

A Quantum Mechanical Study of Tautomeric Triggers of Bergman Cyclization

Arijun Jaini and Carol A. Parish

Department of Chemistry, University of Richmond, VA

Enediynes have the potential to be effective anti-cancer pro-drugs. Enediynes cyclize via the well-studied endothermic Bergman Cyclization Reaction in order to form para-benzyne. Para-benzyne is a diradical that destroys cancerous cells by extracting hydrogen atoms from tumor cell DNA. Although this reaction can be initiated with light or heat, an efficient way to trigger Bergman Cyclization solely in the presence of a cancerous cell has yet to be found. Keto-enol tautomerization was studied as a possible trigger for Bergman Cyclization. The activation barriers and reaction energies of Bergman Cyclization of various tautomeric structures were calculated and compared using density functional theory with a 6-31G** basis set and a UB3LYP functional. The data displayed several key relationships between tautomerism, structure, and the energetics of the Bergman Cyclization Reaction. Overall, the results of this experiment highlight the potential for using tautomers to trigger Bergman Cyclization.