Nueva

So far this year, the overall goal for Francine's senior Drug Design class is to simulate an authentic research experience by identifying analogs of oil of wintergreen active E. coli. Students design and synthesize small-molecule analogs using basic principles of medicinal chemistry, test compounds on E. coli, analyze data, and plan the next round of experiments. Students practice the concept of structure-activity relationship with compounds that have the potential to be antimicrobials.

"My motivation for taking this class was that I wanted to spend more time in a lab rather than a lecture environment. I also wanted to have a class that was very free form; where we would be presented with a large problem and then would have to figure out the different parts with little to no direct guidance, as if we were actually working at a biotech company." — Alex

Early Objectives

Many of the early activities and lessons were structured in order to bring students up to speed on organic chemistry. Francine provided instruction about how to characterize the molecules they would be making. She made sure to establish a foundational understanding of the concept of structure-activity relationship.

Marc and Zubin planned their syntheses and determined the quantities of reagents needed to synthesize their analogs.

Students used an ice bath to recrystallize one of their analogs.

Zubin prepared to filter his product using a vacuum filtration apparatus.

"The feeling of finally achieving success, learning along the way from failure, and synthesizing all the concepts we had learned in our own experiment was unparalleled. We are building several foundational skills and techniques and then moving to creating our own experiments." — Daniel

Instruction Followed by Practice

Francine introduced the fundamentals of spectroscopic methods, such as NMR, which are then used to characterize synthesized compounds.

Francine asked, "What do you know about light? And in chemistry, how does light interact with matter and molecules?"

Answers included, "There are photons." — "Light exhibits the characteristics of a wave and a particle." — "The energy of the photons can excite the molecules."

One student asked, "What is the application of spectroscopy in what we are doing?"

Francine answered, "You will be able to get information about the types of bonds or the types of atoms that are in your molecule. All of this information will help you determine the structure of your molecule."

"I have learned many new skills, including IR spectroscopy, NMR spectroscopy, SAR, and also how to test antibacterial substances on bacteria. I think this class has given me more perspective on real-world problem solving." — Alex

Constant Learning Opportunties

While waiting for the completion of experiments, ordering supplies, and navigating the uncertainties of scientific experimentation, students research and present individual lessons on drug processes such as absorption, distribution, metabolism, and excretion.

Students conducted mini-experiments aimed at mastering skills and concepts that will be crucial aspects of their larger group and individual research projects.

"I gained a new perspective on life from taking this class. I realized that I truly enjoyed biology even though it was outside the realm of my other interests. Being open to academic exploration and not trapping yourself into a hole built by either yourself, your parents, or your friends is an incredibly valuable life perspective as it gives you the key to unlock any door." — Daniel

A Collaborative Effort

Francine has organized the class in a way that fosters individual growth and learning while also providing daily opportunities for the groupwork and collaborative effort that are the hallmark of both scientific research teams and 21st century problem-solving skills.

Yoni and Marc planned the design of analogs, that led them to create an inventory of in-house chemicals that could be used as a starting point for their syntheses.

Yoni and Will proposed a synthetic analog of oil of wintergreen, monitoring for cLogP and pKa. They wanted to create a balanced list of analogs, exploring the result of changing one criterion at a time.

The class, a biotech team in training, worked together to determine the next steps toward procuring materials and determining which team members will test which analogs in the weeks to come.

VLP
VISIBLE LEARNING PROJECT