



# COSMOS UC San Diego

California State Summer School for Mathematics and Science

UCSD Jacobs School of Engineering

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

## Week 2 Newsletter

### REMINDER!

**F**amily Weekend is July 20nd through July 22nd. Students must be checked out by an adult specified on the Family Weekend Form between **5-9pm on Friday and must return between 2-5pm on Sunday.** Optionally, students can be checked out at 5pm on Friday and returned by 9pm that same evening or alternatively, 2pm on Sunday, returning by 5pm that day. We do not have the staff to accommodate individual schedules. **Parental visits will not be permitted outside of designated hours. All students MUST be back to campus by 5pm on Sunday.** If you have any questions, please call our office at (858) 822-4361 or email: [cosmos@ucsd.edu](mailto:cosmos@ucsd.edu).

### ADMISSIONS PRESENTATION

**T**his coming Sunday, students and parents will be given the opportunity to attend a UCSD Admissions presentation. The presentation will be conducted by the Office of Admissions at UCSD. It will begin with basic eligibility requirements for applying to UC colleges, followed by the presentation of statistics to provide students with a visual of the competitiveness of the applicant pool. It will conclude with a Q&A session. The presentation will be held this

**Sunday, July 22nd from 3-4pm at Peterson 110.**

### IN THIS ISSUE:

Reminders/ Admissions Presentation	1
Discovery Lecture/ Cluster Exploration	2
Residential Life	3
Cluster 1 Highlights	4
Cluster 2 Highlights	5
Cluster 3 Highlights	6
Cluster 4 Highlights	7
Cluster 5 Highlights	8
Cluster 6 Highlights	9
Cluster 7 Highlights	10
Cluster 8 Highlights	11
Cluster 9 Highlights	12
Cluster 10 Highlights	13
COSMOlympics	14
Residential Activities	15
Safari Park	16

### MAILING ADDRESSES:

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# DISCOVERY LECTURE SERIES

Dr. Henrik Christensen, from UCSD's Computer Science and Engineering department, gave an interesting lecture titled "Robots for Everyone." In addition to his role as Professor, Dr. Christensen is also the Qualcomm Chancellor's Chair of Robot Systems as well as the Director of the Institute for Contextual Robotics. Prior to UC San Diego he was the founding director of Institute for Robotics and Intelligent machines (IRIM) at Georgia Institute of Technology (2006-2016). Dr. Christensen does research on systems integration, human-robot interaction, mapping and robot vision. The research is performed within the Cognitive Robotics Laboratory. He has published more than 350 contributions across AI, robotics and vision. His research has a strong emphasis on "real problems with real solutions". A problem needs a theoretical model, implementation, evaluation, and translation to the real world. He is actively engaged in the setup and coordination of robotics research in the US (and worldwide). Dr. Christensen received an honorary doctorate in engineering from Aalborg University 2014. He collaborates with institutions and industries across three continents and his research has been featured in major media such as CNN, NY Times, and the BBC.

Dr. Christensen began by saying that robot engineers do not like Hollywood because in films, robots are often portrayed as evil things which must be stopped by humans. He went on to explain the numerous ways in which robots are incredibly useful to humans, and very much a part of what makes our world operate at the speed that it does. Dr. Christensen mentioned that there are three main things that robots should do: to physically interact with the world, to perceive the world, and to be smart. He discussed the time frame that robots have existed - from the late 1950's until present, and the amazing ways in which they have evolved. Robots have many advantages over humans: they are faster and more precise, have a high level of accuracy, and can do many tasks which humans cannot do. Robots are usefully as painters, sorters, and in health care and space exploration in addition to many other fields. Dr. Christensen concluded by discussing the movement toward driver-less vehicles, including cars and aircraft, as well as Amazon's use of robots to cut down their delivery time. It was clear from Dr. Christensen's lecture that there are many possibilities in the very near future for robots to be incorporated into human's daily lives, and that the only limit is the imagination of our future robot engineers!



# CLUSTER EXPLORATION

Professors from Clusters 4, 5, 7, and 9 gave great summaries of the various research topics that COSMOS students are engaged in. This gave students an idea of the variety of research going on at COSMOS and on the campus. We started off with Professor Shlomo Dubnov from UCSD's Department of Music and one of our faculty for Cluster 9, who showed us how COSMOS students are learning about the nature of sound waves, using UCSD's state of the art recording facility. Next we had Professor Carlos Vera, who discussed the topics Cluster 7 students are learning in the labs, such as studying how to mask the scent of E. Coli. Dr. Charles Tu, Director of the COSMOS program and lead faculty for Cluster 5, showed us some video demonstrating the amazing powers of light waves. Finally, Professor Lelli Van Den Einde, showed some powerful video to demonstrate how an earthquake can impact large scale buildings, both inside and out. Students in Cluster 4 are learning about different types of soil, and how they are impacted in an earthquake. Next week, students will hear from Clusters 1, 2, 3, 6, 8 and 10!



# RESIDENTIAL LIFE

We are half way through COSMOS! Can you believe it? After the first week of awkward hellos and getting to know new people, your student has acclimated to this new environment and is making friends both in their suite and their cluster! Last Friday we had our annual COSMOlympics competition with Cluster 10 coming out on top. This second week was exciting and eventful. The RAs planned another week of amazing programs including a spelling bee, airplane making competition, nacho bar, and spa night. Not only did we have our typical week of programs, but we also went on two field trips. On Saturday we went to the San Diego Safari Park and on Sunday we went to the Fleet Science Center and Balboa Park. Lastly, since several kids have their birthdays during COSMOS, we had one giant birthday party and celebrated all of the COSMOS birthdays with delicious cakes and cookies.



Emilie O. & Sashwath G. 7/8

Maya D. & Ricardo O. 7/9

Jose S. 7/12

Daniel K. 7/14

Dongchen L. & Rachel L. 7/15

Mark L. 7/18

Joyita B. 7/19

Sumedh V. 7/20

Bao N. 7/22

Paymon H. & Sandy T. 7/23

Kristofer T. 7/26

Ryan H. 7/27

Andrew S. & Aidan Z. 7/28

Justin D. 7/31

Jianjun X. 8/1

Rebecah H. 8/2

Shawn X. 8/3

## Happy Birthdays!





# CLUSTER 1: COMPUTERS IN EVERYDAY LIFE

## Cluster 1



An update to Week 1's adventures can be found on our blog [ucsdcosmoscluster1-2018.blogspot.com](http://ucsdcosmoscluster1-2018.blogspot.com). Demos of our labs, presentations, and photos and videos from Week 1 and COS-MOlympics now available. To see who was recognized with the Faculty's Choice and People's Choice awards check out our blog!

Last Friday, we began to work on tutorials for filters on images to do some basic image processing.

On Monday, we learned about binary numbers and why we care about base 2. We learned a little about encryption and the space on hard drives. Then we played two versions of "Around the World": converting binary to decimal and identifying the power of 2 given a value. Sandy won "Around the World: Binary" and Brian P. won "Around the World: ID the Power of 2".

Afterwards, we learned about advanced image processing. We learned how programs like paint and Photoshop do some of their basic functionality like finding a color and changing it to another or clearing the screen. We discovered how to do some image processing functions in Python. In lab, we began to work on creating our own unique image processing on photos – including using a green screen to superimpose ourselves into pictures with code.

After our Discovery Lecture on Tuesday about Robotics, we got a chance to peer edit our ethics essay. It's due this week and the top COSMOS essays will be announced at the closing ceremony! Wish us luck!

In the afternoon, we had our field trip to Qualcomm. We checked out the Qualcomm Museum which shows the history of technology that the company has done and their future projects. We then checked out a self-charging car. This car doesn't have to be plugged in to charge! Currently, it sits on a mat which charges it. It's 90% efficient! We also had the opportunity to listen to a panel of college students who are interning at Qualcomm this summer.

On Wednesday, spent the day working in the lab on our image processing projects. We're excited to show off our work to our cluster and faculty on Thursday afternoon. You'll find the projects and presentations on our blog by this weekend. On Friday, we'll learn about Arduinos and circuits!



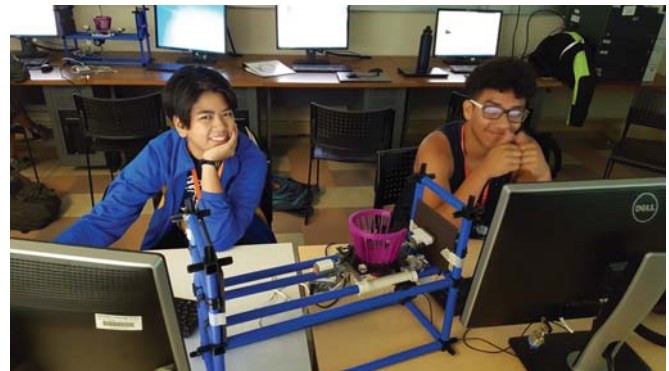
## CLUSTER 2: ENGINEERING DESIGN AND CONTROL OF KINETIC SCULPTURES

Students started the week by forming groups that were diverse. The diversity component consisted of a lot of different factors. In groups they discussed their water balloon designs and agreed on a design that would best protect the balloon. Each team had 500 straws, an assortment of rubber bands, paper and balloons to create a housing for a water balloon to be dropped from different heights onto a bed of nails. The goal was to have the housing absorb the force of impact and protect the water balloon from the one inch nails. Students designed, tested and modified their design based on observations during each drop. They practiced what many engineers do when designing new cool applications.

On Tuesday all students attended a lecture on robotics by a UCSD professor in the engineering department. Subsequently, students worked on their own presentations for the water balloon experiment. They presented their design analysis, along with very cool slow-motion footage of their water balloon housing being dropped from varying heights. The presentation will help them prepare for their final presentation at the end of the program. Tuesday afternoon consisted of a short lecture by Professor De Callafon on kinetic and potential energy followed by a short lab where students measured the speed of a falling marble with a very cool accelerometer built by UCSD students and staff.

Wednesday morning was the morning students were all waiting for. They were given time to finish their clocks, and work on the corresponding analysis and webpage. Soon all webpages will be shared with the p. In the afternoon they received their first programming assignment. They were introduced to RobotC, a derivative of C++, to help them get started on their final project. They worked on programming a small NXT computer to have it read sensors and drive from side to side. It was their first, basic, programming assignment.

On Thursday and Friday students continued with the design, fabrication and modeling of their pendulum clocks. The clocks were all completed and their analysis has been uploaded to their websites. They will continue getting more familiar with RobotC, as they will be using it to program their kinetic sculptures. They will also receive more physics lectures that will prepare them for analysis the motion of the marbles within their kinetic sculptures. Students continue to experience the engineering college life. The deadlines imposed by professors have kept them busy but they have also had time to indulge extra-curricular activities.





# CLUSTER 3: LIVING OCEANS AND GLOBAL CLIMATE CHANGE

Hello from Cluster 3! We can't believe that the program is halfway over already. We have started on our projects, written our ethics essays and learned to navigate the campus. Here is what we have done since last time you've heard from us.

"This past Friday, our cluster started off our morning with guest lecturer Stephen Mayfield. He discussed his work on molecular genetics in green algae, and on the production of protein and biofuel molecules using algae as a production platform. After the lecture, we got to spend the rest of the day exploring Birch Aquarium, learning and trying to identify the various parts of a fish with Dr. Lai!" - Lena J

"On Monday, Cluster 3 started off the week with many exciting activities. Starting our day off at Scripps Institute of Oceanography, we walked down to the beach and saw the tide pools and the many different sea life living in this environment. After our time at Scripps ended, we headed back to UCSD to listen

to a lecture given by Mario Molina, a Nobel Peace Prize winner for his work in Chemistry and the role he played in discovering the effects of CFCs on Earth's Ozone layer!! We ended our day with an interesting lab dealing with releasing carbon dioxide from cartridges and observing the effect this had on the temperature change." - Ella S.

"On Tuesday, we attended a discovery lecture on the uses of robots in our everyday lives, followed by science communications where we continued working on our ethics essays. After lunch, we split into our project groups and continued collecting data and designing experiments relating to our projects." - Shreya K.

"On Wednesday, we went on a field trip, arriving first at the Hubbs Fish Hatchery, a fishery aiming to cultivate and monitor white seabass at different stages of their life. Though we had to step in disinfectant every time we entered a new room, we were able to see both adult reproductive fish as well as

juveniles and every fish that were only days old. Next, we attended the Batiquitos Lagoon to learn about the diversity in the type of habitat and how each species' traits are adapted to the marshy and varied conditions of the lagoon. There, some of us took samples of the water, and we tested its dissolved oxygen level and temperature." - Courtney L.

"On Thursday morning, we went to a presentation session where professors of different clusters educated us on what their groups were doing and learning. Afterwards, Cluster 3 spent a lot of time peer reviewing and writing our ethics essays. After lunch, our cluster divided into our project groups to continue our research for our final presentations." - Maddie L.

On Friday we will be running labs focused on aerosol creation and interactions in the morning. In the afternoon, the students will be at SIO to dissect fish.



# CLUSTER 4: WHEN DISASTER STRIKES: EARTHQUAKE ENGINEERING



We are fully involved in project work now, and our C4 students continue to impress us with their superior work effort, problem solving strategies, and positive attitudes. Last Friday students were placed into one of eight project groups comprised of three students each, and on Monday they began to delineate the individual responsibilities required to carry out their mission, and to create organizational time charts.

The eight project groups each have their own unique characteristics and design challenges, not to mention time management hurdles. Yet, the students have bravely forged ahead, and soon will experience the realities of a three week deadline. The groups include 'soft story' structures, timber, masonry, concrete bridge columns, liquefaction, lightweight reinforced concrete aggregate, base isolation, and tuned mass dampers.

During the morning sessions, Lelli and Jacqui continue to explore various aspects of engineering design considerations with the students, preparing them to strike out on their own with idea development. Following approval of their designs, they began building and testing their models based upon the assigned structural type. Cluster Assistants Rad and Alan keep very busy advising and supporting our student groups during the afternoon project sessions. Almost all groups completed their models by Thursday and began testing the strength of their models Friday. They will be using the 'earthquake shake table', or another instrument specific to their structure during testing. Keen observations are necessary while testing for structural failure, and these notes are used in assessing the needs during the redesigning days to come.



Between our preliminary designing and testing, we toured some campus engineering labs this week, and learned about the various problems the investigators are trying to model and solve. All students attended the weekly discovery lecture Tuesday, and learned some amazing things about robotics and its future potential. On Thursday we are attending our first cluster exploration hour, where they are able to hear about the cool things other clusters are doing.

Wednesday was spent soaking in the warm San Diego sun and learning about San Diego geology from Bob atop the Torrey Pines Reserve. We trekked down the beach trail to the shore, and enjoyed box lunches on the sand. Frisbees flew, footballs spiraled, and many students enjoyed some uncharacteristic warm waves. A pod of dolphins cruised by and even surfed a bit before continuing their journey up the coast. A perfect day!

Our student groups are functioning well thus far, and the process of building, testing, analyzing, and redesigning will continue into next week. Those families taking advantage of Parent Weekend will undoubtedly hear all about their successes and challenges over some home cooking. They look forward to sharing their final results and products with you in two more weeks. As always, please keep up with their endeavors by checking out our Cluster 4 Website and photo galleries.





# CLUSTER 5: FROM LASERS TO LCDS: LIGHT AT WORK

We are already finishing up our second week of COSMOS! It sure is going fast, but that's what happens when you're having fun! Students in Cluster 5 are really settling in and getting comfortable with the morning lectures and afternoon labs, while still finding time to work on their Ethics Essays and have fun with their fellow COSMO-nauts. ;)

Last Friday, students had the chance to create their own functioning solar cells that utilized blackberry juice to sensitize the device and absorb light. They got down and dirty to smash the blackberries and strain the juice, coat the conductive glass cell with a titanium dioxide paste, bake the cell components, and construct and test the device to see which group could get the most current to flow from their cell.

On Monday of Week 2, the morning lecture started with a discussion with Dr. Charles Tu about the various ways semiconductors and pn junctions can be used to create LEDs, laser diodes, and photodiode detectors. Next, students learned about geometrical optics (lenses, diffractions, and refraction) before getting the chance to see a wonderful demonstration from Dr. Janet Pan on spherical and chromatic aberrations with lights and lasers passing through a clear jar of water that acts as a cylindrical lens. During the afternoon lab session, students continued their exploration of semiconductor lasers and LEDs.

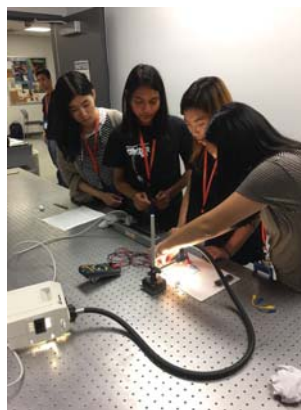
On Tuesday morning at the Discovery Lecture, students had the privilege to listen to a talk from Dr. Henrik Christensen on the latest developments in robotics, human-robot interaction, and how robots will be used to improve the quality of life of everyone in society. Next, students worked together to peer-edit their Ethics Essays for submission later this week. Some of the student essay topics have been extremely interesting and wide-ranging in terms of important ethical issues related to light and society, including laser surgery, light pollution, and LIDAR speed detection, among many others.

On Wednesday, the morning lecture began with a discussion with Dr. Tu and Dr. Pan of how lasers work and their fundamental role in creating the computer and smartphone technology we all use today. During the afternoon lab, students had the chance to learn about the polarization of light and how polarizers can be used in everyday applications such as sunglasses and high-tech scientific experiments with lasers. After our regular day finished, most of Cluster 5 had the chance to participate in the "Treats with Tu" session where we got to enjoy snacks and a Q&A with Dr. Tu on various topics of interest to the students.

On Thursday, the morning began with the first Cluster Exploration Session where some of the cluster professors gave the whole COSMOS program a quick look at what students in their cluster have been working on during the first two weeks of the program. Next, students had the chance to learn a bit about solar observation and solar spectroscopy with the cluster Teacher Fellow, Scott Patterson. Students then had the chance to go outside and safely observe the sun with a solar telescope and look for solar flares and sunspots. Next, we had

a great guest lecture from Eric Takeuchi, the VP of Business Development at Daylight Solutions, about applications of the Quantum Cascade Laser (QCL) technology. Everyone is excited for our field trip to Daylight Solutions on Monday! During the afternoon lab session, students learned about and conducted experiments on light interference and interferometry using various laser setups.

Another busy week full of interesting, exciting, and fun science! We will keep you all updated on Friday's happenings in the next Newsletter.





# CLUSTER 6: BIODIESEL FROM RENEWABLE SOURCES

During week 2, the focus of Cluster 6 is to begin our projects, finish the ethics essays and to begin the analysis of our biodiesel.

On Friday, July 13th, Cluster 6 started their morning by continuing to dry their biodiesel in the lab, followed by an afternoon lecture about sustainability and the history of different energy sources. After class we participated in the Cosmos Olympics, in which our performance placed second and overall we placed fourth!. – Helena C.

On Monday, the 16th, we learned about the inner working of a Diesel engine from Dr. Pomeroy. After lunch, we learned about the different lab equipment we'd be using for the next two weeks as well as heard a lecture from Nobel Prize winning Mario Molina about climate change and

the myths around it.- Jackson R.

On Tuesday morning, COSMOS students began their day with a guest lecture from Henrik Christensen, in which the professor of computer science at UCSD discussed advancements in robotic engineering. Cluster six students then separated into their project groups, working on various tasks, such as measuring the particulate emissions from a diesel engine. – Joseph M.

On Wednesday, we visited the algae fields, hydrology labs, and the aquarium. It was cool that the hydrology lab design was unique to San Diego and found no where else in the country. – Karen P.

For Thursday's morning activity, the students in Cluster 6 attended the Cluster Exploration Lecture where they were pro-

vided a brief synopsis of the activities undertaken by various clusters. In the afternoon, they collaborated with their project groups to produce an experiment pertaining to their respective topics. - Kristine K.





# CLUSTER 7: SYNTHETIC BIOLOGY



Week 2 in Cluster 7 has been really interesting and full of new concepts and ideas to help us understand how to integrate Boolean algebra, electrical and genetic circuits! Dr. Vera and Dr. de Oliveira have been working with students to bring these two concepts together to try to program a living organism to make something we want!

Here is what the students had to say:

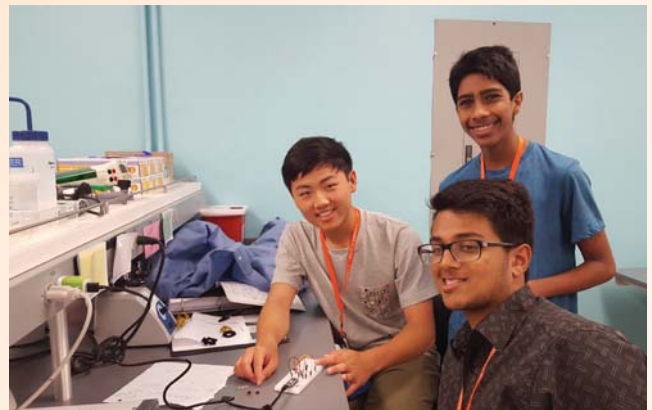
7/13/18 Experiencing lab technologies firsthand at York Hall has been phenomenal. The jump from high school to college-level labs was a little overwhelming, but overall, we thoroughly enjoyed it! Dr. Vera is very patient and understanding, knowing that we are performing higher-level lab studies that are unfamiliar to us. Through the gel electrophoresis, circuits, and logic tables, we have learned a tremendous amount and are excited to continue on and learn more and more. Although some of the lectures may be slightly boring, the labs and fun environment created by our amazing teachers and fellow cluster members do more than make our day fun, they make it an experience to look forward to. ~Zach and Rupin

7/16/18 Monday's class began with an exploration of the fundamentals of biodesign in lecture with Dr. Vera. The class debated different ways to design a arsenic-detecting biosensor composed of bioengineered bacteria, using those same biodesign concepts discussed earlier in class. Lecture then transitioned into an in-depth review of the conversion of genetic material from DNA to protein, followed-up by an exercise in 3D protein modelling. Class then let out for lunch at the 64<sup>th</sup> dining hall. Following lunch, students began to prepare for this week's lab, which involves engineering *e. coli* to produce a fluorescent green protein called GFP. After Dr. Vera finished lecture about the techniques and concepts utilized in the lab, as well as the

significance of GFP in biological research. Students were asked to propose a biological circuit to describe a GFP expression mechanism in engineered cells. To conclude class, students prepared varied compositions of cell media that will be used when they return to lab on Wednesday.

~Jenna and Nikki

7/18/18 On Wednesday, Dr. Vera presented a lecture informing us on the process of transcription and translation. We also deepened our knowledge on the LAC operon, which digests lactose depending on the surrounding glucose, cap, and cAMP. We constructed our own analogy, in groups, in order to understand it. Later, we watched several TEDx talks regarding the advances in synthetic biology and CRISPR cas9. We also talked about the ethical implications advanced technology will have. After lunch, Mauricio (our other lecturer) came to talk more about logical circuits. We then attempted to construct a logical circuit based on a map Mauricio showed us. After that, we continued our pGLO and Eau that smell lab with Dr. Vera in which we spread bacteria over our LB plates. ~Ammerica and Koko





# CLUSTER 8: TISSUE ENGINEERING AND REGENERATIVE MEDICINE

The first week ended with our final lecture on Biomechanics and Bioreactors and a wrap up of our first six skill labs. Friday night was COSMOS Olympics! GR8 fun-filled evening of skits and challenges. Over the weekend we took time out to go the San Diego Safari Park and the Fleet Science Center, all the while spending a little time writing our ethics paper rough drafts.

We began our second week with Dr. Gaetani and Dr. Sah introducing our much anticipated projects. Then we were off to our first field trip to Advanced Biomatrix. They are a local company that makes innovative 3D matrix products for tissue culture, cell assay, and cell proliferation. They gave us a tour of the facility, an overview of their company, and answered all of our questions from how the business began, to what was involved in manufacturing and production, and the purposes of their various products. Over the last two years they have helped advance the field of 3D printing using collagen and other 'bioinks' they have developed. They showed us some of the structures they have made, including a nose and a heart valve! As we left they gave us a very generous gift of collagen for us to use in our projects!

In the communications portion of the cluster we attended a Discovery Lecture from Dr. Henrik Christensen, Qualcomm Chancellor's Chair of Robot Systems and Professor of Computer Science at UCSD. His presentation was thoroughly enjoyed by our entire cluster as he spoke to use about his research on systems, integration, human-robot interactions, mapping and robot vision. He is a global leader in the coordination of robotics research that emphasizes 'real problems with real solutions'.

In the lab, with the help of our CA's, we have finished mastering our twelve lab skills. We are now accomplished enough to use thaw, grow and passage our cells, use a hemocytometer to count cells, a microscope to view stained and unstained cells, create collagen gels for our cells to grow, decellularize tissue, and examine histology slides to evaluate our tissues. Our CA's, Erica, Nathan, Julian and Kurt, have taken the lead instructing us in pre and post lab and guiding us as we navigate through a wide range of bioengineering skills. We know that next week, as we embark on our projects, we will have the expertise needed to perform our own experiments, with a little guidance of course.

In Science Communications we had time to debrief after Discovery Lecture, review other students' ethics papers, submit our final ethics papers on Thursday, discuss and work on presentation skills, and discuss the research process.

Our plans are finalized and next week our much anticipated projects begin.

What a GR8 week we had!





# CLUSTER 9: MUSIC AND TECHNOLOGY

The Cluster Nine's second week ramped up the technology that the students will be using for their projects. On Friday, students learned to program and control electronics using the Arduino Teensy microcontroller, a slimmed down version of the widely used Arduino series. Monday students were introduced to the python programming language. Python has gained popularity due to its ease to learn and its versatility of use. On Tuesday, Grad Assistant Kevin Haywood be-

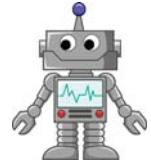
gan brainstorming different project ideas with the students. Also, on this day students downloaded and executed several musical applications written in python. On Wednesday students were treated to the audio spatial lab wherein asymmetrical walls and 28 speakers allow different sound effects to be generated. The group also did several additional projects using Arduinos. The weekend was also filled with activities. On Saturday, students visited the San Diego Zoo Safari

Park, an open environment wildlife habitat wherein animals of different species cohabitate in a recreation of the African Serengeti Plain. On Sunday, the cluster visited Balboa Park, an area near downtown San Diego originally built for the 1915 Pan Pacific Exhibition that has preserved the architecture of that era. The trip featured a visit to the Reuben H. Fleet Science Center. Next week, students will form groups and begin their capstone Music and Technology projects.





# CLUSTER 10: ROBOT INVENTORS



Cluster 10 is having an a-MAZE-ing week this week - using colored flags and a camera to autonomously navigate a maze! Week 1 wrapped up with battle of the bots! Teams competed in three rounds of competition - last to have their balloon popped, most balloons of others popped, and finally a few rounds of "capture the flag" as teams. The robots battled as best they could and all teams were able to compete!

## Week 2:

Day 1: the cluster is now in new teams for a new challenge - navigating a maze using a camera operated through a raspberry pi. Our professors reviewed code with the students to help them learn about optics and how a computer interprets images. We also had a guest lecturer today - Dr. Tom Bewley, who introduced hurricane prediction tools and the background to a toy robot called MiP.

Day 2: today we began with an exciting discovery lecture - all about robotics! Professor Henrik Christensen introduced the students to more advances in the field of robotics, and why rockets and airplanes are challenging to build quickly. Students continued development of their ethics essays today, and worked hard in lab to develop strategies for their robots to navigate the maze.

Day 3: today we began with another exciting guest lecture - Dr. Mike Tolley introduced the students to the world of soft robots. These robots prove challenging to work with, as new materials and structures need to be developed as part of the design process. Students learned more about coding as

well, exploring a new type of interface called Picobot (ask them to show you how it works!).

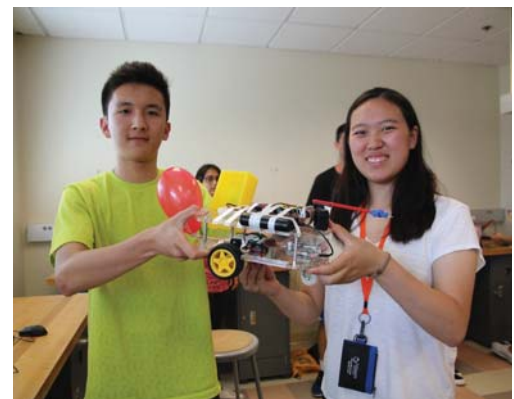
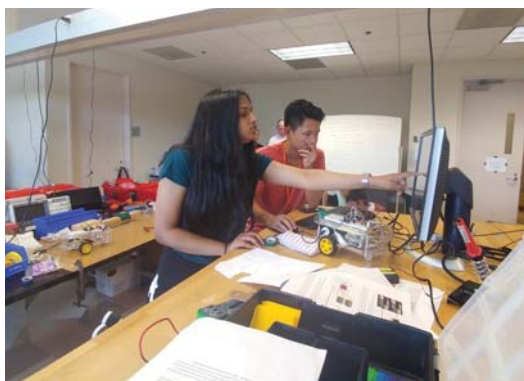
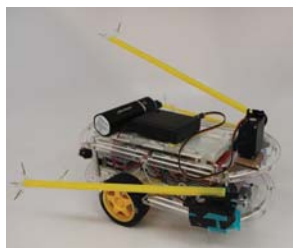
Day 4: cluster exploration sessions kicked off day 4 - students got an exciting intro to what was happening in the other COSMOS clusters. Today was their final work time for their ethics essays in science communication - editing and reviewing citations was definitely the focus for the day. This afternoon students were off to an exciting field trip - General Atomics! Here they toured the facility to see the development of drone technology and had a discussion panel with a variety of GA employees to understand their backgrounds and what type of work they do.

"I really enjoyed learning how to make a robot detect certain colors and then make decisions based upon them." - Edwin

"I enjoyed programming color masks/filters for the robot to use to get through the maze on its own." - Anika

"I was fascinated by how changing HSV values with the Pi cam would allow only certain colors to be detected" - Aishwarya

"This week was filled with a variety of fun events and educational opportunities: I got to detect colors using a camera and a color filter, explore basic programming languages such as Picobot, sit in interesting lectures, enjoy a movie, and go on a field trip to General Atomics." - Gene



# COSMOlympics



Cluster 1



Cluster 2



Cluster 3



Cluster 4



Cluster 5





Cluster 6



Cluster 7



Cluster 8



Cluster 9



Cluster 10

**1st: Cluster 10**

**2nd: Cluster 5**

**3rd: Cluster 2**

# Fleet Science Center

COSMOS students had an exciting new opportunity this year. For the first time ever, they were invited to come to the Ruben H Fleet Science Center for an enrichment day including the Myth-Busters exhibition and a viewing of the film Dream Big. Dream Big is a movie narrated by Jeff Bridges which focuses on people who are achieving great things in the field of STEM, sometimes in spite of great odds. After the film, students had the opportunity to explore the Science Center and interact with the many different experiments available there. 30 of our COSMOS students were invited to be on a panel where they could share their thoughts on an ideal makerspace, which is going to be built in a joint initiative between the Jacobs School of Engineering and the Science Center. After students enjoyed an outdoor lunch, they were able to explore Balboa Park for a while. Balboa Park is home to 17 museums and cultural institutions with an incredible diversity of collections. From local San Diego history, to the history of flight, trains, or automobiles, to the workmanship of the old masters, and the arts, crafts, and culture of people near and far, recent and historical, Balboa Park is definitely a gem of the city of San Diego!





# Safari Park

