## Metal-Catalyzed Asymmetric Synthesis and Stereoselective Reactions

## Key words

## rhenium

tetrahydropyrans

## Prins cyclization

SYNFACTI

# Stereocontrolled Synthesis of Highly Substituted Tetrahydropyrans 



Selected examples:


Proposed mechanism:


Significance: $\mathrm{ARe}(\mathrm{VII})$ complex catalyzed the highly selective condensation of easily accessible starting materials using a very mild and simple protocol to give densely functionalized tetrahydropyrans 3 (THP). Aromatic aldehyde partners 2 give a single diastereomer where all substituents are equatorially oriented. Whereas aliphatic aldehydes give diastereomeric mixtures (4 and 5), alkenyl aldehydes provide an alternative, as illustrated by complex THP 11. Achieving high atom-efficiency, the catalytic Prins cyclization reported improves previous protocols using excess acid (the conjugate base moiety is generally incorporated into the THP at the end of the reaction).
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Comment: Both $\mathrm{ReO}_{3}(\mathrm{OH})$ and $\mathrm{Re}_{2} \mathrm{O}_{7}$ were shown to be effective catalysts to mediate the transformation. The authors were inspired by seminal work on allylic alcohol isomerization done by Osborn and co-workers (Angew. Chem. Int. Ed. 1997, 36, 976), as well as later investigations done by Grubbs and co-workers (J. Am. Chem. Soc. 2005, 127, 2842). These early studies invoked a cationic intermediate suggesting that intermediate $\mathbf{C}$ might be a viable species in the above process. A potential limitation of the reaction is seen with aliphatic aldehydes $\mathbf{2}$, which are prone to form side-products arising from competing oxonia-Cope rearrangements under these conditions.

