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ANALYSIS OF BIOMOLECULES USING ULTRASENSITIVE MICROCALORIMETRY

Several methods have been described for studying protein interactions with either other macromolecules or with small ligands. These include optical fluorescence spectroscopy, plasmon resonance biosensors, microcalorimetry and mass spectroscopy. This seminar will focus on biological applications of microcalorimetry, where the thermodynamics, stoichiometry and binding constants of molecules can be determined. The two methods that will be covered are Isothermal Titration Calorimetry, or ITC, and Differential Scanning Calorimetry, or DSC.

Instrumentation for measuring exothermic or endothermic reactions of biomolecules has been developed over the last few years. This ultrasensitive instrumentation (ITC) can measure heats of binding of two interacting molecules and determine the binding constants, stoichiometry and thermodynamic parameters of enthalpy (ΔH) and entropy (ΔS), in a single experiment, that is performed in less than an hour. DSC instruments can observe the heat capacity (ΔC_p) of biomolecules, and determine the melting temperature, T_m , and other thermodynamic information.

Examples of biomolecular interactions and heat capacity changes will be discussed, with an emphasis on the instrumentation and software (Origin), to show the utility of microcalorimetric methods and their applicability in research, quality control and production laboratories.