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Editorial

Introduction to the special issue on biothermodynamics

In its broadest sense, biothermodynamics encompasses all thermochemical and thermophysical property measurements and calculations on biochemical and biological systems. This makes for an *extremely* broad field given the large number of properties and the wide variety of biochemical systems, which range from relatively small molecules and simple reactions to macromolecules, cells, and living organisms. Certain methods have been of both historic and continuing importance. These include combustion calorimetry, heat-capacity calorimetry, solution calorimetry, electrochemistry, microcalorimetry, equilibrium measurements, isothermal titration calorimetry, density measurements, differential scanning calorimetry, and speed of sound measurements. While research in these areas has, in many cases, been made somewhat easier by the development of sophisticated, computer controlled instrumentation, there is still a great need for careful experimental design, implementation, and analysis – items that cannot yet be done by computers. In addition to measurement, there is a critical, continuing need for data collection, data evaluation, and the development of empirical estimation methods such as the Benson and other related approaches. The fact that the Gibbs free energy, enthalpy, and entropy are state functions enables the calculation of many thermodynamic properties for substances where direct measurements have not been performed. Thus, the possibility exists for the construction of comprehensive tables of thermodynamic properties of biochemical substances. Also, improvements in computational chemistry have made it possible to obtain accurate thermodynamic property values for small molecules in the gas phase. There is now a strong indication that the same can be done for small molecules in water. With further progress and the utilization of existing information and methods, biothermodynamics will continue to play an important role in applied areas such as bioprocess engineering, drug development, and in understanding the basis of several diseases. Given this perspective, this special issue of *The Journal of Chemical Thermodynamics* contains several studies that demonstrate the detail and care required for high-quality research in biothermodynamics.

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