Now, I absolutely adore them!

In just the 10-week span of the 4Cs REU summer program, I have accumulated laboratory skills, formed meaningful interpersonal relationships, and was provided opportunities that were supplemental to my professional development and endeavors as a student in science. It has been a delightful experience having the pleasure of being exposed to a network of like-minded colleagues and inspiring mentors. Getting to work alongside such passionate and captivating lab mates and fellows has made the daily responsibilities of conducting research and performing analysis feel fun rather than like work. Initially, on my first few days I felt uncertain of my ability to keep up with unfamiliar territory and techniques. However, I am pleased to say that I am finishing up the program able to use and communicate the techniques and knowledge I have gained with confidence. I’d like to extend a special thanks to my mentor, Mike, for his time and expertise in helping me realize and reach my greatest potential. I am excited to apply the payoffs I have acquired from this program to my subsequent career strides.

Transition-Metal-Substituted Polyoxometalate Clusters

Polyoxometalates (POMs) containing transition-metal addendum atoms have unique structural and electronic properties that allow for various applications in fields such as catalysis, antiseptics, and sensing. Our goal is to synthesize new materials comprised of POMs linked with transition metals. Using POM precursor $\text{H}_2\text{O}_4\text{SiW}_{12}$, transition metal salt Co(NO$_3$)$_3 \cdot 6\text{H}_2\text{O}$, and K$_2$HPO$_4$ buffer, two cobalt monosubstituted Keggin structures were synthesized—one of which has been previously reported in literature and one that has not. The product crystals were characterized by IR and visible absorption spectroscopy and x-ray diffraction. In both structures, it was found that a Co atom has replaced a W atom. The known structure contains four K atoms while the new structure was found to have six K atoms per POM cluster. These preliminary results suggest that, under varied pH, solutions will yield different crystal packing. To date, understanding about the self-assembly of these materials is limited. We will explore the influence of factors such as pH, temperature, concentration, and ions. With this knowledge, experiments will be designed to synthesize transition-metal-linked POM frameworks.
Brandon Bizzarro  
Cuyamaca College

Career Goals: To obtain a Ph.D. in Computational Physics  
Fun fact: I spent 17 years in Hawaii without learning how to surf.

A human life can be reduced to the fictional narratives marketed in 100 page paperbacks buried under freshman textbooks on discount racks. These yellowed pages are noisy with meaningless phonemes, so thin as to be indecipherable palimpsests, and an unforgivable waste of 99 cents. Reflecting on this condition, one cannot help but be drawn to the curious quandaries somehow inherent in an unintuitive universe, mocking our ideas of meaning. We may never be able to derive meaning from the inadequate language we use to encompass our experience, but the illusion of control given by scientific understanding may suffice to substantiate our lives, and perhaps, inscribe these pages with the retrospective pleasure of a reread. Research inspires this perspective because it straddles the border of ignorance, an area of human thought so terrifying to some so as to provoke a default to delusion. The 4Cs Program has enabled my participation in this process and, in so doing, has solidified my intention to pursue what is sometimes derided as ivory tower thinking, divorced from the more sober and quotidian engagements of everyday life. I think, however, that the fundamentality of such understanding is inextricable from the everyday, as it serves to expand the extent of one’s experience. Finally, recognizing a suitable path in life has demanded from me more time than most. Having targeted community colleges, where nontraditional age students such as myself may seek to redirect and focus our paths, 4Cs has provided me with the confidence to pursue possibilities otherwise dismissed as improbable, as I am sure it will continue to do for many more students in the future.

Design and Synthesis of a Fluorogenic Probe for Covalent Esterase Labeling

Fluorogenic probes are valuable tools for investigating the activity of a specific protein in a cell or the metabolism of ester-containing drugs by simulating the substrates of mammalian carboxylesterases. These organic molecules are biomimetic analogs, which can undergo the metabolic mechanisms essential to the functioning of human cells in the same capacity as their natural counterparts, but can be modified to reveal information about cell processes due to their ability to fluoresce. We aim to construct a probe consisting of three key segments: 1) a phenol acetate moiety that responds to esterases, 2) a masked quinone methide reactive group that can be used to covalently modify the esterase, and 3) a xanthene fluorophore that is initially non-fluorescent but becomes fluorescent after esterase cleavage. Finally, we used an oxazolidinone scaffold to combine these segments and facilitate the activation of the fluorophore. The synthetic route was optimized by using an Ullmann-type (C-N) coupling to conjugate the fluorophore to the masked quinone methide-containing segment.
Kyle Davis
Palomar College

Research Mentor: Andrew Ostericher
Faculty Sponsor: Prof. Clifford Kubiak

Career Goals: To become a PI in charge of my own research lab

Fun fact: In my free time I enjoy surfing, playing music, and working out at the gym.

As soon as I took my first chemistry class, I knew that I was interested in the field. I had professors tell me that research is important and that I should get involved as early as possible, but I had no idea where to look. In organic chemistry my professor really pushed the class to apply to different internships, so I took his advice and applied to the NSF-REU funded 4Cs program here at UCSD. For the last 10 weeks I have been working in the Kubiak group, and the experience has been a complete life changer for me. I have probably learned more working in a research lab for 10 weeks than I learned in my last year of college, including everything from how to read a research paper to conducting experiments in the lab. It was a little intimidating at first, being a community college student around all of these graduate students. I quickly learned, however, that most of them were more than willing to answer my questions and help me out along the way. I ended up having a great time this summer, and I also learned that research is something that I really enjoy doing. I greatly encourage everybody to apply for summer research, even if you don’t think you want to go to graduate school. Finally, I would like to give a huge thanks to Dr. Cliff Kubiak, my PI, for allowing me to work in his lab all summer, Dr. Stacey Brydges and Dr. Haim Weizman for hosting the 4Cs Program at UCSD, my graduate student mentor Andrew Ostericher, as well as the rest of the Kubiak Lab Group, and the NSF-REU for funding my research experience.

Tuning Nickel Complexes for the Reduction of Carbon Dioxide via Modification of N-Heterocyclic Carbene Ligands

Carbon dioxide (CO₂) levels in the atmosphere have been rising at an alarming rate since the 1950’s; because of this, CO₂ reduction has become an important field of study in inorganic chemistry. Rhodium-based catalysts have been shown to work well for the reduction of CO₂ to formate (HCO₂⁻), but second row metals are quite expensive. We have recently developed a new class of heteroleptic nickel complexes utilizing diphosphines with an N-heterocyclic carbene (NHC) chelate in the hope of generating new, first row metal CO₂ reduction catalysts. For successful catalytic activity, the metal center must be accessible through various 4- and 5-coordinate geometries. However, current NHC chelates pose a significant strain at the metal center. The goal of this project is therefore to present a modification of the NHC bridge which will facilitate the formation of reduced state geometries and 5-coordinate metal hydride species.
Israel Lopez  
Cuyamaca College

**Research Mentor:** Kyle Mandla  
**Faculty Sponsor:** Prof. Joshua Figueroa

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**Design and Synthesis of Molybdenum Alkyne Complexes: Potential Catalysts for C-C Bond Formation**

Divalent molybdenum complexes featuring sterically encumbering isocyanide ligands are thought to be strong candidates for catalysis of C-C bond formation. Despite an abundance of coupling reactions utilizing costly late transition metals (e.g. Pt, Pd), the development of earth abundant processes has been slower to develop. Toward that goal, a series of Mo(II) alkyne complexes have been prepared for screening in catalysis. These potential catalysts were prepared by decarbonylative substitution of alkyynes with MoI₂(CO)₂Dipp₂ to give MoI₂(CO)(CNArDipp₂)(η²-alkyne) (Ar⁷⁻⁷ = 2,6-(2,6-((i-Pr)₂C₆H₃)₂C₆H₃ ; alkyne = propargyl acetate, 1-hexyne, phenyl-2-propyne, diphenyl acetylene, 4-octyne). With a series of Mo(II) alkynes in hand, and the use of spectroscopy, x-ray diffraction, NMR, etc., it will be possible to carry out reactions and analyze the usefulness of their catalytic nature.

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The past ten weeks have been full of excitement, challenges, but most of all, rewards! The activities of which I have been a part of through the 4Cs’ @ UCSD REU program, both inside the lab and outside, have enriched my life and have given me some tools that I will be using in my life and professional career. The work done at my lab was made possible thanks to the supportive community of grad and undergrad students that make up the Figueroa lab. A special thanks to my mentor, Kyle Mandla, for taking his time to teach me the background behind my project, for being there to answer any questions I had, and to troubleshoot me whenever I ran into road blocks. Not only was I part of a lab, but also part of a greater community. Weekly faculty-given seminars gave us a glimpse on what other labs, along with our fellow REU peers, were doing and the accomplishments of their work. Each of these lectures showed us the importance of team work and of being committed to one’s work. Biweekly professional development seminars equipped us with information that helped us carry out our research. There were also opportunities to give back to our community. We had the chance to be part of an outreach program geared towards high school students of underrepresented groups. It was exciting for us to see the kids’ excitement as we interacted with them and showed them the way science works. The capstone of this program was being able to present our research outcomes at a conference hosted by UCSD and hear what other peers are doing in the field of science! The friendships formed with peers, mentors, and faculty have been invaluable and have added to the overall experience. I urge future applicants to come with a disposition to learn, be challenged, and reach goals that one never thought possible!

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**Career Goal:** To become a surgical oncologist  
**Fun Fact:** I’m a professional musician.
Career Goals: To work in cancer immunotherapy or genetics research

Fun fact: I considered a career in film before I became interested in STEM.

I’ve learned so much these past ten weeks! The thing that stands out in my research experience was the emotional ups and downs that follow success and the unavoidable roadblocks, respectively. This kept everything exciting, and taught me a valuable lesson in resilience, which I believe is an important trait in any researcher. Learning how to craft a presentation was invaluable, as well as learning how to search databases for relevant articles. And being able to work and communicate with people from various backgrounds was the best part of this experience. I interacted with people I look up to - professors, researchers, etc. - and people who look up to the position I am currently in, such as under-represented high school students. This exposure to a wide range of people in the scientific community has given me a unique perspective for which I am grateful.

Insights into NS1 and eIF4G Construct Design and Purification

On average, roughly 39,000 people die from the flu each year in the United States alone, with death tolls reaching about 2 million worldwide. Our current vaccine methods to prevent illness are consistently thwarted by Influenza A Virus’ ability to rapidly mutate. The Influenza virus has a multifunctional non-structural (NS1) protein whose role is to inhibit host immune response. NS1 has been known to bind to several human proteins including Poly (A) Binding Protein (PABP1) and eukaryotic initiation factor 4G (eIF4G). The goal of our current project is to obtain quantitative data on NS1’s binding interaction with eIF4G using an in vitro reconstitution assay. To perform experiments and obtain this data set, recombinant human eIF4G and eukaryotic initiation factor 4E (eIF4E) must be expressed and purified. The expression of a stable full-length eIF4G protein has historically been quite difficult. Therefore, a truncation of eIF4G will be used for these experiments. Through multiple trials of eIF4G construct design involving multiple vectors, we have constructed a plasmid that shows promising results regarding the expression and purification of eIF4G. With NS1 binding data, we may be able to find a new approach for designing a broad-protection drug or vaccine.
Career Goals: To pursue a career in biochemistry
Fun fact: I served 5 years in the United States Marine Corps.

When I first heard about the 4Cs@UCSD-REU program, I was really excited! 'I get to do research through summer in one of the top research universities in the world? Sign me up!' This is a once-in-a-lifetime opportunity that many wish they could have, and I was lucky enough to take part in it. I've always wondered what life as a researcher was like, and I definitely got a first-hand taste of that. One of the things I quickly discovered is that research doesn’t always go the way you expect it to. However, this is how you truly learn: through missteps. The feeling of overcoming a problem in research is beyond rewarding. I got to experience many of those hurdles with my awesome mentor, Troy Bemis, who took many hours of his days to teach me some invaluable laboratory/research skills, along with basic concepts of organic chemistry. Every person in the lab was beyond supportive, Dr. Burkart included! I also learned about the projects of other principal investigators, which made me realize how vast the world of chemistry and biochemistry is. Through some professional development opportunities, I learned about reading and writing scientific literature, ethics in research, presentation skills, among other valuable lessons. Also, the time I spent with my fellow REU students, A.K.A. Chem Cats, was definitely one of the highlights of the program! We supported and cheered each other throughout this adventure! To conclude, I want to thank Cuyamaca College and UC San Diego for collaborating on this wonderful program.

Gabriel Nieto
Grossmont / Cuyamaca College

Research Mentor: Troy Bemis
Faculty Sponsor: Prof. Michael Burkart

Synthesis of Thalidomide-Based Molecules for the Development of Bioconjugated PROTACs for Transcription Factors

Proteolysis targeting chimeras (PROTACs) are being used to selectively degrade specific proteins. PROTACs are molecules that consist of two subunits that have an affinity for an ubiquitinE3 ligase and a target protein, bringing the target protein within proximity of the ubiquitin E3 ligase for ubiquitin conjugation. The focus of this project is to synthesize a thalidomide analog PROTAC that could potentially be used to target transcription factors (TF) via conjugation of thalidomide with TFs specific DNA sequence.

The TF of interest is PU.1 in the cell line THP-1. Cellular localization will be monitored via a fluorescent tag on the dsDNA oligo. PU.1 degradation will be monitored by western blot. This new strategy has potential to be useful in targeting TFs for proteolysis.
Sarah Schwab  
MiraCosta College

**Career Goals:** To become a researcher in the field of chemistry/biochemistry and to continue being an ocean lifeguard/EMT.

**Fun fact:** I love to surf, ride motorcycles, fix cars, play piano, and TIG weld.

I realized during this program I can do whatever I set my mind to. I will continue to reach for the stars even after this program ends. I learned a lot from watching and working with my mentor in the lab (he was very patient and helpful). Also, it was wonderful to go once a week and learn about the different research that was going on in the other labs on campus. Meeting and talking to faculty gave me a personal perspective on how to tackle school and life. Volunteering and teaching different groups of kids about chemistry concepts helped me with my ability to communicate science.

**Investigating Chemistry of Indoor Surfaces Using AFM-IR Spectroscopy**

Atmospheric chemistry research has primarily been directed at understanding the outside world but, with people spending increased amounts of time within buildings it is important to understand the chemistry of indoor environments. Indoor chemistry presents different challenges than outdoors because there are larger concentrations of pollutants in the air and because there is an overall increase in the surface-to-volume ratio. With surfaces playing such a large role, a robust understanding of interfacial chemistry is important for studies on indoor air chemistry. This research utilizes AFM-IR (Atomic Force Microscopy Based Infrared Spectroscopy) in obtaining nanoscale topographical images and infrared spectra of different samples of various indoor surfaces and adsorbed particles/materials on these surfaces to better understand the interfacial chemistry of indoor environments.
Magaly Guzman Sosa
Palomar College

Career Goals: To earn my BS degree in Biotechnology, possibly enroll in a PhD program.

Fun fact: I am older than I look!

I was born and raised in Oaxaca, Mexico. My parents have no formal education, but they had the vision that their children could do better than them. I am among the first generation in my family (but not the first one!) to go to college. Since I came to the U.S. when I was older, the (English) language was the first barrier that I had to break to fulfill my dreams. I have wanted to earn a Bachelor’s Degree in Biotechnology, but now I am seriously considering graduate school. I love working in the laboratory and before this program the only experience that I had was at school. Being accepted to this program and working with grad students, as part of an amazing team (which is where I ended up!), has been the best thing that ever happened to me. The Zid lab has welcomed me with open arms, my designated mentor helps me as much as he can to understand the procedures and guides me in my small project, while other laboratory members also clarify some of my questions. Overall, this experience was unique, from the great team to the other participants of the program - I love it and I expect that future student can benefit from the same!

Concentration Dependence of TDP-43 Aggregation During Stress Conditions

Degenerative diseases result from cell decay caused by natural or external factors. A significant portion of the population suffers from two such degenerative diseases, amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD). Investigations have found that mutations in the TAR DNA binding protein (TDP-43), a transcriptional repressor that regulates mRNA stability, transport and local translation in neurons, are linked to both ALS and FTD. Recent studies have shown that TDP-43 co-localizes with stress granules (SG), foci that form during stress conditions by aggregation of proteins and RNAs. We are interested in understanding the aggregation and localization of TDP-43. We will fuse TDP-43 with a fluorescent protein (mRuby) for imaging and determine TDP-43 expression to investigate the concentration gradient required for this aggregation to occur. These tests are planned to be conducted in mammalian and yeast cells. Future work will include testing ALS or FTD-linked mutations in TDP-43 to find if they have an effect on aggregation rate and to test the effect of other stress conditions on nucleation.
Soluna Whaley
MiraCosta College

Research Mentor: Jason Stofleth
Faculty Sponsor: Prof. Patricia Jennings

Career Goals: Ph.D. in Biochemistry
Fun fact: I am currently recording my voice reading of my best friend's recently published book so that he can increase his sales on Audible.com.

This program has lots of highlights for me. The seminar series featured many powerful chemistry professors at UCSD, eager to share their research. Often I got to learn about their breakthroughs, set-backs and yet unpublished work. Talking with professors and other researchers, human-to-human, about their paths through chemistry and what mine might look like was life-changing. The mentorship they offered impacted me deeply. Another highlight included the biochemistry research I did on mitochondrial protein kinetics. As I go back to my classes this fall, I am amazed at how much experiential understanding, confidence and awareness I gained about doing science. Nowadays, as an experiment in chemistry class fails, I laugh and say, "This is Sciencing!" and I begin troubleshooting the process. On the first day in the lab, my graduate mentor at UCSD shared that most research is actually troubleshooting. Another mentor shared that science is relationships. After 2.5 months at UCSD, I knew exactly what they mean! I leave 4Cs @ UCSD REU with sweet memories of people I have bonded and worked with, skills I have gained, confidence as a chemist, and the ability ask and explore excellent chemistry questions.

Novel Protein Interactions Regulating Iron Trafficking between Mitochondrial and Cytosolic Environments

Proteins containing iron-sulfur clusters mediate a vast array of redox reactions and are involved in diverse processes including cell respiration, transcription, and photosynthesis. Owing to the toxicity of free iron, cells have evolved a tightly-regulated iron trafficking system to deliver, sequester and utilize iron-sulfur clusters. Deregulation of iron trafficking results in iron overload and is implicated in a wide range of human metabolic disorders including diabetes and cancers. Therefore, proteins involved in iron homeostasis, iron-sulfur cluster transfer and utilization have drawn considerable research interest including the evolutionarily related NEET proteins (mitoNEET (mNT), NAF-1, and CISD3) since the initial identification of their role in coordinating 2Fe-25 clusters. Our current research focuses on identifying novel protein interactions mediating communication between intra-mitochondrial and cytosolic iron-sulfur containing proteins by the NEET protein family due to their function as key regulators of iron trafficking. It is hypothesized that GRX3 transfers labile 2Fe-25 clusters to mNT. We are testing this hypothesis via binding kinetics experiments.
Getting Acquainted with a New Campus

June 5 – August 11, 2017

REU students visited campus art attractions, including: The Dr. Seuss statue near the forum level of Geisel Library (above, left); Tim Hawkinson’s Bear sculpture (above, left) and Niki de Saint Phalle’s Sun God (above, right).

They also took part in UC San Diego student traditions, like watching the annual watermelon drop from Urey Hall (middle photo) and hiking along the cliffs above La Jolla Shores (below).
Taking Part in Adventure-Based Team-Building

UC San Diego Challenge Course
Eucalyptus Grove Reserve on Campus, June 7, 2017

Having just met each other two days prior, REU students developed leadership, goal setting and decision-making skills while building group cohesiveness and a shared sense of purpose. It was a great experience!

Whether at ground level or 55 ft. above, activities required participation and cooperation of our entire team!
"Keep your eyes open for opportunities - you never know when they'll show up. My path was changed by a chance meeting on a train." – Kamil Godula, Assistant Prof.

"Have confidence that whatever decision you make, it'll be the right one!" – Vicki Grassian, Distinguished Prof. and Associate Dean, Division of Physical Sciences

"I think having a balanced life is really important." – Brian Zid, Assistant Prof.

We thank our speakers - Professors Michael Burkart (bottom left), Thomas Bussey (bottom right), Joshua Figueroa, Kamil Godula (top right), Vicki Grassian (top left), Alina Schimpf, and Brian Zid (adjacent) - for so graciously sharing their time, scientific insights, and words of wisdom.

Connecting with a New Academic Community

June 5 – August 11, 2017

REU participants were introduced to a broad spectrum of research programs, academic trajectories, and personal anecdotes through weekly research seminars and luncheons with chemistry and biochemistry faculty.
Developing Research Skills

June 5 – August 11, 2017

REU students participated in bi-weekly professional development workshops on topics such as safety, information mining and library resources, research ethics, and scientific communication.

Top left: Video tutorials (produced by Prof. Brydges, Program co-PI, in collaboration with UC San Diego Librarians) that accompanied the workshops on information mining and scientific reading/writing.

Top right: Video-recording rehearsed research presentations at the One Button Studio. Afterwards, students viewed their video file to determine areas for growth and improvement.

Middle: Students are enculturated into science communication through a series of scaffolded activities during the entire 4Cs @ UCSD program.

Bottom left: Prof. Weizman (Program PI) gives REU students instructions on how to create and enact a commercial for a new product. This exercise was used to introduce effective strategies in the science communication workshop.
Learning About Informal Science Education

Field Trip to the Birch Aquarium @ Scripps
La Jolla, July 7, 2017

After reading the first chapter of the NAS publication, “Surrounded by Science: Learning Science in Informal Environments”, REU Fellows traveled to the Aquarium, where they met with Education Specialist Cari Paulenich. They then used an observation protocol to note how other visitors interacted with the exhibits (self-directed areas) and the outdoor tide pool (a volunteer-facilitated activity).
Participating in Chemistry Outreach

Tech Trek @ UC San Diego
Solis Hall, UC San Diego, July 6, 2017

Tech Trek is a UC-wide, AAUW-sponsored one-week, academic residential science and math program designed to develop interest, excitement and self-confidence in middle school girls. Female REU Fellows joined Prof. Brydges in delivering an interactive presentation on synthetic materials to the 100+ students in attendance at this year’s UC San Diego camp. The REU Fellows prepared and passed out to each student an “Idea Bag” to kindle their imaginations.
Participating in Chemistry Outreach

Upward Bound @ UC San Diego
Natural Sciences Building, UC San Diego, August 3, 2017

REU Fellows facilitated active-learning stations on climate and chemistry as part of an outreach event for 50+ high-school students (from San Diego and Imperial Counties) enrolled in UC San Diego’s TRIO Program, Upward Bound. The goal is to help young students recognize their potential to excel in math and science, and to encourage them to pursue postsecondary degrees.

What causes ice nucleation?

What is a sea spray aerosol?

Why is the sky blue?

How do clouds form?

“Having young adults in front of you, and looking up to you, that you know are statistically less likely to go to college and pursue their dreams, makes everything feel more real. It was a great experience to get them excited about science, and to be able to tell them that it is totally possible to end up where we are.” – Soluna Whaley, REU Fellow
Planned and coordinated by UC San Diego’s Academic Enrichment Programs, the one-day conference featured 378 participants from institutions from across the country who were part of faculty-mentored summer research programs at CSUSM, SDSU, USD, and UC San Diego.

Each REU Fellow delivered a 15-minute oral presentation of their research in progress, and then addressed questions from the panel moderator and other attendees. In doing so, students demonstrated significant poise, enthusiasm, and understanding of their individual projects.
Taking Part in Social Activities

Department Summer BBQ and Volleyball Tournament
Muir College, UC San Diego, June 29, 2017

REU Fellows welcomed the opportunity to participate in Chemistry & Biochemistry departmental initiatives, allowing them to witness and be a part of the strong and inclusive network of research scholars and staff that comprise our academic community here at UC San Diego.
Celebrating with the Team – Faculty, Mentors, and Fellows

End-of-Summer BBQ
Revelle College, UC San Diego, August 11, 2017
Blazing Trails …
2015-16 REU Alumni

Above (Left to right): Bottom row is Sara Beck-Pancer (Cuyamaca College), Shelby Friends (Palomar College); Middle row is Frankie Monzon (Southwestern College), Ritchie Hernandez (Cuyamaca College), Nicole Riccobono (MiraCosta College), Paul Cativiela (MiraCosta College); Top row is Steven Ortiz (MiraCosta College), Bermet Souminen (MiraCosta College), Peter Glatt (MiraCosta College). Missing: Jessica Sustaita (Southwestern College).

Sara Beck-Pancer: “I am entering my second year of graduate school at Anschutz Medical Campus in Aurora, CO where I am pursuing a Master of Science in Modern Human Anatomy. This fall I will begin tutoring science in the TRIO ESL program at Community College of Aurora. Hopefully, soon I will be joining a lab that is working on improving methods of imaging optically-cleared tissue with light-sheet microscopy ... 4C’s definitely helped with my confidence when it comes to joining a lab, or even knowing how to reach out to one. Though each lab is different, the environment of a research lab doesn’t feel as foreign or intimidating as it once did. I am very grateful for that!! Thank you for everything!”

Shelby Friends: “Since the Internship at UCSD I have changed my major to Biology after rediscovering my love for it in an upper division course at Palomar. I have also been accepted at Cal State San Marcos. I will be completing my bachelors there in Biology and hope to go to Veterinarian school afterwards. I am so thankful that I had the opportunity for undergraduate research...”

Peter Glatz: “I finished my studies at MiraCosta and am transferring to UCSD (Thurgood Marshall) for this coming fall quarter. ... I have continued working in Seth Cohen’s lab, as infrequent as it was during my time at MiraCosta, and I’m looking forward to working there consistently this fall (hopefully working on my own project!!!!!). I took this summer off to study for the MCAT, which I’m taking this September, as I would like to still keep that door open.”

Ritchie Hernandez: “I am on track to graduate in Winter quarter of this upcoming academic year with my Bachelor of Science in Chemistry (with departmental honors) from UC San Diego. I am still continuing in Mark Thiemens’ group on a limited scale, where we continue to look at the change of carbon isotopes from sea spray aerosols. And in summer 2017 I began working with Professor Michael Burkart and Professor Stephen Mayfield in characterizing and understanding algae based lipids. My next goal is to apply to graduate programs in environmental chemistry.”

Nicole Riccobono: “I’m transferring this semester to UC Berkeley in the College of Chemistry and cannot wait to jump into some more research. I still think of the program all the time. It has changed my approach to everything I do chemistry related and would like you both to know you are much appreciated!”

Jessica Sustaita: “I will be transferring to Cal Poly Pomona in Fall 2017. I was accepted to UC Davis, UC Santa Barbara, San Francisco State, SDSU, and for UCSD was offered the Chancellor’s Associate scholarship but decided Pomona would be the best place for my bachelor’s in environmental biology. Thank you for the opportunity I had at UCSD!”
I have been accepted and am currently participating in the UCSD Biology Research Showcase on June 7, 2017. Myself and a few other students from my molecular biology class created and presented a poster illustrating Cuyamaca’s role in the DNA Barcoding Biodiversity Project (which) involves the collaboration of Cuyamaca College, Palomar College, UCSD, and Mt. San Jacinto College. I am planning on staying at Cuyamaca College for another two semesters and transferring in Fall 2018. This fall 2017, I will begin applying to schools. The 4Cs@UCSD program has really made me fall in love with science and the UCSD campus even more, so I am hoping that I will get to attend UCSD in the future! I also love the fellowship aspect of 4Cs@UCSD; it has helped me to be more engaging with other students about topics in science. I am happy to be able to share my experience with others and encourage them to apply to summer research programs too. My experience last summer is truly invaluable! Thank you both so much for all that you do for students like us.”

Saman Bilgari: “I have been accepted and am going to transfer to UCSD for the Fall 2017 quarter. Also, I am doing another REU program at Boston College this summer (in Dr. Kenneth Burch's lab in the Department of Physics). The impact that the UCSD REU program has had on me is, I would say, greater than any other program that I have been a part of in my career as a student. It has allowed me to experience real world research and, most importantly, research in chemistry. Prior to completing the UCSD REU program last summer, I had many doubts about myself. I was unsure and undecided about many things. I didn’t know if I wanted to go to med school or graduate school, and I wasn’t even sure about chemistry as a major for me. Now, I know that chemistry is what I want to study and devote the rest of my life to. Furthermore, my interest in chemistry and all of my hard work in Dr. Thiemens’s lab has not gone unnoticed. As of now, I am a published (second) author on two scientific papers…”

Ximei Ackerman: “Since last summer, I began tutoring general chemistry and general biology at Cuyamaca College. I was also given the privilege of participating in the UCSD Biology Research Showcase on June 7, 2017. Myself and a few other students from my molecular biology class created and presented a poster illustrating Cuyamaca’s role in the DNA Barcoding Biodiversity Project (which) involves the collaboration of Cuyamaca College, Palomar College, UCSD, and Mt. San Jacinto College. I am planning on staying at Cuyamaca College for another two semesters and transferring in Fall 2018. This fall 2017, I will begin applying to schools. The 4Cs@UCSD program has really made me fall in love with science and the UCSD campus even more, so I am hoping that I will get to attend UCSD in the future! I also love the fellowship aspect of 4Cs@UCSD; it has helped me to be more engaging with other students about topics in science. I am happy to be able to share my experience with others and encourage them to apply to summer research programs too. My experience last summer is truly invaluable! Thank you both so much for all that you do for students like us.”

Isabel Parades: “Currently I’m participating in another REU program at USD. I’ve been working with Dr. Jane Friedman in the mathematics and computer science department where I’ve been researching methods that estimate the biomass of trees based on their diameter at breast height. In October, I’ll be presenting my research at the SACNAS conference in Salt Lake City, Utah. Since last year, I was also able to complete the NASA Aerospace Scholars program where I had the opportunity to go to the Jet Propulsion Laboratory (JPL) in Pasadena. This was such a wonderful experience for me that I’m hoping to go back to JPL in the future. And in regards to my education, I’m transferring to UC Berkeley in three weeks. I was really lucky to get accepted to my dream school. I’m going to be studying Mechanical Engineering for the next couple years and after that I’m applying for grad school. I want to take a moment to thank you for everything that you taught me. When I first started the program at UCSD, I had no idea how internships or grad school worked. Months later I had to select among internship offers and now I actually think it’s possible for me to obtain a Ph.D. and I know the steps to get there. I hope other students also have the opportunity to gain this much knowledge from you.”
Looking Ahead … 2017-18 Academic Year Program
Research and Academic Enrichment Continues!

Current NSF-REU Fellows can expect to participate in the following activities ...

Fall 2017
- Week(end) research apprenticeship at UC San Diego (Sept.-Dec.)
- Industrial/lab Field Trip (date to be decided)

Winter 2018
- Research and Recruitment Seminars by UCSD faculty at SD Community Colleges (Jan.-Feb.)
- 255th ACS National Meeting & Exposition in New Orleans, LA (March 18-22)
  Congratulations to Alma Anides Morales, Sarah Schwab, and Magaly Guzman Sosa, who have been awarded NSF funds (via our 4Cs @ UCSD program) to cover registration, travel and accommodations in order to present their research at this national conference.

Spring 2018
- ACCSA Undergraduate Research Symposium in Chemistry at UC San Diego (May)

Connecting with research scholars & mentors
Contributing to cutting-edge research
Cultivating a professional future
through the ...
CHEMICAL SCIENCES

2018-19 Program Application Deadline: March 30, 2018*
Please encourage interested students to visit our program website for more information on eligibility requirements and the application process. * Pending renewal of our REU site.