



# COSMOS UC San Diego

California State Summer School for Mathematics and Science

UC San Diego  
JACOBS SCHOOL OF ENGINEERING

A RESIDENTIAL ACADEMIC EXPERIENCE FOR TALENTED HIGH SCHOOL STUDENTS AT UC SAN DIEGO

## Week 3 Newsletter



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### MAILING ADDRESSES:

Please address **PACKAGES:**  
Student's FULL Name  
COSMOS @ UCSD  
9500 Gilman Drive #0429  
La Jolla, CA 92093-0429

**NOTE:** there is an Amazon pick up location at ERC called "Ellie" for easy pick up

**\*\*PLEASE DO NOT SEND ANY MORE PACKAGES AFTER MONDAY BECAUSE THEY MIGHT ARRIVE AFTER COSMOS HAS ENDED**

# CLOSING DAY!

## Closing Day Timeline

8:30 AM — 9:00 AM	Parents and Guest are escorted to Cluster Presentations
9:00 AM — 10:15 AM	Cluster Presentations (Location varies by Cluster)
10:15 AM — 10:30 AM	Walk to Price Center West Ballroom
10:30 AM — 11:45 AM	COSMOS Award Ceremony
11:45 AM — 12:00 PM	Head back to ERC
12:00 PM — 1:00 PM	Check Out of ERC
1:00 PM	Student Check Out Deadline

\*\* Starbucks will be open at 8:30 AM on Closing Day.

On Saturday, August 3rd, students will present their final projects. Please plan to arrive at **8:30am to Warren Mall**. You will be escorted to your student's cluster project location where presentations will be from 9-10:15 am. Following the presentations will be the COSMOS Awards Ceremony at 10:30am at the Price Center Ballroom. Students will be presented with their Completion Certificates and special awards. We encourage friends and family to come see all of the hard work that the student have been putting in during their month at COSMOS!

After the Awards Ceremony, we ask that families start heading back to the Eleanor Roosevelt College (ERC) residential halls to pick up the student's belongings and check-out. This means that all students should be packed prior to the Research Expo and have their keys and meal cards ready to be turned in. If your student has lost their key(s), it is a \$155 expense per set of keys and this must be paid at the time of check-out if not before. Broken keys are free to replace.

Families should park at the Gilman Parking structure near the Price Center. **Do not use the 9500 Gilman Dr. address in your navigation system-it will take you to our central mail processing!** Families can park in Gilman for the Research Expo and Awards Ceremony then drive to the Pangea Parking Structure to pick-up their student's belongings and check-out. All students **MUST** be checked out by 1:00 PM.



# Closing Day Driving Directions

## Getting to GILMAN PARKING STRUCTURE

3100 Gilman Dr. La Jolla, CA 92093

1. Exit La Jolla Village Drive from the I-5 South and head west to turn onto La Jolla Village Drive.
2. Turn right onto Villa La Jolla Drive.
3. Continue straight past Gilman Drive into Gilman Parking structure.

## (Walking) From GILMAN PARKING STRUCTURE to WARREN MALL

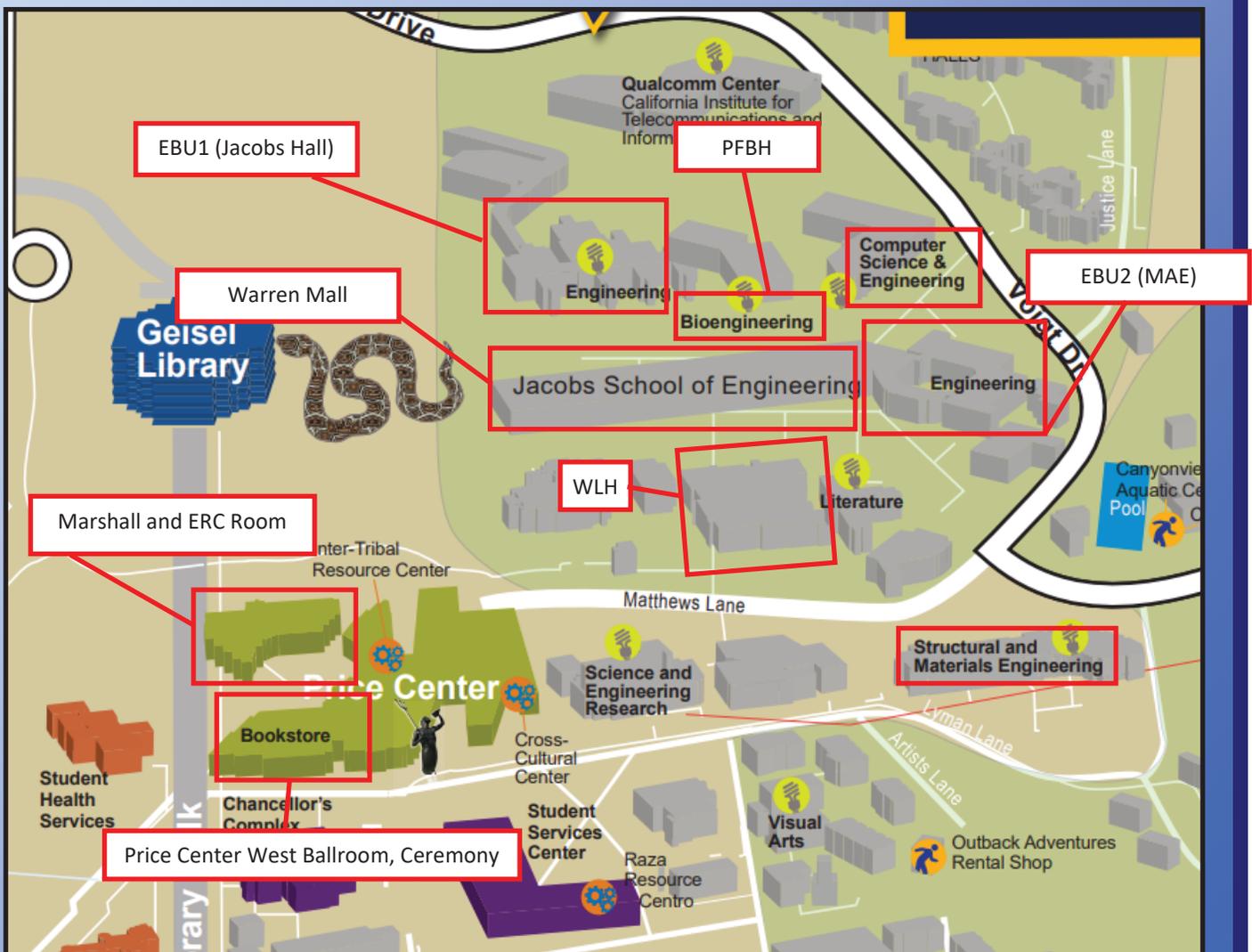
1. Head North from the Gilman Parking Structure on Russell Lane. Look for COSMOS signs that will be along the way to Warren Mall from Gilman parking structure.
2. Continue Past Matthews Ln. Walk Straight.
3. Turn Left upon arriving in Warren Mall.
4. Closing Ceremony will take place in Price Center West Ball Room, directly above the Amazon Locker near the Bookstore.



\*NOTE: Parking is free on weekends unless otherwise noted.

# Cluster Presentation Locations

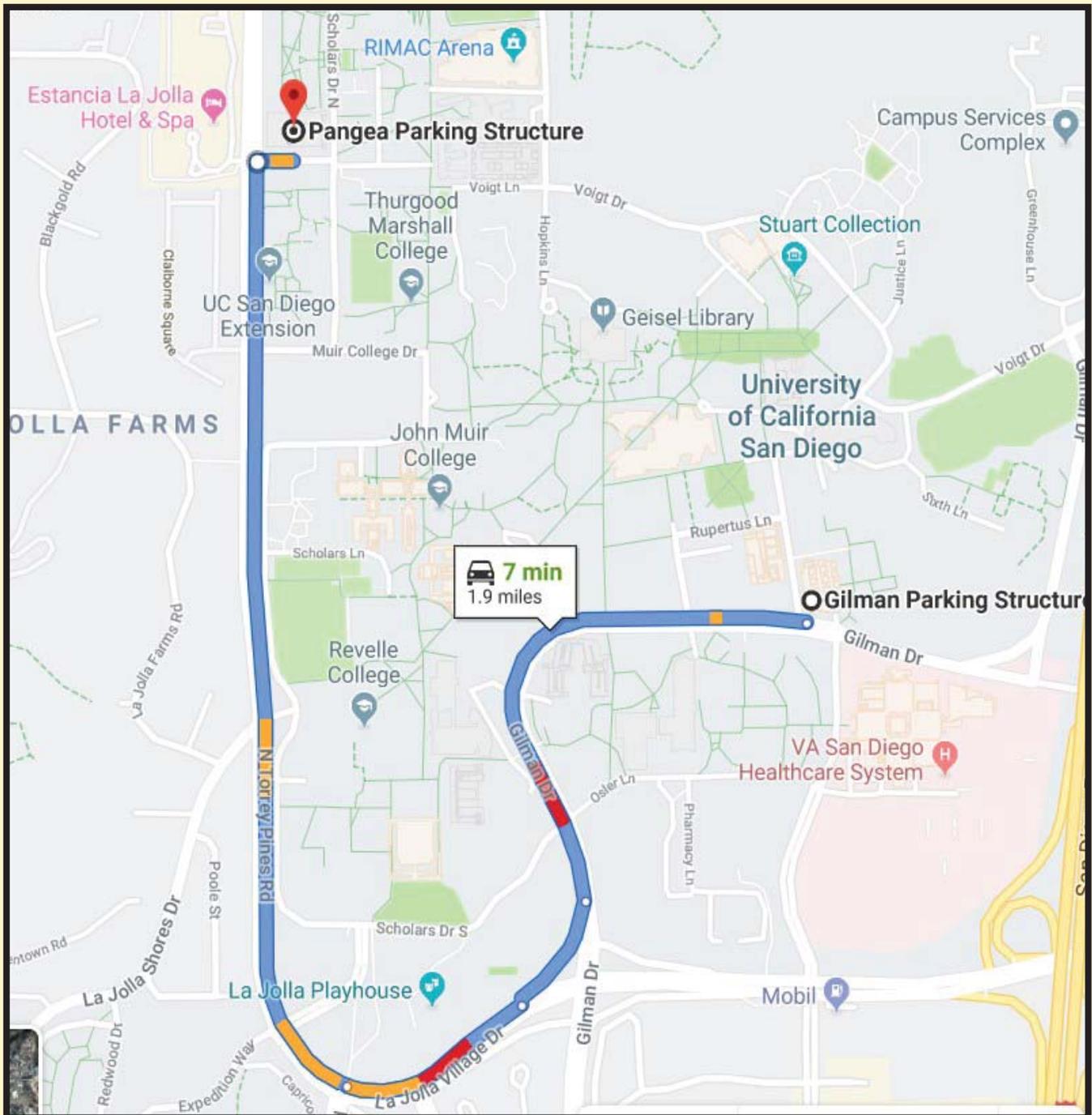
- Cluster 1: CSE 1202 (Computer Science Engineering)
- Cluster 2: EBU2-315 (MAE-Pink Building)
- Cluster 3: ERC room (Inside Price Center West)
- Cluster 4: SME 248 (Structural & Mechanical Engineering Building)
- Cluster 5: EBU1 2315 (Jacobs Hall)
- Cluster 6: Marshall Room (Inside Price Center West)
- Cluster 7: WLH 2111 (Warren Lecture Hall)
- Cluster 8: PFBH191 (Bio Engineering Building, Fung Auditorium)
- Cluster 9: EBU2-335 (MAE-Pink Building)
- Cluster 10: EBU1 2512 (Jacobs Hall-Booker Room)
- Cluster 11: EBU2 105 (MAE-Pink Building)



# Closing Day Driving Directions cont.

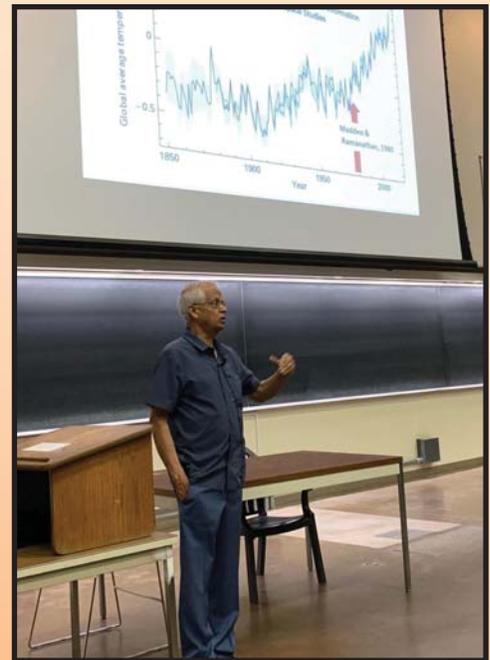
## (Driving) From GILMAN PARKING STRUCTURE to PANGEA PARKING LOT

1. Head West on Gilman Drive toward Russell Lane.
2. Using the right lane to take La Jolla Village Drive West Ramp
3. Turn right onto La Jolla Village Drive
4. Continue on North Torrey Pines Road
5. Turn right onto Pangea Drive.
6. Pangea Parking lot will be on your left.



# DISCOVERY LECTURE SERIES

Dr. Ram Ramanathan, Professor of Atmospheric and Climate Sciences at the Scripps Institute of Oceanography at UC San Diego, gave COSMOS students an interesting lecture on Climate Change titled "Bending the Curve to Fight Climate Change." Dr. Ramanathan discussed the importance of solving the issue of climate change in our lifetime, equating it to the odds of getting on airplane with a 1 in 20 chance of crashing. Dr. Ramanathan went on to discuss the importance of forming an alliance between science, religion and policy in regards to climate change, as it will impact all future generations. When he finished grad school, Dr. Ramanathan joined NASA to help engineers build a drone which would measure the greenhouse gasses in the earth. As many know, the impact of carbon dioxide in the atmosphere lasts for hundreds and even thousands of years. Also, everything is connected: the air from China comes to the US in 5 days, and between China and India in just three days. Therefore, all carbon emissions from all countries are significant to everyone on Earth. Dr. Ramanathan concluded by discussing what people can do to help fight climate change and achieve carbon neutrality. These are ecosystem management, societal transformation, governance, technology measures, and markets and regulations. He suggested that humans examine their relationship with the climate - by replacing resources that have been taken from nature. He encouraged our COSMOS students to spread the message to their peers to help repair and restore the climate damage that has been done.



# RESIDENTIAL LIFE

COSMOS is almost coming to an end! We are in week 3 of the program and it has been a remarkable and memorable experience for all of the students. [On Sunday evening](#), after the students returned from Family Weekend they all were invited to attend our annual Casino Night. They had an opportunity to play, blackjack, Texas hold'em poker, bingo, and board games. The students were able to earn lottery tickets by winning at the tables and turning in those tickets for awesome prizes! [On Tuesday night](#), we hosted the Women in STEM panel and these women shared their personal experiences with the students as well as answered student questions. This week our evening programs entailed a Bob Ross Painting Night where students showed their artistic talents, participated in a Smash Bros. & Chess Tournament, walked to Torrey Pines Gliderport to see the Sunset, and relaxed with an evening of Yoga. This weekend will be our last full weekend at COSMOS. We will be traveling to Balboa Park to visit the Fleet Science Center and the Natural History Museum. We will end the weekend with the Carnival event and COSMOS Dance so their last weekend will be a blast!



# WOMEN IN STEM

This past Tuesday, COSMOS hosted their annual Women In STEM Night, an event highlighting the challenges and successes a woman has experienced in the STEM field. Students had the opportunity to attend an outstanding panel discussion that featured five diverse and impactful women. Our panelists were:

**Danielle Schmitt, Ph.D.**, is a University of California President's Postdoctoral Fellow in the Department of Pharmacology at UC San Diego. Danielle works on understanding how cells sense and respond to changes in their metabolism. Prior to coming to UC San Diego, Danielle did her doctoral work at the University of Maryland Baltimore County specializing in biochemistry, and her Bachelor's of Science at Ball State University, majoring in chemistry. Outside of the lab, Danielle is a leader for the San Diego affiliate of 500 Women Scientists, a grassroots organization working to promote science in local communities and inclusivity in STEM.

**Anny Reyes, M.S.**, is a fourth-year doctoral student at San Diego State/ UC San Diego Joint Doctoral Program in Clinical Neuropsychology. Anny's main research objective is to use neuroimaging and neuropsychological tools to better characterize cognitive phenotypes in temporal lobe epilepsy and other epilepsy syndromes in order to better predict the risk for cognitive decline associated with aging or medical/surgical interventions. Specifically, she is interested in identifying individual differences (e.g., demographic, vascular, genetic) that can alter the response to brain pathology and influence the relationship between brain pathology and clinical phenotypes in patients with epilepsy. Her long-term goal is to study brain networks and risk/factors in a range of epilepsy syndromes and neurological disorders, as well as those associated with aging.

**Linh Anh Cat, Ph.D.**, is a scientist studying how tiny microbes make big impacts on ecosystems. Her research has brought her to scenic environments from deserts to boreal forests, and her favorite fieldwork spot in Southern California. At the University of California, Irvine, Linh Anh earned her Ph.D. in biological sciences studying airborne microbes, particularly those that cause disease. Soon, she will be a postdoctoral scholar at Scripps Institution of Oceanography. She is extremely passionate about connecting science to policy and was recently a Public Policy Fellow with the University Corporation for Atmospheric Research. Linh Anh is also a contributing writer for Forbes Science, where she addresses microbes through the mainstream media.

**Bridget Kohlnhofer, Ph.D.**, is a Neuroscience Postdoctoral Fellow at Janssen, a Pharmaceutical Company of Johnson & Johnson. Bridget models neuropsychiatric disorders utilizing human genetics and induced pluripotent stem cells by generating 3D mini-brains and 2D neurons with the goal of discovering new drug therapies for patients with autism, bipolar disorder, and schizophrenia. Bridget holds a BS in Cell and Molecular Biology from the University of Wisconsin- La Crosse, a Ph.D. in Cell Biology from the Medical College of Wisconsin, and was a postdoc at UCSD in the Department of Cell and Molecular Medicine.

**Jacqui Le** received her B.S. and M.S. in Structural Engineering from UC San Diego and is a licensed engineer. She has been a part of a large variety of projects ranging from retrofitting underground large diameter pipes and analyzing carbon composite airplane panel damage from hail ice impact, to remodeling historic museums and designing new hospitals and hotels. Jacqui currently works at KPFF Consulting in San Diego as a structural engineer. She is excited about knowledge sharing, mentorship, and solving real-life, as well as engineering, problems. During the summer, Jacqui teaches COSMOS Cluster 4: When Disaster Strikes: Earthquake Engineering at UC San Diego. Jacqui is also an active member of the Structural Engineering Association of San Diego, Commercial Real Estate Women (C.R.E.W.), and the American Society for Engineering Education (ASEE). When she's not working or sleeping, Jacqui likes to spend her time hanging out with her dog, practicing Pilates, and volunteering with Promises2Kids and Frosted Faces Foundation. These five panelists shared their journey as Women in STEM and answered questions about their work experiences and career tracks from the student audience. It was a great opportunity for students to gain insight and understanding about the success strategies employed by these successful Women in STEM!



# CLUSTER 1: COMPUTERS IN EVERYDAY LIFE



**Late last week**, we saw a demo of a cucumber sound board. A mini sound effect board Curt made from actual CUCUMBER SLICES. This was our intro into circuits and Arduinos. Then in lab, we got to begin working with tutorials so we can learn how to wire and program our circuits in C using push buttons, speakers, temperature sensors and servos to name a few. It was exciting to see our circuits working! We began **Monday** with a guest speaker, Julian McAuley who talked about his work in data mining. The field of data science is growing! There is so much data that is gathered today that can help guide us in things we do every day and to help us as a society. In the field of data science/mining, they build models to “help us understand data in order to gain insights and predictions”. For example, recommender systems are made to predict a rating a person will give on a product. This will allow a system to be built which will recommend products that people are interested in and gain insight on how opinions are influenced by gender, age and location. Some areas which use it today are social networks (such as trying to predict whether two users might be friends), advertising and medical informatics. Afterwards, we began learning about Boolean logic, gates and DeMorgan’s Law. We were challenged to create the logic for trying to escape campus given constraints such as two roads out, a booby trapped scooter and Shirley trying to catch us. In lab, we began working on our project this week – creating a musical instrument using an Arduino. **Wednesday** morning we learned about adders and made our cluster into a 20-bit adder!

We also learned that:

$$1 + 1 = 0$$

$$1 + 1 = 1$$

$$1 + 1 = 2$$

$$1 + 1 = 10$$

To find out why, watch the video on our blog! We wrapped up our morning lecture learning about transistors (switches) which are made with semi-conductors. We learned how nMOS and pMOS transistors can be configured together to build inverters and NAND gates.

Afterwards, we our guest speaker was Deian Stefan. His insights on cybersecurity helped us relate what security issues in the physical world to that of the cyber world. There are two main types of security – defensive and offensive. He spoke about the analysis and protection of computer systems in an adversarial setting. The main focus was the protection on confidentiality, integrity, and availability of a system against an adversary. A couple of the big tips we walked away with were use password managers (so you don’t use the same password for everything and they are complex) and don’t install too many extensions! On **Thursday**, we’ll present our musical instrument Arduino project. Videos and demos will be uploaded by the weekend! Then we’ll officially begin working on our final projects!



# CLUSTER 2: ENGINEERING DESIGN AND CONTROL OF KINETIC SCULPTURES



Week 3 was all about mini sculptures. During this week students learned about physics of ball motion, energy, and impact through which they honed their creative, analytical, communication, project management, and teamwork skills.



Cluster 2 teams started the week by sharing the initial sketches of their mini sculptures, discussed uncertainties in their designs, and got feedback from professor de Calafon. Students used their time in the design studio to prototype and test their initial designs; they added motors, forces, sensors, baskets, trampolines and ramps. In the computer lab, students used Working Model 2D to simulate the behavior in their sculptures, and programmed NXT sensors in RobotC. Professor de Calafon gave two lec-



tures this week. The first was an introduction on the dynamics and control of mechanical systems through which he explained the study of the action of forces on bodies and the changes in motion they produce. And the second was about automatic control & microprocessors. He talked about the interdisciplinary

branch of engineering and mathematics that deals with the behavior of dynamical systems, which allows automatic regularization, stabilization, tracking and disturbance attenuation.



The Discovery lecture this week was about solving climate change with Science, Society & Technology by Dr. V. Ram Ramanathan, a professor of Atmospheric and Climate Sciences at the Scripps Institute of Oceanography, UCSD. After the lecture, cluster



2 students learned about the design thinking process and used it as a framework for their mini-sculpture designs. They started developing their team websites to document their learning experience and keep a digital portfolio to archive work and reflect on their growth and learning. Cluster 2 students also toured the Structural and Material Engineering (SME) and Mechanical and Aerospace Engineering (MAE) labs this week and saw large scale experiments that are currently set up there.





# CLUSTER 3: LIVING OCEANS AND GLOBAL CLIMATE CHANGE



Greetings from Cluster 3! Our third week has flown by quicker than we could have imagined. We are currently designing our presentations for our projects and working hard to prepare for our talks next week! This week we will be applying our knowledge of global climate change to ocean acidification. Here are some insights to our busy week:

"On Friday 7/19, cluster 3 went to a morning lecture with Kim Prather and Stephen Mayfield. Kim taught the cluster about major causes and effects of climate change as well as trends linked to climate change. Mayfield focused on biomanufacturing and introduced flip flops he and Dr. Pomeroy made from algae. After the lectures, students went down to SIO to see Professor Lai.

He brought the cluster to the peer as he taught about fish in the different layers of the ocean and how they have adapted to surroundings. Finally, it was time to head back to the dorms and say goodbye for family weekend." Chris L.

"On Monday, Cluster 3, Living Oceans and Global Climate Change, started off the day doing a few different demos. The first one we did was called Cloud in a Bottle, which was where we condensed water in a soda bottle by rapidly expanding the air particles within the bottle, thus forming a cloud. Second, we did a demo called Milky Sunset where we gradually added milk to water and to see how light passed through the liquid as it became more translucent. Lastly, we poured root beer in a cup and saw where bubbles formed. In the afternoon, we made a circuit board which would be used on Wednesday to titrate a solution of NaCl with HCL."- Ethan C.

"On Tuesday morning, all of the students of COSMOS met in Warren Lecture Hall for a discovery lecture presentation. This week's presenter was Veerabhadran Ramanathan, director of the Center for Atmospheric Sciences at the Scripps Institution of Oceanography at UCSD. He spoke to us about the science and implications of global climate change. The presentation covered specific scientific ideas such as the albedo effect and the relationship of chlorofluorocarbons and the earth's ozone layer, but also included personal narratives and the direct consequences of global warming on people's lives all over the world. After the lecture, we returned to the Natural Sciences Building to work on our projects. We have a variety of student projects we are working on in Cluster 3; some groups are looking at the earth's atmosphere, while other groups are focusing more on chemistry and biology of the living oceans. On Tuesday, my group used a spectrometer to calculate the relationship between silicate concentration and light absorbance, in order to reach our final goal of determining and analyzing the amount of reactive silicate in seawater."- Alexis C.

"Today, July 24th, we began with a lecture about clouds. After the lecture we tried to learn organic chemistry in 10 minutes and it was hard. Peter in the day we had a lab and we built a constant current source to react with an indicator to calculate the molarity of HCL" Ricardo R.

"On Thursday, July 25, we opened by going to cluster exploration. We learned about clusters 4, 5, 7, 8, and 9 as instructors from each cluster discussed what each cluster was learning about and what the students would be doing for their final projects. We then went to Bonner Hall to look at examples of scientific posters. Later we worked on our final presentations and analyzed more solutions to determine absorption. One group went to SIO to work on their project with Dr. Lai, while the other groups stayed on campus to work in the lab at NSB with George." Connor C.

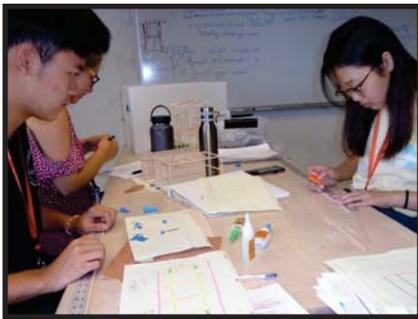
We can't wait to see you next week to present our projects to faculty, families, and friends!



# CLUSTER 4: WHEN DISASTER STRIKES: EARTHQUAKE ENGINEERING

After learning about various seismic retrofit strategies and soil improvements for mitigating hazards in week three we continued on our Phase 2 testing; some of which needed careful calculations. The Slope Stability group found out how slippery sand could be as forces were applied to replicate seismic activity. Reinforced Concrete group made some hot progress with their newly found soldering and cementing skills. The Timber group members found themselves constantly cutting away at their work load. Some groups like the Soft Story team was stuck in a holding pattern as they waited for their glued joints to dry. Other groups like Liquefaction were pillars of the classroom when they successfully tested their first re-design.

This week Cluster 4 was lucky enough to have field trips where we saw similarities in the COSMOS tests we have been doing at the research and professional levels. Jacqui gave us a quick lesson about the sites and Personal Protective Equipment (PPE)



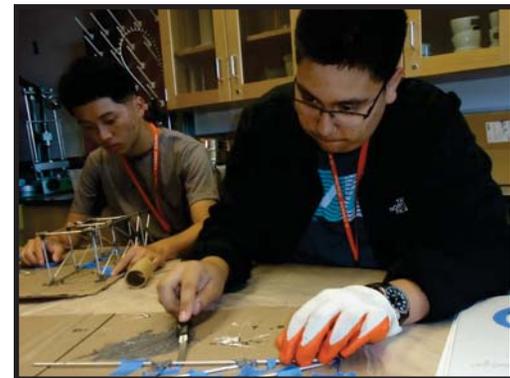
prior to the tour of Powell Lab facilities and shake table on the UCSD campus. Here we were able to see large scale testing of engineering solutions similar to our own COSMOS projects. At the Seismic Response Modification Device

(SMRD) test facility we were given insight regarding retrofit strategies for earthquake design. Later at Englekirk Structural Engineering Center we viewed the largest outdoor shake table that allows researchers to perform earthquake safety tests at full scale. Lelli is even one of the Principal Investigators helping to get the shake table updated to allow for six degrees of freedom.

Once we had learned about schematics, design development and construction drawings Cluster 4 did a site analysis using construction documents. The lesson was that design is only good if someone else can use it to correctly build the structure; and that



requires lots of detail. Although we only navigated a small section of the documents required for the building, the volume of information was overwhelming. This reinforced the takeaway that as engineers the final product for the client are always the drawings that are created and instilled the idea of the various stakeholders in the project team. By Thursday we were a shoe in, with our hard soles and leather uppers, for the construction site visit. When we saw it the building was far from done, but with the concrete poured and the designs we analyzed in our mind, we could envision the completed project.



# CLUSTER 5: Photonics: Light-based Technologies in Everyday Life



brand new facility so students could see their QCL infrared microscope (used to advance cutting-edge cancer-detection) and CAD software techniques, before finishing with a great discussion with one of the company's founders about optics, astronomy, and spectroscopy and Daylight's connections to all areas of science. It was a truly great trip!

Students in Cluster 5 have been tackling some great physics and engineering problems and seen some wonderful and interesting labs over the past week. In our lectures, students had the chance to learn about quantum cascade lasers (QCLs), quantum dots, LCDs, polarization of light, and holography from Dr. Tu, and biosensor science and applications from Dr. Baghdadchi. In the afternoon, students started planning and working on their group final project that will become their main focus for the remainder of the program. Many students also had the opportunity to go home or leave UCSD with their family for the Family Weekend – hopefully everyone enjoyed that time together!

On Monday this week, we took our much-anticipated field trip to Daylight Solutions and had a great time learning from and interacting with numerous scientists and engineers in the field of photonics. The wonderful staff organized three rotating mini-tours of their

Tuesday began with a great Discovery Lecture from Dr. V. "Ram" Ramanathan on climate change, the dire consequences of inaction, and the great potential within every one of these amazing students to change the world. Later, students had a chance to visit the Fallen Star art installation on the top of the Jacobs Engineering Building, and continue making progress on their final projects. In the evening, students saw a great discussion panel on Women in STEM and learned a lot.

On Wednesday, after a great lecture from Dr. Charles Tu on more detailed solar cell technology and demonstrations from Dr. Janet Pan on light scattering and rainbows, students continued to develop plans for completing their final project by the middle of Week 4 in order to be prepared for their presentations at the end of the COSMOS program. We won't give anything away just yet, but student groups have come up with some very innovative and interesting ideas for investigating scientific

phenomena in the world of optics and photonics – it is sure to be fun!

Thursday began the second Cluster Exploration session, followed by our Science Communication course. There, students discussed some of the most effective techniques for presenting science ideas and starting working on presentations. Finally, students continued to make some great progress on their final projects. Here are a few more quotes from students as we head into the final week of COSMOS!

"My favorite part of COSMOS so far was finding out that there are so many people who share the same interests as me. Every time I meet someone new, I am always surprised to find things after things we have in common with each other." - Nabeel S.

"The best moments I had in COSMOS so far is all the laughter and inside jokes we share with each other. We also build our relationships through the labs and whenever we hang out together." - Lilyan M.

"The best part of COSMOS is the connection everyone forms with each other through the long periods of time we spend together. From lectures to labs, we always have a way to get a laugh out of one another!" - Austin P.

"I liked learning what time purple was and learning how the face ID on Apple iPhones works." - Kiana S.

"Our cluster is filled with geniuses and goofballs. Correction: geniuses that are also goofballs. It's been such a fun time so far learning and laughing with you all." -Don L.





# CLUSTER 6: BIODIESEL FROM RENEWABLE SOURCES

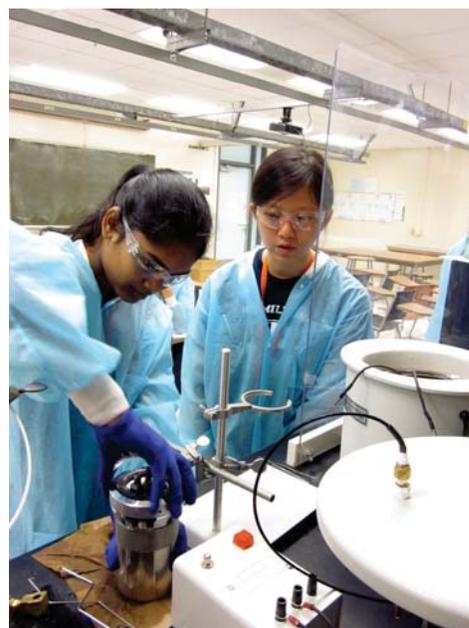
"On Friday we joined cluster 3 for guest lectures by Dr. Prather about aerosols impact on climate change and Dr. Mayfield about the uses of bio plastics. In the afternoon we continued to test our biodiesel for impurities. In the evening students who were leaving for family weekend got ready to leave." Iraa Kalambur

"Monday, we had a lab rotation in which we tested our biodiesel samples. My lab group did the viscosity and cloud point tests with Dr. Watson. Afterwards, our entire cluster went to get frozen yogurt and bonded." Jessica Liu

"On Tuesday, we had our third discovery lecture on climate change and the possible solutions to combat it. In the afternoon, we worked in our project groups and began planning our presentations. We also had a lecture on Women in STEM." Kinsey Clark

"On Wednesday, we started the day in the lab, performing various tests on our biodiesel to contribute to our certificate of analysis. In the afternoon, we had a lecture on the chemical analysis of our biodiesel by Professor Pomeroy. After classes were over, some of us headed over to Glider port with the Ra's to watch the Oceanside sunset." Michael Wu

"Thursday we attended a presentation where we learned about what the other clusters have been doing in the last three weeks. After that, we went to the lab where we continued to work on our projects and presentations for next week." Nicole Lazovsky



# CLUSTER 7: SYNTHETIC BIOLOGY



Week 3 has gone fast for Cluster 7. Students have been busy working on skills in the lab and learning about how to program cells to do interesting and useful things. Students purified glowing protein, measured the activity of an enzyme, and have been practicing their graphing and data analysis skills with Dr. Vera. They had a special guest speaker, Dr. Eva Sanchez come in and share her work on microalgae with them. They have been honing their circuit building skills with Mauricio as well. Student projects are well under way, and they are working hard to create awe-

some projects to share with our COSMOS family!

Cosmos has been an amazing experience so far, and week 3 was even better. We dove into labs such as isolating proteins and measuring bioluminescence, and we are all ecstatic to start pursuing our final group projects! Jennifer and I became very close friends at COSMOS, and we always look forward to the various cluster bonding activities after class. We all plan to make the most of our last week in this enlightening academic and social environment. - Nico M

Cosmos has been a very eye-opening experience! I have learned so many new techniques and done numerous interesting experiments such as the gel electrophoresis lab and making fluorescent E. coli. Week three has been even better! This week I got to explore the UCSD campus further and participate in a variety of activities such as watching the sunset and playing cards with the other students. I am excited to see what happens next week! -Jorina C.

We've been working on so many different experiments this past week, from sniff-testing E.coli that smell like bananas to testing the activity of beta galactosidase using a spectrophotometer. There's always something new and exciting to work on in the lab. I'm stoked to start working on our final project. We had some trouble agreeing on a project in the beginning because all of us had really ambitious and cool project ideas but I'm glad we all decided on something that we hope to share with everyone in the near future! -Ellie F



# CLUSTER 8: TISSUE ENGINEERING AND REGENERATIVE MEDICINE

Our second week ended with a GR8 tour of Gilead, a local biotech company that, "...researches, develop and commercializes drugs, primarily antiviral drugs used in the treatment of HIV, hepatitis B, hepatitis C, and influenza." We had an overview presentation followed by an extensive tour of their large facility, including a glimpse at their bioreactors, protein purification processes, mass spectrometers, and drug delivery systems. Week three began with a wonderful field trip to Sanford Consortium for Regenerative Medicine, a research center whose mission is 'to advance stem cell research through collaborative, multi-disciplinary interactions...to promote diagnoses, treatments, and cures for degenerative diseases and injuries.' Dr. Gaetani guided us on an extensive tour including a visit to the lab he collaborates with, a lab that is sending neural organoids to the space station this week, the stem core facility, and then concluding with a poster presentation given by some of the graduate students in his lab. Our morning ended with lunch at the Torrey Pines Glider Port overlooking the beach.



In Discovery Lecture, Dr. Ramanathan spoke about climate change morphing into climate disruption and the need to society to step up. In Cluster Explorations, it was all about cluster pride, as Dr. Sah presented Cluster Eight's undertakings to all of COSMOS. Dr. Sah definitely impressed everyone when he gave brief glimpse into the 'GR8' projects underway! In science communications, we began to present our ethics topics within cluster, worked on creating posters, power points, and papers to document our projects and prepared for our up-

coming presentations.



Everyone was prepared to execute the much anticipated projects. Briefly, three groups will be studying Cartilage Tissue Engineering with Dr. Sah. Celine, Jared and Mitchell, with the guidance of Swetha, will be 'Determining if Implanted Chondrocytes Helps Induce Cartilage Regeneration Using Cell Trackers', Elizabeth, Michael and Rachel, with the assistance of Arya, will be investigating 'Cartilage Resurfacing in Osteoarthritic Tissue' and Kaylin, Matthew and Shreya, with the help of Swetha, will be looking at 'A Model to Observe Cellular "Cross-Talk" Through the Subchondral Plate'. The other three groups will be focusing on Cardiac Regenerative Medicine with Dr. Gaetani. Anna, Esha and Luke, with

the guidance of Arya, will be investigating, 'The Effects of Skeletal Muscle ECM on Endothelial Cell Proliferation and Function', Andy, Jenny and



Sameer, with the assistance of Steven with look at, 'The effects of ECM Proteins on Cardiac Progenitor Cells' Ability to Proliferate', and Allison, Misha and Smera, with the help of Steven, will study, 'The Modulation of Microenvironments in Cardiac Progenitor Cells Across Dimensions'.

The week has been exciting in the lab as tissues are being processed, gels formed, cells cultured, and materials are being prepared and tested. Cluster 8 continues to be 'GR8' as we have mastered the required expertise to plan and execute our projects.

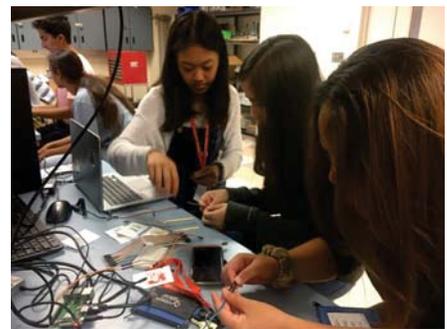
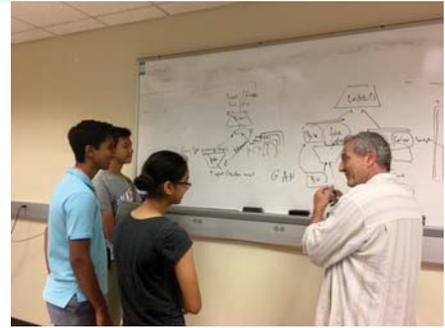


# CLUSTER 9: MUSIC AND TECHNOLOGY

This week we had our first experience talking to Python. Thankfully, it was nothing like the snake scene in Harry Potter — our professors gave us a careful introduction to the language/world of Python (or parseltongue) so that we wouldn't get into serious syntax trouble. From writing programs to print out list of numbers and sums to flailing around with Librosa, Pretty-MIDI to play audio files and draw spectrograms, we realized Python's potential to transform the music industry especially with the Raspberry Pi. The Raspberry Pi (not edible) is a small computer that allows us to modify both software and hardware like running Python programs, *playing* Minecraft, and attaching wires. Using a breadboard (not edible), wires, and Python, we programmed a circuit to turn an LED light bulb on/off. Additionally, we got to play with Tensorflow's online playground, which visually modeled artificial intelligence and neural networks, revealing to us that computers can maybe compose the future.

Don't worry; we aren't turning into computer nerds — yet. Remember our trip to the recording studio? We finally received our self-recorded sound effects from the studio. Using Ableton, we attempted to use these effects to compose our own beats. While synthesizing sounds was interesting, Jacob, our TA, displayed his passion for creating unorthodox sounds by stretching real life sounds. We also became more open-minded and listened to airport/museum music. Listening to museum music was intriguing, but taking a tour of the Museum of Making Music was even more exciting. In this field trip, we were accompanied by John, the tour guide who led us around the museum explaining the brief history of music from the time the National Association of Making Music (NAMM) was created, starting from small military bands in the Civil War, to self-playing pianos, to electric guitars. We were able to learn about how famous artists like Benny Goodman influenced music (swing) in their era and play around with unusual instruments such as the theremin, the accordion, and the djembes (African drums).

The knowledge and experiences from this week are going to help us greatly in our final projects! We have already formed our groups and pitched our ideas to our professors — almost like SharkTank except the "I'm out" part. Overall, week 3 was action-packed, and we are all diligently working on our projects. We really hope that everyone will enjoy our presentations!



# CLUSTER 10: ROBOT INVENTORS

**Day 11:** Walking robots are the theme of the week, and we began with a lecture from professor Nick Gravish on walking robots, PID, and the math behind controlling robots. We then had a guest lecture from Dr. Tania Morimoto on flexible robots for surgical applications. The students had a chance to check out some haptic feedback devices and learn how growing robots and continuum robots work. In the afternoon walking robot design continued with an introduction to laser cutting, and more design work.

**Day 12:** Our discovery lecture this morning was by Dr. V. Ram Ramanathan, a world renowned climate scientist from Scripps Institution of Oceanography, who spoke to the students about the reality of climate change and what can be done now to curb the effects. Students then made their project pitches for their final week projects, and did some refining with the help of the professors and staff. This afternoon saw students working on their walking robots once again, getting ready for Thursday's competition - whose robot can walk a distance of ten feet the fastest?

**Day 13:** We had two excellent guest speakers this morning, both students who are currently in a PhD program here at UCSD and work on soft robotics - Paul Glick is working in the area of robots in extreme environments, and Emily Lathrop is working on robots moving over challenging terrain. Both shared their stories from high school to graduate school as well. We then transitioned to the lab for the remainder of the day so students could work on their walking robots!

**Day 14:** Cluster Exploration Sessions finished up this morning with the remaining clusters. We then moved to Science Communication, where students chose final project titles and began working on their digital portfolios and final project posters. After lunch we headed back to lab and had our walking robot competition! Congratulations to winners Stefan and Valentina!

**Day 15:** Today will be work on final projects all day in the lab!

Congratulations to our Week 2 competition winners: Stefan and Sonali!



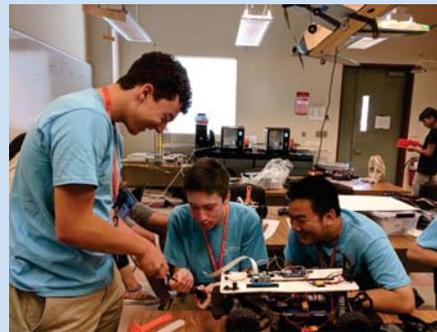
# CLUSTER 11 : Autonomous Vehicles



Students asked questions of Mark Murray, the head of electrical engineering for Brain. The cluster learned some of the details of how Brain's vehicles work and how they are different

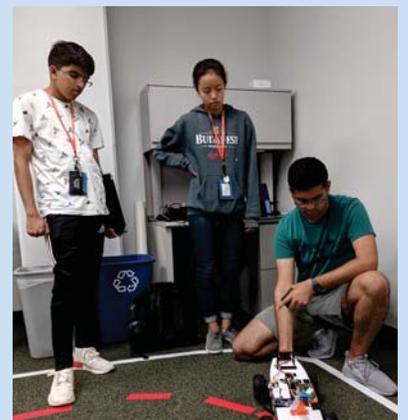
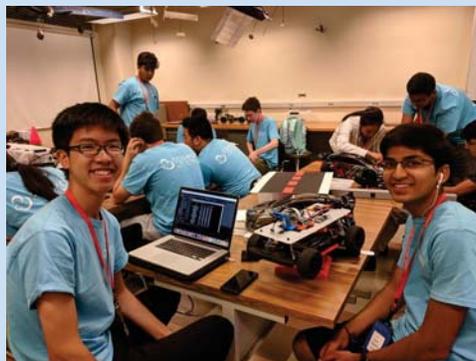
Week 3 of Cluster 11 began with students training the cars to drive on an indoor track. Indoors is easier because of consistent lighting. The data was uploaded to the supercomputer center and the cars could drive themselves. Once this goal was achieved by all groups, outdoor driving commenced. We also standardized on a single camera mount design so that each group's car had the same view of the road. This allowed all the groups to share each other's data and train the cars together.

from the RC cars we are working on. They also learned about the STEM job market. All in all it was an amazing field trip to a very special company with incredible people.



Tuesday began with the Discovery lecture by Professor Veerabhadran Ramanathan on climate change. More car training completed the morning. Students tried training the car to drive around cones placed on the outdoor track. In the afternoon was the field trip to Brain Corp, a local company that specializes in AI. Students got to see autonomous floor cleaning robots. Some students had the opportunity to drive the vehicles and train them. After the demonstration stu-

On Wednesday, the day was spent training the cars for outdoor tracks. Thursday morning began with Cluster Explorations where we heard from Clusters 4, 5, 7, 8, and 9 about the work going on there. We continued training the cars on the outdoor track and improving the performance. The rest of the week was spent refining the outdoor training and planning the additional behavior of the car, which is the Cluster 11 final project.



# Treats with ...



**Dr. Charles Tu,  
COSMOS Director &  
Luis Pineda**

**Dr. Charles Tu &  
Dr. Leo Porter,  
COSMOS Co-Directors  
this Summer**



**Dr. Leo Porter,  
COSMOS  
Directors**



# Casino Night



# Reslife Activities



## Paint Night



# Glider Port Sunset

