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## The Etiology and Pathophysiology of Major Human Diseases Are Unified by Aberrant Free Radical Biology

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**Abstract:** The abnormal generation and/or elimination of biologically produced free radicals and other reactive oxygen and nitrogen species (ROS/RNS) is now known to be a common trait across the apparently unrelated fields of oxygen toxicity, radiation exposure, and aging. Clinically feasible diagnostic and therapeutic applications have been and still are being developed from advances in our knowledge of the impact of free radicals in biology and medicine. Recent developments in the study of free radicals in biology and medicine, including fundamental findings and practical applications, are the focus of this issue. Much more will be discovered about the similarities in the processes driving apparently different disease states as we get a better understanding of the proximal biological targets of reactive substances that are created or eliminated abnormally, as well as their sensors and effectors of compensatory response. Opportunities to develop logical treatment approaches to lessen the prevalence and severity of these illnesses and enhance human health will present themselves along with this increased knowledge.

**Keywords:** mitochondria; oxidative stress; reactive oxygen; nitric oxide; free radicals; cancer; diabetes; vascular disease; neurodegenerative disease; aging

### INTRODUCTION

In addition to radiation exposure and oxygen toxicity, many human disorders are characterized by the abnormal creation and/or elimination of biologically produced free radicals and other reactive oxygen and nitrogen species (ROS/RNS). Clinically feasible diagnostic and therapeutic applications have been and still are being developed from advances in our knowledge of the impact of free radicals in biology and medicine. Recent developments in the study of free radicals in biology and medicine, including fundamental findings and practical applications, are the focus of this issue.

This special issue ([www.mdpi.com/journal/ijms/special\\_issues/free\\_radicals](http://www.mdpi.com/journal/ijms/special_issues/free_radicals)) includes 24 rigorously peer-reviewed manuscripts from 11 different countries (Brazil, Canada, China, Italy, Korea, Mexico, Netherlands, Slovenia, Spain, Taiwan, and United States) across four continents (Asia, Europe, North America, and South America) that demonstrate the depth and breadth of the now-mature field of free radical biology and medicine. Interest in free radical biology and medicine is widespread not just geographically but also throughout a wide range of medical specializations, including the diagnosis and treatment of the majority of the world's main illnesses. We think the issue is therefore well-balanced, with 10 review papers and 14 original research articles covering a variety of topics encompassing the role(s) of free radicals and ROS or nitric oxide in the molecular pathologies and/or etiologies of almost all of the major human diseases, such as diabetes [6], cancer [1,2], vascular diseases [3–5], and neurodegenerative disease [7]. A high mitochondrial DNA copy number was linked to greater invasiveness in esophageal squamous cell carcinoma [1], whereas another cancer research presented findings from an investigation of mitochondrial modifications in lymphoma [2]. Reports on the function of endothelial cells in the cerebral vascular [4] and pulmonary vascular [3] systems were included in the vascular biology articles. Papers discussing the roles of ROS and mitochondrial activity in other uncommon and particular disease states,



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