

End of Summer Report

For my FURSCA project, I worked with Dr. Craig Streu to identify the potential of nanobody platforms for targeting glycopeptide escape mutants. Prior to the changes made due to COVID-19, we would have been in the lab collecting data from a library of nanobody-displaying yeast cells that we had expanded earlier this year. We would've used directed evolution techniques to sort our yeast cells into "binders" and "nonbinders", allowing us to find the DNA sequence that codes for the nanobodies we refined to our antigens, or targets. Instead, we aimed to do a plethora of literature research regarding antibiotic resistance and its effect on the efficacy of glycopeptide antibiotics such as vancomycin, teicoplanin, and others that target peptidoglycan of gram-positive bacteria. We also wanted to dedicate time to learn Python and R, two computer programming languages that will help us handle large data sets and display them in useful ways. Some additional time was set aside to become familiar with Adobe Illustrator in hopes to create figures for future presentations and potential theses. On top of reading about glycopeptide antibiotics and learning programming languages throughout the 10 weeks, we also scheduled weekly "journal club" meetings to discuss and present on topics regarding COVID-19 therapies and vaccines. My lab group, consisting of three other students and Dr. Streu, also worked together to write an opinion piece for ASBMB Today about summer research during the pandemic. Towards the end of the summer, we decided to allocate time to work on grant proposals for ongoing projects in Dr. Streu's lab.

After 10 weeks of ongoing literature research, one of my biggest accomplishments was being able to optimize my project. I was previously going to be using nanobodies to target part of Dengue virus; however, with the help of my literature research this summer, I was able to figure out that this target had some logistical problems. Reading about the pathway of viral pathogenicity and work that others have done allowed me to determine that my original plan wouldn't yield worthwhile results. Instead, I read numerous primary research articles about glycopeptide antibiotics, specifically vancomycin and its derivatives. Through my reading, I've been able to connect our directed evolution techniques with other research to optimize my project and refine my target for work in the fall. I have been able to develop a strong understanding of many biological and biochemical processes which will allow me to work more efficiently when the time comes to collect data from my project in the fall. Using our enhanced knowledge of the subject of our projects, my lab group and I have been able to help Dr. Streu draft a grant proposal for the directed evolution project I've been working on. This was not completed by the end of the 10 weeks of FURSCA, but we have been able to get a head start for continuing in the fall.

We learned Python through an online course and followed up with R tutorials from Dr. Streu. These two languages will help us read programming that allow us to interpret data from Next Generation (DNA) Sequencing and produce accurate graphs and figures from this data. Our in-lab research outputs massive amounts of data—our yeast cell library has 2.5×10^8 diversity, which only gets refined to millions of different cells that need get sequenced. No human is capable of looking through millions of data and interpreting each one, so programs written in Python help us understand this data. In order to accurately and efficiently use these programs, being familiar with the language is essential. After learning how to write some code in Python and understand its functions, we translated this knowledge into R, a similar programming language. R has similar syntax to Python,

yet it is highly compatible with sciences that need massive amounts of data to be analyzed and displayed in a comprehensible way. Another tool that we familiarized ourselves with was Adobe Illustrator. Published researchers use this software to create figures for their articles, and since many of us in Dr. Streu's lab group plan to write theses and create poster presentations, this skill is incredibly beneficial to have.

In the last half of the summer, my lab group and I reached out to biochemistry students across the country to hear about their summer research experiences. With this summer being unique and unprecedented for everyone, not just students participating in FURSCA, we were interested in hearing how they were able to adapt. We compiled all of our responses and wrote a piece for the American Society for Biochemistry and Molecular Biology (ASBMB), which we are hoping will get published in their news magazine, ASBMB Today. This experience allowed me to improve on my writing skills outside of a science application. I found that I have become accustomed to writing science reports, so writing our piece entitled "Summer Undergraduate Research Weathers the Pandemic" gave me chance to practice different writing styles.

The most influential part of my summer research experience has been via Zoom meetings with my lab group and Dr. Streu. With research being remote, we didn't see each other for 40 hours a week as we previously would have. Thankfully Zoom meetings offered an alternative, since a valuable part of any undergraduate program is gaining connections among classmates and professors. In these meetings we would discuss articles of all sorts (i.e. news, primary research, journal publications) that related to our projects. We also discussed any new COVID-19 vaccine developments which allowed us all to stay updated in today's science.

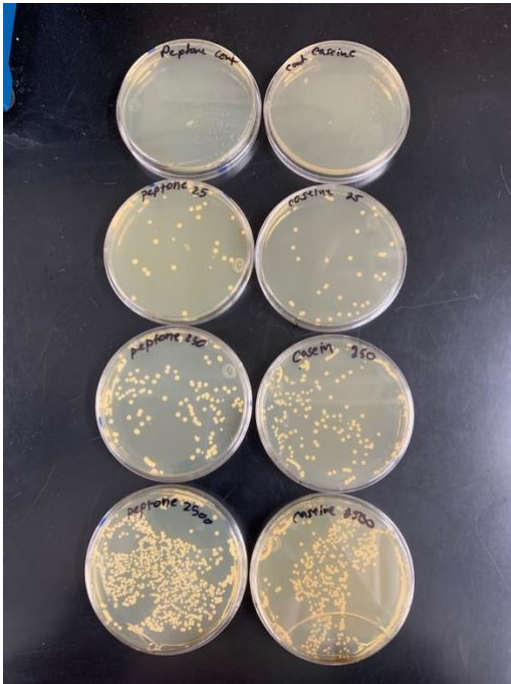
During the past 10 weeks, I have learned a plethora of new skills that will be valuable to any education or career I pursue in the future. Although the logistics of this summer were drastically altered, I have become a better student, researcher, and communicator through my FURSCA experience. I am more confident in my ability to read primary research articles about new topics, and I have become more efficient in my literature researching. Being completely online has taught me how to effectively communicate using scientific jargon and give a presentation about topics in the biochemical field. In my next two years at Albion, I plan to write my honors program thesis about my research and present at Elkin Isaac Symposium. I also hope to attend a couple of national conferences to present and meet others in my field. I am currently undecided about my plans after Albion, but I am considering medical school or graduate school. I am hoping another two years of research will help guide me in the right direction for my goals and passions!

To the Orpha Leiter Irwin Fellowship:

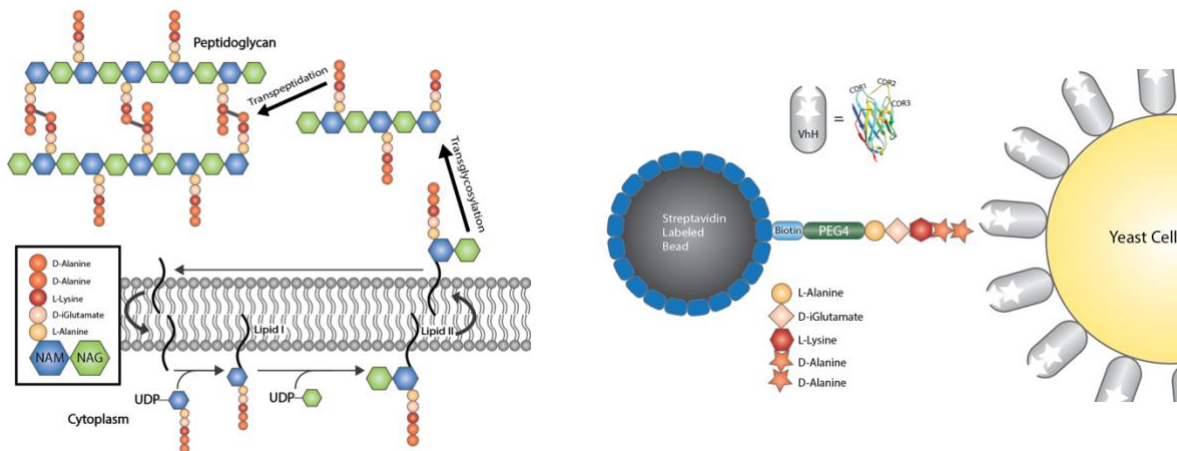
Thank you for giving me the opportunity to participate in Albion's FURSCA program this summer. With everything changing due to the pandemic and many other opportunities getting put on hold, I am grateful that my research was able to be successfully adapted. This remote summer provided many unanticipated benefits that will greatly influence my future education and research endeavors. Thank you!

Anna Crysler

Photos from some of my work this year and this summer:



1. Prior to the pandemic, we were able to test our cells for expression (left) and expand and freeze our yeast library so we can use the cells for many projects (right).



2. Using Adobe Illustrator, I was able to create figures that I hope to use in future papers and presentations.