

ASYMMETRIC CARBINOL SYNTHESIS

BY MEANS OF (-)-SPARTEINE-MODIFIED ORGANOMETALLIC REAGENTS

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The reactivity of n-butyllithium is enhanced by coordinating tertiary diamines (1). (-)-Sparteine as a bidentate ligand gives a modified allyllithium which induces asymmetric ring opening of *gem*-dibromocyclopropanes leading to active allenic hydrocarbons (2). This paper is concerned with the asymmetric addition of organolithium and organomagnesium reagents to carbonyl compounds in the presence of (-)-sparteine. Asymmetric carbinol synthesis by means of a chiral organolithium complex appears without precedent.

To a homogeneous mixture of n-butyllithium and (-)-sparteine in hexane (0.35 M each) was added a hexane solution of benzaldehyde at -70° during 1 hr. Work up followed by gas chromatographic (GC) purification gave 1-phenyl-1-pentanol,  $[\alpha]_D^{20} +1.0^\circ$  (neat), the optical yield being 6% (3). Other carbinols similarly obtained are listed in Table 1.

Applying Ashby's procedure (4), we have prepared a homogeneous benzene solution (0.5 M) of ethylmagnesium bromide in the presence of an equimolar (-)-sparteine. This solution was added to a benzene solution of ethyl benzoylformate at 5°. Ethyl 2-hydroxy-2-phenylbutanoate was isolated by chromatography on silica gel and purified by GC. This sample showed  $[\alpha]_D^{20} +4.4^\circ$  (neat), the optical yield being 18% (5). The same carbinol was previously obtained in a 5% optical yield by asymmetric Grignard reaction in (+)-2,3-dimethoxybutane (6).

The reacting species involved may be tentatively represented as shown below. The absolute configuration of the resulting carbinols implies that the preferred attack occurs as indicated. Conformational correlation between the inducing and induced centres is rather equivocal at present in view of the lack of knowledge on the detailed structure of reagents and the exact mode of attack (7, 8).

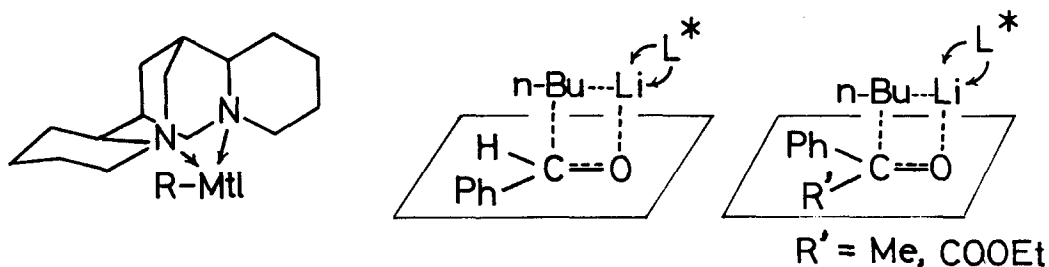


TABLE 1  
Asymmetric Induction in Carbinol Synthesis

R-Mtl	PhCOR' R' =	Product <sup>a</sup>	Yield %	$\alpha_D^{20}$ <sup>b</sup> Obsd.	Concn. g/100 ml	$[\alpha]_D^{20}$ deg.
n-BuLi <sup>c</sup>	H	( <u>R</u> )-1-phenyl-1-pentanol	90	+0.26	27	+2.0
n-BuLi <sup>c</sup>	Me	( <u>S</u> )-2-phenyl-2-hexanol	83	-0.17	22	-1.6
n-BuLi <sup>c</sup>	COOEt	( <u>S</u> )-ethyl 2-hydroxy-2-phenylhexanoate	85	+0.13	3.9	+6.7
EtMgBr <sup>d</sup>	H	( <u>R</u> )-1-phenyl-1-propanol	15	+0.08	1.7	+9.4
EtMgBr <sup>d</sup>	Me	( <u>L</u> )-2-phenyl-2-butanol	11	<0.01	6.5	0
EtMgBr <sup>e</sup>	COOEt	( <u>S</u> )-ethyl 2-hydroxy-2-phenylbutanoate	48	+0.36	9.7	+7.4

<sup>a</sup> All products gave correct elemental analyses. IR and NMR spectra were compatible with the assigned structures.

<sup>b</sup> Rotatory values were obtained in chloroform solutions with 5 cm cells. The reaction was conducted <sup>c</sup> in hexane at -70°, <sup>d</sup> in toluene at -70° or <sup>e</sup> in benzene at 5°.

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