

CONTENTS

Contributors, ix

Acknowledgments, xv

List of Abbreviations, xix

INTRODUCTION TO OXIDATIVE STRESS IN AQUATIC ECOSYSTEMS, 1

Doris Abele, José Pablo Vázquez-Medina, and Tania Zenteno-Savín

PART I. CLIMATE REGIONS AND SPECIAL HABITATS, 7

1. OXIDATIVE STRESS IN TROPICAL MARINE ECOSYSTEMS, 9

Michael P. Lesser

2. OXIDATIVE CHALLENGES IN POLAR SEAS, 20

Francesco Regoli, Maura Benedetti, Andreas Krell, and Doris Abele

3. OXIDATIVE STRESS IN ESTUARINE AND INTERTIDAL ENVIRONMENTS (TEMPERATE AND TROPICAL), 41

Carolina A. Freire, Alexis F. Welker, Janet M. Storey, Kenneth B. Storey, and Marcelo Hermes-Lima

4. OXIDATIVE STRESS TOLERANCE STRATEGIES OF INTERTIDAL MACROALGAE, 58

José Aguilera and Ralf Rautenberger

5. OXIDATIVE STRESS IN AQUATIC PRIMARY PRODUCERS AS A DRIVING FORCE FOR ECOSYSTEM RESPONSES TO LARGE-SCALE ENVIRONMENTAL CHANGES, 72

Pauline Snoeijs, Peter Sylvander, and Norbert Häubner

6. MIGRATING TO THE OXYGEN MINIMUM LAYER: EUPHAUSIIDS, 89

Nelly Tremblay, Tania Zenteno-Savín, Jaime Gómez-Gutiérrez, and Alfonso N. Maeda-Martínez

7. OXIDATIVE STRESS IN SULFIDIC HABITATS, 99

Joanna Joyner-Matos and David Julian

8. IRON IN COASTAL MARINE ECOSYSTEMS: ROLE IN OXIDATIVE STRESS, 115

Paula Mariela González, Dorothee Wilhelms-Dick, Doris Abele, and Susana Puntarulo

9. OXIDATIVE STRESS IN CORAL-PHOTOBIONT COMMUNITIES, 127

Marco A. Liñán-Cabello, Michael P. Lesser, Laura A. Flores-Ramírez, Tania Zenteno-Savín, and Héctor Reyes-Bonilla

PART II. AQUATIC RESPIRATION AND OXYGEN SENSING, 139

10. PRINCIPLES OF OXYGEN UPTAKE AND TISSUE OXYGENATION IN WATER-BREATHING ANIMALS, 141

J. C. Massabuau and Doris Abele

11. OXIDATIVE STRESS IN SHARKS AND RAYS, 157

Roberto I. López-Cruz, Aletr Latiz Dafre, and Danilo Wilhelm Filho

12. OXYGEN SENSING: THE ROLE OF REACTIVE OXYGEN SPECIES, 165

Mikko Nikinmaa, Max Gassmann, and Anna Bogdanova

13. ISCHEMIA/REPERFUSION IN DIVING BIRDS AND MAMMALS: HOW THEY AVOID OXIDATIVE DAMAGE, 178

Tania Zenteno-Savín, José Pablo Vázquez-Medina, Nadiezha Cantú-Medellín, Paul J. Pongonis, and Robert Elsner

PART III. MARINE ANIMAL MODELS FOR AGING, DEVELOPMENT, AND DISEASE, 191

14. AGING IN MARINE ANIMALS, 193

Eva E. R. Philipp, Julia Strahl, and Alexey A. Sukhotin

15. OXIDATIVE STRESS AND ANTIOXIDANT SYSTEMS IN CRUSTACEAN LIFE CYCLES, 208

Maria Luisa Fanjul-Moles and María E. Gonsebatt

16. TRANSFER OF FREE RADICALS BETWEEN PROTEINS AND MEMBRANE LIPIDS: IMPLICATIONS FOR AQUATIC BIOLOGY, 224

Brenda Valderrama, Gustavo Rodríguez-Alonso, and Rebecca Pogni

17. IMMUNE DEFENSE OF MARINE INVERTEBRATES: THE ROLE OF REACTIVE OXYGEN AND NITROGEN SPECIES, 236

Eva E. R. Philipp, Simone Lipinski, Jonathan Rast, and Philip Rosenstiel

18. ATTACK AND DEFENSE: REACTIVE OXYGEN AND NITROGEN SPECIES IN TELEOST FISH IMMUNE RESPONSE AND THE COEVOLVED EVASION OF MICROBES AND PARASITES, 247

Katja Broeg and Dieter Steinhagen

PART IV. MARINE ANIMAL STRESS RESPONSE AND BIOMONITORING, 261

19. STRESS EFFECTS ON METABOLISM AND ENERGY BUDGETS IN MOLLUSKS, 263

Inna M. Sokolova, Alexey A. Sukhotin, and Gisela Lammig

20. STARVATION, ENERGETICS, AND ANTIOXIDANT DEFENSES, 281

Amalia E. Morales, Amalia Pérez-Jiménez, Miriam Furné, and Helga Guderley

21. ENVIRONMENTALLY INDUCED OXIDATIVE STRESS IN FISH, 295

Volodymyr I. Lushchak

22. CHEMICAL POLLUTANTS AND THE MECHANISMS OF REACTIVE OXYGEN SPECIES GENERATION IN AQUATIC ORGANISMS, 308

Francesco Regoli

23. BIOMARKERS OF OXIDATIVE STRESS: BENEFITS AND DRAWBACKS FOR THEIR APPLICATION IN BIOMONITORING OF AQUATIC ENVIRONMENTS, 317

José María Monserrat, Rafaela Elias Letts, Josencler L. Ribas Ferreira, Juliana Ventura-Lima, Lilian L. Amado, Alessandra M. Rocha, Stefania Gorbi, Raffaella Bocchetti, Maura Benedetti, and Francesco Regoli

PART V. METHODS OF OXIDATIVE STRESS DETECTION, 327

24. DETECTION OF REACTIVE METABOLITES OF OXYGEN AND NITROGEN, 329

Matthew B. Grisham

25. ROLE OF SINGLET MOLECULAR OXYGEN IN THE OXIDATIVE DAMAGE TO BIOMOLECULES, 344

Graziella Eliza Ronsein, Glauca Regina Martinez, Eduardo Alves de Almeida, Sayuri Miyamoto, Marisa Helena Gennari de Medeiros, and Paolo Di Mascio

26. TOTAL OXYRADICAL SCAVENGING CAPACITY ASSAY, 359

Stefania Gorbi and Francesco Regoli

27. SPECTROPHOTOMETRIC ASSAYS OF ANTIOXIDANTS, 367

Francesco Regoli, Raffaella Bocchetti, and Danilo Wilhelm Filho

28. EVALUATION OF GLUTATHIONE STATUS IN AQUATIC ORGANISMS, 381

Eduardo Alves de Almeida, Danilo Grunig Humberto Silva, Afonso Celso Dias Balny, Florêncio Porto Freitas, Flávia Daniela Motta, Omar Francisco Gomes, Marisa Helena Gennari de Medeiros, and Paolo Di Mascio

29. MEASUREMENT OF ANTIOXIDANT PIGMENTS AND VITAMINS IN PHYTOPLANKTON, ZOOPLANKTON, AND FISH, 389

Pauline Snoeijs, Norbert Häubner, Peter Sylvaender, and Xiang-Ping Nie

30. CAROTENOID ANALYSIS AND IDENTIFICATION IN MARINE ANIMALS, 402

Eduardo Alves de Almeida, Glaucia Regina Martinez, and Paolo Di Mascio

31. LINOLEIC ACID OXIDATION PRODUCTS AS BIOMARKERS OF OXIDATIVE STRESS IN VIVO, 412

Etsuo Niki and Yasukazu Yoshida

32. THE CLASSIC METHODS TO MEASURE OXIDATIVE DAMAGE: LIPID PEROXIDES, THIOBARBITURIC-ACID REACTIVE SUBSTANCES, AND PROTEIN CARBONYLS, 420

Volodymyr I. Lushchak, Halyna M. Semchyshyn, and Oleh V. Lushchak

33. PROTEIN CARBONYL MEASUREMENT BY ENZYME LINKED IMMUNOSORBENT ASSAY, 432

Betul Catalgol, Stefanie Grimm, and Tilman Grune

34. EVALUATION OF MALONDIALDEHYDE LEVELS, 440

Sayuri Miyamoto, Eduardo Alves de Almeida, Lillian Nogueira, Marisa Helena Gennari de Medeiros, and Paolo Di Mascio

35. THE USE OF ELECTRON PARAMAGNETIC RESONANCE IN STUDIES OF OXIDATIVE DAMAGE TO LIPIDS IN AQUATIC SYSTEMS, 448

Gabriela Malanga and Susana Puntarulo

36. THE ASCORBYL RADICAL/ASCORBATE RATIO AS AN INDEX OF OXIDATIVE STRESS IN AQUATIC ORGANISMS, 458

Gabriela Malanga, María Belén Aguiar, and Susana Puntarulo

37. EVALUATION OF OXIDATIVE DNA DAMAGE IN AQUATIC ANIMALS: COMET ASSAYS AND 8-OXO-7,8-DIHYDRO-2'-DEOXYGUANOSINE LEVELS, 465

José Pedro Friedmann Angeli, Glaucia Regina Martinez, Flávia Daniela Motta, Eduardo Alves de Almeida, Marisa Helena Gennari de Medeiros, and Paolo Di Mascio

38. EVALUATION OF DNA ADDUCTS FORMED BY LIPID PEROXIDATION BY-PRODUCTS, 475

Camila Corrêa Machado Garcia, José Pedro Friedmann Angeli, Eduardo Alves de Almeida, Marisa Helena Gennari de Medeiros, and Paolo Di Mascio

39. METHODS TO QUANTIFY LYSOSOMAL MEMBRANE STABILITY AND THE ACCUMULATION OF LIPOFUSCIN, 487

Katja Broeg and Stefania Gorbi

Index, 507

Color plate section appears between pages 250 and 251