

## **Biological Building Blocks**

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Professor Douglas Vander Griend

This summer I worked in Professor Vander Griend's lab synthesizing six peptides and studying how they fold and bind metals. Peptides are miniature proteins which are often used by the body as pheromones and signaling molecules. Studying peptides is also important because they can serve as a model system for the binding pockets which exist in much larger proteins.

Proteins are an essential part of living things, as they perform a wide array of functions within the cell. Proteins are assembled from the "instructions" of DNA which code for each "building block" of amino acid that is to be added to the structure. This primary structure, however, would lack rigidity (think of a randomly bent wire) if it were not for the secondary and tertiary structure that determined its consistent three dimensional conformation (think of a coiled spring). Since, "structure determines function," a protein cannot function correctly if it is not folded correctly.

The peptides I studied this summer are much the same. However, our peptides were 12 amino acids in length whereas larger proteins are commonly around 200-600 amino acids. Based on the research of past groups we designed a sequence of amino acids that we thought would fold creating a pocket that was favorable for metal binding. Rather than being made biologically, these peptides were made synthetically by doing chemistry to add one amino acid "building block" at a time. This part of the project was accomplished thanks to collaboration with Professor Tatko's lab.

After synthesizing and purifying these peptides, we were able to characterize them. First we verified that they were of the correct size and sequence, and second that they folded as we had hoped. With these peptides synthesized and characterized, we are beginning to study how they bind to metals, and how this affects their folding. One property that is indicative of metals binding to a protein or peptide structure is how much light the molecules absorb. Some of the amino acid "building blocks" absorb a lot of light at a certain range of wavelengths. When a metal binds to these residues, their absorbance changes and can shift to different wavelengths because the environment around these specific amino acids has changed significantly. In order to monitor these changes, we perform titrations. In a titration one solution is added to another and the mixture is monitored in order to learn something about the system.

I plan to continue this research into the school year and we hope to publish our findings. This summer I also learned things far beyond the bounds of our project. These skills included research procedures, how to operate specific instruments, searching literature sources, clear communication of scientific work, critical thinking, and effective teamwork. These are skills that I will utilize for the entirety of my career in science. Learning these lessons from Professor Vander Griend who has valuable research experience and teaches college students every day is an invaluable experience. Through this research the project I am learning an amazing amount, and would like to thank the National Science Foundation for funding as well as Calvin College for providing facilities and organizing a quality undergraduate research experience. I am excited to share my research with others at upcoming poster sessions and presentations, including one at the American Chemical Society conference in Philadelphia.