

Contents

Acknowledgements	ix
Foreword	xi
1 Introduction	1
1.1 Amphibian Characteristics and Monophyly	1
1.2 Amphibian Orders	3
1.3 Environmental Biophysics of Gas, Water and Ion Exchange: Aquatic-Terrestrial Transition	10
1.4 Biophysics of Thermal Balance	20
1.5 Habitats and Morphotypes	23
1.6 Phylogeny of the Amphibia	59
1.7 Phylogeny and Environmental Physiology	62
2 General Physiological Principles	69
2.1 Water and Ion Budgets	69
2.2 Temperature and Thermal Energy Budgets	95
2.3 Chemical Energy Budgets	99
2.4 Respiratory Oxygen and Carbon Dioxide Exchange	110
2.5 Erythrocytes Oxygen and Carbon Dioxide Exchange	129
2.6 Cardiovascular Oxygen and Carbon Dioxide Exchange	138
2.7 Tissue Oxygen and Carbon Dioxide Exchange	155
2.8 Blood Volume Control	157
3 Specialized Physiological Characteristics of Amphibia	165
3.1 Skin and Urinary Bladder as Models for Water and Ion Exchange	165
3.2 Cutaneous Water Exchange: Skin Uptake and Evaporation	184
3.3 Dehydration Tolerance	203
3.4 Temperature	215
3.5 Metabolism	236
3.6 Nitrogen Excretion	255

3.7 Kidneys and Nephrostomes	263
3.8 Developmental Plasticity	275
4 Physiological Adaptations to Extreme Environments	281
4.1 Salt and Osmotic Sensitivity	281
4.2 Arid Environments	287
4.3 Hibernation Adaptations	306
4.4 Metabolic Depression	333
5 Approaches and Techniques	343
5.1 The Comparative Method Approach	343
5.2 Techniques	350
6 Conclusions and Future Directions	375
6.1 What We Know Now	375
6.2 Phylogenetic Breadth	376
6.3 Population Declines and Environmental Physiology	378
6.4 Genomics, Proteomics and Metabolomics	379
6.5 Levels of Organization	380
Bibliography	383
Index	461