



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!

Family Weekend is July 22nd through July 24th. Students must be checked out by an adult specified on the Family Weekend Form between **6-9pm on Friday and must return between 2-5pm on Sunday**. Optionally, students can be checked out at 6pm 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. **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.

ADMISSIONS PRESENTATION

This 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 24th from 3-4pm at Solis 107.

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MAILING ADDRESSES:

Please address **REGULAR MAIL**:

Student's FULL Name
ERC Conference Services Center,
COSMOS
9450 Gilman Drive
La Jolla, CA 92092-0100

Please address **PACKAGES**:

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COSMOS @ UCSD
9500 Gilman Drive #0429
La Jolla, CA 92093-0429

CONTACT INFORMATION:

COSMOS Office Hours:

(during the summer program)

Monday - Friday: 7:30am - 5:30pm

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DISCOVERY LECTURE SERIES

“Embryos and Evolution” - Dr. William McGinnis

Dr. William “Bill” McGinnis, distinguished professor of cell and developmental biology and Dean of the Division of Biological Sciences at UC San Diego, was our second discovery lecturer this summer. Dr. McGinnis is a very accomplished scientist. He received a Searle Scholar Award, a Presidential Young Investigator Award, and a Dreyfuss Teacher/Scholar Award. Dr. McGinnis was elected to the American Academy of Arts and Sciences in 2010.



Dr. McGinnis gave a fascinating lecture on how the fruit fly is a model organism for genetics and development. According to McGinnis, “at a superficial level, fruit flies seem about as similar to humans as canoes do to aircraft carriers.” He argues that his most impressive discovery is finding that mammalian Hox genes align with fruit fly Hox genes. Hox genes control embryonic development in fruit flies and can act as master switches by turning on and off other genes during embryonic development. The implications of his research were huge and many of your students learn about his discoveries in their high school classrooms! He also stated that his research has only been made possible due to the technology advances made in the last 30 years, such as the Recombinant DNA revolution.

Before taking questions from the audience, he ended his lecture with his favorite quote: “There is grandeur in this view of life....that from so simple a beginning, endless forms most beautiful and most wonderful have been and are being, evolved” - Charles Darwin. Dr. McGinnis then took questions from the captive audience, who asked about the ethical issues related to his research and where he saw the future of the industry taking us. Stay tuned next week for our third discovery lecture.

If you would like to view this year's Discovery Lectures, please go to our [UCSD COSMOS Youtube channel!!](#).



CLUSTER EXPLORATION

Four professors from Cluster 1, 2, 3, 4 and 6 gave an intriguing look into the exciting science and engineering topics that our students are working on this summer! The students were captivated to learn about how their friends in other clusters have been spending their time. Professor Curt Schurgers from Cluster 1 took us back in time to when computers were first developed and showed us far they have evolved and how much we rely on computers in our every day lives. Professor Raymond de Callafon showed us how students from Cluster 2 use concepts they learn in Physics and math and how they apply to large structures that involve sensors and robots. Then Professor Lelli Van Den Eide from cluster 4 showed us the importance of studying earthquakes so that we can continue to learn from them and build safer structures. Students in her cluster get to build large structures and test them on a shake table to test their stability. Finally, Professor Robert “Skip” Pomeroy, faculty for both cluster 3 and 6, discussed the importance of learning about CO2 and the effects on our environment. Cluster 3 learns about the ocean and how we can protect them. Cluster 6 learns about biodiesel and renewable energy sources. The students learned a lot about alternative energy sources, such as algae biofuels, and how economics plays a large role in determining the sources of energy people use today. Next week, students will hear from Clusters 5, 7, 8, and 9!



RESIDENTIAL LIFE

OMG! Who would believe we are already halfway through the program. You are going to love all the exciting stories your student will be sharing with you if you ask the right questions! Be sure to ask and listen regarding what they are learning in class, in lab, and on their field trips. Ask them which programs they participated in, about their suite time activities, and all the new people they have met. There's could share what it is like to run in elongated circles. Arjun could share how binary looks great in sky blue. Holly could teach everyone a thing or two about yoga. Pio could expand upon the importance of prioritization and how if you give yourself a little bit of time you can be "inclusive" of all the thing you want to do. Rosalinda might tell you that with a little bit of patience water can even be found in a traveling Infinity. And NA 110-116 and NA 210-216 may share how carne asada fries are best served when only two feet and a few hands are involved.

I am happy to share that beyond safety, academic excellence, and having fun, our other goal is to prepare students for life outside of the classroom typical of a college environment. Some years we have had difficulty getting student to put down the electronics and really socialize during the free time or the 90 minutes of required programming time. I am thrilled to share that you have done a superb job in teaching your student that it is not only important that they be knowledgeable about what happens in class, but that they also be skilled in socializing with other humans face to face outside of the classroom. This is a skill that can only be practiced by actually interacting with others and most of this year's group are aces.

In other news, some students are getting a bit of a sore throat so please help us in reminding your students to spend less of their meal times eating pizza and frozen treats and more of the time eating fruit and the salad bar. The biggest challenges cur-

rently are keeping everyone from excessive flirting, teaching everyone to use the 4-8 quiet free time productively, and getting them to actually go to sleep when they go to bed. However due to the continued overall positive behavior their boundaries around campus had been extended. Therefore they have been using some of their free time to go to the Geisel library which houses 3.2 million books, to window shop at the UCSD Bookstore which has everything from scotch tape to Dr. Seuss hats, or to visit our many recreational and art facilities within the shuttle loop of the UC San Diego main campus.

"Parent's Weekend" is this weekend, but don't be surprised if your student didn't want to stay initially and now does. Also don't be surprised if your student was originally planning on staying, but now needs the time away to decompress from being around people ALL of the time. For those who do stay we will be going to the Balboa Park together and afterwards some will go with RAs in small groups to places within walking distance like the beach, the canyon, and more. When everyone gets back by 5pm Sunday we will kick off week three with casino night, resume writing, a bonfire, and more. Thank you for loaning us your student. The pleasure has been ours.



CLUSTER 1: COMPUTERS IN EVERYDAY LIFE



Cluster 1: ucsdcosmoscluster1-2016.blogspot.com/

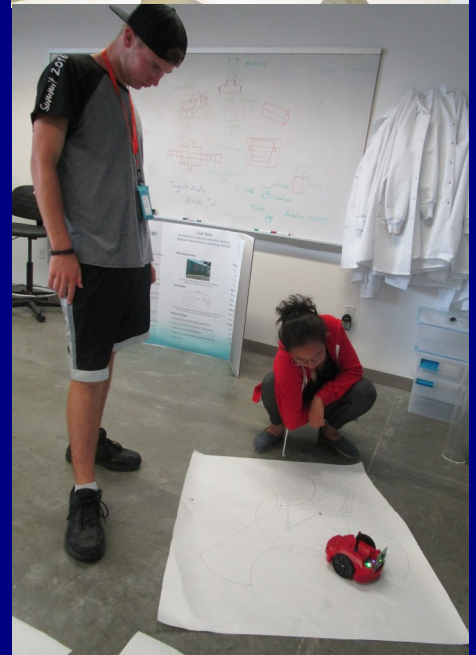
An update to Week 1's adventures can be found on our blog ucsdcosmoscluster1-2016.blogspot.com. Demos of our RoboArt will be available by Sunday, July 24. To see who was recognized with the Faculty's Choice and People's Choice awards check out our blog!

On Monday, we learned about 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 – which means we'll be able to do it with the Scribblers! Currently, we are trying to get our Scribbler to traverse a maze, identify the colors and if a vertical or horizontal line is present. We've learned that the cameras on our Scribblers don't always seem to present the exact color shade we expect and we had to adjust for that. Also, textures and shadows give off different shades of blue (for example), so we can't just use one single definition of blue. To get our Scribblers to recognize (and communicate appropriately) vertical and horizontal our code had to analyze the pixels and perform calculations

Tuesday was our field trip to Qualcomm. Saura Naderi (formerly a Cluster 1 faculty in 2012) was our host. 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 their robotics and drone lab. The mechanical engineer who shared his work was a BattleBot champion and demonstrated one of their drones. Afterwards, we visited their Research Showcase which highlighted some of the current technology they are working on such as small cell towers that we could have at home and autonomous vehicles.

On Wednesday, we learned about truth tables and logic gates. Inverter, AND, OR, NAND and NOR gates can be used in different combinations to create any function in the computer. We even took a real world scenario, applied what we just learned about logic gates and created an equation to represent the situation. So, if we even had two scooters (one good and one bad), two different paths out of a facility and a guard who was chasing us, we know the equation to use to escape from getting caught!

Later that morning, Sanjay Dasgupta guest spoke about algorithms and how they determine which ones are "good" (more efficient) or "bad" (less efficient). While there are thousands upon thousands of problems out there, most can be reduced down to a much smaller subset of algorithms. For example, the cartographer's problem of color coding a map with the fewest number of colors while having neighboring countries have different colors is really a graph color problem. Another graph color problem is exam scheduling – using as few time slots as possible but not scheduling two exams for one person at the same time. At the end of the week, we'll start our Arduino labs and submit our ethics essay for the contest. It's been a busy, challenging and fun week!



CLUSTER 2: ENGINEERING DESIGN AND CONTROL OF KINETIC SCULPTURES

<https://sites.google.com/a/eng.ucsd.edu/kinetic-sculpt/home/teams>

Now that students have all individually created their clocks and have at least the same baseline of skills in the machine shop as well as the computer lab, students started this week off forming teams. You can see your student's teams by go to the [course website](#). They will work in these teams and on their websites for the rest of COSMOS. Dr. Delson started the week off with the first design challenge for teams which was a water balloon drop. **Monday**—Water Balloon Project: Students had only a few hours as a team to work together, design, build, and test their water balloon structure that is dropped. The best drop survived 8 feet! Two GoPros were used during the tests for students to analyze the strengths and failures of their structure.

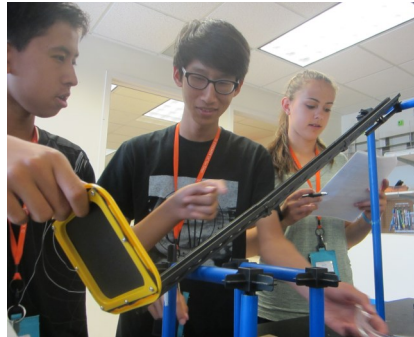
Today was our water balloon project day and it was stressful yet productive. In the morning, Dr. Delson spoke to us about teamwork and the water balloon project before we started building our contrap-



tions. As soon as we got to the design studio, teams began to discuss and prototype. After numerous drops and analysis through the GoPro, many teams managed to successfully drop the balloon from at least 4 feet without breaking. **-Tiffany**

Following a balanced weekend of recreation and academics, cluster two started the day with a review of team management and principles. Following a review of guidelines and material constraints, we broke out into teams and started brainstorming designs for our water balloon drop. Once our design was completed we tested it and made the necessary improvements. After lunch we made the final itera-

tions and tested the design at 2, 4, 6 and 8 feet. Finally all teams were responsible for completing a lab presentation. **-Estelle Tuesday**- We started off with a Discovery lecture from Dr. William McGinnis; McGinnis spoke about the human genome, the genetics of other animals, evolution, the

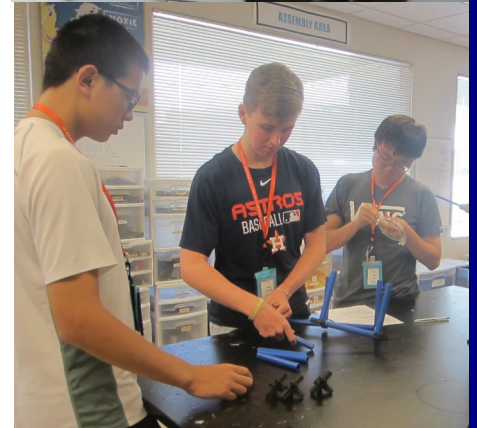


ture of genetic technology, and his participation in fruit fly genocide. After his speech the Clusters' days deviated from each other. As a member of Cluster 2 the meant going to the creatively named Engineering II building to work on our Kinetic sculptures and giving water balloon presentations.

This meant a couple minutes of presenting, followed by an afternoon of panic considering the Ethics essay is due. Cluster 2 tried to drop a ball straight down to measure its speed to prove the relationship between Potential Energy and Kinetic Energy. Cluster 2 working on either their CAD or their analysis for their clock. Slowly students trickled out of the computer lab, and went to the dorms until the last group of four students, including yours truly ran back to make it before check in. The programs included Cereal and Cartoons, Open Mic, and Love Languages. I know the Cereal program played the Spongebob Movie, and Open mic had some poetry reciting, but I have yet to know what Love Languages was about. Though this day sounds extremely busy, it's just an ordinary day at COSMOS. **-Bryce** We practiced scientific communication by presenting our PowerPoint's on our water balloon projects with our teams. We were nervous because it was our first presentation, but we got a lot of good feedback from the teachers and other students. We then learned about the physics behind freefall to prepare us for our lab that followed shortly. We had fun

doing the lab and learned a lot while doing it. **-Gabriel Wednesday**- Today we learned the RobotC language to program the Lego NXT module. Our tasks were to achieve the four functions: able to control the basket to run back and forth, the speed of the basket, the number of times it runs, and a user interface. I had some previous programming experience, and finished the first three tasks quickly. However, I still encountered some problems because I learnt computer science in Java, and it is very different than RobotC. Anyway, I and my partner Paul learnt a lot today about both programming and robot control. I look forward to doing our final project. **-Hongyi**

Thursday & Friday- Students are now programming in RobotC working in pairs on challenges created by the Professors. They have had a few challenges so far, and some will receive a surprise on Friday for winning a challenge! On Friday, the teams will begin to design and build their mini sculptures.



CLUSTER 3: LIVING OCEANS AND GLOBAL CLIMATE CHANGE

Greetings! It's hard to believe that we are already halfway through COSMOS! We have all been having such a great time – doing experiments in marine biology, learning about how our atmosphere works, writing essays on ethical issues in science, and even taking some time to visit the awesome Birch Aquarium. Again, I'll let the students tell you more details.



"On Monday we started off in Dr. Lai's class experimenting with crabs that we had seen in our previous week's trip to the tidal pools. There were two control groups, one group who tested to see how many crabs would escape to land at certain temperatures, and one group who tested to see how many crabs would escape to land when they were put in completely fresh water. We later learned more about gills, sharks and adaptation and got to visit a marine biology lab. In Dr. Pomeroy's class we learned about aerosols, clouds and the climate and performed labs to stimulate the things that we learned. It was overall very helpful and fun to do." – **Alyssa Liu**



"This past Tuesday we began to work on our group projects. My group is focusing on counting brown carbon and other organic aerosols in the air. We looked at the particle counters and walked around and

did background research on the topic. We had discussions and came up with a hypothesis to test out in the field. We'll be putting together a presentation for everyone at the end of the camp. Other groups were working in the lab with acids, or down at Scripps. Overall, very excited to finish the projects." – **Zach Wu**



"We visited an invertebrate collection and got to hear more about different types of krill, shrimp, squid, and other cool animals. One of the research papers that they were doing involved sifting through whale poop to find krill teeth. The whale poop was purple!" – **Emily Chu**



"Today, instead of going to our usual Wednesday classes, our cluster took a trip to the White Sea Bass hatchery where we got to see how populations of fish are regulated. It was fascinating to see how the scientists studied the fish using special tags. After that, we ate lunch with the beautiful scenery by the Gliderport. Then, we visited the Birch Aquarium where we learned a lot about global warming and its effect on our oceans and biodiversity. It was really cool to see how the different traits of fish contribute to their survival!" – **Alan Liu**



"At the aquarium, there was an exhibit "Feeling the Heat" dedicated to climate change. I was glad to see that the aquarium was educating the public about the effect of global warming on marine life, since it is a topic that has been relevant for decades. Outside of the exhibit, we were also able to learn interactively by feeding fish at the tide pool. My favorite part of the aquarium was the seahorse display. Though it was a hot day, the opportunity to explore the boundless wonders of the ocean was worth it." – **Cindy Vu**



With week two now a wrap, we are all super excited to dig in further on our individual projects and find some really cool scientific results! Stay tuned!



CLUSTER 4: WHEN DISASTER STRIKES: EARTHQUAKE ENGINEERING

Time flies when you're part of the amazing Cluster 4! We have been very busy with challenging lectures, cool cluster activities, writing the infamous COSMOS ethics in earthquake engineering essay, and organizing our project timelines. Our motto: Keep Calm and Call an Engineer!

The newly-formed student groups received vital instruction in engineering and geotechnical methods this week, and were directed in developing their individual group project designs. This required internet research time and some creative thinking. Discussions on seismic behavior and soil analysis were provided, and their notebooks are filling up! The students are also adjusting nicely to the new dynamics required for effective group results.

Our eight student project groups include 'soft story' structures, timber, masonry, slope stability, liquefaction, reinforced concrete columns, base isolation, and tuned mass dampers. Each group has almost completed an initial design of their structure, and will begin testing the strength of their models soon. They will be using the 'earthquake shake' table, or another instruments specific to their structure during testing.

We enjoyed our Tuesday 'Discovery Lecture' which is attended by all COSMOS students. This week the students were amazed by Dr. William McGinnis' lecture on 'development, embryos, and evolution'. These mornings are always motivational and energizing as the students hear some unique and important re-

search from around the UCSD campus. Thursday morning provided a chance to hear about the other clusters at COSMOS with the cluster information hour. Students often wonder what the other clusters are up to, so this is an interesting session.

A highlight of the week was the Torrey Pines State Beach field trip. Weather was perfect, temperatures in the upper 70's, and enough humidity to break a good sweat hiking in the state park. We enjoyed coastal vistas from high atop the bluffs, and then lunched on the sandy beach at the hike's end. Frisbees were flying and rocks were skipped, and several students decided to 'liquify' themselves in the sand. During a hike, our Cluster Assistant Robert provided a succinct geologic history of the region as students viewed colorful rock outcrops and took pictures. Prior to Torrey Pines, we ascended local Mt. Soledad for a 360 degree view of the local tectonic setting. This is where students are apt to proclaim, "I want to go to school here! Its so beautiful."

We think our Cluster 4 students are progressing well, and beginning to understand many of the components that are required for successful design. You should be proud of them, as we are, given their polite, inquisitive, and engaged manner. We know you will enjoy hearing all the cluster details during the upcoming parent weekend if you are participating. We will try to document the week's activities with many pictures and movies on the website. Please enjoy them!



<https://sites.google.com/a/eng.ucsd.edu/ucsd-cosmos-cluster-4-2016/>



CLUSTER 5: FROM LASERS TO LCDS: LIGHT AT WORK

After training hard for the COSMOS Olympics, Cluster 5 acquitted themselves honorably all the while building their sense of comradeship and fun! The weekend was spent relaxing at the world-famous San Diego Zoo and on the beaches of La Jolla Shores. Rested and refreshed, they were ready to explore laser theory, diffraction optics and polarization in week two.

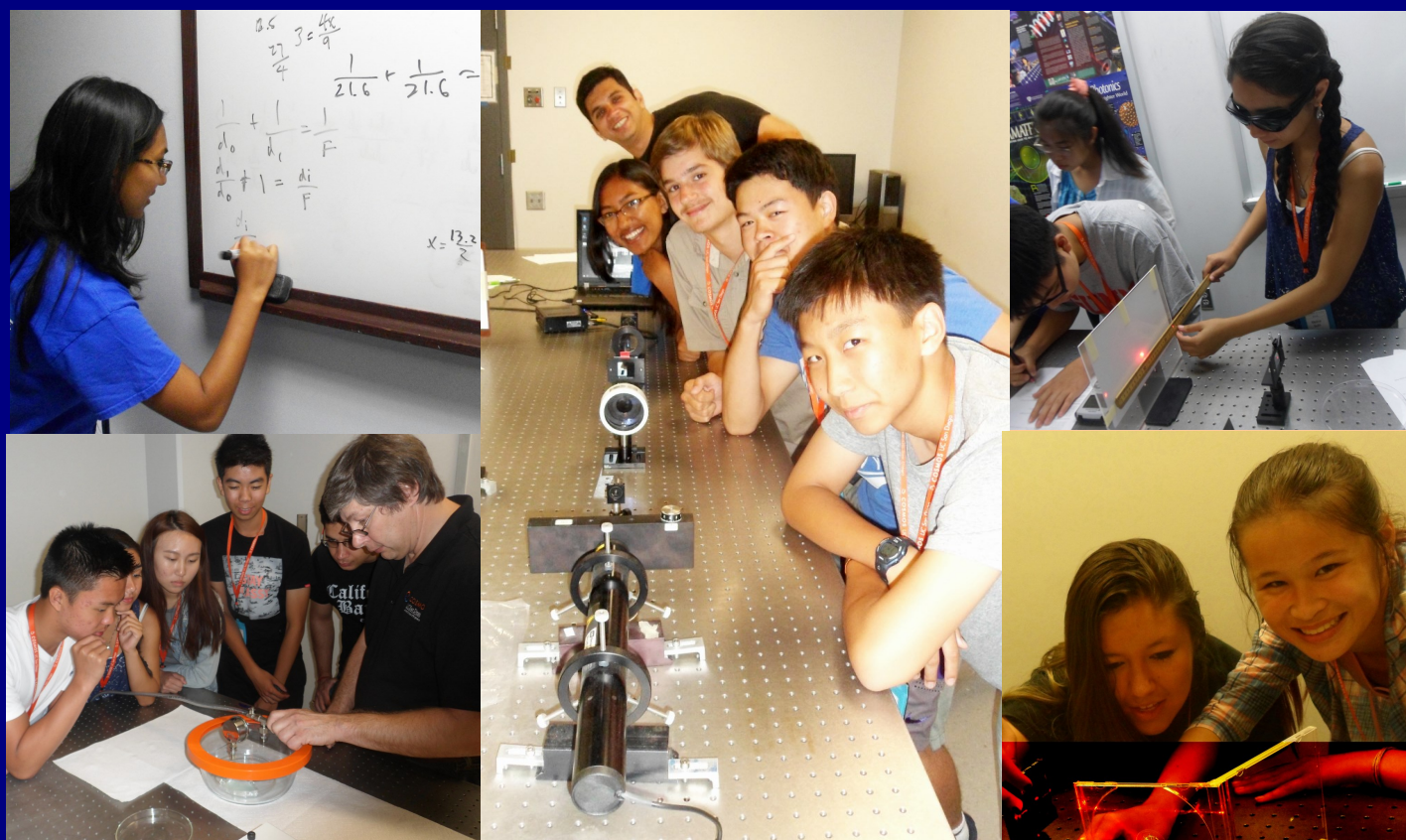
From learning how to polarize light to constructing Michelson Interferometers*, students have developed an understanding of the theory and technology behind the tools through both lecture and lab. To prepare for their final presentations, they gather data then share their conclusions with the class while surviving the good-natured grilling of Principal Investigator Dr. Peter Ilinykh and Lab assistants Rui La and Sushant Kumar.

Everyone found the second Discovery Lecture on Tuesday entitled "Embryos and Evolution" given by Professor Bill McGinnis, Dean of Biological Science at UC San Diego, most intriguing! The slides showing mutant fruit flies with extra wings and eyes growing from odd places were very popular. On Wednesday, we toured the Qualcomm Institute, right next door to our lecture and lab spaces in Jacob Hall, and were immersed in their 3-D visualization technology in the StarCAVE and NextCave before heading to the Nano3 Lab for our first look at a nanotechnology microfabrication lab.

Cluster 5 students have now achieved a working knowledge of photonics that most are starting to apply and use to communicate in deeper and more exciting ways. However, it is also important that these future scientists and technologists be prepared for the increasingly critical role that ethical considerations concerning science and technology will play in their social, academic and professional lives.

Our five-page Ethics in Science Essay is a unique requirement of the UC San Diego COSMOS program that asks students to consider the power of light-based technologies for potential good or ill to society and the future. After last week's orientation to the Geisel's Library collection and online resources, they have spent hours researching the ethical issues in the general field of photonics and those touching upon their own final project areas. Cluster 5 is tackling issues as diverse as the use of nanophotonics to improve stealth technology for the military, to dealing with pollution associated with manufacturing LEDs and solar panels, to the effect of health-care high technology such as cosmetic lasers on the cost to consumers. They will find out soon who among them will claim the \$200 prize for best essay!

* Michelson's Interferometer is an arrangement of lens and mirrors that splits a light beam into two separate paths, creating an interference pattern when recombined that is sensitive to any changes along either path. It was used to disprove the 'ether' theory describing the propagation of electromagnetic waves (1887 Michelson-Morley), leading to the Special Theory of Relativity (1905 Einstein), and to the recent demonstration of the existence of gravity waves predicted by the General Theory of Relativity (2016 LIGO).



CLUSTER 6: BIODIESEL FROM RENEWABLE SOURCES

Captain's Log: Andrew here. At our first lecture, we learned about the library resources available for us on this ship. After the presentation, we visited the bookstore, where many crew members bought clothes to avoid doing laundry for as long as possible. After visiting the bookstore, we stopped for coffee and then headed straight to the lab. At the lab, everyone presented which topics they would write



about, and we practiced our presentation skills. Then, we worked on our group projects. My group made polyols from algae oil and jatropha oil, and now I feel like I'm starting to understand the material more with repeated exposure to concepts of organic chemistry. After eating our supper at Cafe V, programs proceeded as usual, with the highlight of the ice cream social. Overall, today was great, and I'm looking forward to more adventures on this voyage. - **Andrew Chen** Friday was an interesting day for Cluster 6. After a grueling week of creating soybean biodiesel, many of us discovered that the solution that we had created was impure. When heated to remove water, a mysterious snot-like soap residue would form inside the biodiesel, indicating that more washing was required. Several of our lab mates were able to purify their biodiesel in one try, and continued on to two tests to analyze their biodiesel. The first was a density meter which measured the density of the biodiesel. Second, we had to test the amount of water using a Karl Fischer Titration. These two tests helped determine the validity of our biodiesel and are the first of many. But for the rest of us, Friday meant putting our biodiesel once again into our separation flasks and using water to remove impurities. - **Andy Ju**

During our lecture on Monday, Dr. Pomeroy taught us about the three different forms of fossil fuels and how they all

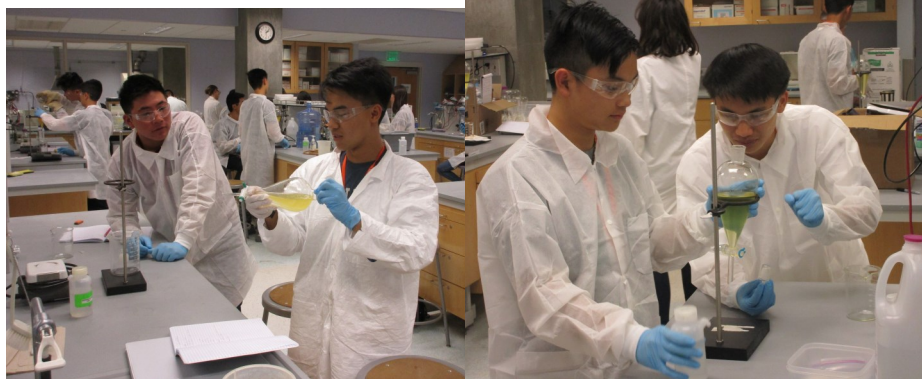
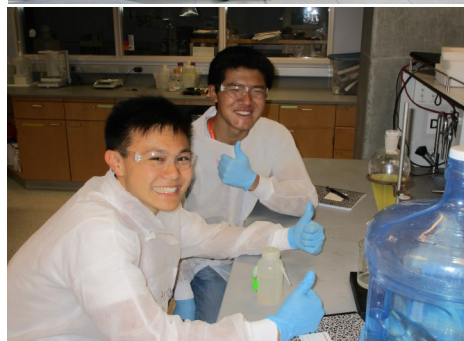
possess several advantages and disadvantages. Ultimately, Dr. Pomeroy's lecture today reinforced the reason of why it is so important to conduct research and find alternative sources of energy such as biodiesel. After eating a great lunch and playing several matches of ping-pong, we went to York Hall, where we continued to wash, dry, measure the water concentration, and measure the density of our biodiesel. With boundaries finally extended, many of us went to Price Center to get boba drinks after lab time was over. Overall, it was another great day with Cluster 6. SHAKA!!! - **Brian Nguyen**

Tuesday at Cosmos began with a discovery lecture from Dr. McGinnis in the morning, which talked about genetics and recombinant DNA. Our cluster separated into their project groups after lunch; my group is testing particle concentrations and how different

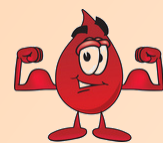
areas have larger particle levels than others depending on the current situations. My group went around and tested particle sizes levels in various areas and we found that construction is three times worst for the air then the particles coming from the backend on a bus. We also washed some algae biodiesel which will be used in a diesel generator so we can measure the particle output. This week has been a blast and I cannot wait to see how our project turns out. - **Cameron Chen**

Wednesday, my cluster attended a field trip to a marine hatchery and aquarium with cluster 3. Upon arriving at the Hubbs-SeaWorld Marine Hatchery, an institute which raises White Seabass for release into the wild, my cluster began touring the facility with a researcher working at the location. We explored the various tanks filled with fish ranging from an inch in total length to those larger than an average per-

son. My cluster was also able to enter the lab and see how the marine biologists there used techniques that we had learned to conduct cutting edge research. After finishing our tour at the hatchery and enjoying lunch with a view at the Torrey Pines glider port, my cluster and cluster 3 traveled to the Birch aquarium, which is run by the renowned Scripps institution of oceanography. One of the most notable exhibits was the one dedicated to global warming and its effect on marine life. This sobering display showed various impacts that climate change had on marine organisms, such as coral bleaching, and several statistics which stated that global warming would only increase if modern society continued on its current path. It gave meaning to the research that my cluster is doing in clean and renewable biofuels and inspired us to work harder to try and reach a solution to this global problem. - **Charley Wang**



CLUSTER 7: BIOENGINEERING/MECHANICAL ENGINEERING: THE AMAZING RED BLOOD CELL

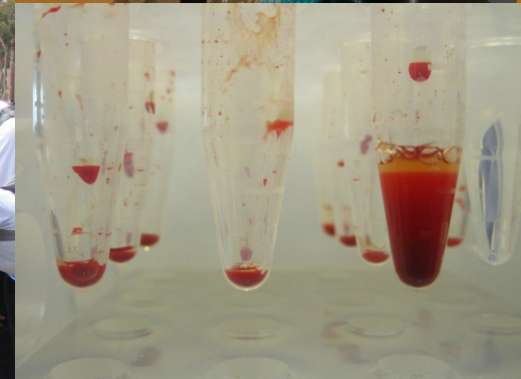
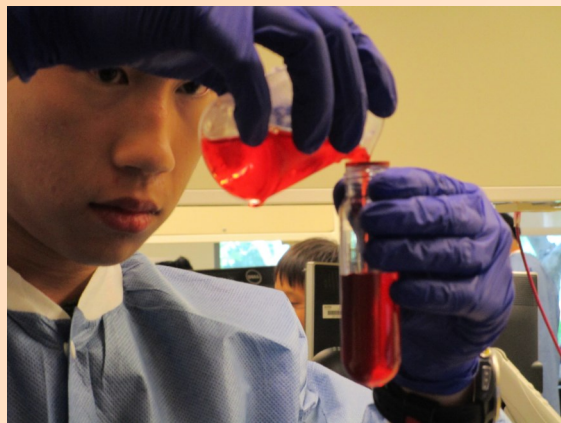


Yet another action packed week for Cluster 7!!! In lab Friday, students tested the effects of osmolarity on the morphology of red blood cells followed by a fun filled COSMOS Olympics in the evening. Over the weekend, the students were able to take a well-deserved break from the academic rigors of the week, such as their ethics essays. Saturday, the students visited the world famous San Diego Zoo, exploring the wonders of animals, including the zoo's famous giant pandas. On Sunday afternoon, we took a trip to the La Jolla beach, where we swam in the ocean, explored the shoreline, caught Pokemon, and just relaxed outside. After an amazing weekend of fun, the students returned refreshed and ready to dive back into the wonderful study of the amazing red blood cell.

Monday morning we watched a fascinating TED Talk by Paul Root Wolpe on the Ethical boundaries of Biomedical Engineering. Engaging conversations were had on the ethical treatment of animals in experimental settings. Dr Vera also elaborated on the structural make-up of RBC membranes and techniques used to measure biomechanical stress in the surface of RBCs. On Monday, students also engaged in labs involving the separation and centrifugation of red blood cell proteins. Techniques such as staining and gel electrophoresis were used to separate and examine the composition of red these membrane proteins.

The Discovery Lecture on Tuesday was by the Dean of Biological Sciences *Bill McGinnis* who spoke about the Developmental Biology and Evolution. In this mind blowing talk, Dr McGinnis discussed HOX genes and the critical role that they have played not only in development of organisms body plans but also in the evolution and diversification of Kingdom Animalia over the past 600 million years. These modular genes determine where your arms, legs, eyes and hands will be placed on your body and even how many there will be....just crazy!!

During our Spirometry lab, we measured our pulse and oxygen levels with pulse oximeters. These functional objects are about the size of a key and fit snug on your fingers, and they work by flashing lights through tissues to determine the saturation of saturation and heartbeat. We watched our heart rates change from 70 bpm to 140 bpm within five minutes of playing Jenga, literally.... OUR ADRENAL GLANDS WENT CRAZZYYYY!! Eventually, staring at numbers became boring, and we decided to challenge ourselves by seeing how we can physically (and maybe mentally) manipulate the saturation of oxygen in our bodies and our heart rates. While waiting for our samples to develop, students completed their Ethics papers and prepared for our Thursday excursion to the J. Craig Venter Institute. We will let you all know about our experiences in next week's newsletter!!!



CLUSTER 8: TISSUE ENGINEERING AND REGENERATIVE MEDICINE

The first week ended with a marvelous tour of Sanford Consortium, COSMOlympics, and an introduction to our projects. At Sanford Consortium Dr. Gaetani gave us an overview of the facility whose goal is to "advance stem cell research through collaborative, multi-disciplinary interactions... applying the powers of stem cells to promote diagnoses, treatments, and cures for degenerative diseases and injuries" (<http://www.sanfordconsortium.org/>). Then we were able to tour various labs, listen to informative mini lectures from leading faculty, attend a poster session with post-doctoral fellows, and even watch a flow cytometry run! After the tour we walked to the Glider Port and enjoyed our ocean view as we ate lunch. The next day, Dr. Sah and Dr. Gaetani introduced us to a variety of projects so we could ponder the choices over the weekend. And then to wrap up the week, we had COSMOS Olympics. Our skit, which won first place, skills in a variety of events, and of course brain power was GR8!

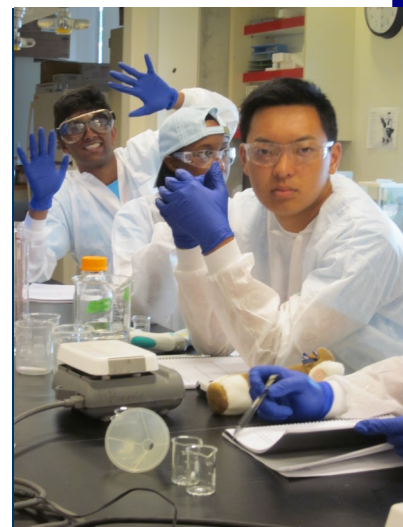
We began our second week with a tour of Advanced Biomatrix which is involved in the production of three dimensional (3D) applications for tissue culture, cell assay, and cell proliferation. They gave us an overview of their company and answered all of our questions from how the business began, to what was involved in manufacturing and production, and the purposes of their various products. We were given a company tour and then they gave us a very generous gift of collagen which we will be able to use for our projects!

In the lab we have finished learning our twelve lab skills. We can now use a microscope to view stained and unstained cells and use a hemocytometer to count cells. Additionally we can thaw, grow and passage our cells, create collagen gels, decellularize tissue, and examine histology slides to evaluate our tissues. Our TA's, Erica, Rebecca and Neha, have taken the lead instructing us in pre and post lab and guiding us through each lab. They have been GR8 teachers as we navigate through a wide

range of skills.

Our lectures and discussions by our distinguished faculty, Dr. Sah and Dr. Gaetani have expanded our knowledge about stem cells, biomaterials and biomechanics in tissue engineering. As we increase our comprehension about tissue engineering we have many more questions and Dr. Sah and Dr. Gaetani are always eager to help us. This week was exciting as we spent time summarizing our lectures, and discussing and researching our groups' project ideas with our professors so that next week we can begin our much anticipated projects.

In the communications portion of the cluster we have had the opportunity to attend a Discovery Lecture from Dean McGinnis. His research involves the regulation of transcription factors in embryonic Hox genes which determine the morphological features in animals. The thought of being able to regulate body structure fascinated us as we pondered if we could create wings on a human, or ethically, should we! Each of us has done background research on our personally selected ethics topic, written a rough draft of our paper, and we all submitted our final drafts on Thursday. Finally, we have been discussing what makes a presentation effective and using this knowledge to present our ethical issues in Tissue Engineering within our cluster. What a GR8 week we had!



CLUSTER 9: MUSIC AND TECHNOLOGY

One of the most exciting events for us this week was COSMOlympics! Each cluster had to create an original skit and work together as a team to try and win relay races and other games. Every cluster performed a 4-6 minute long skit to compete for the bragging rights of top cluster. As a cluster, we contributed our ideas and showed support for one another in order to come up with a musically

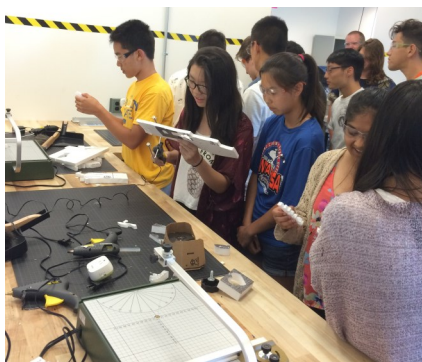


infused performance using everyday objects. Our skit took place in the COSMOS Coffee House where one person started by tapping on a plate and others slowly joined in, tapping on different objects including buckets, cans, and bottles to create a rhythm. Then, three of our group played the guitar and later, others performed an original rap about our cluster. We spent the first week practicing or performance for at least an hour each day. All of our hard work paid off in the end because we won! COSMOlympics really brought Cluster 9 together as a whole, and although winning was a plus, the teamwork we exercised was what was truly incredible. We ended the night celebrating at the Cosmos-wide dance on top of Middle Earth. Overall, COSMOlympics was a remarkably fun and exciting night for all of us!

This week we were challenged with the task of writing an essay discussing an ethical challenge related to music and technology. The ethics paper is one of our biggest assignments, and everyone in the cluster is exploring the various connections between ethics and music. We

spent a lot of time at the UCSD Geisel Library researching on multiple topics concerning ethics in music and technology. It was really eye opening and we were exposed to many of the current issues the music industry has. Our topics include piracy, record labels taking a majority of artists' profits, streaming services such as Spotify, and using algorithmic music composition software to create original music. We know our teacher fellow Kim is going to have a tough time choosing the top 3!

On Wednesday, we took our first look at synthesizers and how they can control the frequencies of sound waves. We learned all about oscillators and their role in creating the sound waves. We also learned about how there are different variations of waves that you can have within music. You can have a saw shaped frequency, a triangular shape, and a wavy formation. These different



waves all have different effects relative to the outputting sounds. For example, a triangular shaped wave will have more characteristics of harmonics being played then the wavy frequency wavy which has a more bland deep tone. We also learned about the capabilities of Raspberry Pi. A Raspberry Pi is essentially a 35 dollar mini computer that can run some of our important programs such as Pure Data, Audacity, Ableton Live and more. Using this device we can program a certain function within music, and then take it stored somewhere as convenient as your

pocket to then use somewhere else.

We have also been learning a lot about college life. On Tuesday, we talked about the differences between college life and high school life and how to be better prepared for the college environment. We also talked about some of the skills we will need to excel in college. All in all, we have had great learning experiences in the first two weeks. We are excited to begin our cluster projects next week!



COSMOlympics



CLUSTER 1



CLUSTER 2



CLUSTER 5



CLUSTER 3



CLUSTER 4



CLUSTER 6



CLUSTER 7



CLUSTER 8



CLUSTER 9

1st: Cluster 9

2nd: Cluster 1

3rd: Cluster 2

Residential Activities

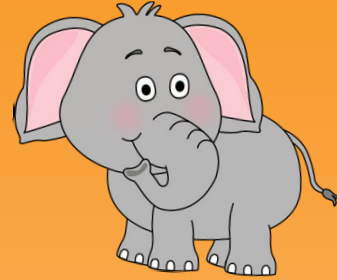


Happy Birthday!!!!

- Jonah Tobin — 7/21
- Sehun Park — 7/22
- Andy Zhu — 7/15
- Garrett Ma — 7/16
- Andrew Chen — 7/23



San Diego Zoo



Treats With Tu



20 students had the opportunity to sit with Charles and get to know him better. They got to ask him questions about his career path and how he decided he wanted to be an engineer. They also got to eat some yummy treats like carne asada fries! Those who missed out this week will have a second and third chance to have Treats with Tu next week!