### Synthesis of (±)-Cocaine

**Significance:** Cocaine is a tropane alkaloid isolated from the *erythroxylum coca* native to South America. It exhibits polypharmacology, including the inhibition of the dopamine transporter protein in the central nervous system. Reduced activity of this transmembrane protein leads to higher concentration of dopamine in the synaptic cleft which activates the brain’s reward system and results in feelings of satisfaction and euphoria. Cocaine is used medicinally as a numbing agent for surgical procedures in the mouth or nose; however, it is notorious for its use as a recreational drug worldwide. Cocaine features a bicyclic 8-azabicyclo[3.2.1]octane core with an axial ester substituent. In 1978, Tufariello and co-workers reported the first stereoselective synthesis of cocaine. Previous synthetic approaches were hampered by limited control over the relative stereochemistry of the ester moiety, resulting predominately in the thermodynamically favored equatorial epimer. Tufariello and co-workers addressed this challenge with a sequence of highly stereoselective nitrone-olefin cycloadditions, affording the natural product as a single stereoisomer.

**Comment:** The synthesis commenced with the dipolar cycloaddition of nitrone A and olefin B, affording isoxazolidine C in 96% yield. Subsequent oxidation and elimination furnished nitrone D as an inconsequential mixture of stereoisomers. Initial attempts to dehydrate D only resulted in the formation of polymeric materials. Thus, the nitrone moiety was masked with methyl acrylate via a dipolar cycloaddition. Mesylation and elimination of the secondary alcohol cleanly furnished α,β-unsaturated ester G. Heating G in toluene initiated a retro 1,3-dipolar cycloaddition releasing methyl acrylate and the resulting intermediate nitrone H underwent an intramolecular nitrone-olefin cycloaddition to afford tricycle I. Notably, isoxazolidine I was isolated as a single diastereomer in 40% overall yield from A. Methylation followed by reductive N-O cleavage gave access to the bicyclic tropane core of cocaine. Finally, benzoylation afforded the natural product.