Methods in ENZYMOLOGY

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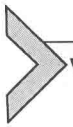
Hydrogen Sulfide in Redox Biology Part A

Edited by

Enrique Cadenas and Lester Packer



VOLUME FIVE HUNDRED AND FIFTY FOUR

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Hydrogen Sulfide in Redox Biology Part A

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METHODS IN ENZYMOLOGY

Hydrogen Sulfide in Redox Biology Part A

METHODS IN ENZYMOLOGY

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PREFACE

Hydrogen sulfide is viewed as the third gasotransmmitter, gaseous signaling molecule, together with nitric oxide and carbon monoxide. The cellular sources of hydrogen sulfide involve enzymes of the trans-sulfuration pathway CBS (cystathionine β-synthase), CSE (cystathioine γ-lyase), and 3MST (3-mercaptopyruvate sulfur-transferase). Storages of hydrogen sulfide occur in mitochondria (iron–sulfur clusters of enzymes) and cytosol (bound sulfane sulfur). Of course, the release of hydrogen sulfide from these storages is tightly regulated by several pathophysiological processes.

In addition to the myriad of effects arising from hydrogen sulfide as a signaling molecule, it also protects against oxidative stress and glutamate toxicity, inhibits the release of insulin, preserves mitochondrial function, and is a modulator of inflammatory responses. These pleiotropic effects of hydrogen sulfide have been the subject of numerous investigations in the last years and are largely accounted for by as its role as a gaseous signaling molecule. Hydrogen sulfide may act alone or in conjunction with other gasotransmitters and, in doing so, it regulates a number of physiological processes and is involved in some stages of the pathogenesis of several diseases.

These volumes of *Methods in Enzymology* were designed as a compendium for hydrogen sulfide detection methods, the pharmacological activity of hydrogen sulfide donors, the redox biochemistry of hydrogen sulfide and its metabolism in mammalian tissues, the mechanisms inherent in hydrogen sulfide cell signaling and transcriptional pathways, and cell signaling in specific systems, such as cardiovascular and nervous system as well as its function in inflammatory responses. Three chapters are also devoted to hydrogen sulfide in plants and a newcomer, molecular hydrogen, its function as a novel antioxidant.

In bringing these volumes of *Methods in Enzymology* to fruition, credit must be given to the experts in various aspects of hydrogen sulfide research, whose thorough and innovative work is the basis of these *Methods in Enzymology* volumes. We hope that these volumes will be of help to both new and established investigators in the field.

ENRIQUE CADENAS
LESTER PACKER

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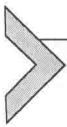

SECTION I

Hydrogen Sulfide Detection Methods

CHAPTER ONE

Mechanistic Chemical Perspective of Hydrogen Sulfide Signaling

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Contents

Abstract

Hydrogen sulfide is now a well-appreciated master regulator in a diverse array of physiological processes. However, as a consequence of the rapid growth of the area, sulfide biology suffers from an increasing number of controversial observations and interpretations. A better understanding of the underlying molecular pathways of sulfide's actions is key to reconcile controversial issues, which calls for rigorous chemical/biochemical investigations.

Protein sulfhydration and coordination/redox chemical interactions of sulfide with heme proteins are the two most extensively studied pathways in sulfide biochemistry. These pathways are important mediators of protein functions, generate bioactive

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