CHEM 7600-7600 (held with undergraduate course): Topics in Natural Products Chemistry / Synthetic Methods in Organic Chemistry

This course will familiarize students with some of the modern synthetic methods used in academia and industry for the formation of carbon-carbon bonds in organic compounds. An array of anionic, cationic, pericyclic, and organometallic methods will be introduced, namely condensations and alpha substitutions of carbonyl compounds, conjugate addition to α, β -unsaturated carbonyl compounds, Friedel-Crafts alkylation/acylation reactions and related processes, pericyclic reactions (cycloadditions, electrocyclizations, and sigmatropic rearrangements), and organometallic-promoted reactions, with a particular attention to cross-coupling, and C-H functionalization reactions. The factors governing the mechanistic, stereochemical and regiochemical course of these processes will be presented and discussed for each method. For pericyclic reactions, the emphasis will be on how appreciation of the frontier molecular orbitals allows prediction regarding the reactivity of the system, as well as relative reaction rates, regiochemistry and stereochemistry

The importance of carbon-carbon bond forming processes in academia and industry will be illustrated by examples selected from the contemporary literature. An emphasis on natural and non-natural product total synthesis and retrosynthetic analysis will allow to broaden some fundamentals of modern synthetic organic chemistry, namely stereoselective synthesis in cyclic and acyclic systems, protective group, and reduction/oxidation strategies. Synthetic planning will be discussed in details along with some classic and modern total syntheses of natural products.

The discussion of modern synthetic methods and applications will improve students? understanding of fundamental organic reactions and strategies and add further principle and transformations to their knowledge foundation. Furthermore, it will develop independent and critical thinking about Organic Chemistry, and most importantly, the students will gain and demonstrate an understanding of the relationship between the structure of an organic molecule and its reactivity. By the end of the course, the student should be able to design a valid synthetic route to novel chemical structures from precursor molecules.