

PREFACE

Protein oxidation is one of the intensively investigated areas in modern cell biology. With increasing knowledge about protein-damaging agents, including reactive oxygen and nitrogen species, reducing sugars, and others, the involvement of protein oxidation in numerous diseases and the aging process itself becomes more obvious.

Interestingly, the chemical processes of protein and amino acid oxidation were already studied a long time ago. At the very beginning of modern biochemistry, for example, in one of the first issues of the *Journal of Biological Chemistry*, the chemical oxidation of amino acids was already tested, as in the article of H.D. Dakin, "The oxidation of leucin, α -amido-isovaleric acid and of α -amido-n-valeric acid with hydrogen peroxide" (*J. Biol. Chem.* 4: 63-76, 1908). Later that year, the same author described in more detail the formation of aldehydic oxidation products of amino acids in an article called "Note on the oxidation of glutamic and aspartic acids by means of hydrogen peroxide" (*J. Biol. Chem.* 5: 409-411, 1908). Until today, the formation of such protein carbonyls is still considered to be one of the most important highlights of protein oxidation. Although protein oxidation was investigated for a long time in chemical models in biology, it was somehow neglected, whereas the processes of lipid peroxidation were studied intensively.

Today, it is well accepted that proteins are among the main targets for oxidants. This is due to their abundance in biological systems and the high rate constants for several reactions of proteins with some oxidants. Since protein oxidation impairs the functionality of enzymes, receptors, antibodies, transport, and structural proteins, it is of immense importance for cell biology. However, most oxidized proteins are degraded by various intracellular proteolytic pathways, but some oxidized proteins appear to be poorly degraded

and, therefore, accumulate within cells. This accumulation was one of the first discovered highlights of biochemical changes during the aging process, already described in the nineteenth century by A. Hannover (Kgl. Danske Vidensk. Kabernes Selkobs Naturv. Math. Afh. Copenhagen 10: 1–112, 1842) and J. H. Koneff (Beiträge zur Kenntnis der Nervenzellen der peripheren Ganglien. Mitt. Naturforsch. Gesellsch. Bern. 44: 13–14, 1886). Today, it is well accepted that protein oxidation and the accumulation of oxidized proteins contributes to the aging process, especially in postmitotic tissues. Furthermore, oxidized and modified proteins accumulate in a range of human pathologies.

This monograph will focus on the major aspects of the protein oxidation process (Chapter 1) and the main mechanisms that show how cells deal with proteins once they are oxidized (Chapter 2). The role of protein oxidation during aging, as well as the investigation of various aging models, the roles of genetic and environmental factors, and the ways of measuring protein oxidation in the aging process, are described in Chapter 3. In the last chapter (Chapter 4), a short overview on protein oxidation in a number of age-related diseases is described; however, in view of the abundance of literature on the modification and aggregation of proteins in some of the mentioned diseases, this is just a short excursion into this field.

Since I was busy with several projects, I first declined the invitation of the publisher John Wiley & Sons, Inc., to prepare a monograph on protein oxidation and aging, and it was only by Dr. Betül Catalgol and Dr. Tobias Jung offering their help that persuaded me to write this book. I want to take this opportunity to thank both of my coworkers for their extensive support. Dr. Betül Catalgol did the search and viewing of several thousand literature sources and is responsible for drafting Chapters 1, 3, and 4. Dr. Tobias Jung is responsible for Chapter 2 and the diagrams in this volume.

I cordially wish to thank my collaborators for their contribution and hope that the scope and the details of this monograph will be a useful source for basic scientists working in the field of protein oxidation and biology of aging.

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