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REVOLUTIONARY AGRICULTURE AND ALLIED SCIENCES



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Chapter 16

Oxidative Stress and Antioxidant Mechanism

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1. Introduction to Oxidative Stress

Oxidative stress refers to a significant and concerning imbalance between oxidants and antioxidants, which favors the oxidants, thereby leading to a substantial disruption of redox signaling and/or causing molecular damage. The term ‘oxidative stress’ was first coined by the scientist Helmut Sies, who defined it as an imbalance between the production of oxidants and the antioxidant defenses that can potentially result in damage to biological systems. This important concept has attracted widespread interest in the fields of biology and medicine ever since the year 1985. It involves a complex interplay of various antioxidant enzymes, their substrates, coenzymes, along with a limited role of exogenous low-molecular-mass compounds which can influence oxidative status. Multiple biomarkers indicating damage to proteins, lipids, carbohydrates, and DNA have been identified, providing insight into the extent and nature of oxidative damage. Because of the numerous oxidant and antioxidant processes occurring in various cells and organs, there have been many translational applications arising from this concept, although some are often oversimplified to the detriment of their accuracy. The concept of oxidative stress continues to evolve significantly with ongoing research, highlighting its relevance in understanding numerous pathological conditions and developing potential therapeutic interventions. (Sies, 2015) (Jay Forman & Zhang, 2021) (Sies, 2020)