Cluster 7 started off bold and strong. We began the week with a few presentations on safety precautions and procedures, library resources, and our first discovery lecture from Dr. Tina Ng on Printable Electronics. It was fascinating. We also walked, a LOT! The students from Cluster 7 are really getting to know the UCSD campus! They walked all over campus on Monday. Tuesday they also walked quite a lot around campus. The weather has been treating us fairly well, with clouds decreasing the heat on Tuesday and Wednesday.

Each week the students spend Monday, Wednesday, and Friday with Dr. Vera and Dr. de Oliveira in lecture and lab. The lab has two fantastic TAs, Kritin and Jacob who are bioengineering majors. The lab manager Ana is also on hand during lab to help us out. Trudy, the teacher fellow, also helps out in lab. Students have lots of support as they are learning to use the tools of biotechnology.

On Tuesday and Thursday, students spend time in Science Communications with Trudy working on their Ethics Essay and science communication skills. Each student is creating an essay on an ethical issue related to Synthetic Biology. They will present to our class on this and we will discuss these issues in both the lab and in SciComm class.

Our first lab experience was spent learning how to use the micropipette and an introduction to Synthetic Biology. During our second day of labs, we used gel electrophoresis to separate DNA into bands on agarose gels. In our third lab, on Friday, we will be using restriction enzymes to digest DNA and checking our results using electrophoresis.

Dr. de Oliveira also taught the students about logic tables and how to create a circuit using Boolean logic on Wednesday. Students used circuit boards with various switches and logic to light up LEDs. We will be using this logic next week to build biological circuits with living organisms! This is very exciting new stuff and a really different way to think about how living things work! Everyone is enjoying their time at COSMOS and doing exceptionally well!
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 64º 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
Thursday, July 19th Cluster 7 went to the J. Craig Venter Institute (JCVI). What a great experience! Students were well prepared to make the most of the visit. Students heard about the work of Dr. Sheuermann, Dr. Tran and Dr. Glass (Leader of the Synthetic Biology Division). Dr. Sheuermann, Director of the La Jolla JCVI, told us he had never heard such great questions from students!

Here is a photo of the students in front of J. Craig Venter’s office facing gorgeous La Jolla Shores (Dr. Venter was there, but was being taped for a TV show).

Friday, the students transformed bacteria to make them glow. After students finished their work to transform and plate the bacteria, they had did an activity which looked at gene drive and malaria.

Students spent this week doing additional experiments with bacteria that smell like banana, and growing glowing bacteria! They also presented their final projects to the professors and received feedback and advice on how to improve their projects.

Today, Thursday July 26, students are touring Illumina. This company is the leader in gene sequencing technology and students will be seeing where gene sequencers are developed, made and used. Companies like 23 and me and Ancestry.com use Illumina to sequence DNA from their customers. It was a very busy and exciting week of learning and discovery!

Here’s what the students had to say:

We learned about the mechanism in which malaria works, both within humans and mosquitoes. By reading case studies, we were able to see how complex the issue of gene drive is by looking at how it would affect a community in Kenya socially, economically, and politically. As a group, we shared our own recommended stance on this issue and defended our proposals to our peers. Throughout the afternoon, we gained valuable research and science communication skills, as well as become more prepared to look at the ethical implications that might come with using synthetic biology to solve real-world problems. ~ Airol

We began the day by looking at the results of the pGLO lab, in which we used DNA from a fluorescent Jellyfish to make e. Coli glow under UV light. Most groups saw their bacteria grow and fluorescence, which proved that we had successfully transformed the bacteria! Next we previewed the Eau That Smell lab that we’ll be performing for the rest of the week in which we make e. Coli smell like bananas. We watched a video of MIT students explaining the experiment and stopped to discuss the purpose and procedure. After lunch, we proposed our ideas for final projects to the class and shared our plans. Groups are doing everything from making e. Coli turn different colors to making yogurt that glows under UV light. We spent the rest of the afternoon preparing for our next two labs, the purification of the green fluorescent protein from the pGLO lab and Eau That Smell, which will begin the rest of our hectic week. It was a fun-packed day full of learning and science! ~ Lea and Julia
Students in Cluster 7 had a very busy last week of COSMOS! They worked on their experiments with bacteria that smell like bananas, did protein purification, did protein electrophoresis, and finished their projects, presentations and posters. Somehow, they still had time to see the Salk Institute and the Fallen Star at the top of the Engineering Building. It’s been great seeing the innovative and creative final projects these students have designed. They are incredible. We’re all sad to see the program end, but hope the lessons we have learned will last us a lifetime!

Here’s what the students had to say:

7/30/18

On Monday we spent the whole day working and learning in the lab! First, Dr Vera taught us about RNA interference, or RNAi and we watched a video about it. This is a phenomenon where RNA will get destroyed in the cell if it looks like it might be a virus. We learned about how it worked and what possible applications it could have, like in medicine for example. After that we got to work on our final project for awhile. There are a lot of interesting projects going in in cluster 7, from colored E coli to glowing yogurt! After lunch we learned about a lab called What a Colorful World, that another group did as part of their final project. Then we did a lab called GFP purification where we were able to isolate green fluorescent protein from a sample from a previous lab we did. We returned to working on our final project for the rest of the day afterward.

~Hallie and Nathan

8/1/18

Today was a day of science communication. All of the groups presented their work on their final projects through really amazing slides and investigational queries. In doing so, we learned so much about the possibilities of synthetic biology, but more importantly, we learned more about how much we were able to accomplish in under two weeks. As we near the end of COSMOS, it’s amazing to see our growth in the synthetic biology field as students creating our own ideas and innovative projects. We look forward to when we all present on the last two days where we truly get to show all that we have learned and are able to perform. This has been a great experience, and we have learned more than we ever thought we would.

~Zach, Rupin, and Ravi