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Preface

The basic mechanisms underlying the metabolism of molecular oxygen have been one of the most important and challenging subjects in biochemistry since Lavoisier initiated the study of biological oxidative processes some 200 years ago. In 1955, very little was understood about how molecular oxygen was utilized in respiration at the molecular level, because the principal focus in the field of biological oxidation was the elucidation of pathways in which electrons or hydrogen atoms were transferred from a substrate through various carriers to molecular oxygen. The enzymes that catalyzed these reactions were termed "dehydrogenases." In cases in which molecular oxygen served as the ultimate electron acceptor, forming H_2O or H_2O_2, the enzymes were referred to as "oxidases." However, the direct addition of molecular oxygen to a substrate was considered completely irrelevant to biological oxidation since the famous "dehydrogenation theory" was proposed by H. Wieland in 1932.

In 1955, through the use of the stable oxygen isotope ^{18}O, unexpected but unequivocal evidence that oxygen also plays a direct role in substrate oxidation was obtained. In a diverse group of reactions, including cleavage of aromatic rings, hydroxylation of a host of compounds with various structures, cyclization of intermediates in steroid biosynthesis, and so forth, molecular oxygen has been demonstrated to be incorporated directly into substrates. This new class of oxidative reactions, oxygen fixation, was catalyzed by a novel group of enzymes that required a new terminology and these enzymes have since been designated as "oxygenases."

The discovery of oxygenases has triggered an explosion of research on dioxygen activation over the last 50 years and has had an enormous impact on nearly all fields of medical, biological, and physicochemical sciences, as well as on environmental health problems. This special issue of *Biochemical Biophysical Research Communications* commemorates the 50th anniversary of this landmark development. We are gratified that 91 authors together with their co-authors have contributed excellent review articles and original papers in spite of the short notice given. Here, we salute the heritage of the oxygenase field and look forward to its further development in many related fields of research. We express our special thanks to Dr. Ernesto Carafoli, who initially suggested this special issue, and to Ms. Heather Devereaux of the BBRC office for excellent editorial work.

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