

Application of Enzyme Coupling Reactions to Shift Thermodynamically Limited Biocatalytic Reactions

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ABSTRACT

In recent years, much interest has been shown in the use of multi-enzyme cascades as a tool in organic synthesis. Such enzymatic cascades can provide added value to a synthetic scheme by starting from cheaper raw materials or making more valuable products. Additionally, they can be used to help shift the equilibrium of otherwise thermodynamically unfavourable reactions to give a higher conversion of the target product. By coupling an energetically unfavourable reaction with a more favourable one, the multi-enzyme cascade mimics the approach taken in nature in metabolic pathways. Nevertheless, it can be challenging to combine several engineered enzymes *in vitro* for the conversion of non-natural substrates. In this mini-review we focus on enzyme coupling reactions as a tool to alleviate thermodynamic constraints in synthetically useful biocatalytic reactions. The implications of thermodynamic parameters such as the equilibrium constant on the multi-enzyme cascades and the conventional methods of equilibrium shifting are also discussed in addition to methods used to estimate such values.

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