

Contents

Disease Resistance, 815
M.E. Alvarez and C. Loesh

Free Radicals in Cell Death, 839
O.J. Aronson

Air Pollution and Free Radical Production, 859
A.R. Welleben and P.A.M. Welleben

Index, 877

Preface, ix

The Oxygen Paradox: Biochemistry of Active Oxygen, 1
N. Hauptmann and E. Cadenas

Mediation of Signal Transduction by Oxidants, 21
M.S. Wolin and K.M. Mohazzab-H.

Oxidative Damage to DNA and Its Repair, 49
S.S. Wallace

Transcriptional Regulators of Oxidative Stress Responses, 91
D.J. Jamieson and G. Storz

Redox Regulation by the HIV-1 Tat Transcriptional Factor, 117
S.C. Flores and J.M. McCord

Reactive Oxygen and Apoptosis, 139
D. Fuchs, G. Baier-Bitterlich, I. Wede, and H. Wachter

Oxidative Stress in Mitochondria, 169
C. Richter and M. Schweizer

Oxidants, Antioxidants, and Aging, 201
K.B. Beckman and B.N. Ames

Oxidative Stress, Gene Expression, and the Aging Process, 247
K.Z. Guyton, M. Gorospe, and N.J. Holbrook

Bacterial Catalases, 273
P.C. Loewen

Biochemistry, Molecular Biology, and Cell Biology of Yeast and Fungal Catalases, 309

H. Ruis and F. Koller

Catalases in Plants: Gene Structure, Properties, Regulation, and Expression, 343

J.G. Scandalios, L. Guan, and A.N. Polidoros

Structure of Catalases, 407

J. Bravo, I. Fita, P. Gouet, H.M. Jouve, W. Melik-Adamyan, and G.N. Murshudov

Superoxide Dismutases in Bacteria and Pathogen Protists, 447

D. Touati

Superoxide Dismutase: Studies in the Yeast

Saccharomyces cerevisiae, 495

E.B. Gralla

Molecular Genetics of Superoxide Dismutases in Plants, 527

J.G. Scandalios

Superoxide Dismutase and Oxidative Stress in Amyotrophic Lateral Sclerosis, 569

R.H. Brown, Jr.

Oxygen Metabolism and Electron Transport in Photosynthesis, 587

C.H. Foyer

Defense against Photooxidative Damage in Plants, 623

A. Polle

Glutathione Reductase: Regulation and Role in Oxidative Stress, 667

P.M. Mullineaux and G.P. Creissen

The Role of Ascorbate Peroxidase and Monodehydroascorbate Reductase in H_2O_2 Scavenging in Plants, 715

K. Asada

The NADPH Oxidase of Leukocytes: The Respiratory Burst Oxidase, 737

B.M. Babior, J. El Benna, S.J. Chanock, and R.M. Smith

The Oxidative Burst: Roles in Signal Transduction and Plant Stress, 785

N. Doke

Oxidative Burst-mediated Defense Responses in Plant Disease Resistance, 815
M.E. Alvarez and C. Lamb

Free Radicals: Dietary Advantages and Disadvantages, 841
O.I. Aruoma

Air Pollution and Free Radical Protection Responses of Plants, 861
A.R. Wellburn and F.A.M. Wellburn

Index, 877

*is the real marvel of DNA...
 Without this special attribute,
 we would still be anaerobic bacteria,
 and there would be no mice.*

Lewis Thomas, *The Mindful Universe*

In November 1990, one of the prestigious Banbury Conferences at Cold Spring Harbor was devoted to the molecular biology of free radical scavenging systems. That conference and a subsequent book published in 1991 brought together a great deal of information concerning the existing knowledge from the two relatively new areas of free radical biology and molecular biology. The seeds for the present book were sown over the last few years as numerous individuals suggested a more current and more encompassing volume to bring together the ever-increasing and significant developments in this field. With the continued encouragement of John Inglis, Director of the Cold Spring Harbor Laboratory Press, I undertook the task to arrange and develop this work. The invited chapters clearly reflect the state of the field and future research directions in this very important and exciting area of molecular biology.

Although the importance of reactive oxygen species in living biological systems has been recognized for some time, their significance to biological, medical, and agricultural problems has become more apparent with the advent and application of the methods of molecular genetics. The molecular dissection of oxidative-stress and antioxidant defense systems is an exciting area in biological research. These reactions play a central role in biology. Oxidative metabolism supplies energy for most organisms, and oxidative reactions are employed as responses to stress and as defense mechanisms by all aerobic cells.

ROS generated during normal metabolic activity or in the aqueous environment of environmental insults can cause significant damage. These molecules readily react with various macromolecules, including nucleic acids, in biochemical and physiological lesions, often leading to cellular dysfunction.