EDITORIAL

Metals, Men and Microbes: The Diversity of Metal Ions in Biological Systems

Although only a relatively small number of metals are considered essential (iron, copper, zinc, manganese, molybdenum, chromium, magnesium and calcium), their impact is enormous. Metals play a wide range of critical functions in biological systems, but they are particularly noted for their roles in enzyme catalysis and protein structure. The ability of several metals to exist in more than one stable oxidation state under physiological conditions means that they are redox active and this underlies their participation in electron transfer reactions. Many Australian scientists have an interest in the biology of metals and in this issue of the *Australian Biochemist* we highlight the activities of just a few of these.

Since a number of metals are essential, it is not surprising that metal deficiencies can have significant clinical consequences. On the other hand, the very property that makes metals so important in enzyme catalysis – the ability to transfer electrons – makes them able to catalyse reactions leading the to formation of reactive oxygen species, so metal toxicity is also a problem. This dual nature of metals is very well exemplified by copper in the first article by Julian Mercer and Jim Camakaris. Julian and Jim have continued a long tradition of outstanding copper research in Australia, and they show how a combination of human genetics, focussed molecular analysis and cell biology have combined to provide a detailed picture of cellular copper homeostasis. In the following article, Teresa Steele, David Frazer and I continue the theme of mammalian metal metabolism and summarise some of the very significant recent advances in how the body regulates its iron intake.

In order to investigate metals in biological systems researchers need appropriate tools. In the third article of this series Stephen Lincoln brings us up to date with one such tool – fluorescent sensors for zinc. Steve describes the range of compounds that are available for measuring zinc levels and localisation within cells, and details their mode of action. Finally, we turn our attention to the prokaryotes where Al McEwan and Ulrike Kappler use molybdenum as an example to show how a single metal can participate in a wide range of catalytic processes, in particular as an important component of the DMSO reductase family of enzymes.

In these articles we have touched on only four metals and just a fraction of the Australian research in this area. The depth of interest in the biology of metals is very well emphasised by the proposed ARC network on 'Metals in Medicine' and the reader is referred to the website http://www.mimn.chem.usyd.edu.au/ for further details.

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Cover Illustration

Localisation of the iron efflux protein Ireg1 in the rat small intestine.

This immunofluorescence image was collected by confocal microscopy. A rabbit polyclonal antibody to Ireg1 was used to localise this important iron export protein to the basolateral membrane of the enterocytes (shown in green). A mouse monoclonal antibody to the brush border enzyme sucrase-isomaltase indicates the apical surface of the enterocytes (shown in red). The cell nuclei are indicated by blue DAPI staining.

Image supplied by Greg Anderson, Queensland Institute of Medical Research.

Metal Ions in Biology

Guest Editor: Greg Anderson

In the next issue...

In April, Showcase on Research will be on **Stem Cells** – *Guest Editor: Miranda Grounds*