

4.10: Hazards of Life with Dioxygen

The binding of dioxygen is normally a reversible process:



Under some circumstances, such as in the presence of added nucleophiles and protons, coordinated dioxygen is displaced as the superoxide anion radical, O_2^- , leaving the metal center oxidized by one electron and unreactive to dioxygen:^{49,50}



For hemoglobin there exists a flavoprotein reductase system, comprising a reduced pyridine nucleotide (e.g., NADH), cytochrome b_5 reductase, and cytochrome b_5 , that reduces the ferric iron back to the ferrous state, so that it may coordinate dioxygen again.^{1,51} In addition, all aerobically respiring organisms and many air-tolerant anaerobes contain a protein, superoxide dismutase, that very efficiently catalyzes the dismutation of superoxide ion to dioxygen and hydrogen peroxide:⁵²⁻⁵⁴



However, the physiological effects of the superoxide moiety remain controversial.^{53,54} Finally, there is a third enzyme, the hemoprotein catalase, that converts the toxic hydrogen peroxide into water and dioxygen:¹



This topic is discussed further in Chapter 5.

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