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Can cubane act as a benzene isostere?

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The synthesis of cubane (1), achieved in 1964 by Eaton, was previously predicted to be impossible, due to the immense strain of the molecular structure. Since then a large array of chemical transformations have been performed on the cubane ring system demonstrating the framework to be both a stable and robust building block. Considering the geometry of cubane (1), it is noteworthy that the distance across the cube (the body diagonal) is 2.72 Å, which is almost equivalent to the distance across the benzene ring i.e. 2.79 Å. This similarity is best viewed from one of the 8 apexes (see apex representation 2). Eaton observed that a number of other similarities exist between cubane (1) and benzene (3), for example the enhanced s orbital character of the C-H bond and the similar spatial relationships to ortho and para substituents (i.e. 1,2- and 1,4-disubstitution). However, whilst the physical, or spatial, appearance of cubane (1) is similar to benzene (3), spectroscopically, cubane (1) has both proton and carbon peaks much further up-field in the nuclear magnetic resonance (NMR) spectrum (1H ~4ppm 13C ~50ppm) suggesting obvious electronic differences. This lecture will disclose our recent efforts to explore, using known drugs, whether cubane can act as a benzene ring bioisostere in biologically active molecules.

Biography

Craig M. Williams obtained a B.Sc. (Hons) and Ph.D. in synthetic organic chemistry from Flinders University (South Australia) under the supervision of Prof. Rolf Prager. He held an Alexander von Humboldt post-doctorial appointment at the University of Göttingen in Germany (Prof. Armin de Meijere) and an Australian National University post-doctorial fellowship in Canberra (Prof. Lewis N. Mander) before being appointed as a Lecturer in Organic Chemistry at the University of Queensland in 2000. Currently he holds the position of Associate Professor supported by an Australian Research Council Future Fellowship. Williams has published over 90 scientific papers, patents, review articles and book chapters, and supervised 68 researchers to date.

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