CHM 2321: Organic Chemistry 2 Laboratory – Dr. Timmons

Organic Chemistry 2 Laboratory is a sophomore-level course taken by all chemistry, chemical biology, environmental chemistry, and molecular and cell biology majors at LTU. Some biomedical engineering and psychology majors interested in health-related careers also complete this course. The curriculum aims to build upon the laboratory skills learned in the Organic Chemistry 1 Laboratory prerequisite course using a medicinal chemistry-focused CURE approach throughout the 15-week semester.

During the first week of the semester, students read a journal article focused on the synthesis of aspirin analogs with anticancer activity (Deb et al., 2011). They work in partners to first understand the mechanism of the target reaction used to prepare the analogs and then prepare a proposal to modify a reagent found within the published synthetic scheme in the quest to prepare a new aspirin analog for medicinal testing. During weeks 2-5 of the semester, students transcribe and execute the protocols for the synthesis and purification of aspirin into their laboratory notebooks. Aspirin products are fully characterized using thin-layer chromatography, infrared spectroscopy, melting point determination, and 1H NMR spectroscopy.

Once students have successfully synthesized aspirin, they extend the methodology described in the journal article to the synthesis of their own aspirin analog. During weeks 6-8 of the semester, students explore the effect of changing the reaction time by conducting reactions for both 30 minutes and 24 hours at room temperature. Weeks 9-11 are focused on exploring the effect of reagent stoichiometry at both 30 minutes and 24 hours. Based on the characterization of crude reaction products, the most successful reaction mixture is selected and purified during week 12 of the semester. Week 13 was dedicated to fully characterizing the purified aspirin analog, while week 14 was devoted to antibacterial testing using a disc diffusion assay. During the final week of the semester, each group presented the results and conclusions of their research project. Purified aspirin analogs are tested for antibacterial activity using additional bacterial strains by undergraduate student researchers following course completion; analogs are also tested for anticancer activity by a collaborator. This CURE model could be extended to many different syntheses, and is helpful for testing the effects of reaction variables, while affording students an authentic research experience in organic chemistry.