

# Optimizing The Design of Photoactive Yellow Protein

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## Introduction

The Life Sciences Summer Institute (LSSI) connects high school students to San Diego's Life Sciences Industry since 2005. Students complete a one-week pre-internship "boot camp" training followed by 7-weeks of paid research work experience.



- The goal of our project is to optimize the structure of Photoactive Yellow Protein (PYP).

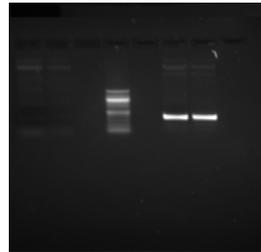
- Using computational biology, Dr. Zhu engineered PYP and then we tested it.

- After, the researchers here will collaborate with the Dorris Neuroscience Center to apply optogenetics with neuron stem cells. PYP is an important component of optogenetics.

## PCR Results

- We ran the PCR results through gel electrophoresis. It was half successful because something was wrong with the template, so we redid the procedure.

- This is a picture of the PCR product, which is the PYP gene.

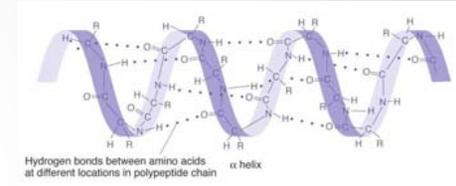


- We then used this gene for bacterial transformation.

## Protein Design

- Using computational biology, our lab optimized the protein by changing the amino acid residues at the N-terminus of PYP.

- The residues are changed to form an  $\alpha$ -helix structure so that they are more tightly packed together.

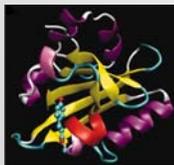
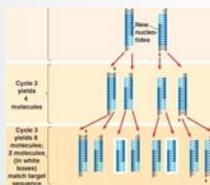


## Methods

- Polymerase Chain Reaction (PCR) is a process by which DNA is exponentially copied.

- Bacteria culture was used for gene expression.

- Computational biology is used to engineer Photoactive Yellow Protein



## E. Coli Culture

- After integrating PYP gene into a vector, we used E. Coli DH5a for the transformation.

- E. Coli DH5a cultured successfully and then we ran another PCR to obtain the positive colonies only, since some bacteria may not have taken in the PYP gene completely.



## Conclusion

- After PYP was optimized, our lab used its findings to collaborate with Dorris Neuroscience Center. I will explore the application of PYP and optogenetics on stem cell research and shadow the researchers there.

- Optogenetics has the potential to stimulate transplanted stem cells that do not function properly. Throughout this internship, I learned how scientific research is mainly focused on helping others, especially stem cells. The potential of stem cells is limitless but we need to discover how to unlock its potential. I now have an idea of what it is like to be a researcher and will continue science in college.

## Acknowledgements

I would like to thank CIRM, my mentor Tingting Liu, our PI Jiang Zhu, our program coordinator Suzanne Russell, and all my fellow interns here at The Scripps Research Institute for an enriching summer.