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Investigating the Catalytic Mechanism of β-Cyclodextrin Dimer in Previtamin D3 Isomerization

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The sigmatropic isomerization reaction of previtamin D3 to vitamin D3, when encapsulated within a dimer of β-cyclodextrin, exhibits a 40-fold enhanced rate compared to its counterpart in an isotropic organic solution [1]. Despite several hypotheses, the exact mechanism by which β-cyclodextrin dimer catalyzes the reaction remained elusive.

We have conducted a rigorous investigation of the isomerization dynamics of previtamin D3 within a β-cyclodextrin dimer through a combination of molecular dynamic simulations and statistical multi-structural transition state theory to address this knowledge gap. Two key programs in the field of Chemical Kinetics, namely *TorsiFlex* [2,3] and *Pilgrim* [4], play a crucial role in facilitating our investigations. *TorsiFlex* allows for an extensive conformational search encompassing both previtamin D and the reaction transition state, while *Pilgrim* enables precise calculations of thermal rate constants within systems comprising multiple conformations.

Our results verify the experimental observations and provide unprecedented insights into the β-cyclodextrin dimer catalytic mechanism.

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Primary author: Dr FERRO-COSTAS, David (Universidade de Santiago de Compostela)

Presenter: Dr FERRO-COSTAS, David (Universidade de Santiago de Compostela)

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