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Preface

Respiratory oxidases

Respiratory oxidases are central components of most aerobic electron transfer chains, coupling the free energy of water formation to the generation of a transmembrane proton gradient eventually driving ATP synthesis. Yet even 50 years after Peter Mitchell first presented his chemiosmotic coupling hypothesis, and with high-resolution 3-D structures pouring in since about 15 years, a distinct molecular understanding of both the electron transfer and the proton translocation reactions, and in particular their interrelation in energy transduction, is still at large.

In a blend of 25 topical review and research contributions, this Special Edition attempts to summarize our present state of knowledge on this family of terminal oxidases. Focusing on those members that share a heme/copper binuclear center protein scaffold for oxygen reduction in subunit I, research in the past few decades has brought about a seemingly bewildering variety of bacterial representatives often differing from the canonical mitochondrial enzyme: always considerably less complex in subunit composition, they may vary in their specific heme setup, their electron donor type and entry pathway, as well as in their substrate affinity properties. Yet characterization of these bacterial pendants has provided valuable information for honing our view for the essentials common to all members on the one hand, and the sometimes subtly discriminating deviations on the other, owing to efficient prokaryotic adaptation strategies. In this issue, experts have highlighted evolutionary, genetic, biochemical, spectral, as well as computational approaches, and provide a perspective for future developments in the oxidase field.

To keep the scope of this issue within a manageable frame, aspects of subunit import and assembly of the mitochondrial enzyme, as well as general biogenesis and cofactor insertion mechanisms, are not covered here, with the latter topic being addressed by a companion issue of BBA Bioenergetics edited by Jon Hosler, Biogenesis/Assembly of Respiratory Enzyme Complexes.

Let me acknowledge all contributors for having kept to the tight schedule in assembling this issue, and to the numerous colleagues for their help in reviewing; my special thanks also go to the publishing staff of BBA Bioenergetics, in particular Sandra Tokashiki, for her great support in preparing this issue.

Bernd Ludwig has been a professor of Biochemistry at Goethe University (Frankfurt/Main) since 1992. Having studied chemistry in Marburg, he went on for post-doctoral positions with Rod Capaldi (Eugene, OR) and Jeff Schatz (Basel, Switzerland). After a long-term appointment as assistant professor with the Medical U of Lübeck, he moved to Frankfurt, co-founding and later directing the Collaborative Research Centre "Molecular Bioenergetics"; he is also a member of CEF (Center of Excellence Frankfurt "Macromolecular Complexes"). His research interests focus on structure and function of membrane proteins, in particular cytochrome complexes and terminal oxidases in bacterial redox chains, and their genetic organization; more recently, he has also studied mechanisms of metal cofactor insertion during bacterial oxidase biogenesis.

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