Preface

The first formal ISBC conference arranged by *The International Society for Biological Calorimetry (ISBC)* was actually the 8th meeting in a series following the 7th ISMAB - International Symposia on Microcalorimetric Applications in Biology. It was decided to celebrate the 2nd anniversary of the Society's birth by organizing a meeting which not only would cover in a broad sense the different fields within biocalorimetry, but include contributions from interrelated areas. The intention was to stimulate an exchange of ideas in the field of energetics and regulation of bioprocesses alongside the presentation of recent biocalorimetric and biothermodynamic advances.

The conference was organized under the heading "*CALORIMETRY AND THERMODYNAMICS OF BIOLOGICAL PROCESSES*" with the following subsections:

* *Growth Energetics - Energy Budgets and Efficiency - Thermodynamic Concepts on Biological Energy Transformations.*
* *Biotechnology - Instrumentation and Data Analysis.*
* *Molecular Interactions - Binding Studies of Enzymes, Antibodies , other Biomolecules and Molecule-Membrane Interactions.*
* *Cellular and Organismic Energetics - Physiological , Ecological, Pharmacological and Toxicological Aspects.*

The contributions to this issue of *PAC* are ordered according to the stucture of the different subsections of the meeting. All the contributions are intended to stimulate interdisciplinary discussions in the continuously growing field of experimental and theoretical bioenergetics.

During the opening ceremony, a Medal lecture was given in the name of the famous French scientist Lavoisier who, over 200 years ago, first demonstrated the physicochemical basis of physiology by showing that respiration by animals is a simple combustion of carbonaceous food. With Laplace, he used an ice calorimeter to quantify the heat dissipated per unit CO_2. Following this tradition, the lecturer reviewed developments in the calorimetry of animal cells *in vitro* and paid particular attention to the enthalpy balance method for assessing the relative contributions of aerobic and anaerobic pathways to cellular metabolism.

Cellular metabolism is not just a simple combustion, and the production of heat is rarely the main significance of the oxidation of reduced organic substrates. Metabolism is characterized by two different functions, namely the provision of molecular compounds and the supply of energy for performing various kinds of work. In the absence of work, heat dissipation is quantitatively related to the enthalpy change of metabolic reactions. The dissipated heat, however, is not a general measure of the potential for the metabolic machinery to perform work, which stems from the Gibbs energy change of the metabolic reactions. Inefficiency and dissipation of Gibbs energy contribute to, but are not generally identical with the calorimetric measure of heat dissipation.

The measurement of heat dissipation is a fundamental component in the construction of energy budgets of biological systems. In this respect, biological calorimetry is firmly established in the domain of classical thermodynamics. It is equally important however, to recognize that metabolic heat flow is related to irreversible processes in open biological systems. From this perspective, biological calorimetry should be discussed within the framework of nonequilibrium thermodynamics. As such biological calorimetry should become a pivot for uniting concepts of classical and nonequilibrium thermodynamics. This important link is at present entirely missing in the pertinent textbooks. The different approaches used in the description and analyses of biological energy transformations have also led to diverse nomenclature and *IUPAC* recommendations are not available for establishing a concise terminology across the borders between classical and nonequilibrium thermodynamics. This problem was addressed in a round table discussion during the conference and is dealt with in a contribution to this volume, discussing concepts and terminology in the interdisciplinary field of classical and nonequilibrium thermodynamics.

The multidisiplinary contributions to the present volume on "*Calorimetry and Thermodynamics of Biological Processes*" should provide an incentive for important further developments on the consistent description of the structure and dynamics of biological systems.

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Göteborg, May 1993 *Lena Gustafsson*, *Richard Kemp* and *Erich Gnaiger*