

Summer Scholars Project Proposal

Title: The Synthesis of Pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}] non-4(5)-ene

Names of student and faculty mentor:

XXXX and Dr. XXXX

Department of Chemistry, Saint Joseph's University

Relevant Course Work Already Completed:

General Chemistry I and II, Organic Chemistry I and II

Summer Scholars Program, 2006

Junior Research, Spring 2007



Background:

The study of pyramidalized alkenes is important because of the highly strained double bond. In the ideal carbon-carbon double bond, the four substituents on the two carbons participating in the double bond lie in the same plane. However, in pyramidalized alkenes, strain is placed on the double bond through the syn-folding of the p-orbitals creating the pi bond, and the substituent groups are pulled out of the same plane. This pyramidalization places a high strain on the molecule, giving it a fleeting existence. Therefore, in the synthesis of the target molecule, a trapping agent will be used in order to isolate the molecule. Because of the strain in the carbon-carbon double bond, it is expected that the double bond will exhibit interesting properties, and it is the ultimate goal of this research project to study these properties.

Description of the Proposed Project:

The synthesis of a pyramidalized alkene is often accomplished via dehalogenation of vicinal dihalide, or diiodide, with an alkyllithium. Last summer, I synthesized large quantities of 4,5-diiodopentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]nonane- the direct precursor to the target pyramidalized alkene via treatment with an alkyllithium. However, previous students in the XXXX group have learned that the alkyllithiums used to generate the

pyramidalized alkene add to the strained double bond of the product. This addition reaction interferes with the group's efforts at further studying the pyramidalized double bond. For example, the XXXX group would like to study how pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene reacts with a variety of other reagents besides alkyllithiums. This can only be accomplished if new precursors and or synthetic methods are devised.

One alternative method of preparing the pyramidalized alkene would be to conduct the dehalogenation in the gas phase without the use of alkyllithiums. For example, sublimation of a sample of 4,5-diiodopentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]nonane into a stream of sodium or potassium vapor in a heated reaction zone should lead to dehalogenation to the target alkene. Condensation of the reaction products on a cold finger will allow us to study the reactions of pentacyclo[4.3.0.0^{2,4}.0^{3,8}.0^{5,7}]non-4-ene in the gas phase and in the absence of alkyllithiums. This method of dehalogenation has been used by Michl to prepare adamantene and by Borden and Wiberg to generate other pyramidalized alkenes.

Work already performed:

I am currently participating in undergraduate research with Dr. XXXX, which I have been working on during the summer of 2006 and the spring 2007 with junior research. I will carry on with this project during my senior year also. In the summer I spent over 400 hours in the lab and during the semester I spend 10 hours per week.