Preface

A rigorous understanding of any biological system that undergoes some change requires quantification of its thermodynamic and kinetic properties. Combined with structural detail, these data can be assimilated to enable a picture of the mechanism of the change (for example, going from the free to bound state in a biomolecular interaction, or from the folded to the unfolded state of a biomolecule). Isothermal titration calorimetry (ITC) and differential scanning calorimetry (DSC) provide the thermodynamic data required for developing this understanding. The microcalorimetric instrumentation currently available can provide a highly accurate measurement of the heat (or molar change in enthalpy, ΔH) associated with the change in the system. This direct determination of one of the thermodynamic properties is unique to the calorimetric method. Using heat as the probe of the extent of change, the equilibrium constant K can be determined. After determination of ΔH and K a full characterization of the thermodynamic properties of the change in the system can be calculated. This provides a unique description of the event and allows for comparison with other similar data. This allows wholesale comparison of absolute affinities of interactions, the stability of biomolecules, changes in non-covalent bond formation etc. As a result calorimetry has become one of the primary tools in the arsenal of the biological scientist.

The inaugural Applications of Bio-Calorimetry (ABCI) meeting took place at St Anne's College, Oxford, UK, in September 1996. This meeting drew together a group of scientists from all over the world with a large variety of professional affiliations to discuss applications of the relatively recently commercially available microcalorimeters (both isothermal titration calorimeters and differential scanning calorimeters). The meeting provided a base for users of the techniques of different levels of experience to meet. It was clear at this first such meeting that it was necessary to provide for the dissemination of ideas, data and methodologies in this rapidly evolving area. As a result the impetus to establish meetings on a more regular basis was born. Since that meeting there have been additional meetings focusing on the application aspects of the microcalorimetric instrumentation (ABCII (1998), Halle, Germany; ABCIII (2002), Dublin, Ireland; ABCIV (to be held 2004),

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Budapest, Hungary) as well as meetings in which trends and developments in the field have been highlighted (Trends in Calorimetry (2001), Philadelphia, PA, USA; Trends in Calorimetry (2003), Boston, MA, USA). As a result of these meetings a forum for the microcalorimetry field has been established. The book *Biocalorimetry: Applications of Calorimetry in the Biological Sciences* (Eds. J. E. Ladbury and B. Z. Chowdhry) was published as a tribute to the development of the calorimetric field and to summarize the state of the art after the inaugural meeting. Since there are now several hundred microcalorimeters in various laboratories throughout the world, and the techniques have become almost routine in areas as diverse as drug discovery to whole cell interactions, we felt that it would be appropriate to update the field on current applications and trends. This book is based on a selection of issues and applications that were presented by contributors to the meetings in 2002 and 2003. As such we are indebted to all the participants at both of these meetings.

Clearly, this volume cannot hope to cover all possible applications for calorimetric instrumentation; however, we attempt to provide a flavour of the types of study possible and also an idea of how the data derived can be interpreted and utilized in a better understanding of biological science. This book pays particular attention to areas where calorimetry has made a significant impact in recent years and attempts to highlight the work of people we consider as making key contributions to the modern field.

The editors have decided, despite attempts to unify calorimetric data under IUPAC directives, to allow individual authors to present their work using the system adopted in their country. This means that some data are reported in different units. It should thus be noted that $1\,\text{cal} = 4.18\,\text{J}$.

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