



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

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The four weeks of COSMOS seem to have flown by this summer. Faculty, teacher fellows, cluster assistants, residential life staff, and office staff have worked hard all year to provide a unique opportunity for students to grow and excel both academically and socially. Over half of our students this summer will be entering their senior year of high school this fall and will have a much better idea of what's ahead as they complete their college applications. Hopefully some of our students from this summer will return to UCSD for their college experience. If you do, stop by our office and say hi! Many of our cluster assistants and residential life advisors were COSMOS students within the last two to three years and are now undergraduates at UCSD. For most of these COSMOS alumni, their time at COSMOS remains a special memory and time, one that they are excited to give back to. Perhaps that will be you!

[LINK TO PHOTOS](#) [COSMOS ALUMNI](#)

Now that you're a COSMOS Alum, please stay in touch and check back regularly for information about alumni events and volunteer opportunities:

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COSMOS alum are our best ambassadors. If you would like to help promote the COSMOS program in your area, contact us at cosmos@ucsd.edu

A lot happened at the end of last week. Last Thursday, we presented our Arduinos musical instrument projects. Congratulations to the Faculty Choice Award winners: Clarice and Zarco for "Bop It!" for creating their own Bop It style game and instrument! Congratulations to the People's Choice award winners: Christine and Kevin D. for "Bunny Ears" for their instrument which plays musical notes based on the movement of a worn glove!

Last Friday, Sanjoy Dasgupta guest spoke about machine learning and how a computer can determine handwritten numbers. For example, the post office uses software which has to determine the addresses written on an envelope. However, not everyone writes the number 5 *exactly* the same. Some may curl more that it could be considered by a computer as the number six. There are different algorithms that can be used to most effectively and accurately determine the values. Later that morning we learned about computer architecture including registers, MUXs, memory and ALUs. Leo connected everything that we learned so we had a better understanding of how it all fit together.

The majority of this week, we focused on our final projects. We got to propose our own final project and get it approved. It had to involve AppInventor, image processing or Arduinos. After many hours of hard work and some laughs at the weird things our programs

CLUSTER 2: ENGINEERING DESIGN AND CONTROL OF KINETIC SCULPTURES

In our last week of COSMOS, our Cluster 2 students were working on evolving their mini sculptures this week to full operating sculptures integrating their design. They started off by performing risk analysis, testing their sensors, motors, and overall dynamics to determine if the design concept was working as planned. The challenges were to identify the highest risk components of a design, and be creative in finding ways to verify if they will work.



CLUSTER 3: LIVING OCEANS AND GLOBAL CLIMATE CHANGE

It's hard to believe that we are just a few days from the end of COSMOS. I am very proud of Cluster 3's progress over the past few weeks. Many started the program with limited knowledge of oceanography and atmospheric chemistry and have learned so much. Cluster 3 has been able to absorb a lot of knowledge from our amazing faculty and TA's. Now, they are experts in their projects!

"Last Friday morning began with two intriguing guest lectures from field experts. One discussed his work in engineering cyanobacteria to increase its predator resistance, and the other described the process of ocean acidification and measuring oceanic carbon levels. In the afternoon, we commuted to Scripps Institution of Oceanography to learn how to identify different types of fish. We physically classified them by analyzing their body structure and through hands-on interaction." David Y.

"Entering the classroom at NSB on Monday was a sobering experience for me. After weeks of insights and revelations from Dr. Skip Pomeroy, this was going to be his last lecture with us. When we all settled down, he declared "I'm either going to dazzle you with my brilliance, or baffle you". In a flourish of strokes, he began writing chemical reactions on the board. As he scrawled equations on the board, he explained to us how to derive the basicity of the ocean using simple logarithms and pH equations. I was amazed how he was able to accurately find the pH of the ocean by calculating the excess acidity from carbon dioxide entering the ocean and turning into acid and factoring in the excess basicity from carbon dioxide dissolving the calcium carbonate on the ocean floor. In the afternoon we completed an acid base titration lab in which we used a pH probe. We slowly added hydrochloric acid to a beaker full of deionized water, making sure to keep track of the amount of acid added and the pH of the solution. Inputting our data into google sheets, we were able to calculate the alkalinity of the water." Anthony S.

"Tuesday 7/30: Continuing our weekly lecture series, we heard from Dr. Margaret Roberts, a professor at UCSD specializing in data science. She details her findings from the book Censored: Distraction and Diversion Inside China's Great Fi

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

Somehow it's already over, but COSMOS 2019 was a huge success! Students in Cluster 5 learned so much from their time with professors, hands-on experiments, and activities with new friends that surely created lasting memories and will inspire future scientific endeavors. Right now, students are working diligently on the final touches of their projects as they prepare to present at the Research Expo on Saturday.

During lectures this week, students learned more about biosensors, optoelectronics, and how nanostructures influence color in nature and engineering. There was even a chance to discuss some solar spectroscopy and use a solar telescope to view the Sun. Finally, two of the most fun and interesting parts of the week were some hands-on activities. In the first, students built an electric circuit that converts sound (music from your cell phone) into a light signal from an LED that can be detected by a solar panel or photodiode and played through a speaker. In the second, students build a \$1 foldable microscope that could be used to magnify to an astounding degree. Students had a great time learning the circuitry, playing music with light, and learning about simple, yet powerful microscope technology!

The final Discovery Lecture of the program was a wonderfully interesting and engaging talk by Dr. Margaret Roberts on censorship in China and the Great Firewall. She explained her research and the impacts of internet censorship on citizens of autocratic countries as well as some potential effects around the world, and students were very interested and learned a lot.

Students are now working diligently on their projects; implementing plans, collecting and analyzing data, writing and practicing their

presentations, and preparing for the Research Expo on Saturday. Keep an eye out for the awesome Cluster 5 t-shirts

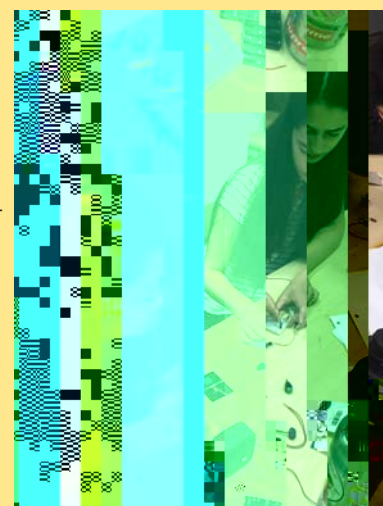
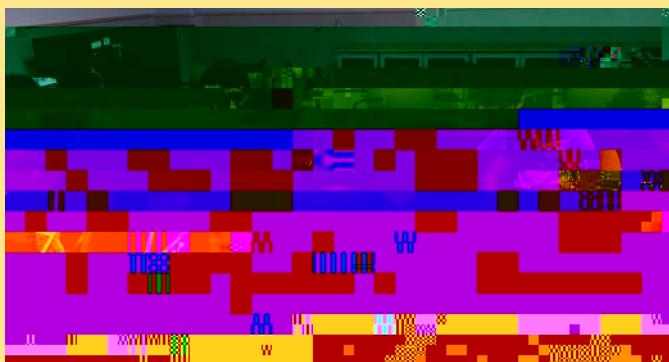
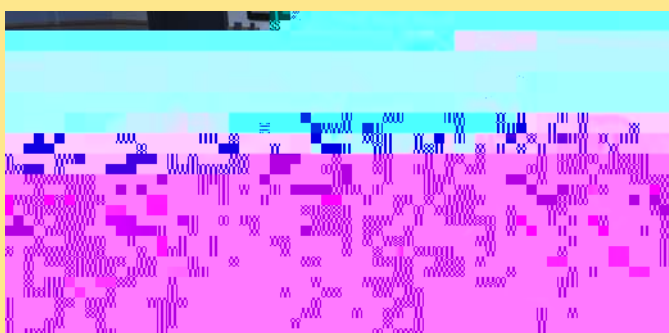
when you join us for the final day of COSMOS 2019! Here are a few send-offs from students.

"The time we spent in the photonics lab is by far the best academic activity our cluster provides. We have the opportunity to learn in a collaborative with like-minded peers while also being able to utilize lasers, lenses, and other various tools that we would have access to in a high school environment" - Austin P.

"I liked learning about how fiber optic cables worked in the lab because it is so cool how much information you can fit in just one fiber." - Nina H.

"I think that my favorite academic activity would actually be the lectures since a lot of the information was new to me and has taught me a lot about how semiconductors work in the molecular level and how lasers are made." - Emily C.

"What I enjoyed most about COSMOS was making tons of new friends with my cluster and roommates. During the first week, I didn't really enjoy the program, but my friends really made the next few weeks fly by, and now I'm really sad that we have to go back to our own separate lives in a few days. I loved complaining about Cafe V food with my cluster, listening to Prof. Peter's savage jokes, seeing Prof. Charles ride his bike every day, running under the beautiful morning sky (as exercise, definitely not because I was late to class haha), and more. Thanks for such a memorable month everyone!" - Rebecca M.





CLUSTER 6: BIODIESEL FROM RENEWABLE SOURCES

"In the morning Friday, Dr. Ryan Simkovsky gave us a lecture on his research on algae and some of the problems with scaling up algae production from a lab to a large farm. May Linn Paulsen then gave us a lecture on ocean geochemistry and her work in measuring ocean alkalinity. After lunch, we cleaned up the lab that we first made biodiesel in and continued working on our final projects." Phillip Jeong

"On Monday, July 29, we opened the week with our first time organizing our thoughts from our projects into a presentation. Our guides for each of our projects clarified the requirements for the presentation. Shortly thereafter, we began our slideshows and posters, considering every aspect of our presentations along the way, from our scientific findings to visuals and speaking style. Later that afternoon, we continued our initial take at the presentation, gathering all data of which had had collected throughout the length of the project." Prerana Devadhar

"On Tuesday, we had our last discovery lecture from Dr. Margaret Roberts about censorship in China. Afterwards, we worked in our project groups to complete our posters and presentations."

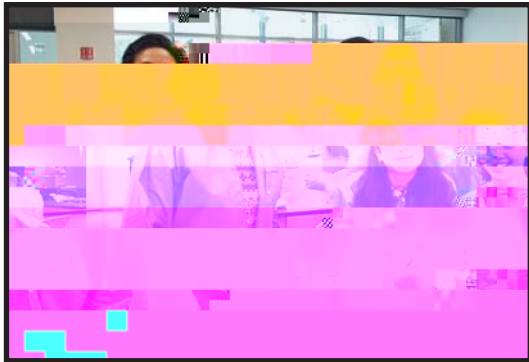
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CLUSTER 7: SYNTHETIC BIOLOGY

Week 4 students have been working really hard on their experiments. Of course, we had our Discovery Lecture, which was a fascinating exploration of internet censorship in China. We visited Illumina on Wednesday and had a great tour and panel discussion with Illumina associates.

Our six groups worked on their projects all week, and had to overcome some issues with the experiments as well. In the end, they learned a lot, and ended up with interesting questions about why things turned out the way they did! All of the students are excited to share their work with the families on Saturday!



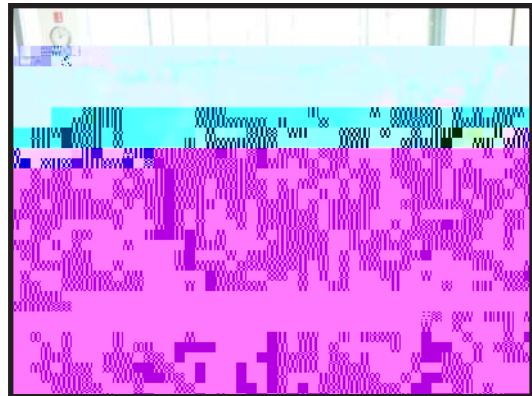
Alguys working with Dr. Eva Sanchez on microalgae. They worked on a really cool system and did something really unique.



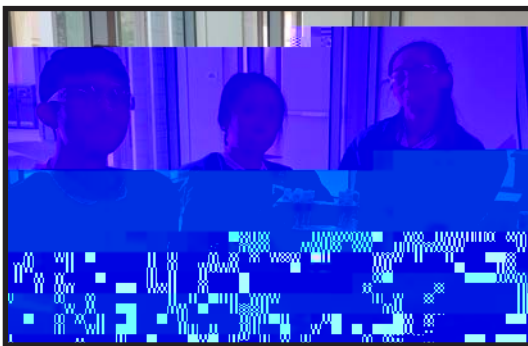
The Yeasty Boys worked on glowing yeast. They have an interesting story to tell with some cool photos and videos.



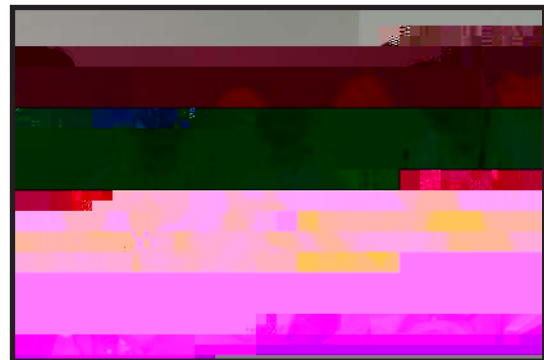
Luminescents did interesting things with plasmids tried to answer complex questions around protein expression.



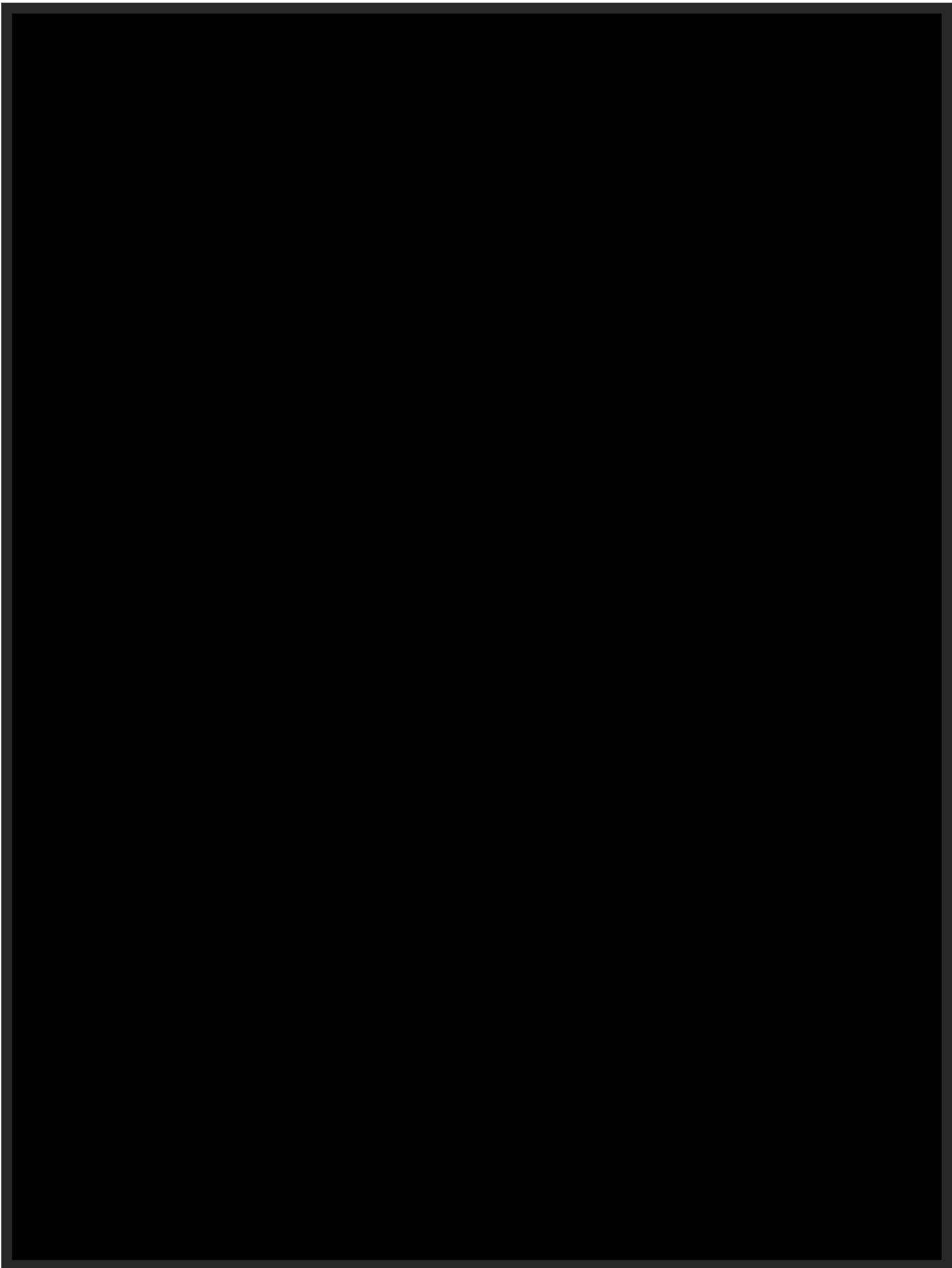
The CRISPY Ladies worked on a CRISPR project. They solved problems in a really innovative way.



ProGlo worked on a design for probiotics. They did a lot of work on their project and had a lot of issues because of the complexity of their project.



KEWLights engineered a really cool device for growing glowing bacteria. They had a really unique project that will inspire new groups of students to follow their project.





Introduction:

CLUSTER 10: ROBOT INVENTORS



We have made it to the final week of COSMOS, and students are taking on their greatest challenges: custom robots!

Day 16: Our final week in COSMOS kicked off in the lab with individual robot designs. Today was completely focused on working in the lab and getting ready for Friday's cluster showcase.

Day 17: Today's discovery lecture was all about China's Great Firewall, presented by Dr. Margaret Roberts. She talked about the challenges of censorship in China and how people are getting around it. We then worked on the students' final posters for their projects (ask them to show you their posters!). We then transitioned to the lab for the remainder of the day for everyone to work on their final projects!

Day 18: We began with a panel of undergraduate students sharing their college experiences and high school choices with the cluster. The students were able to ask many questions and hear about college life and college choices. We then spent the rest of the day in the lab preparing final robots!

Day 19: Today was the last day to work on robots in the lab, and it was exciting to watch ideas come

CLUSTER 11: Introduction to Autonomous Vehicles

Week 4 began with a lecture on Open CV from Dr. Phan. Students then began hard coding a line following program to see the difference between using a neural net and traditional coding. In most cases the neural net worked better but the drawback is that it requires a great deal of training. Various groups got the cars to follow other cars, follow people with tape attached to their shoes, and drive around courses made of cones.

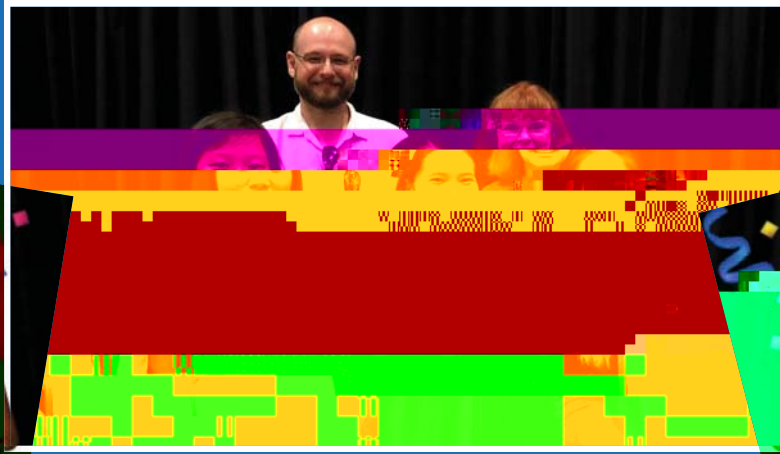
Tuesday morning was the Discovery lecture by Professor Molly Roberts on the topic of online censorship. After that students worked on their final projects. In the afternoon students were taught Tensorflow by Dr. de Oliveira of Clusters 7 and 9. There was also more time for the final projects. Topics include following other cars, following bouncing balls, stopping at stop signs, following people and adaptive cruise control to avoid rear ending other cars.

Wednesday afternoon was a lecture on the technologies employed in full size autonomous vehicles. Thursday morning we visited the robosub competition and saw teams from around the world competing.

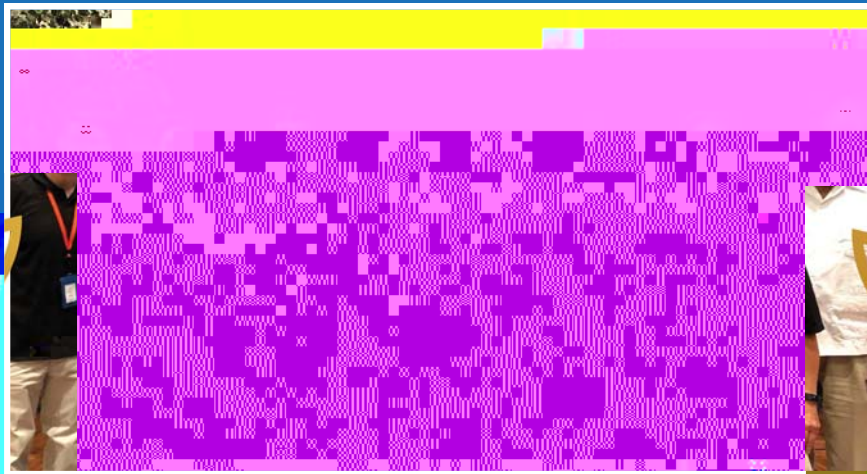
On Friday students presented their work to Clusters 1 and 10 and also heard from those clusters on their work in computer science and robotics. Late Friday afternoon was practice for the final ceremony. On Saturday families had the opportunity to see the cars and ask questions of the students and the cluster staff. H

CONGRATULATIONS

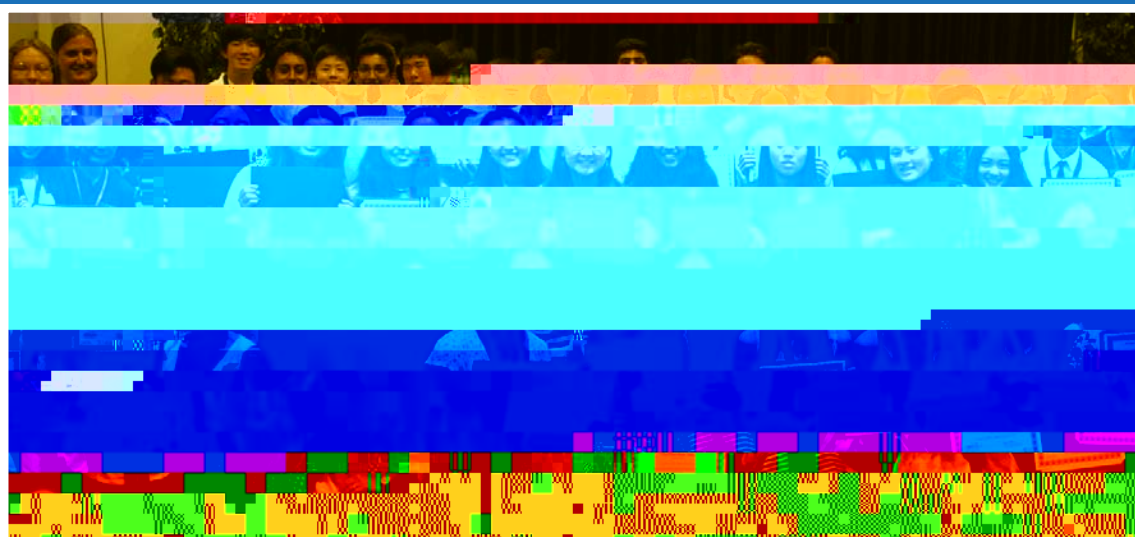
Ethics Essay Awardees



Dr. Joseph Watson Awardees



Gordon Engineering Leadership Center High School Fellows



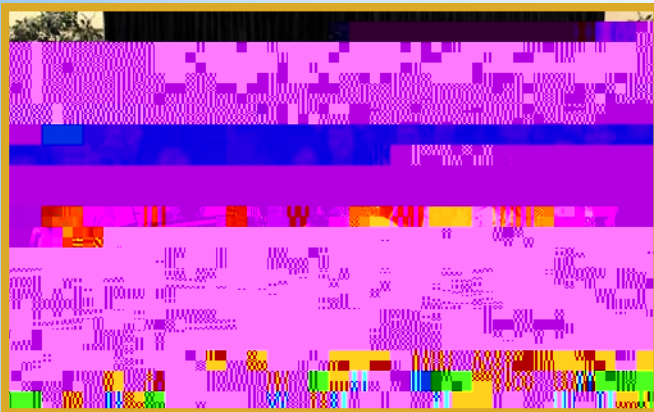
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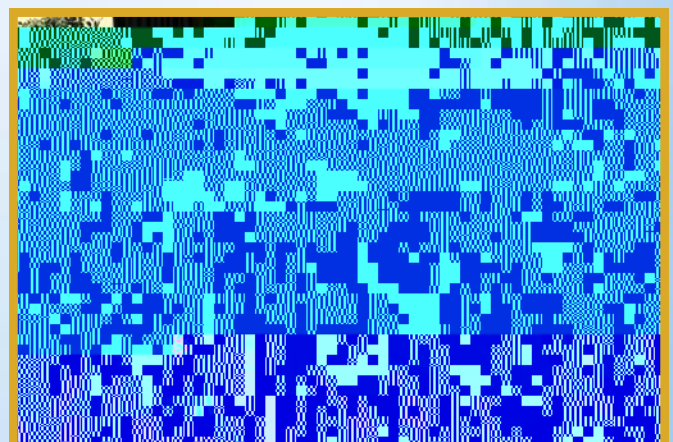
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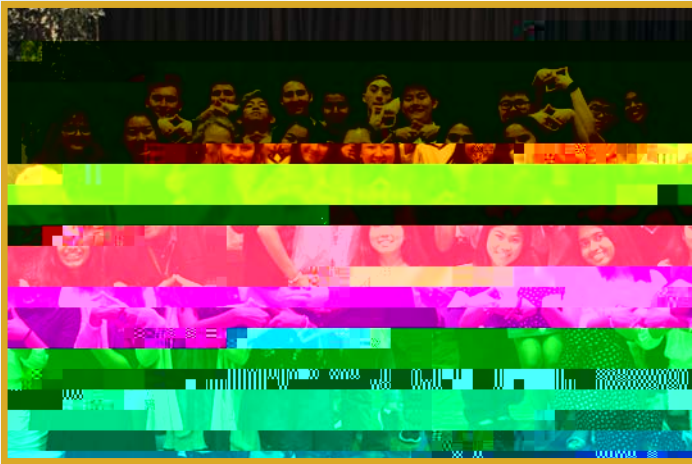


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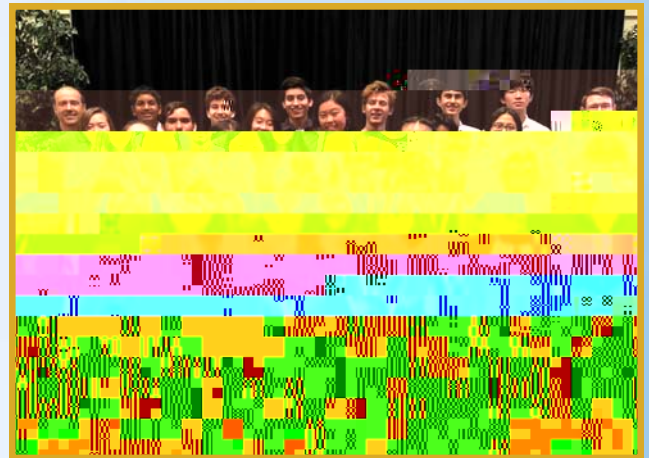


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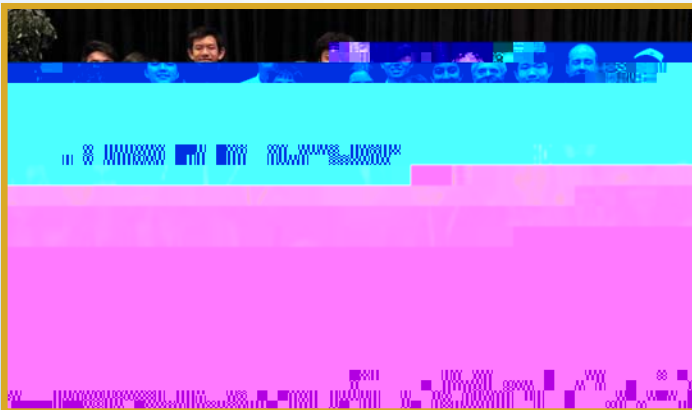
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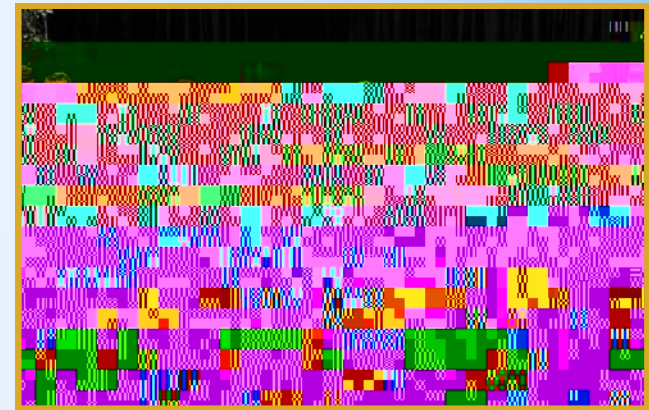
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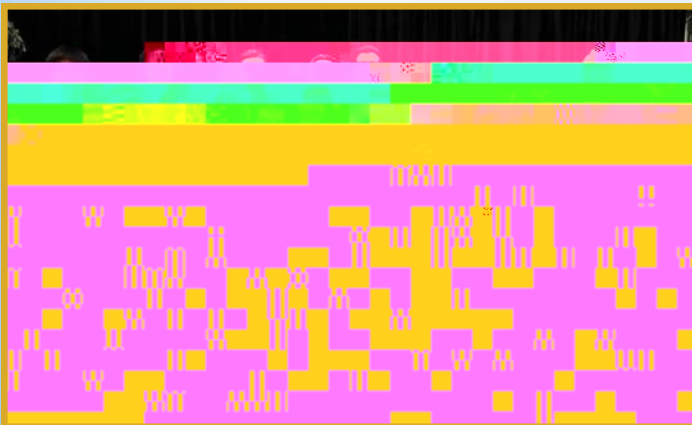
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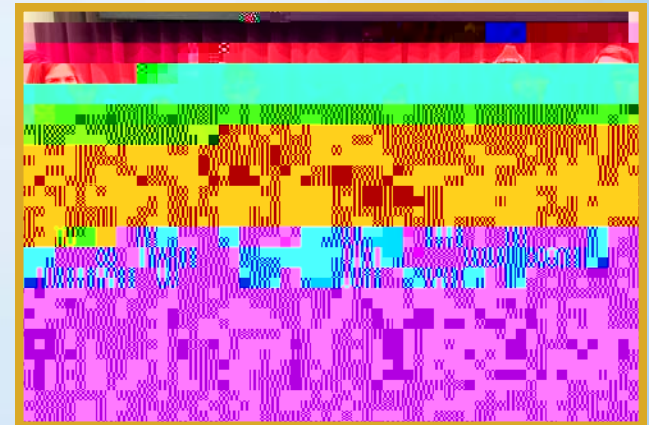
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