Free Radical Research, March 2007; 41(3): 376–377

Book reviews

Free-Radical-Induced DNA Damage and its Repair; A Chemical Perspective

C. Von Sonntag, 2006
Springer-Verlag, Berlin and Heidelberg
ISBN: 10-3-540-26120-6

I am a frequent user of Professor von Sonntag's previous book *The Chemical Basis of Radiation Biology*, published in 1987 but still useful today. I therefore looked forward to this sequel with interest, and have not been disappointed. Proper understanding of free radicals and antioxidants requires a good basis of chemistry, often sadly lacking in the biomedical literature. This book should be required reading for all in the field.

After a brief introduction (Chapter 1), Chapter 2 discusses ionizing radiation, ultrasound, thermolysis, photolysis, photosensitization, and metal ion-dependent reactions as sources of free radicals, as well as the chemistry of peroxynitrite. I especially enjoyed the discussion of the Udenfriend reaction. Chapter 3 is an excellent review of $OH^{\cdot}$, especially the discussion of the reliability of using "probes" such as salicylate to detect $OH^{\cdot}$ in biological systems. Chapter 4 follows with an equally good account of $H^{\cdot}$ and e^{-}_{aq}. Chapter 5 reviews inorganic radicals such as $Br_2^{\cdot -}$, $Cl_2^{\cdot -}$, $CO_3^{\cdot -}$, $NO_2^{\cdot}$, $SO_4^{\cdot -}$, $PO_4^{\cdot 2-}$ and $SeO_3^{\cdot -}$. Carbon-centred radicals are discussed in Chapter 6, and alkoxyl, phenoxyl, peroxyl, nitrogen- and sulphur-centred radicals in Chapters 7 and 8.

Polymer radicals, including DNA radicals, are dealt with thoroughly in Chapter 9, the latter being followed up in detail in Chapter 10, which has an excellent and detailed account of the reactions of DNA bases and deoxyribose with $OH^{\cdot}$ and other radicals under aerobic and anoxic conditions. Reactions with singlet O_2 are also considered. Chapters 11 and 12 expand on these areas, the latter having nice accounts of the "O_2 effect", clustered lesions, DNA-protein crosslinks, and the chemistry of bleomycin-induced DNA damage. Charge transfer along DNA is also considered in detail. The last chapter of the book is devoted to methods for studying DNA damage; this is perhaps the weakest part, since the intense controversies as to the validity of the data generated by these various methods are scarcely considered.

A few errors exist. Thus glutamate is not the substrate of NOS enzymes (p. 17), formation of allantoin from urate is not an index of $OH^{\cdot}$ formation *in vivo* (p. 66) and $O_2^{\cdot -}$ is not the cause of ischaemia (p. 178). There are also multiple typographical errors in the text. However, none of these minor flaws detracts significantly from what is an excellent text that I recommend highly.

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Oxidative Stress, Disease and Cancer

Editor: Kevash K. Singh
World Scientific Publishing
ISBN 1-86094-609-7

General

The book, "Oxidative stress, Disease and Cancer" edited by K. K. Singh is timely since it is ever more evident that oxidative stress plays a major role in a host of important diseases including cancer and aging. The organization of the book is logical since it begins by

ISSN 1071-5762 print/ISSN 1029-2470 online © 2007 Informa UK Ltd.
DOI: 10.1080/10715760601179439

introducing the basic mechanisms of reactive oxygen species (ROS) production followed by the cellular and biomolecular targets of ROS, and the cellular responses to ROS. This is followed by a major section dedicated to the role of oxidative stress in cancer and other diseases including neurodegenerative disease, respiratory disease, mitochondrial disease. Other, more specialised areas such as the role of oxidative stress in insulin resistance, ulcerative colitis, autoimmune diseases and human reproduction are also discussed. A final short section deals with disease prevention and treatment and includes accounts of the use of photocarcinogenesis, coenzyme Q_{10} therapy, plant derived antioxidants and nanoscale antioxidants.

Specific

The first chapter, "Yin and Yang of Mitochondrial ROS," by Starkov and Wallace discusses mechanisms of mitochondrial ROS production and is highly readable, informative and comprehensive. Certain other chapters are not so well organized or particularly well written. This is evident with the chapter by Tilak and Devasagayam entitled "Oxidative damage to mitochondria" which includes a lengthy introduction which is not particularly relevant to the focus of the chapter. The organization of this chapter is also, at times, difficult to follow. For example, there are a numerous sections dealing with ischemia and reperfusion and oxidative stress. In other parts of this chapter important information seems to be omitted. For example, the discussion of the mitochondrial permeability transition (MPT) under the section heading "The MPT and apoptosis", fails to mention the common model invoking the idea that mitochondrial swelling leads to mechanical rupture of the organelle and is commonly considered to be the MPT mechanism of cytochrome c release. On the whole, I found this section to be long, at times tedious, and not particularly informative. This material is followed by a chapter titled "Oxidative stress and antioxidant defenses in plants" and although this deals in detail with the important role of small molecules such as glutathione and ascorbate in plant defense, I would have expected a more in depth account of oxidant signal transduction mechanisms in plants which are known to be essential plant defense strategies. For example, there is no mention of the peroxide-induced hypersensitivity reaction against plant pathogens and systemic acquired resistance (SAR) both of which are crucial oxidant-dependent plant defense strategies. The following chapters on "Lipid and Protein mediated Oxidative damage to DNA" by Evans and Cooke and the "Cellular responses to ROS in the yeast *Saccharomyces cerevisiae*" by Dawes are comprehensive, readable and highly informative. For example, Dawes gives an interesting account of the general response to ROS in *S. cerevisiae* followed by adaptation mechanisms, specific gene expression and the transcriptional response. The chapter by Muller and Van Remmen, "Does oxidative stress determine life-span?" deals with *Drosophila* and *Caenorhabditis elegans* and also studies performed in mice however, the brief and interesting review fails to mention the importance of the forkhead proteins Daf-2 and Daf-16 as regulators of longevity of *C. elegans* aging. I would have considered this important since it is thought that mitochondrial electron transport and the *Daf-2* gene network controls longevity by regulating the MnSOD-associated antioxidant defense system. Also, there was no mention of the relationship between p66shc and mammalian forkhead homolog FKHRL1, which regulates intracellular oxidant levels in mice. Furthermore, the review did not mention the role and relationship between mitochondrial oxidative stress, caloric restriction (CR) and aging which might have been expected since CR is considered by many as a key determinant of aging. There are a number of chapters dedicated to different aspects of oxidative stress and cancer and so this subject is treated quite comprehensively. The later half of the book deals with more arcane aspects of oxidative stress in specific disease situations such as ataxia telangiectasia, ulcerative colitis and cancer cachexia and are, therefore, highly specialized and of limited general interest. Other chapters, while not my research specialty, are highly relevant to the field of oxidative stress in relation to disease by discussing novel ideas on antioxidant targeting in specific disease situation. See for example, "Nanoscale Antioxidant Therapeutics" by Dziubla and colleagues.

Summary

Overall, this is a useful general text on "Oxidative stress, in Disease and Cancer," and should be used selectively and, possibly, with supplementation from latest reviews on specific subjects. I would recommend the work to new and old investigators alike who are working in the field of oxidative stress and oxidative stress-related disease.

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