
BOOK REVIEW

Free Radicals and Inflammation

(Progress in Inflammation Research Series, 1999, 260 p.)

The role of free radicals in the regulation of various cell functions still attracts much attention. Many publications highlight the role of reactive oxygen- and nitrogen-containing species in inflammation, apoptosis, and regulation of cytokine expression. This book describes mechanisms of formation of reactive oxygen and nitrogen species and mechanisms of their action in inflammation.

The book consists of 18 chapters written by distinguished experts in the field. An introduction (by D. Blake, T. Bodamyali, C. Stevens, and P. Winyard) gives brief general information about inflammation and mechanisms underlying inflammatory response. It also contains classification of immune reactions (induced by the formation of the immune complex), activating polymorphonuclear leukocytes, macrophages, and also anaphylactic shock and allergy. Components of the inflammatory cascade are considered in detail. These include plasma proteins, proteolytic enzymes that remove necrotic tissue, lysed bacteria, products of arachidonic acid metabolism (prostaglandins, leukotrienes), and transmitters formed by platelets, lymphocytes, and other immune competent cells.

The chapter “Reactive Oxygen/Nitrogen Species and Acute Inflammation: Physiology of the Process” (written by T. Bodamyali, C. Stevens, D. Blake, and P. Winyard) considers the structure of reactive oxygen species (ROS) and reactive nitrogen species (RNS), ways of their enzymatic formation in the body, and their role in acute inflammation. Inflammatory processes include ROS-dependent damage to normal tissues important for localization of infection and “fencing” from normal healthy cells, the development of local hypoxia accompanied by secondary increase of ROS level, and ROS-dependent bactericidal effect. This chapter also deals with components of the antioxidant defense system, which include enzymes (superoxide dismutase, catalase, glutathione peroxidase) and such free radical scavengers as vitamins C and E.

The chapter “Free Radicals and Pathology: Modern Concepts” (by D. Blake, T. Bodamyali, and P. Winyard) uses various diseases such as rheumatoid arthritis as examples to consider the role of local hypoxia followed by subsequent re-perfusion and impairment of the antioxidant defense leading to alteration of oxidant/antioxidant ratio in the pathogenesis of these diseases.

Functioning of phagocyte NADPH-oxidase leading to ROS formation is considered in the chapter

“NADPH-Oxidase in Neutrophils and Other Cells” (O. Jones and J. Hancock). This chapter contains a scheme for the formation of various ROS during NADPH oxidation. The structure of cytochrome b_{558} is considered with emphasis on data on the functional role of each of its subunits. The mechanism of functioning of various cytosolic factors ($p47^{\text{phox}}$, $p67^{\text{phox}}$, $p40^{\text{phox}}$, $p21^{\text{rac}}$) involved in activation of cytochrome b_{558} is considered in detail, and special attention is paid to the interactions of these factors. The chapter also deals with receptor and non-receptor mechanisms of NADPH-oxidase activation and pathways of signal transduction. It contains a scheme of NADPH-oxidase arrangement in the membrane and the role of proton channels and potential difference gradient between the inner and the outer sides of the inner membrane for the functioning of the enzyme. The chapter also describes functioning and regulation of NADPH-oxidase in various cell types. In conclusion, the possible use of NADPH-oxidase as a sensor of oxygen level in a cell is discussed.

The chapter “Nitric Oxide—A New Antimicrobial Agent” (N. Benjamin) describes the identification of nitric oxide as the “endothelium derived relaxing factor” and its formation in various cell types. The mechanism of the antimicrobial effect of nitric oxide is discussed.

The chapter “Xanthine Oxidoreductase” was written by R. Harrison. This enzyme plays an important role in ROS formation during ischemia–reperfusion and inflammation. It can also reduce nitric oxide to nitrate.

Chapters “Inflammatory Transmitters” (V. Gilston, D. Blake, and P. Winyard) and “The Role of Thioredoxin in the Reductive Regulation of Gene Expression in Inflammatory Diseases” (T. Okamoto and T. Tetsuka) consider the expression of so-called inflammatory proteins that accompany such diseases as rheumatoid arthritis. Transcription factor NF- κ B activated by ROS is considered as the transmitter. Antioxidants like N-acetylcysteine may block NF- κ B activation. Leukocyte penetration into inflamed synovial lining is one of the most dangerous consequences of rheumatoid arthritis.

The interaction between leukocytes and endothelial cells is described in the chapter “Reactive Oxygen and Nitrogen Metabolites, Expression of Adhesion Molecules Accompanying Chronic Inflammation” (M. Grisham and R. Wolf).

Results of the latest studies on the effects of ROS on the signal transducing system and regulation of expres-

sion of enzymes involved in degradation of extracellular matrix are considered in the chapter "Reactive Oxygen Species and Regulation of Metalloproteinase Expression" (I. Lo, J. Wong, W. Cheung, and T. Cruz).

The chapter "Nitric Oxide and Diseases Related to Inflammation" (C. Evans and M. Stefanovic-Racic) deals with the possible role of increased ROS production in various forms of arthritis.

The effect of nitric oxide on bone tissue and possible pharmacological approaches for inhibition of its biosynthesis are considered in the chapter "Nitric Oxide and Bone Damage" (H. McPherson and S. Ralston). Damage to proteins, DNA, apoptosis, and cell proliferation during inflammation are considered in the chapter "Why Does Chronic Inflammation Exist?" (J. Lunec and H. Griffiths).

The chapter "Radicals, Granuloma Formation and Fibrosis" (G. Murrell) considers the role of ROS and RNS in pathological processes related to fibrosis and granuloma formation.

The role of ROS and RNS in apoptosis is considered in the chapter "Reactive Oxygen Species, Nitric Oxide and Apoptosis" (C. Bombeck, J. Li, and T. Billiar).

In the chapter "Assay of Radical Products. What Do They Tell Us About Inflammation?" H. Kaur and B. Halliwell discuss methods of ROS and RNS detection in the body by measuring formation of lipid peroxides, 8-oxoguanine, prostaglandins, and carbohydrates in exhaled air.

The last chapter is entitled "Do Antioxidants Play Any Role in the Therapy of Inflammatory Diseases?" (written by S. Edmonds). Since inflammatory diseases are related to the formation of active oxidants, antioxidants are employed for pharmacological treatment of various diseases of this type. Although there are no exiting new achievements in this field, lack of serious side effects during antioxidant therapy gives some basis for further development of effective antioxidants suitable for clinical application.

The book is well illustrated; it contains many schemes and figures promoting better understanding of the text.

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