Cover illustration

Enzymes that contain metal atoms (yellow) at their active sites are involved in many biological processes. (Artwork by N. Spencer)

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METALLOPROTEINS

Proteins can catalyse a remarkably wide range of chemical reactions. Yet the main differences among polypeptides are in the side chains of naturally occurring amino acids, which account for only a small proportion of the possible chemical functionality. The diversity of function is instead made possible partly because proteins can incorporate cofactors — such as small organic molecules, single metal atoms or clusters that contain metal and non-metal atoms — into their active sites.

Almost half of all enzymes require the presence of a metal atom to function. These ‘metalloproteins’ have captivated chemists and biochemists, particularly since the 1950s, when the first X-ray crystal structure of a protein, sperm whale myoglobin, indicated the presence of an iron atom. Much is now understood about how metal clusters are assembled, how metal ions or clusters are introduced into target proteins, and which metal ions are commonly found in metalloenzymes. In addition, we are much closer to understanding the mechanisms by which metalloenzymes catalyse such a range of complex chemical reactions. But, despite more than half a century of research by chemists, biochemists and cell biologists, many discoveries remain to be made.

The articles in this Insight highlight some of the most exciting current research on metalloproteins, including how enzymes containing complex metal clusters metabolize small gaseous molecules, how proteins containing iron–sulphur clusters are assembled, and how metalloenzymes containing a single metal ion catalyse the halogenation of small organic molecules.

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Joshua Finkelstein, Senior Editor

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