

CONTENTS

CONTENTS OF HOMEOSTASIS AND TOXICOLOGY OF ESSENTIAL METALS, VOLUME 31A	ix
CONTRIBUTORS	xv
PREFACE	xvii

1. Silver	
<i>Chris M. Wood</i>	
1. Introduction	2
2. Sources of Silver and Occurrence in Natural Waters	3
3. Speciation in Freshwater	5
4. Speciation in Seawater	6
5. Environmental Situations of Concern	8
6. Acute and Chronic Ambient Water Quality Criteria in Freshwater and Seawater	8
7. Waterborne Silver Toxicity in Freshwater	10
8. Waterborne Silver Toxicity in Saltwater	29
9. Essentiality or Non-Essentiality of Silver	35
10. Potential for Bioconcentration and/or Biomagnification of Silver	35
11. Characterization of Uptake Routes	36
12. Characterization of Internal Handling	45
13. Characterization of Excretion Routes	52
14. Behavioral Effects of Silver	53
15. Molecular Characterization of Silver Transporters, Storage Proteins, and Chaperones	53
16. Genomic and Proteomic Studies	54
17. Interactions with Other Metals	54
18. Knowledge Gaps and Future Directions	54
2. Aluminum	
<i>Rod W. Wilson</i>	
1. Introduction	68
2. Chemical Speciation in Freshwater and Seawater	69
3. Sources (Natural and Anthropogenic) of Aluminum and Economic Importance	74

4.	Environmental Situations of Concern	75
5.	Ambient Water Quality Criteria in Freshwater	77
6.	Mechanisms of Toxicity	79
7.	Non-Essentiality of Aluminum	94
8.	Potential for Bioconcentration and/or Biomagnification of Aluminum	95
9.	Characterization of Uptake Routes	95
10.	Characterization of Internal Handling	97
11.	Characterization of Excretion Routes	98
12.	Behavioral Effects of Aluminum	98
13.	Molecular Characterization of Aluminum Transporters, Storage Proteins, and Chaperones	103
14.	Genomic and Proteomic Studies	103
15.	Interactions with Other Metals	104
16.	Knowledge Gaps and Future Directions	104
3.	Cadmium <i>James C. McGeer, Som Niyogi and D. Scott Smith</i>	
1.	Introduction	126
2.	Chemical Speciation in Freshwater and Seawater	127
3.	Sources (Natural and Anthropogenic) of Cadmium and Economic Importance	131
4.	A Survey of Acute and Chronic Ambient Water Quality Criteria	135
5.	Mechanisms of Toxicity	138
6.	Essentiality of Cadmium	148
7.	Potential for Bioconcentration and Biomagnification of Cadmium	148
8.	Characterization of Uptake Routes	152
9.	Characterization of Internal Handling	158
10.	Characterization of Excretion Routes	161
11.	Behavioral Effects of Cadmium	162
12.	Molecular Characterization of Cadmium Transporters and Storage Proteins	164
13.	Genomic and Proteomic Studies	166
14.	Interactions with Other Metals	167
15.	Knowledge Gaps and Future Directions	168
4.	Lead <i>Edward M. Mager</i>	
1.	Chemical Speciation in Freshwater and Seawater	186
2.	Sources (Natural and Anthropogenic) of Lead and Economic Importance	191
3.	Environmental Situations of Concern	194
4.	A Survey of Acute and Chronic Ambient Water Quality Criteria in Various Jurisdictions in Freshwater and Seawater	196
5.	Mechanisms of Toxicity	198
6.	Non-Essentiality of Lead	204
7.	Potential for Bioconcentration and Biomagnification of Lead	204
8.	Characterization of Uptake Routes	207

9. Characterization of Internal Handling	212
10. Characterization of Excretion Routes	218
11. Behavioral Effects of Lead	220
12. Molecular Characterization of Lead Transporters, Storage Proteins, and Chaperones	221
13. Genomic Studies	222
14. Interactions with Other Metals	223
15. Knowledge Gaps and Future Directions	225
5. Mercury	
<i>Karen Kidd and Katharina Batchelar</i>	
1. Introduction	238
2. Chemical Speciation in Water	239
3. Sources of Mercury and Economic Importance	240
4. Environmental Situations of Concern	241
5. A Survey of Acute and Chronic Ambient Water Quality Criteria for Freshwater and Seawater	242
6. Mechanisms of Toxicity	242
7. Essentiality or Non-Essentiality of Mercury	261
8. Bioconcentration and Biomagnification of Mercury	261
9. Characterization of Uptake Routes	262
10. Characterization of Internal Handling	270
11. Characterization of Excretion Routes	277
12. Behavioral Effects of Mercury	282
13. Molecular Characterization of Mercury Transporters, Storage Proteins, and Chaperones	283
14. Genomic and Proteomic Studies	284
15. Knowledge Gaps and Future Directions	284
6. Arsenic	
<i>Dennis O. McIntyre and Tyler K. Linton</i>	
1. Chemical Speciation in Freshwater and Saltwater	298
2. Sources (Natural and Anthropogenic) of Arsenic and Economic Importance	303
3. Environmental Situations of Concern	304
4. A Survey of Acute and Chronic Ambient Water Quality Criteria in Various Jurisdictions in Freshwater and Saltwater	304
5. Mechanisms of Toxicity	306
6. Essentiality or Non-Essentiality of Arsenic	321
7. Potential for Bioaccumulation and/or Biomagnification (or Biodiminution) of Arsenic	321
8. Characterization of Uptake, Internal Handling, and Excretion	326
9. Detoxification and Mechanisms for Tolerance	334
10. Behavioral Effects of Arsenic	335
11. Molecular Characterization of Arsenic Transporters, Storage Proteins, and Chaperones	336
12. Interactions with Other Metals	336
13. Knowledge Gaps and Future Directions	337

7.	Strontium	
	<i>M. Jasim Chowdhury and Ronny Blust</i>	
1.	Chemical Speciation in Freshwater and Seawater	352
2.	Sources and Economic Importance of Strontium	354
3.	Environmental Situations of Concern	356
4.	Acute and Chronic Ambient Water Quality Criteria in Various Jurisdictions in Freshwater and Seawater	357
5.	Mechanisms of Toxicity	358
6.	Non-Essentiality of Strontium	362
7.	Potential for Bioconcentration and Biomagnification of Strontium	362
8.	Characterization of Uptake Routes	366
9.	Characterization of Internal Handling	374
10.	Characterization of Excretion Routes	379
11.	Behavioral Effects of Strontium	380
12.	Molecular Characterization of Strontium Transporters, Storage Proteins, and Chaperones	380
13.	Genomic and Proteomic Studies	381
14.	Interactions with Other Metals	382
15.	Knowledge Gaps and Future Directions	382
8.	Uranium	
	<i>Richard R. Goulet, Claude Fortin and Douglas J. Spry</i>	
1.	Chemical Speciation in Freshwater and Seawater	392
2.	Sources of Uranium and its Economic Importance	398
3.	Environmental Situations of Concern	399
4.	A Survey of Acute and Chronic Ambient Water Quality Criteria in Various Jurisdictions in Freshwater and Seawater	401
5.	Mechanisms of Toxicity	403
6.	Water Chemistry Influences on Bioavailability and Toxicity	408
7.	Non-Essentiality of Uranium	412
8.	Potential for Bioaccumulation of Uranium	412
9.	Characterization of Uptake Routes	413
10.	Characterization of Internal Handling	416
11.	Characterization of Excretion Routes	417
12.	Behavioral Effects of Uranium	417
13.	Genomic and Proteomic Studies	418
14.	Interactions with Other Metals	418
15.	Knowledge Gaps and Future Directions	418
9.	Modeling the Physiology and Toxicology of Metals	
	<i>Paul Paquin, Aaron Redman, Adam Ryan and Robert Santore</i>	
1.	Introduction	430
2.	Model Frameworks for Evaluating Metal Accumulation	432
3.	Models Relating Metal Accumulation to Effects	447
4.	Regulatory Applications	467
5.	Future Model Development Needs	470
	INDEX	485
	OTHER VOLUMES IN THE FISH PHYSIOLOGY SERIES	505
	COLOR PLATE SECTION	