Metal: mobile or stationary to enable catalysis?

S.R. Marsden[1], I. Bento[2], P.-L. Hagedoorn[1], U. Hanefeld[1]*

[1]*Biotechnologie, Technische Universiteit Delft, van der Maasweg 9, 2629HZ Delft, The Netherlands*

[2]*EMBL Hamburg, Notkestrasse 85, 22607 Hamburg, Germany*

u.hanefeld@tudelft.nl

Enzymes are the catalysts of life and a third of them are metalloenzymes that require a metal cofactor for their catalytic activity. This metal cofactor is seen as static. It is perceived as fixed in one single position and to be motionless. We recently observed that the substrate can induce a 2.4 Å shift of the metal from a resting state to an active state. In the resting state, the metal is coordinated by three residues of the enzyme *Sw*HKA (E145, D171 and S116'), a Class II pyruvate dependent aldolase. In contrast, in the active state two residues (E145, D171) bind the metal, and a pyruvate derivative (not shown) is coordinated as substrate. Remarkably all this occurs without significant changes in the protein structure [1,2].

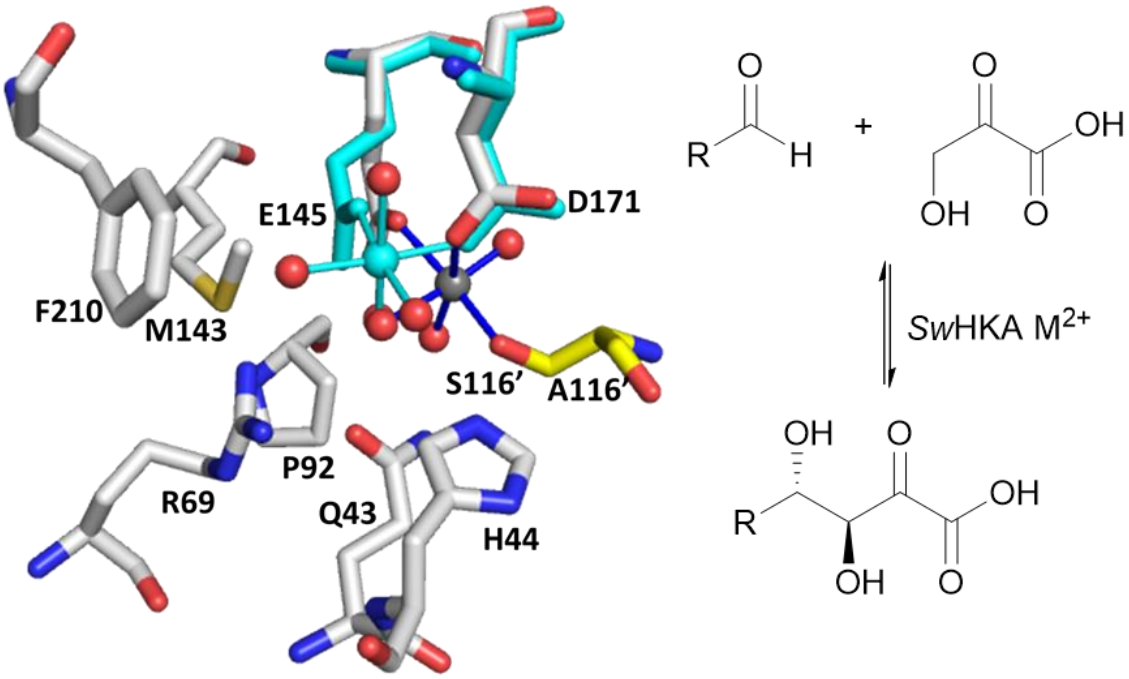

Figure 1. Metal shift in SwHKA. Mg(II) moves more than 2 Å upon docking of the substrate.

To gain insight into the generality of this metal shift for catalysis we extended our studies to other Class II pyruvate dependent aldolases [3]. Remarkably the closely related *Bp*HKA does not show this metal shift. Both enzymes require a divalent metal for their catalytic activity yet they differ in how they utilize this metal. Interestingly, they also differ in regard to phosphate.

*Sw*HKA is activated by phosphate with *Bp*HKA does not display any differences in activity in the presence of phosphate.

References

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