

# Reactive Oxygen Species, Antioxidants & Aging: Who is the Master & Who is the Servant?

## Reaktif Oksijen Türleri, Antioksidanlar ve Yaşlanma: Hangisi Üst Hangisi Ast ?

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**ABSTRACT** The free-radical theory of aging (FRTA), proposed in 1956, has become the most frequently considered theory of aging. Since its initial formulation it has been subject to many refinements and modifications, and also to criticism. Identification of mitochondria as the main cellular source of superoxide and hydrogen peroxide contributed to the formulation of the “mitochondrial theory of aging”. Not only free radicals but also non-radical reactive oxygen species (ROS) contribute to uncontrolled oxidation in the body so perhaps it would be more appropriate to use the term “ROS theory of aging”. There are some challenging questions for FRTA, e.g.: Should non-aerobes be subject to aging? Why the germ line of cells does not suffer ROS-invoked damage and genome is safely transmitted to next generations? Why the effects of antioxidants supplementation on the lifespan do not meet expectations? Recently, emphasis has been put on the signaling role of ROS and on the redox homeostasis. The dual biological role of ROS and the tendency of the body to maintain the redox homeostasis may explain the limited efficiency of antioxidant supplementation.

The redox equilibrium of the body changes towards higher oxidation state over the lifespan but reasons for this effect are not clear. While, generally, increased ROS formation accompanies aging, antioxidant defense is not always impaired and sometimes even augmented. Limited doses of ROS (oxidative stress) are known to induce antioxidant response via a hormesis effect. Oxidative stress accompanies diseases, physical exercise, action of many toxins and emotional stress. All these events may contribute to a progressive shift of redox equilibrium. High-intensity oxidative stress may be an apoptotic stimulus promoting depletion of the body in sensitive cells and contributing to organismal aging. The ability of cells to respond to oxidative stress may be a critical facet determining their role in aging.

**Key Words:** Aging, Reactive Oxygen Species, Antioxidant, Oxidative Stress

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