

Tandem Reactions in the Synthesis of Heterocycles

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Professor Dieter's research group is actively engaged in developing synthetic methodology for the synthesis of oxygen and nitrogen heterocycles. Utilization of tandem reaction sequences involving allylic substitution, conjugate addition, and/or enolate alkylation reactions provide for a divergent synthetic strategy where key common intermediates can be quickly converted to large libraries of substituted heterocycles with control of regiochemistry and stereochemistry. These key intermediates include γ,δ -epoxy- α,β -enoates and amides, α,β -epoxy- γ,δ enoates and amides, *N*-Boc-4-pyridone, 2-pyrone, and 2-oxo-3,4-enoates. Enantiopure epoxides are available via asymmetric epoxidation, while enantiopure allylic alcohols are available from the 2-oxo-3,4-enoates via asymmetric reduction. Cuprate mediated conjugate additions to *N*-Boc-4-pyridone and 2-pyrones have been developed in Professor Dieter's laboratory, and catalytic asymmetric variations will be examined. Students will gain experience with organic synthesis, organometallic chemistry, and research involving the development of synthetic methods. This experience will expose the student to the art and skills of organic synthesis necessary for synthesizing reagents and substrates, optimizing yields, and extending and applying knowledge of organic reactions to laboratory problems.

The student(s) will work in collaboration with either a graduate student or postdoctoral fellow. Initial work will focus on large-scale syntheses of substrates employed in the cuprate methodology studies. Several methodology studies on the regio-, stereo-, and chemoselective functionalization of these key intermediates not involving cuprate chemistry (e.g., nucleophilic opening of epoxides) will also be examined. These latter studies will focus on green chemistry involving catalysis and solvent free reactions. This work will give the student an opportunity to quickly develop experience in synthetic work and product analysis on systems where a large amount of preliminary work has been done or on the methodology studies involving a single reaction of one of the key intermediates.