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Entities -- Part III. Emergent Complexity -- Chapter 7. The Coral Holobiont -- Chapter 8. Complexity of the Coral Microbiome Assembly -- Part IV. Ecosystem-Scale Microbiology -- Chapter 9. Microbial Processes and Nutrient Uptake in the Coral Holobiont and Reef Ecosystems -- Chapter 10. Ecosystem Microbiology of Coral Reefs -- Chapter 11. Coral Reef Microbialization and Viralization Shape Ecosystem Health, Stability, and Resilience -- Part V. Host-Microbial Interactions as Culprit and Remedy -- Chapter 12. When Microbial Interactions Go Wrong: Coral Bleaching, Disease, and Dysbiosis -- Chapter 13. Microbial-based Therapies to Restore and Rehabilitate Disrupted Coral Health -- Chapter 14. Considerations, Ethics and Risk Assessment for the Development and Application of Microbial-based Therapies; Introducing a Rights-based Framework for Reef Communities -- Part VI. Microbiome Biotechnology and Future Outlook -- Chapter 15. Beyond Restoration: Coral Microbiome Biotechnology -- Chapter 16. Building Coral Reef Resilience through Assisted Restoration.

Sommario/riassunto

Microorganisms, the catalysts of all biogeochemical cycles on Earth, are the origin and essence of life—an invisible yet powerful force sustaining all living organisms. The health of both individual organisms and ecosystems critically depends on functional microbiomes that drive essential processes such as nutrient cycling, pathogen control, detoxification, and resilience. However, like their macroorganism counterparts, these beneficial microbes are vulnerable to environmental changes, and their decline often accelerates ecosystem degradation. Anthropogenic impacts have profoundly altered and often degraded most ecosystems and their microbiomes, with coral reefs being no exception. Stony corals, the foundation of these vibrant ecosystems, are among the most threatened marine organisms. Shifts in coral microbiomes toward dysbiotic (harmful) assemblages are increasingly recognized as both a cause and consequence of coral mortality. In response, active intervention strategies are being developed to restore and rehabilitate degraded microbiomes, aiming to restore and re-establish the beneficial microbial communities that sustain the health of both their host organisms and ecosystems. The success of these approaches depends on our understanding of the distribution, ecological roles, and interactions between corals and their associated microbiomes, as well as how environmental factors influence them and their potential to either amplify or mitigate anthropogenic impacts. This book delves into these topics, examining how they shape coral holobiont assemblages and offer pathways for active intervention. In addition, this book provides a practical, tailored, and adaptable roadmap for stakeholders to integrate the latest insights into a broader One Health framework and ecosystem perspective.