Pot-Economic Organocatalytic Asymmetric Synthesis of the Corey Lactone

$$\begin{array}{c} \text{catalyst (10 mol\%)} \\ \text{4-nitrophenol (1 equiv)} \\ \text{H}_2\text{O (3 equiv)} \\ \\ \text{2-PrOH (2.0 M)} \\ \text{r.t., 4-24 h} \\ \\ \text{R} = (\text{Het})\text{Ar, SiMe}_2\text{Ph} \\ \text{(2 equiv)} \\ \\ \text{2-PrOH (2.0 M)} \\ \text{r.t., 4-24 h} \\ \\ \text{11 examples} \\ \\ \text{74-95\% yield} \\ \\ \text{dr. 98:2} \\ \text{er from 98:2 to > 99:1} \\ \\ \text{CO}_2\text{Et} \\ \text{11 examples} \\ \\ \text{74-95\% yield} \\ \\ \text{4-nitrophenol (1 equiv)} \\ \\ \text{H}_2\text{O (3 equiv)} \\ \\ \text{2-PrOH (4.0 M)} \\ \text{r.t., 1 min} \\ \\ \text{11 examples} \\ \\ \text{2-PrOH (4.0 M)} \\ \text{r.t., 1 min} \\ \\ \text{2-PrOH (4.0 M)} \\ \text{r.t., 1 min} \\ \\ \text{2 evaporation} \\ \text{80 °C, 15 min} \\ \\ \text{80 °C, 15 min} \\ \\ \text{12 evaporation} \\ \text{80 °C, 15 min} \\ \\ \text{13.5 equiv)} \\ \\ \text{14.6 CO}_2\text{Et} \\ \\ \text{15 min} \\ \\ \text{15 min} \\ \\ \text{16 equiv} \\ \text{16 equiv} \\ \\ \text{17 mao-Fleming oxidation} \\ \\ \text{18 eragents commercially available} \\ \\ \text{10 equiv} \\ \\ \text{10 equ$$

Significance: Hayashi and co-workers report an organocatalytic domino Michael/Michael reaction of α , β -unsaturated aldehydes and ethyl (E)-4-oxopent-2-enoate that uses a diphenylprolinol silyl ether as catalyst. The desired cyclopentanones were obtained in good to excellent yields and with excellent diastereo- and enantioselectivities. The newly developed formal (3+2) cycloaddition was applied as the key step in a concise and highly stereoselective route towards the Corey lactone.

Comment: Due to its importance as a crucial intermediate for the synthesis of various prostaglandin hormones, efficient, selective, and practical routes toward the Corey lactone are desirable. The authors have developed a time-efficient organocatalytic protocol consisting of seven steps in a single reaction vessel that furnishes enantiopure Corey lactone. The required silvl acrylaldehyde is accessible through an atom-economic trimerization of ethyne, carbon monoxide, and dimethyl(phenyl)silane (I. Matsuda, A. Ogiso, S. Sato, Y. Izumi J. Am. Chem. Soc. 1989, 111, 2332).

SYNFACTS Contributors: Benjamin List, Mathias Turberg Synfacts 2020, 16(04), 0453 Published online: 18.03.2020

DOI: 10.1055/s-0040-1707620; Reg-No.: B01120SF

Key words

Corey lactone amine catalysis Michael addition cascade reaction asymmetric synthesis

