The majority of methods for oxidation of hydrocarbon feedstocks require oxidants that are not environmentally friendly. Nitrous oxide (N$_2$O), a potent greenhouse gas, has received attention as a benign oxidant that yields only N$_2$ as a waste product. The major drawback to using N$_2$O as an oxidant is its high kinetic stability. Homogeneous catalysts reported to activate N$_2$O require high temperatures and pressures. The design of homogenous catalysts capable of N$_2$O activation at near-ambient conditions would represent a major step forward in the utilization of this potent and selective oxidant.

Our mechanistic studies imply that substrate inhibition is the major problem with the use of high-valent oxo complexes in the epoxidation of alkenes with N$_2$O and the regeneration of the Ru(VI)(por)(O)$_2$ is the rate-determining step in the reaction. We are designing catalysts to address these issues.