Antioxidants and Oxidative Stress in Health and Disease: Introduction

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The recent growth in knowledge of free radicals and reactive oxygen species (ROS) in biology is producing a medical revolution that promises a new age of health. In fact, the discovery of the role of free radicals in chronic degenerative disease is as important as the discovery of the role of microorganisms in infectious disease. Reactive oxygen species have been implicated in the etiology of a host of degenerative diseases including cardiovascular disease, diabetes, cancer, Alzheimer's disease, and other neurodegenerative disorders and in aging. In addition, they also play a role not only in acute conditions, such as trauma, stroke, and infection, but also in physical exercise and stress. If oxygen free radicals are involved in all of these clinical conditions, then antioxidants should be effective in preventing their occurrence. Indeed, investigations at the cellular, tissue, and whole animal level, as well as epidemiological studies, support the concept that nutritional antioxidant status is inversely related to the occurrence of free radical–mediated diseases.

In addition to the science of free radicals and antioxidants, the public is also bombarded daily with popular information related to the claims of certain miracle antioxidant vitamins or other nutrient supplements that are supposed to fight free radicals, protect us against disease, and keep us young forever. Medical clinicians and nutritionists are often asked what special food, supplements, or herbal medicines should be taken with our diet so that we can avoid diseases. The public seems to believe that the scientists have found the fountain of youth and possess the best kept secret to be young forever. Do we, scientists, really have the answers? Should we supplement our diet with extra antioxidant vitamins and minerals beyond the Recommended Daily Allowance? Should we take phytochemical supplements to prevent diseases? What are the scientific bases for the answers to all of these questions?

Undoubtedly, oxygen free radical research has led to a new paradigm of human health, with a shift toward a greater emphasis on disease prevention. This has created new interdisciplinary scientific fronts concerned with understanding the basic molecular mechanisms by which ROS cause degenerative disease, the development of sensitive methods for early detection of oxidative damage, and the discovery of new antioxidants in food for disease prevention. Research surrounding the interaction of antioxidants and oxidative stress in health and disease is truly an interdisciplinary field that interfaces many scientific disciplines including nutrition, chemistry, biology, and medicine. As a result, it will be necessary for researchers to work collaboratively and bring together different perspectives, creative ideas, and innovative techniques from various disciplines to uncover a greater understanding of the functional importance of ROS in biology and medicine. Therefore, it is not surprising that scientists in both academia and industry are seeking to establish collaborative arrangements in an effort to meet the challenges of this new paradigm of human health.

This Special Issue entitled "Antioxidants and Oxidative Stress in Health and Disease" is based on the Interdisciplinary Symposium Program proposed by Robert Knopp, M.D., University of Washington and Tammy M. Bray, Ph.D., The Ohio State University, and presented at the Experimental Biology Meeting 1999 in Washington D.C. Each article focuses on the role of free radicals, particularly with regard to the development of diseases such as atherogenesis, diabetogenesis, hypertension, neurological disorders, or carcinogenesis. In this issue, we have also included invited reviews on popular topics such as antioxidants and oxidants in skeletal muscle function and exercise, metallothionein and heme oxygenase as two novel biological antioxidants, and antioxidant and oxidative stress in genetic anemia and aging. The purpose of the Interdisciplinary Symposium Program was to foster collaborative arrangements among scientists in biochemistry, molecular biology, toxicology, medicine, and nutrition who are focused on the relationship between antioxidants and oxidative stress in health and disease. We hope that this issue will provide the research foundation and knowledge base of a few sample topics related to antioxidants and oxidative stress and establish a forefront of research in the new age of health.

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