

CONTENTS

<i>Contributors</i>	<i>xi</i>
<i>Preface</i>	<i>xv</i>

Section I

Hydrogen Sulfide Detection Methods

1. Mechanistic Chemical Perspective of Hydrogen Sulfide Signaling	3
Péter Nagy	
1. Introduction	5
2. Bioavailability of Sulfide—The Signal	5
3. Inorganic Polysulfides	9
4. Sulfide Signaling Via Protein Sulphydrylation	13
5. Sulfide Signaling via Sulfide–Hemeprotein Interactions	18
6. Conclusions	23
Acknowledgments	24
References	24
2. Measurement of H₂S <i>In Vivo</i> and <i>In Vitro</i> by the Monobromobimane Method	31
Xinggui Shen, Gopi K. Kolluru, Shuai Yuan, and Christopher G. Kevil	
1. Introduction	32
2. Experimental Methods	35
3. Summary	43
Acknowledgment	43
References	43
3. Hydrogen Sulfide Detection Using Nucleophilic Substitution–Cyclization-Based Fluorescent Probes	47
Bo Peng and Ming Xian	
1. Introduction	48
2. Design and Synthesis of the Probes	49
3. Chemistry and Properties of the Probes	50
4. Applications of the Probes in H ₂ S Imaging in Cell-Based Experiments	55
5. Conclusions	60
Acknowledgments	61
References	61

4. Azide-Based Fluorescent Probes: Imaging Hydrogen Sulfide in Living Systems	63
Vivian S. Lin, Alexander R. Lippert, and Christopher J. Chang	
1. Introduction	64
2. Fluorescent Azide-Based H ₂ S Probes	66
3. <i>In Vitro</i> Characterization of Probes	69
4. Detection of H ₂ S in Live Cells Using Fluorescent Probes	72
5. Conclusions	77
Acknowledgments	78
References	78
5. Chemiluminescent Detection of Enzymatically Produced H₂S	81
T. Spencer Bailey and Michael D. Pluth	
1. Introduction	82
2. Chemiluminescent Probes for the Determination of Sulfide	85
3. Examples of Routine Probe Usage	89
4. Detection of Enzymatically Produced H ₂ S	92
5. Conclusions	95
Acknowledgments	96
References	96
6. Quantification of Hydrogen Sulfide Concentration Using Methylene Blue and 5,5'-Dithiobis(2-Nitrobenzoic Acid) Methods in Plants	101
Zhong-Guang Li	
1. Theory	102
2. Equipment	103
3. Materials	104
4. Protocol 1	105
5. Step 1: Quantification of H ₂ S Concentration Using MB Method	106
6. Protocol 2	107
7. Step 1: Quantification of H ₂ S concentration using 5,5'-dithiobis (2-nitrobenzoicacid) method	108
Acknowledgment	110
References	110
7. H₂S Analysis in Biological Samples Using Gas Chromatography with Sulfur Chemiluminescence Detection	111
Victor Vitvitsky and Ruma Banerjee	
1. Introduction	112
2. Principle of the GC-Coupled Sulfur Chemiluminescence Method	112

3. Protocol for GC-Coupled Sulfur Chemiluminescence Detection of H ₂ S	114
4. Analysis of Biological Samples	116
5. Additional Technical Details	122
Acknowledgment	122
References	122

Section II

Hydrogen Sulfide Donors and Their Pharmacological Activity

8. Use of Phosphorodithioate-Based Compounds as Hydrogen Sulfide Donors	127
Chung-Min Park and Ming Xian	
1. Introduction	128
2. Synthesis of Phosphorodithioate-Based Donors	129
3. Measurements of H ₂ S Generation from the Donors Using Fluorescence Methods	133
4. H ₂ S Release from the Donors in Cultured Cells	135
5. Donor's Activity Against H ₂ O ₂ -Induced Cell Damage	138
6. Summary	140
Acknowledgments	140
References	140
9. GYY4137, a Novel Water-Soluble, H₂S-Releasing Molecule	143
Peter Rose, Brian W. Dymock, and Philip K. Moore	
1. Introduction	144
2. Why Slow Releasing H ₂ S Donors?	146
3. The Development and Characterization of GYY4137	147
4. Facile Synthesis and Chemical Characterization of GYY4137	148
5. Biological Effects of GYY4137: An Overview and Potential Role in Disease?	149
6. The Effect of GYY4137 in Nonmammalian Systems	159
7. Conclusion	161
References	162
10. Neuroprotective Effects of Hydrogen Sulfide in Parkinson's Disease Animal Models: Methods and Protocols	169
Xue Xue and Jin-Song Bian	
1. Introduction	170
2. PD Animal Models	170
3. H ₂ S and Its Releasing Compound Treatment	176
4. Behavior Tests	177

5. Immunohistochemical Assay	178
6. Brain H ₂ S Activity Tests	180
7. Prospects of H ₂ S Therapy on PD and Conclusions	182
Acknowledgment	184
References	184

Section III

Hydrogen Sulfide Metabolism in Mammalian Tissues

11. Assay Methods for H₂S Biogenesis and Catabolism Enzymes	189
---	------------

Ruma Banerjee, Taurai Chiku, Omer Kabil, Marouane Libiad,
Nicole Motl, and Pramod K. Yadav

1. Introduction	189
2. Assays for H ₂ S Biogenesis	191
3. Assays for Enzymes Involved in H ₂ S Catabolism	195
Acknowledgments	199
References	199

12. Oxidation of H₂S in Mammalian Cells and Mitochondria	201
--	------------

Abbas Abou-Hamdan, Hala Guedouari-Bounihi, Véronique Lenoir,
Mireille Andriamihaja, François Blachier, and Frédéric Bouillaud

1. Introduction	202
2. Sulfide in the Context of Mitochondrial Bioenergetics	203
3. Practical Issues	208
4. Sulfide Oxidation Experiments	214
5. Treatment, Expression, and Interpretation of Results	222
6. Originality and Interest with Regard to Bioenergetics	225
Acknowledgments	227
References	227

13. Redox Regulation of Mammalian 3-Mercaptopyruvate Sulfurtransferase	229
---	------------

Noriyuki Nagahara, Masatoshi Nagano, Takaaki Ito, and Hidenori Suzuki

1. Introduction	230
2. Redox Regulation of Cysteine Metabolism and MST	235
3. Regulation of MST Activity via Redox-Sensing Molecular Switches	235
4. MST Knockout Mouse	245
5. Other Investigation	251
References	252

14. Role of Human Sulfide:Quinone Oxidoreductase in H₂S Metabolism	255
Michael R. Jackson, Scott L. Melideo, and Marilyn Schuman Jorns	
1. Introduction	256
2. Expression of Human SQOR in <i>E. coli</i>	257
3. Purification of Recombinant Human SQOR	257
4. Catalytic Assays	259
5. Spectral Properties of Recombinant Human SQOR	260
6. Survey of Potential Sulfane Sulfur Acceptors for Human SQOR	261
7. Spectral Course of SQOR Catalytic Assays with Sulfite, Cyanide, or Sulfide as Sulfane Sulfur Acceptor	263
8. Steady-State Kinetic Parameters for H ₂ S Oxidation by SQOR with Sulfite, Cyanide, or Sulfide as Sulfane Sulfur Acceptor	265
9. Role of Human SQOR in H ₂ S Metabolism	267
Acknowledgment	268
References	269
15. H₂S Regulation of Nitric Oxide Metabolism	271
Gopi K. Kolluru, Shuai Yuan, Xinggui Shen, and Christopher G. Kevil	
1. Introduction	272
2. Techniques Determining Enzymatic Activity and Expression of NOS	275
3. Detection of NO and Its Metabolites	278
4. Novel Adducts from H ₂ S–NO Interactions	287
5. Conclusion	292
Acknowledgments	293
References	293
<i>Author Index</i>	299
<i>Subject Index</i>	317