

Contents

Preface	v
List of Contributors	vii
1. Introduction: Biophysical Ecology: DAVID M. GATES	1

Part I. Analytical Models of Plants

Introduction: DAVID M. GATES	31
2. Photosynthetic Model: PAUL W. LOMMEN, SANDRA K. SMITH, CONRAD S. YOCUM and DAVID M. GATES	33
3. Mesophyll Resistances: CONRAD S. YOCUM and PAUL W. LOMMEN	45
4. Model of Leaf Photosynthesis and Respiration: ANTHONY E. HALL and OLLE BJÖRKMAN	55
5. Optimal Leaf Form: S. ELWYNN TAYLOR	73
6. Aspects of Predicting Gross Photosynthesis (Net Photosynthesis Plus Light and Dark Respiration) For an Energy-Metabolic Balance in the Plant: RANDALL S. ALBERTE, JOHN D. HESKETH, and DONALD N. BAKER	87

Part II. Extreme Climate and Plant Productivity

Introduction: DAVID M. GATES	101
7. Gas-Exchange Strategies in Desert Plants: HYRUM B. JOHNSON	105
8. Photosynthesis of Desert Plants as Influenced by Internal and External Factors: OTTO L. LANGE, ERNST-D. SCHULZE, LUDGER KAPPEN, UWE BUSCHBOM, and MICHAEL EVENARI	121
9. Field Measurements of Carbon Dioxide Exchange in Some Woody Perennials: BOYD R. STRAIN	145

10. Environmental Stresses and Inherent Limitations Affecting CO₂ Exchange in Evergreen Sclerophylls in Mediterranean Climates: E. LLOYD DUNN 159

Part III. Water Transport and Environmental Control of Diffusion

- Introduction: DAVID M. GATES 185
11. Regulation of Water Transport in the Soil-Plant-Atmosphere Continuum: ANTHONY E. HALL and MERRILL R. KAUFMANN 187
12. Environmental Influence on Total Water Consumption by Whole Plants: JAMES W. O'LEARY 203
13. Light Intensity and Leaf Temperature as Determining Factors in Diffusion Resistance: JOHN D. TENHUNEN and DAVID M. GATES 213
14. Photosynthesis in Developing Plant Canopies: RONALD G. ALDERFER 227
15. Energy Exchange and Plant Survival on Disturbed Lands: RICHARD LEE, WILLIAM G. HUTSON, and STEPHEN C. HILL 239

Part IV. Theoretical Models of Animals

- Introduction: DAVID M. GATES 251
16. Heat-Transfer Analysis of Animals: Some Implications for Field Ecology, Physiology and Evolution: GEORGE S. BAKKEN and DAVID M. GATES 255
17. Body Size, Insulation, and Optimum Body Temperatures of Homeotherms: JAMES R. SPOTILA and DAVID M. GATES 291
18. Use of Climate Diagrams to Describe Microhabitats Occupied by Belding Ground Squirrels and to Predict Rates of Change of Body Temperature: SYLVIA STAEHLE MORHARDT 303
19. Water and Energy Relations of Terrestrial Amphibians: Insights from Mechanistic Modeling: C. RICHARD TRACY 325
20. Environmental Constraints on Some Predator-Prey Interactions: WARREN P. PORTER, JOHN W. MITCHELL, WILLIAM A. BECKMAN, and C. RICHARD TRACY 347

21. Experimental and Fossil Evidence for the Evolution of Tetrapod Bioenergetics: ROBERT T. BAKKER . . . 365

Part V. Observation of Animal Body Temperatures

- Introduction: DAVID M. GATES. 403
22. Rates of Post-flight Cooling in Sphinx Moths: GEORGE E. BARTHOLOMEW and ROBERT J. EPTING . . . 405
23. Energetics of Occupied Hummingbird Nests: EDWARD E. SOUTHWICK and DAVID M. GATES . . . 417
24. Factors in the Energy Budget of Mountain Hummingbirds: WILLIAM A. CALDER III 431
25. On the Physiological Significance of the Preferred Body Temperatures of Reptiles: WILLIAM R. DAWSON 443
26. Preferred Body Temperatures of Small Birds and Rodents: Behavioral and Physiological Determinations of Variable Set Points: J. EMIL MORHARDT . . . 475

Part VI. Energy-Transfer Studies of Animals

- Introduction: DAVID M. GATES. 493
27. Energy Balance in the Resting and Exercising Rabbit: MATTHEW J. KLUGER 497
28. Thermal Exchange, Physiology, and Behavior of White-Tailed Deer: AARON N. MOEN and NADINE K. JACOBSEN 509
29. Convective Energy Transfer in Fur: L. BERKLEY DAVIS, JR., and RICHARD C. BIRKEBAK 525
30. Conduction and Radiation in Artificial Fur: DALE J. SKULDY, WILLIAM A. BECKMAN, JOHN W. MITCHELL, and WARREN P. PORTER 549
31. Microclimate and Energy Flow in the Marine Rocky Intertidal: SAMUEL E. JOHNSON II 559
32. Conclusions: The Challenge of the Future for Biophysical Ecology: DAVID M. GATES 589