Contents

PREFACE TO THE SERIES iii

PREFACE TO VOLUME 24 v

CONTRIBUTORS xiii

CONTENTS OF OTHER VOLUMES xv

HANDBOOK ON TOXICITY OF INORGANIC COMPOUNDS xxix

Chapter 1

BIOINORGANIC CHEMISTRY OF ALUMINUM 1

R. Bruce Martin

1. Introduction 2
2. The Metal 4
3. Occurrences 6
4. Ionic Radii 8
5. Exchange 10
6. Al^{3+} in Aqueous Solutions 11
7. Inorganic Phosphate 17
8. Stability Constants 20
9. Cooperativity in Al^{3+} Hydrolysis Reactions 26
10. Acetate and Lactate 28
11. Citrate 29
12. Fluoride 31
13. Conditional Stability Constants 35
14. Desferrioxamine and Other Ligands 42
15. Salicylate 43
16. Transferrin 43
17. Catecholamines 46
18. Nucleotides and Organic Phosphates 47
19. Conclusion: Al^{3+} Antagonizes Mg^{2+} more than Ca^{2+} in Biology 50

References 52

Chapter 2

ALUMINUM IN THE ENVIRONMENT 59

Charles T. Driscoll and William D. Schecher

1. Introduction 60
2. Distribution of Al in Natural Waters 61
3. Chemistry and Transformations of Al in the Environment 74
4. Ecological Effects of Elevated Concentrations of Al in Surface Waters 104
5. Conclusions 111
Abbreviations 112
Appendices 113
References 116

Chapter 3

THE PHYSIOLOGY OF ALUMINUM PHYTOTOXICITY 123

Gregory J. Taylor

1. Introduction 123
2. Expression of Aluminum Phytotoxicity 125
3. Uptake, Transport, and Distribution of Aluminum 128
4. Mechanisms of Aluminum Phytotoxicity 132
5. Concluding Remarks 150
Abbreviations 151
References 152

Chapter 4

THE PHYSIOLOGY OF ALUMINUM TOLERANCE 165

Gregory J. Taylor

1. Introduction 165
2. Exclusion Mechanisms 167
3. Internal Tolerance Mechanisms 184
4. Concluding Remarks 191
Abbreviations 192
References 193

Chapter 5

ALUMINUM IN THE DIET AND MINERAL METABOLISM 199

Janet L. Greger

1. Oral Exposure to Aluminum 199
2. Interactions of Aluminum with Other Minerals 204
3. Dietary Factors Affecting Aluminum Retention 209
4. Conclusions 211
References 211

Chapter 6

ALUMINUM INTOXICATION: HISTORY OF ITS CLINICAL RECOGNITION AND MANAGEMENT 217

David N. S. Kerr and Michael K. Ward

1. Early Anxieties 218
2. Recognition of Aluminum-Induced Disease 226
3. Management of Aluminum Intoxication in Renal Failure 244
4. Conclusions 250
Abbreviations 251
References 251

Chapter 7

ALUMINUM AND ALZHEIMER'S DISEASE: METHODOLOGIC APPROACHES 259

Daniel P. Perl

1. Introduction 259
2. Alzheimer's Disease 260
3. Guam Amyotrophic Lateral Sclerosis (ALS)/Parkinsonism Dementia 272
4. Discussion of Aluminum Accumulation in Neurodegenerative Diseases with Respect to Pathogenesis 278
References 279

Chapter 8

MECHANISMS OF ALUMINUM NEUROTOXICITY—RELEVANCE TO HUMAN DISEASE 285

Theo P. A. Kruck and Donald R. McLachlan

1. Introduction 286
2. Al Uptake and Transport Mechanism 291
3. Neurotoxic Effects 295
4. Disease and Foci of Accumulation 301
5. Aluminum in Human Disease 303
6. Conclusion and Speculation 305
Abbreviations 307
References 308

Chapter 9

ALUMINUM TOXICITY AND CHRONIC RENAL FAILURE 315

Michael R. Wills and John Savory

1. Introduction 315
2. Sources of Aluminum 317
3. Gastrointestinal Absorption of Aluminum 319
4. Distribution of Aluminum in Serum 323
5. Aluminum Toxicity 325
6. Conclusion 337
References 338

Chapter 10

ANALYSIS OF ALUMINUM IN BIOLOGICAL MATERIALS 347

John Savory and Michael R. Wills

1. Introduction 348
2. Specimen Type 349
3. Sample Collection 350
4. Transport and Storage 353
5. Sources of Contamination in Analysis 354
6. Analytical Methods 355

7. Standard Reference Materials and Quality Assurance 367
8. Summary 368
Abbreviations 368
References 369

AUTHOR INDEX 373

SUBJECT INDEX 407