Abstract

Oxidoreductase enzymes are capable of transforming otherwise inert substrates into a (typically) 2-electron oxidised or reduced form with high selectively. This is an extremely useful feature that can be exploited in the construction of enzyme-based amperometric biosensors for the quantitative analysis of small molecules and ions in solution if the enzyme can be coupled to an electrochemical working electrode.

We have been particularly interested in the mononuclear molybdenum oxidoreductase enzymes. There is a remarkable diversity of substrates within this family but the catalytic reaction in each case can be written the following general form that includes both the oxidases (left to right) and reductases (right to left)

(reductases ←) \( X + H_2O \leftrightarrow XO + 2H^+ + 2e^- \) (oxidases/dehydrogenases)

where ‘X’ can be either an inorganic or organic species depending on the enzyme. The mononuclear Mo-enzymes fall into three distinct families (below) and the O-atom exchanged with the substrate is bound to the Mo ion at some stage of the catalytic cycle.

Here we shall present some of our recent work in this area, where we have applied indirect (mediated) and direct electrochemical approaches to gain insight into electron and atom transfer reactions at the Mo active site and also apply this in the development of prototype biosensors.

References


Biography:

After completing my undergraduate and postgraduate studies at the University of Newcastle (NSW), I held a Postdoctoral Fellowship at the University of Basel (Switzerland) from 1990-2 in the group of Peter Comba. I returned to Australia in 1993 to take up an Australian Research Council Postdoctoral Fellowship at the Australian National University (Canberra) from 1993-4 in the group of Alan Sargeson. I joined The University of Queensland in 1994 as a lecturer and I am currently Professor of Chemistry and President of the Royal Australian Chemical Institute.

Research interests:

- Protein Electrochemistry
- Copper Complexes as ATRP Catalysts
- Chelators for Fe Overload Disorders