**Abstract**

Development of stereoselective [2+2] cycloadditions to access cyclobutanes is an important yet unsolved problem in chemical synthesis. In the absence of efficient methods for the synthesis of chiral cyclobutanes, their accessibility as biologically active synthetic targets and, more generally, their utility as synthons for chemical synthesis, are hindered. Described in this seminar will be development of reagent or catalyst controlled stereoselective [2+2] cycloadditions of alkenes with ketenes or electron-deficient allenes. These reactions lead to the formation of highly substituted chiral cyclobutanes that can be easily transformed into other interesting and important motifs. The mechanism of these reactions will also be discussed. Finally, the stereoselective syntheses of two complex natural products, Gracilioether F and Hippolachnin A, will be described.