In the chemical engineering lab of Dr. Richard Roberts, researchers are conducting experiments to find peptides that bind to a specific target protein. They use a method called mRNA display which was invented by Prof. Roberts.

Sarah, my lab partner, and I worked on one particular part of mRNA display. It is important to reduce the background binding during the selection, which is usually caused by non-specific binders binding to beads. We worked on identifying those non-specific binders that could be used as a blocking reagent in future experiments. Four rounds of selection had been done and the library had been enriching with non-specific binders. We performed one more round of selection against two different types of beads, neutravidin agarose beads and streptavidin agarose beads. We successfully performed the selection and identified peptide sequences that bind to each type of beads.

**Objective & Impact of Professor Roberts Research**

**Treatment/Diagnosis**

Protein-Protein interaction inhibitor

Prevents protein-protein interactions that could cause diseases (e.g. auto-immune diseases and cancers)

**Protein identification**

Peptides could be used as a diagnostic tool by identifying specific proteins that are unique to certain diseases (e.g. overexpressed proteins in cancers)

**Electroelution**

The ligated mRNA sample was eluted from the gel by electroelution. Eluted samples were collected and desalted for the next step (translation)

**Methods/Skills Learned**

1. **PCR**: Polymerase chain reaction→ used to amplify DNA library

   ![Figure 1](Image 1344x1021 to 1725x1106)

   **Figure 1 mRNA display cycle PC:** Roberts Lab

2. **Transcription**: Transcribes DNA to mRNA

3. **Ligation**: The mRNA is ligated to F30P which consists of DNA and Puromycin

4. **Translation**: RNA is translated to Protein (peptides) in vitro

5. **Fusion**: mRNA fuses with the peptide chain via puromycin

6. **Reverse Transcription**: mRNA to DNA. Complementary DNA is generated using mRNA template.

7. **Selection**: Selecting the peptides that bind to the “target” (For our experiments, blank beads were used)

8. **PCR and new cycle**: PCR is performed to create a new DNA library, and another cycle of selection begins

9. **Topo Cloning**: Topo Cloning was performed to sequence DNA, which provide us with binder peptide sequences.

10. **Colonies**: a method to screen for plasmids containing binder DNA.

**How this related to my STEM coursework**

Chemical engineering research requires a lot of outside of lab work and more thought processing. Using the skills I learned in chemistry and biology, I was able to make connections to particular topics that were discussed during this 7 week program. With that said, there were many terms, methods, techniques, practices that seemed completely foreign to me. I learned the principles of research, working in a lab and skills as a student such as time management and patience. Additionally, learned to communicate my ideas with students participating in different labs along with my lab partner and mentor. Opening this new door was a great challenge and an overall amazing experience.

**Acknowledgements**

Thank you to everyone who has helped me throughout my SHINE experience. A special thank you to Professor Richard Roberts, Dr. Kaori Noridomi, Dr. Katherine Mills, Dr. Megan Herrold, Sarah Shintani, Marymount Highschool, and my parents for all their support.