Oxidation is essential to power the cell and induce modifications that turn on cellular processes. Cellular oxidation is accomplished by reactive oxygen species (ROS) including superoxide, hydrogen peroxide, hydroxyl radical, and hypochlorous acid. A moderate increase in ROS can cause cell proliferation and differentiation, while excessive amounts of ROS can cause oxidative damage to lipids, proteins and DNA. Classic cases of too much ROS occurs upon too much sun exposure or during treatment with toxic drugs (chemotherapy). We are interested in developing compounds that are non-functional until ROS oxidation converts the molecules into an active state. This chemical biology research uses chemical mechanism-based approaches to optimize structures and impart a biological effect.