Project title: Investigation of the Binding of Polyhedral Borane Anions to Biologically Significant Molecules
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Department: Chemistry and Biochemistry

Project summary:
The goal of the research project was to investigate the binding of polyhedral borane anions to biologically significant molecules in an effort to understand the retention, or lack of retention, of the boron-containing molecules within the tumor cell. A method has been developed, using a combination of the known DTNB protocol and Job's Method, to ascertain the stoichiometry of the reaction between the polyhedral borane anions and albumin. Results indicate that the [B20H17OH]4- anion does not covalently bind to the albumin whereas both the [B20H18]2- and the [B20H17SH]4- anion bind in a 1:1 stoichiometric ratio. The formation of the covalent bond has been monitored by the reaction of small biologically active molecules, reduced glutathione and cysteine, with polyhedral borane anions using one and two-dimensional NMR techniques. Although the NMR investigations are still underway, the location(s) of the binding should be ascertained once the investigations are complete. The nature of additional binding interactions, whether covalent or ionic in nature, is being investigated using the Biacore instrument in the department. The graduate student on the project, Mr. Barrett Matthews, has successfully bound the albumin to the plates and is currently in the process of developing the reaction conditions necessary for the polyhedral borane anions to bind to the albumin. Once the reaction with the polyhedral borane anion has been completed, a series of solutions with varying ionic strengths will be utilized to investigate the strength of the interaction. Purely ionic interactions should result in clearance of the polyhedral borane anion whereas a covalent interaction will result in continued binding. One undergraduate student, Katherine Schmalzer, also worked on the project.

Presentations:
D. A. Feakes, W. J. McVey, D. M. Motley, and K. D. Linse, "Investigation of the Interactions of Polyhedral Borane Anions with Albumins"