Chemical Strategies for Breaking and Making Carbon–Nitrogen Bonds

Abstract: C-N bond breaking: Amines are ubiquitous functional groups that are simple to prepare and functionalize. We show that tertiary amines can template reductive cyclization reactions, forming biaryl and bibenzyl carbon–carbon bonds. These cyclic amine products can undergo carbon–carbon bond-forming amine rearrangement and deaminative contraction reactions, providing efficient access to polycyclic (hetero)aromatic natural products. These strategies and our understanding of deaminative mechanisms will be presented. II. C-N bond making: Residue-selective methods for peptide modification and cyclization are useful for the development of therapeutic peptides with improved metabolic stability properties. The Roberts laboratory draws inspiration from cyclic peptide natural products that exhibit a host of promising biological properties. Motivated by the phenolic linkages found in both the arylomycin and vancomycin families of natural products, we have developed methods that leverage the in situ generation of 1,2,4-triazoline-3,5-dione moieties on native peptides to achieve tyrosine-selective cyclizations. In awe of lasso peptides, non-covalently interlocked and proteolytically-stable bioactive natural products, we are working to develop strategies for reversible isopeptide bond formation that could enable the sequence-independent chemical synthesis of lasso peptides. Detailed accounts of these methods and their applications will be presented.