Finding the Next Wonder Drug
How has organic chemistry affected society?

Target Grade Levels: 10-12
Subject Areas: Chemistry
Time Required: 6-10 45 minute class periods

Lesson Objectives:
1. Plan and conduct an investigation and describe the data that will be collected and evidence to be derived from the data.
2. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
3. Identify and describe quantities of reactants and products of a chemical reaction in terms of atoms, moles and mass.
4. Use the mole to convert between the atomic and macroscopic scales.

Materials Required:
- Additional information, including Mannich reaction directions and materials can be found at the website http://carrollchemistry.weebly.com/research.html.

Lesson Summary

Organic compounds are some of the most important compounds in our lives. From plastics to medicines they play a role in our everyday lives. In this collaboration students will be using TAL (triacetic acid lactone), supplied by Iowa State University, and combining it with an aldehyde and an amine in what is commonly called a Mannich reaction. TAL is a versatile biorenewable molecule that has the potential to be a platform chemical to create a number of commercially valuable products.

Students will first research functional groups in organic chemistry, and decide what amine and aldehyde they will use in their reaction. An effort will be made to find reactants that would result in products that have never previously been produced.

Members from the ISU Department of Chemistry will provide technical support via email and Skype. Products will be sent to ISU for additional testing, including NMR results, which will then be returned to the students. Students will then analyze the NMR printouts to determine if the expected product was produced.

Partners
- George Kraus, PhD, Department of Chemistry, Iowa State University
- Kevin Baseman, Undergrad student, Department of Chemistry, Iowa State University
- Center for Biorenewable Chemicals, Iowa State University
Lesson Plans

Prior to start of this activity students will have completed an introduction to research by discussing chapters from the STEM: Student Research Handbook. Students will be taught the basics of research and creating a hypothesis for their experiment.

The initial introduction to organic chemistry and functional groups will be done in a flipped method. Students will watch videos and complete online quizzes. Students will also be able to ask questions to members of the ISU Chemistry department.

Once the first two parts listed above have been completed students will begin their initial research on what amine and aldehyde they will be using to create their product.

Once a decision has been made students will perform the experiment, creating the compound. Students will receive NMR results from ISU to analyze and will continue to experiment to work to increase the percent yield of the product by changing various aspects of the product.

Differentiation

Students will be working in large groups within their class. Each group will divide up responsibilities, such as research, running the experiment, or analyzing the outcomes. Responsibilities for the students will vary throughout the project.

Students who need additional training can re-watch any of the training videos. A reference sheet will also be available for organic compounds and functional groups.

There is a possibility of additional research and testing with agribusiness companies such as DuPont or Monsanto in the future.

Teaching Tips

Lab techniques and safety will be essential while working on this project. It will be important that students look up safety issues with the components involved.

Students will need an understanding of moles, basic stoichiometry, limiting reactants and percent yield to complete the calculations. Students will also need a basic understanding of organic chemistry and functional groups before beginning.