

Preface

Living organisms fascinate by their multifaceted complexity, enormous variability, and versatile functionality. The all-encompassing progress in life sciences and medicine during the last years allows now a deep penetration into molecular details of enzyme reactions and receptor-mediated signaling, and it enlarges considerably our knowledge about cell physiological and regulatory processes. Modern analysis methods of the genome, transcriptome, proteome, lipidome, metabolome, and others add a tremendous amount of data about living processes that can be overlooked only by few specialists. Despite sophisticated methods, ingenious simulations, and novel hypothesis, there are large gaps in the understanding of regulatory mechanisms and deviations from normal functions in living structures. Often we can read that the cause of a disease is unknown, details of pathogenesis mechanisms are unclear, and so on. That concerns widespread, very common disorders affecting most of all people of advanced age. The same is valid for the thorough understanding of aging processes. We can describe many facets of how we age, and numerous theories about aging exists, but an all-encompassing explanation for aging phenomena is not given.

These antagonisms reflect two opposing sides of living systems. On the one hand, there are clearly defined routes for the synthesis of complex biomolecules, which are encoded in the genes, and the arrangement of these molecules to ordered structures. On the other hand,

numerous unwanted reactions exist, which disturb the integrity and high order in cells and tissues. Biomolecules are not only involved in specified functional processes, they are also subjected to structural and chemical modifications. Hence, numerous disturbances of physiological processes result. It would be too easy to categorize chemical reactions in living systems as good and bad ones. Destructions of biomolecules and therefore functional disturbances are an indispensable part of life. To minimize damaging reactions and functional constraints, numerous protective mechanisms are employed by cells, tissues, and organisms.

Inspired from the enduring interplay between the maintenance of homeostatic conditions and their disturbances, the analysis of destructive events in complex organisms and protection against these deteriorations starts with a thermodynamic approach to have a rational explanation for this endless struggle. This book gives an overview about main routes of destructive chemical conversions in proteins, lipids, carbohydrates, and nucleic acids. Key players of these modifications and protective mechanisms are described too. Cell and tissue destruction are further regarded in relation to physiological processes of energy production and storage, mechanism of cell death, and the whole field of innate and acquired immunity. Finally, the contribution of damaging mechanisms is analyzed during aging processes and in the pathogenesis of chronic inflammatory diseases. A last chapter is devoted to tissue destructions in the kidney and liver as

well as to sepsis. These wide-ranging subjects are exemplified by detailed descriptions, but it was impossible for me to go into each detail and to analyze all possible disturbances and disease scenarios. A unifying concept is given for the development of chronic inflammatory states and applied to aging processes and chronic diseases.

Subjects presented in this book are the result of more than 40 years of intense scientific work around topics such as lipid peroxidation, immune cell activation, reactions of heme peroxidases, redox biology, hemolysis, pathogenesis mechanisms of diseases, and some others that are all related to the field of cell and tissue destruction.

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