

Title: Experimental & Computational Organic Photochemistry

Project Mentor: Professor Jason Gillmore, Chemistry Department

Project Description: The Gillmore research group in the Chemistry Department at Hope College studies organic (molecules made up mostly of carbon and hydrogen) photochemical (initiated by light) reactions (transformation of one chemical into another). Specifically we work to design new photooxidants. Photooxidants are molecules that use light energy to enable them to remove an electron from another molecule, to generate a positive molecule (called a cation radical) that is able of undergoing interesting reactions that can be important to a number of science and engineering fields. Specifically, we hope to develop photooxidants that can be turned on and off with a second wavelength of light, "gating" their ability to serve as photooxidants. These "gatable" photooxidants are based on photochromes. Photochromes are molecules, like those in Transitions (R) photogray lenses, that undergo a rearrangement on exposure to UV light that changes their color, and their electronic properties. Just like Transitions (R) lenses react with UV light to "gate" the property of "being sunglasses", we hope to make molecules that "gate" the property of "being photooxidants". We make these molecules from commercially available starting materials, and study their photochemical and electrochemical properties. To guide us in which molecules are best to make, we use computational chemistry (simulations done in a computer, instead of reactions done in a test-tube) to predict the properties of possible targets before we invest the time and money in making them.

Two different opportunities are available in the Gillmore Group through REACH this summer:

First, a REACH participant can work with me to support other students' synthetic efforts by making important intermediates on the way to the photochromes we study. To be qualified, a student must have had (or be presently taking) at least one year of high school chemistry.

Alternatively a teacher (either a chemistry teacher, or a teacher in another STEM field who has had at least one semester of a college organic chemistry course with lab), or a student-teacher pair (both meeting the above criteria), would also be welcome!

Second, a REACH participant can work with me on performing computational chemistry to aid us in our use of computations to predict electronic properties of molecules. To be qualified, a student or teacher (or student-teacher pair) must be very comfortable with using Microsoft Excel, and also be very organized. Having had some chemistry would be advantageous but not strictly necessary in this case.

Lastly, an appropriately qualified candidate could explore both options in the course of the summer.