

CONTENTS

Acknowledgments vii

Introduction 1

PART I: FIVE DIFFERENT BIOLUMINESCENCE SYSTEMS 7

1. A Marine Crustacean 9

Bioluminescent fishes as plagiarists and thieves

2. Jellyfish and Green Fluorescent Protein 21

A soft coral, a calcium-sensitive protein, and fish with related bioluminescence systems

3. Fireflies and Other Beetles 31

Luciferase-dependent bioluminescence color and rhythmic displays

4. Dinoflagellates and Krill 45

The sparkling clocks of the oceans and bioluminescent shrimp

5. Bacteria 61

Bacterial “communication,” symbioses, and milky seas

PART II: DIVERSITY, FUNCTIONS, AND EVOLUTIONARY ORIGINS OF BIOLUMINESCENCE 77

6. Short Accounts of Other Luminous Organisms 79

Having different and not well-characterized biochemistries

7. Bioluminescence in the Oceans 105

Anglerfish, dragonfish, and a Lake Baikal parenthesis

8. The Many Functions of Bioluminescence 119

Defense, offense, communication, and propagation

9. The Origins and Evolution of Bioluminescence 125

How did luciferases originate?

PART III: BOOKENDS 133

10. Applications 135

Tools for biology, medicine, and public health

11. How Does Life Make Light? 147

“Excited molecules” and bioluminescence

Glossary	163
Further Reading	169
Illustration Credits	177
Index	181