Chapter 2 - Intracellular magnesium homeostasis

from Section 1 - Magnesium in Normal Brain

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Book contents

Summary

Abstract

Magnesium (Mg^{2+}) is the fourth most abundant cation in the whole body and the second most abundant cation within the cell. Numerous cellular functions and enzymes, including ion channels, metabolic cycles, and signaling pathways are regulated by Mg^{2+}. Our understanding of how cells regulate Mg^{2+} homeostasis and transport has registered significant progress in recent time. Yet, several aspects of Mg^{2+} homeostasis within cellular organelles, and the nature of the Mg^{2+} extrusion mechanisms at the cell membrane are still undefined. The present work attempts to provide a comprehensive and updated review of the mechanisms regulating cellular Mg^{2+} homeostasis in eukaryotic cells under physiological conditions and the modifications these mechanisms undergo in various human and animal pathologies.

Introduction

Mammalian cells contain high concentrations of total and free magnesium ion (Mg^{2+}). These concentrations are essential to regulate numerous cellular functions and enzymes, including ion channels, metabolic cycles, and signaling pathways. While the increasing number of observations supports a key regulatory role for Mg^{2+} within the cell, our understanding of how

Mg^{2+} homeostasis is regulated at the cellular and subcellular level remains sketchy and incomplete. There are both conceptual and methodological reasons for this limitation. The relative slow turnover of Mg^{2+} across the plasma membrane or other biological membranes in the absence of metabolic and hormonal stimuli, the absolute abundance of total and free Mg^{2+} within the cell, and the limited occurrence of significant changes in free [Mg^{2+}] have all contributed for a long time to the assumption that cellular Mg^{2+} concentration does not change significantly, and is consistently at a level adequate for its role as a co-factor for various cellular enzymes and proteins.

Type

Chapter

Information

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