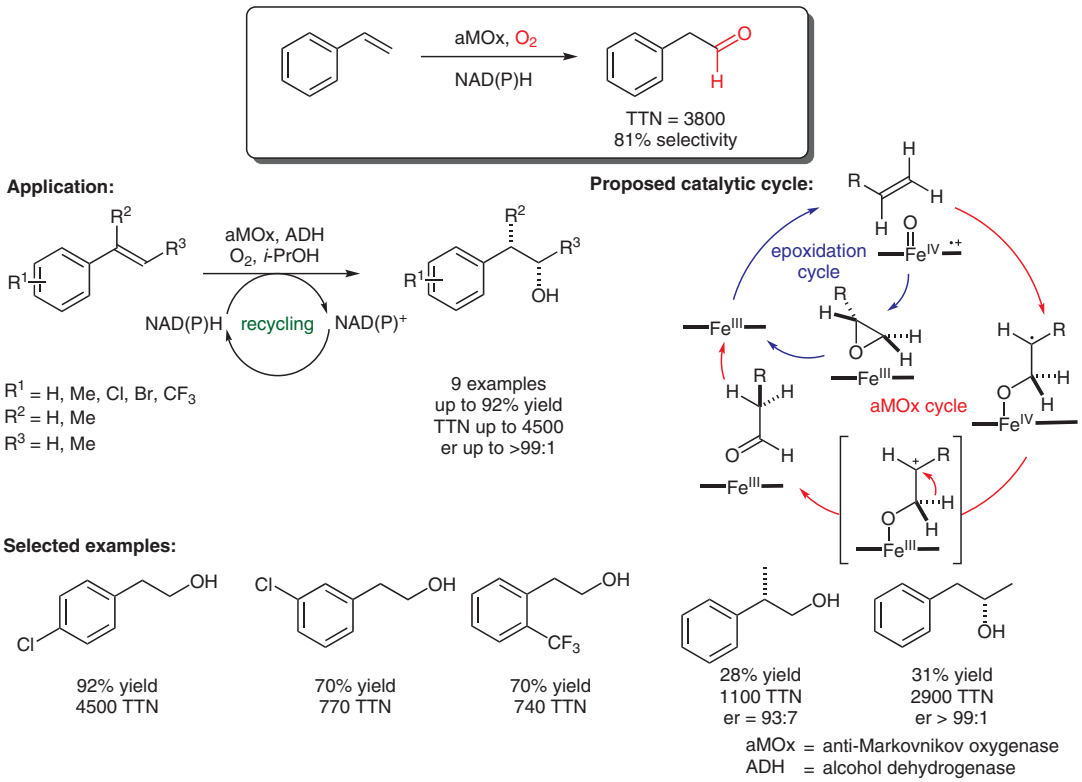
S. C. HAMMER, G. KUBIK, E. WATKINS, S. HUANG, H. MINGENS, F. H. ARNOLD*
(CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, USA)
Anti-Markovnikov Alkene Oxidation by Metal-Oxo-Mediated Enzyme Catalysis
Science **2017**, *358*, 215–218.

Enzymatic Anti-Markovnikov Oxidations of Styrenes



Significance: The Arnold group reports an enzyme-catalyzed anti-Markovnikov oxidation of styrenes for the synthesis of homobenzylic alcohols with molecular oxygen as the oxidant. Several mutations of an iron-heme-dependent cytochrome P450 monooxygenase from the rhodobacterium *Labrenzia aggregata* were necessary to obtain a highly selective alkene anti-Markovnikov oxygenase (aMOx) that is also compatible with α- and β-substituted styrenes. Furthermore, synthetically useful scale-up experiments using 0.05 mol% aMOx resulted in high yields. Control experiments suggest that the reaction occurs through an anti-Markovnikov oxo transfer followed by 1,2-hydride shift and that it competes with the commonly observed epoxidation.

Comment: Anti-Markovnikov oxidations of alkenes are a great synthetic challenge because the corresponding epoxide formation is highly kinetically favored. However, due to their intrinsic properties, enzymes can be evolved toward new reaction pathways. The obtained products are highly valuable and, because combination with other enzymes is possible, further synthetic applications of this system can be envisioned.

SYNFACTS Contributors: Benjamin List, Grigory A. Shevchenko
Synfacts 2018, 14(01), 0083 Published online: 15.12.2017
DOI: 10.1055/s-0036-1592052; **Reg-No.:** B10417SF

Category
Organo- and Biocatalysis

Key words
anti-Markovnikov
monooxygenase
alkenes
oxidation
styrenes
homobenzylic alcohols