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Thematic Minireview Series: Metals in Biology 2014*

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This thematic series, the sixth in the Metals in Biology collection beginning in 2009, addresses the issue of why certain metals are used by particular enzymes, as well as the consequences of using the wrong metal. This prologue introduces the 2014 Metals in Biology thematic series. The first minireview in the series deals with general aspects of metal specificity, and the next two deal with specific cases, the enzyme ribonucleotide reductase and iron/manganese homeostasis in the bacterium *Bacillus subtilis*. The fourth discusses metal selection in oxidative stress, and the final minireview discusses lysosome-related organelles as mediators of metal homeostasis.

Metals play an important role in biochemistry, in that it has been estimated that ~40% of enzymes use metals in some way (1). Microbial "metalloproteomes" are still largely uncharacterized (2). Metals are also critical for most reactions involving nucleic acids. One of the questions is why enzymes are selective for certain metals, and this matter is addressed in this thematic series, the sixth in the area of Metals in Biology in *The Journal of Biological Chemistry* (3–7).

The first minireview in the series, by Andrew W. Foster, Deenah Osman, and Nigel J. Robinson, deals with the general issue of metallation selectivity and the influence of biological systems as well as the thermodynamics, *i.e.* metal affinity and cellular concentration. Zn/Mg and Fe/Mn competition are discussed, as well as the roles of delivery systems in metal homeostasis.

The second minireview in the thematic series is authored by Mingxia Huang, Mackenzie J. Parker, and JoAnne Stubbe, who deal with the important enzyme ribonucleotide reductase. As in the first minireview in this series, the Fe/Mn competition is an issue, and organisms use either or both of these metals in this enzyme. Also, mismetallation can occur under forced conditions.

Our third minireview, by John D. Helmann, also deals with the Fe/Mn conundrum and the roles of sensor proteins in metal homeostasis. In the bacterium *Bacillus subtilis*, the three metalloregulatory proteins Fur, MntR, and PerR are involved in the "perception" of iron and manganese.

The fourth minireview was contributed by James A. Imlay and discusses mismetallation in *Escherichia coli* under oxidative stress. Here we see a Fe/Zn/Mn interaction that can be perturbed due to the oxidation of iron by partially reduced oxygen species. The implications for other bacteria are discussed.

Our fifth minireview, by Crysten E. Blaby-Haas and Sabeeha S. Merchant, addresses how eukaryotes control correct metallation of metal-dependent proteins by regulating metal availability with storage organelles. From yeast and plant models, our understanding of vacuoles and related organelles as mediators of metal homeostasis is growing. The metal transporters in the membranes of these organelles are the central players, and some of these mechanisms have also been identified in animal systems.

The authors of the minireviews and I hope that you will enjoy reading this thematic series and that you will learn something, even if metals are not your primary interest. We are continuing this thematic series on Metals in Biology. Please visit the Enzymology Affinity website (enzyme.jbc.org) for more information on papers in *The Journal of Biological Chemistry* as well as papers on other areas of relevance in this area (other affinity groups are also important in the biology of metals area, including Protein Structure and Folding, Metabolism, Gene Regulation, and Microbiology).

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