Heme enzymes: Structure, oxygen activation, and electron transfer

Thomas Poulos

ACS Fall 2014

Abstract

While heme enzymes catalyze both oxidative and reductive reactions, here we focus on those that catalyze oxidative reactions. Enzymes like cytochromes P450 and peroxidases store the oxidizing power of O2 or H2O2as (Fe(IV)O and a porphyrin or protein radical. We have learned a great deal about how subtle differences in architecture fine tunes these highly oxidizing intermediates to do electron transfer in some cases and oxygen transfer in others. This has been possible owing to a combination of spectroscopy, crystallography, computational chemistry and a rich tradition of porphyrin and model heme chemistry. In this lecture we will review what we have learned from these multidisciplinary approaches. We also will explore the problem of protein-protein interactions involved in electron transfer and how redox partner mediated structural changes might be linked to proton coupled electron transfer.