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Preface – Introduction

Magnesium in the New Millenium

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Divalent magnesium is the fourth most abundant cellular metal ion, the second most abundant in the hydrosphere, and the sixth most abundant in the lithosphere. In spite of its reputation as a dour species, unworthy of experimental interest, the papers in this volume attest to the fact that the chemistry and biological chemistry of this alkaline earth ion is unique among biological cations, both exciting and relevant to fundamentally important problems in modern biology. Moreover, considerable advances toward the understanding of many of these problems have been made. The biological chemistry of magnesium is once more experiencing a resurgence of interest fueled both by increasing interest in the chemistry of magnesium as a cofactor for enzyme and RNA nuclease activity and by the molecular insights opening up in metal ion transport and homeostatic control mechanisms. In turn this has led to new efforts in technique development to monitor and study this inconspicuous ion.

In this volume we sought to compile a selection of articles that provide an overview of current research directions. From a basic summary of biologically relevant magnesium solution chemistry by Maguire and Cowan, the catalytic and structural chemistry of magnesium with proteins and with nucleic acids are reviewed by Cowan. Determination of free Mg^{2+} concentration within cells, particularly with regard to electrophysiological measurements is covered by Günzel while compartmentation and buffering of Mg^{2+} within cells is discussed by Grubbs. Homeostatic control mechanisms and transport pathways are brought up to date, in microbial systems by Kehres and Maguire, in plants by Shaul and in mammalian systems by Romani and Maguire. The basic control of magnesium homeostasis within mammalian systems is controlled almost exclusively by the kidney which is reviewed by Romero. Finally, advances in understanding magnesium homeostasis and in mammalian genetics have made it clear that a number of genetic disorders involve selective loss of magnesium from the body. Exciting progress in mapping and identification of possible genes involved in such magnesium related disorders is described in thought-provoking terms by Meij and colleagues.

It will be clear that the field involves a multitude of disciplines and experimental approaches. Hopefully the juxtaposition of these fields will promote cross-fertilization of subdisciplines, in both ideas and methodologies. If this review issue prompts even the slightest movement in that direction then it will have been well worth the effort in bringing it to fruition.