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N,N' -Dioxide–Scandium(III)-Catalyzed Asymmetric Michael Addition of β,γ -Unsaturated Butenolides to α,β -Unsaturated γ -Keto Esters

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N,N' -Dioxide–Scandium(III)-Catalyzed Asymmetric Michael Addition

Selected examples:

Proposed transition state:

Significance: Butenolide derivatives represent an important structural motif in natural products and pharmaceuticals. The authors develop a highly efficient catalytic system for the asymmetric vinylogous Michael addition of γ -substituted butenolides to α,β -unsaturated γ -keto esters, leading to γ,γ -disubstituted butenolides in good yield and excellent enantioselectivities.

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Comment: The substrate scope of this reaction is well investigated. The ester groups of the α,β -unsaturated γ -keto esters display an influence on both diastereo- and enantioselectivity. The bulkier γ -substituted groups in the butenolides lead to the increase of diastereo- and enantioselectivity, but the reactivities decrease obviously. Aromatic and aliphatic unsaturated γ -keto esters are well tolerated.