Pergamon

Tetrahedron Vol. 51, No. 37, pp. 10343-10360, 1995
Elsevier Science Ltd
Printed in Great Britain
0040-4020/95 $9.50+0.00

0040-4020(95)00602-8

Diastereoselective Reduction and Organometal Addition to 1-Alkoxy-2-phenylalkan-3-ones

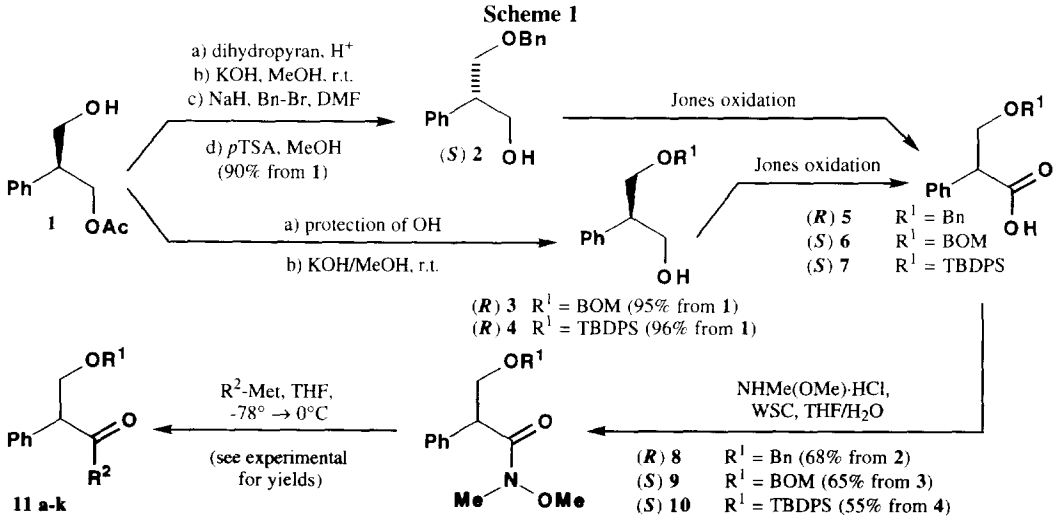
Giuseppe Guanti,* Luca Banfi, and Renata Riva

Istituto di Chimica Organica dell'Università degli Studi di Genova, e C.N.R., Centro di Studio per la Chimica dei Composti Cicloalifatici ed Aromatici, corso Europa 26, I-16132 GENOVA (Italy)

Abstract: The reduction with various hydrides and the addition of some Grignard reagents and alkyl lithiums to various protected 1-hydroxy-2-phenylalkan-3-ones furnished respectively the corresponding secondary and tertiary alcohols with a diastereoselectivity from good to excellent. Both processes were stereoconservative, no racemization being observed.

2-Substituted 1,3-propanediol derivatives are very useful intermediates often used in the synthesis of many biological targets.[1,2] One of the main reasons of their success is the peculiar structure (C_s-symmetry) of these compounds which allows to obtain, after their asymmetrization, both enantiomers by a simple protection-deprotection trick.[1,3] Enzymes, and especially lipases, have been shown to be particularly effective for preparing in high enantiomeric excess some chiral building blocks of this type, which have been used for many synthetic applications.[2] An important aspect of the chemistry of these compounds is that, once asymmetrized, they can be converted through selective manipulation of the alcoholic function into the corresponding aldehydes or ketones, that can in turn undergo further elaborations with the creation of new

Scheme 1

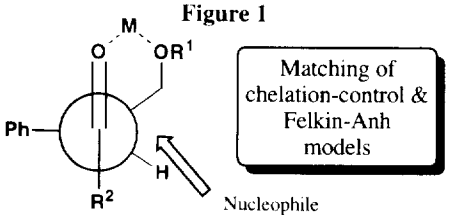


chiral centers, hopefully in a stereocontrolled manner.[4] A crucial role in these transformations has been shown to be played by the type of substituent present in position 2: small changes in its structure were found to have a great influence either on the asymmetrization step or on the stereospecificity of further reactions. In the last years we have been particularly active in this field and we recently published an efficient procedure based on a chemoenzymatic approach for preparing both enantiomers of many monoacetylated 2-aryl-1,3-propanediols.[2d,5] We[2d,f] and others[6] have already used some of these units as precursors in some synthetic applications. Now, within a research program on the preparation of some asymmetrized 2-alkenyl- and 2-aryl substituted 1,3-propanediols and on their exploitation in the asymmetric synthesis of polystereogenic targets, we have prepared a series of differently O-protected 1-hydroxy-2-phenylalkan-3-ones and studied their reduction with various metal hydrides and the addition of some organometals to them, with the purpose to define the best protocol for controlling the stereochemistry of these reactions. The results are herein reported.

The ketones were prepared according to Scheme 1, starting from monoacetate **1**. In this work we utilized the (*S*) monoacetate derived from monohydrolysis of the diacetate (91% e.e.). However it must be stressed that an optimized acetylation procedure of the corresponding diol can now furnish the (*R*) enantiomer of **1** with 97% enantiomeric excess.[5] (*R*) Monoprotected diols **3**,**4** were obtained in high yields by a simple protection-deacetylation procedure.[7] In the case of **2** we utilized a longer, though high yielding, procedure, because, as already noted for a related compound,[2f] direct benzylation of **1** suffered from low yield or partial racemization. By this route the (*S*) monobenzyl ether **2** was obtained.[8] The oxidation of the primary alcoholic function was realized with Jones methodology to give acids **5**, **6**, **7**; they were transformed into the corresponding hydroxamates **8**, **9**, **10** by reaction with N,O-dimethylhydroxylamine in the presence of 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (WSC).[9] The transformation into ketones **11a-k** was realized by treatment of **8**, **9**, **10** with the corresponding organometals.[10]

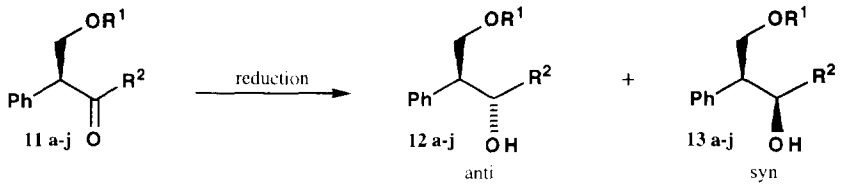
We then examined the stereoselective reduction of these ketones. For this study we chose to use three reducing agents: L-Selectride™, DIBALH, and the system DIBALH/$MgBr_2$. The first two were selected as typical example of basic or acidic hydride-donor reagents. The third one was picked out because it was recently found by us to be the reagent of choice for the diastereoselective reduction under chelation control of differently protected α,α-*bis*(hydroxymethyl)ketones.[4a] The results, depicted in Table 1, show that in all cases the *anti* stereoisomers **12** were preferentially formed, best results being achieved with the bulky basic hydride-donor agent L-Selectride™ as reducing agent and *tert*-butyldimethylsilyl as protecting group. This outcome can be explained with a Felkin-Anh model[11] where the phenyl group plays the role of "large" group, being perpendicular to the carbonyl function (Figure 1). Although previous studies have demonstrated that, in related reductions of α-methyl-α-aryl ketones,[12] the phenyl acted as "large" group, this was not obvious in our case, since the masked hydroxymethyl group, especially when the protecting group is the bulky TBDPS, could in principle compete with the phenyl in size. Thus, the fact that increasing the bulkiness of the protecting group is even beneficial for stereoselectivity implies that the tendency for phenyl group to dispose perpendicularly to the carbonyl is indeed very high, probably not only on steric grounds, but for stereoelectronic reasons as well.

Figure 1



The same outcome could also be explained by taking

Table 1: *reduction of 1-alkoxy-2-phenylalkan-3-ones*



11 a-j 12 a-j 13 a-j

					L-Selectride™		DIBALH/ $MgBr_2$		DIBALH	
entry	*ketone (abs. config.)*	R^1	R^2	$[\alpha]_D$ *of* **12**[a]	***12 : 13***[b]	*yield (%)*[c]	***12 : 13***[b]	*yield (%)*[c]	***12 : 13***[b]	*yield (%)*[c]
1	**11a** (*R*)	Bn	allyl	- 18.1°	97.8 : 2.2	74	63.5 : 36.5	68	69.7 : 30.3	83
2	**11b** (*S*)	BOM	allyl	+ 10.9°	84.6 : 15.4	65	73.4 : 26.6	98	81.5 : 18.5	98
3	**11c** (*S*)	BOM	*n*-Bu	+ 17.4°	99.1 : 0.9	78	67.3 : 32.7	68	79.3 : 20.7	68
4	**11d** (*S*)	TBDPS	*n*-Bu	+ 7.6°	99.7 : 0.3	80	77.9 : 22.1	69	69.3 : 30.7	78
5	**11e** (*S*)	BOM	Ph	+ 50.1°	99.7 : 0.3	91	92.6 : 7.4	95	90.5 : 9.5	89
6	**11f** (*S*)	TBDPS	Ph	+ 36.5°	99.7 : 0.3	82	91.0 : 9.0	79	84.5 : 15.5	72
7	**11g** (*S*)	BOM	vinyl	- 7.4°	1,4-reduction[d]		75.8 : 24.2	78[e]	81.5 : 18.5	48[e]
8	**11h** (*S*)	TBDPS	vinyl	-[f]	1,4-reduction[d]		81.2 : 18.8	60[e]	73.0 : 27.0	64[e]
9	**11i** (*S*)	BOM	heptynyl	- 5.8°	94.1 : 5.9	85	65.4 : 34.6	93	66.9 : 33.1	97
10	**11j** (*S*)	TBDPS	heptynyl	- 10.3°[g]	> 99 : 1[h]	90	63.7 : 36.3[h]	97	69.3 : 30.7[h]	87

Note: a) measured on $CHCl_3$ solution (c ≡ 1); b) determined by HPLC analysis of the mixture; c) yield not optimized and referred to the diastereomeric mixture; d) together with many other byproducts; e) 1,4-reduction product also isolated (that is **11k** or the corresponding TBDPS protected ketone): 9% (DIBALH/$MgBr_2$), 21% (DIBALH) in entry 7; 15% (DIBALH/$MgBr_2$), 21% (DIBALH) in entry 8; f) not determined due to the impossibility to isolate **12h** not contaminated by **13h**; g) determined on the diastereomeric mixture derived from L-Selectride™ reduction (d.r > 99%); h) determined by ^{1}H-n.m.r., because the diastereomers are not separated enough in HPLC.

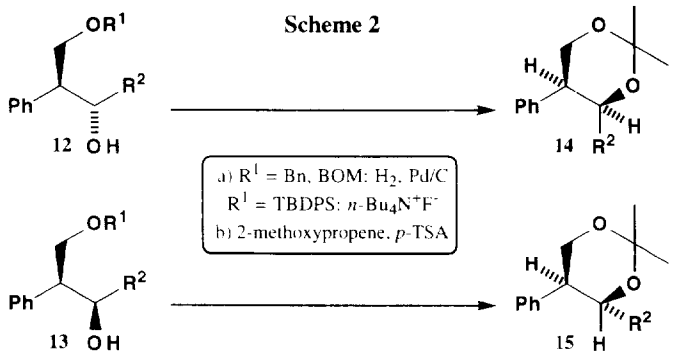
into account a cyclic chelated transition state involving the β-oxygen (Figure 1). In this hypothesis, though, one would have expected a decrease in stereoselectivity on passing from the chelation-favouring BOM protecting group, to the chelation-disfavouring silyl ether.[13] On the contrary, as already stated, the TBDPS was the best protecting group.

The relatively poor results achieved with the system DIBALH/$MgBr_2$ were in some way surprising. On the basis of our previous results,[4a] showing that this system was excellent in promoting chelation-control in some 2-substituted-3-alkoxyketones, and in view of the possibility to match Felkin and chelation control in the present case, we would have expected a high induction, at least for BOM-protected ketones. On the contrary, induction was usually unsatisfactory and no influence of protecting group was evidenced. At present we have no rationale for this behaviour. However it should be noted that the low *anti*/*syn* ratio obtained with DIBALH/$MgBr_2$ in the actual case was confirmed, in preliminary experiments, also using 3-alkoxy-2-methyl ketones derived from 3-hydroxy-2-methylpropanoic acid.

Besides L-Selectride™ we explored other "basic" hydrides, like $NaBH_4$, $Zn(BH_4)_2$, and $NaBH_4/CeCl_3$. The results were still good, but inferior to those achieved by L-Selectride™.

Finally, the collected results show that the influence of R^2 group was not dramatic. However it is worth

Scheme 2

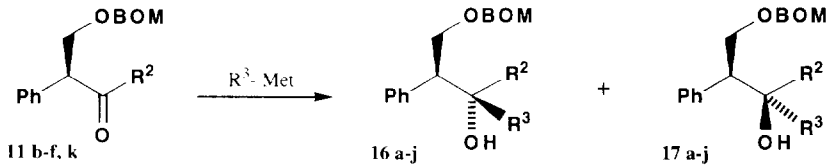


noting that for R^2 = phenyl or vinyl, good results were also realized with DIBALH and DIBALH/$MgBr_2$. In the latter case this fact is quite useful, since L-Selectride™ gives, as expected, 1,4-reduction.

The relative configuration of all reduction products was established through conversion into O,O-*iso*-propylidene derivatives and by ^1H and ^{13}C-n.m.r. analysis of them (Scheme 2);[14] we observed that prevailing alcohols **12** gave always the cis O,O-*iso*-propylidene derivative, while alcohols **13** gave the corresponding trans diastereoisomer.

In order to find an access to the minor *syn* diastereoisomers **13**, we studied also the complementary organometal addition to the aldehydes derived from oxidation of **2-4**, but preliminary results were not encouraging, most of all because of the unavoidable partial racemization occurring during the oxidation even

Table 2: *addition of organometallics to 1-alkoxy-2-phenylalkan-3-ones*



entry	*ketone*	*R^2*	*R^3-Met*	*prevailing product*[15]	*yield (%)*[a] *of 16*	*16 : 17*	*$[\alpha]_D$*[b]
1	**11k**	Et	vinyl-MgBr	**16a**	67 (72)	> 98 : 2[c,d]	- 8.28°[e]
2	**11k**	Et	allyl-MgBr	**16b**	92	91.6 : 8.4[c]	+ 15.66°[e]
3	**11k**	Et	*n*-BuLi	**16c**	68 (70)	94.6 : 5.4[d,f]	+ 7.13°[e]
4	**11k**	Et	PhMgBr	**16d**	84	97.5 : 2.5[g]	+ 4.65°[h]
5	**11k**	Et	propargyl-MgBr	**16e**	95	> 98 : 2[c,d]	+ 34.56°[e]
6	**11k**	Et	heptynyl-Li	**16f**	46	98.8 : 1.2[g]	- 16.27°[h]
7	**11e**	vinyl	EtMgBr	/	0	-	-
8	**11e**	vinyl	EtMgBr/$CeCl_3$	/	0[i]	-	-
9	**11b**	allyl	EtMgBr	**16g**	83 (98)	> 98 : 2[c,d]	+ 3.58°[e]
10	**11c**	*n*-Bu	EtMgBr	**16h**	88	> 95 : 5[d,f]	+ 7.13°[e]
11	**11d**	Ph	EtMgBr	**16i**	99	99.5 : 0.5[g]	+ 26.84°[h]
12	**11f**	heptynyl	EtMgBr	**16j**	86	95.8 : 4.2[g]	- 13.49°[h]

Note: a) in brackets the yield on unrecovered starting material is reported; yields are unoptimized; b) measured on $CHCl_3$ solution (c ≅ 1); c) determined by ^1H-n.m.r.; d) only signals due to one diastereoisomer detected in the spectrum; e) determined on the analyzed diastereomeric mixture; f) determined by ^{13}C-n.m.r.; g) determined by HPLC; h) determined on a purified sample of **16** not contaminated by **17**; i) some unreacted starting material and many other products were formed.

using modified Swern procedures.[16]

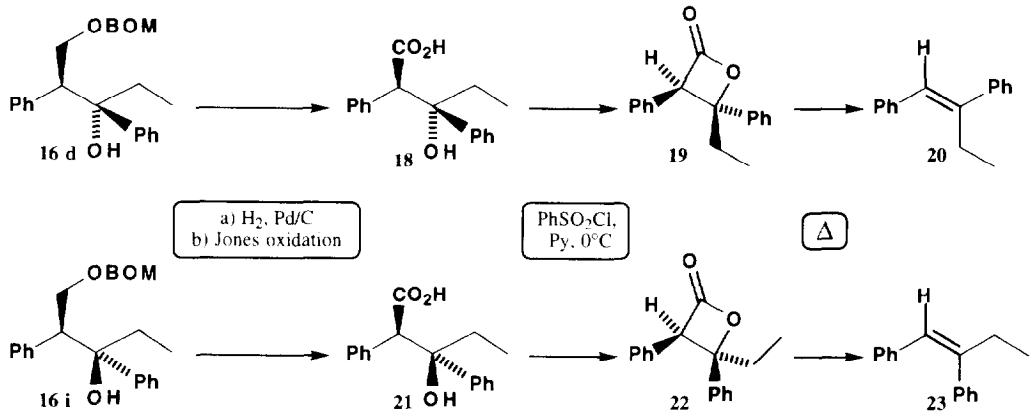
On the contrary we demonstrated that no loss of optical purity had occurred in the acylation-reduction procedure by ^{1}H-n.m.r. analysis of Mosher's esters of reduction products **12**. This fact is important since, as already pointed out, when we attempted to functionalize asymmetrized 2-aryl-1,3-propanediols like **2-4**, via the corresponding aldehydes or different activated carboxylic derivatives like the imidazolide, the S-(2-pyridyl) thioate or the mixed anhydride,[2d] some degree of racemization was always observed. The here reported acylation-reduction strategy represents therefore the procedure of choice for the stereoconservative production of secondary alcohols like **12.**

We have also studied the addition of some organometals to ketones **11**[17] and the results are collected in Table 2. Although tertiary alcohols were not always obtained in high yields,[18] the stereoselectivity was generally excellent (> 9 : 1), either employing organo-lithium or Grignard reagents.

The relative stereochemistry of the obtained alcohols was demonstrated in this way: **16d** and **16i** were converted into the corresponding β-lactones **19** and **22** as reported in Scheme 3.[19] The crude products were characterized by ^{1}H-n.m.r. and I.r.. The former showed clearly that this process was stereospecific, **16d** and **16i** giving **19** and **22** respectively as exclusive products. These β-lactones were directly transformed into the corresponding olefins **20** and **23** by thermal decarboxylative elimination, without further purification (due to their propensity to spontaneously decarboxylate on silica gel). This reaction was mostly stereospecific, each lactone affording nearly exclusively the corresponding alkene. The configuration of olefins **20** and **23** was unambiguously assigned as *E* and *Z* respectively by comparison of their ^{1}H n.m.r. spectra with those reported in the literature for (*E*)- and (*Z*)-1,2-diphenyl-1-butene.[20] So, since the formation of β–lactones by reaction of a 2-hydroxyacid with benzenesulfonyl chloride proceeds with retention of configuration[19,21] and since thermal decarboxylative elimination is reported to occur with a *syn* mechanism, [19,22] we can reasonably conclude that alkene **20** can only derive from alcohol **16d**, while alkene **23** must be obtained from **16i**. The relative configuration of β-lactons **19** and **22** was also corroborated by comparison of the -CH_2CH$_3$ chemical shifts in ^{1}H-n.m.r. spectra. An aryl group *cis* to Et is actually expected to shield the -CH_2-.[19,22] In our case we observed δ = 1.75 for **19** (Ph *cis* to Et), and δ = 2.34 for **22** (Ph *trans* to Et).

Thus, addition of PhMgBr to **11k** or of EtMgBr to **11d** may be rationalised by a Felkin-Anh model where the phenyl group is positioned perpendicularly to the carbonyl, in the same way as described for the

Scheme 3



above discussed reductions. Although we have not demonstrated the relative configuration of other tertiary alcohols **16**, we think that the same model is most likely followed.

It is noteworthy that with the procedure herein described, all four stereoisomers of the final tertiary alcohol can be obtained in high stereomeric excess by: a) using either **1** or ***ent*-1**; b) reverting the order of introduction of R^2 and R^3 in the route from hydroxamate **9** to the alcohols **16-17**. Two exceptions are represented by the ethyl-vinyl and the ethyl-propargyl pairs. In the former case attempts to achieve 1,2-addition of an ethyl-metal compound to vinyl ketone **11e** failed. Surprisingly, EtMgBr furnished neither the 1,2- nor the 1,4-addition products, but a mixture of saturated ketone **11k** (16%) and of the adduct of nucleophilic addition to it (75%). On the other hand, addition of propargyl-MgBr to Weinreb's hydroxamate **9** afforded only the allenyl adduct.[23]

In conclusion the collected results show how, starting from 2-phenyl-1,3-propanediols, a combination of a chemoenzymatic reaction and either hydride-reduction or organometal addition, allows to prepare in good to excellent stereoselectivity secondary and tertiary alcohols like **12** and **16** which represent useful intermediates for further synthetic applications. Through the latter strategy, that is by the stereoselective addition of an enolate to a ketone similar to **11k**, we have recently performed a chemoenzymatic synthesis of the AB ring system of aklavinone.[2f]

Finally, we wish to thank M.U.R.S.T. for financial assistance.

EXPERIMENTAL

All n.m.r. were taken in $CDCl_3$ (if not otherwise specified) at 200 MHz (H) or 50 MHz. (C). Chemical shifts were measured in ppm (δ scale). Coupling constants are reported in Hertz. Attribution of ^{13}C signals was made also with the aid of DEPT experiments. I.r. spectra were recorded in $CHCl_3$ solution on a Perkin Elmer 881 spectrophotometer. For GC-MS analyses we used a HP-5890 series II instrument, equipped with a HP-1 series 530 μ column (l 10 m, i.d. 0.2 mm). Conditions: initial temp. = 140°C; initial time = 2 min; rate = 20°C/min; final temp. = 290°C; constant flow (He) = 0.9 ml/min. Retention times (R_t) are reported in minutes). In MS spectra (E.I., 180°C) relative abundances (ions with rel. ab. < 5% are not usually listed) are reported in brackets. HPLC analyses were performed on a HP-1090 liquid chromatograph, using a Hypersil column, PE/Et_2O mixtures as eluant and an U.V. detector; analyses were not normalized. All reactions employing dry solvents were carried out under a nitrogen atmosphere (if not otherwise specified). Tlc analyses were carried out on silica gel plates, which were developed by spraying a solution of $(NH_4)_4MoO_4{\cdot}4H_2O$ (21g) and $Ce(SO_4)_2{\cdot}4H_2O$ (1g) in H_2SO_4 (31 cc) and H_2O (469 cc) and warming and by U.V. detector. R_f were measured after an elution of 7-9 cm. Chromatographies were carried out on 70-230 mesh silica gel using the "flash" methodology.[24] Petroleum ether (40-60°C) is abbreviated as PE. In extractive work-up aqueous solutions were always reextracted twice with the appropriate organic solvent. Organic extracts, if not otherwise indicated, were finally washed with brine, dried over Na_2SO_4 and filtered, before evaporation of the solvent under reduced pressure.

(*S*)-3-Acetoxy-2-phenylpropan-1-ol 1. This compound was prepared according to ref. 25, starting from commercially available dietyl phenylmalonate (see also ref. 5).

(*S*)-3-(Benzyloxy)-2-phenylpropan-1-ol 2. a) (*S*)-3-Acetoxy-2-phenyl-2-[(tetrahydropyran-2-yl)oxy]propane. A solution of **1** (3.10 g, 15.94 mmol) in dry CH_2Cl_2 (30 ml) was treated at 0°C with 3,4-dihydro-2*H*-pyran (4.37 ml, 47.88 mmol) and *p*-toluenesulfonic acid (1.60 ml of a 0.1 M sol in THF) and stirred at the same temperature for 1 h. Saturated $NaHCO_3$ solution was added and the mixture was extracted

with CH_2Cl_2, to give after solvent removal a pale yellow oil, used as such in the next reaction. R_f 0.56 (PE : Et_2O 1:1). **b**) **(*R*)-2-phenyl-3-[(tetrahydropyran-2-yl)oxy]propan-1-ol**. It was prepared following the general procedure for hydrolysis of acetyl group reported below in 95% yield from **1**. R_f 0.21 (PE : Et_2O 1:1). I.r.: ν_{max} 3515, 2944, 2871, 1602, 1452, 1123, 1074, 1029. GC-MS: R_t 5.45; *m/z* 206 ($M^{+\cdot}$ - 30, 1.8), 117 (5), 105 (10), 104 (63), 103 (8), 101 (19), 91 (30), 85 (100), 77 (6), 67 (10), 57 (10), 43 (13), 41 (10). ^{1}H-n.m.r. : δ 1.43-1.92 [6H, m, -C*H*$_2$- of THP]; 2.58 [1H, centre of m, -O*H*]; 3.11-3.25 [1H, m, >C*H*Ph]; 3.43-4.14 [6H, m, -C*H*$_2$OTHP + -C*H*$_2$O- of THP + -C*H*$_2$OH]; 4.62 [1H, centre of m, -O-C*H*O- of THP]; 7.21-7.37 [5H, m, aromatics]. **c**) **(*R*)-3-Benzyloxy-2-phenyl-2-[(tetrahydropyran-2-yl)oxy]propane**. The above prepared alcohol (3.57 g, 15.11 mmol) was dissolved in dry DMF (50 ml) and cooled to 0°C; it was treated with benzyl bromide (2.75 ml, 22.66 mmol), followed by NaH (1.09 g, 22.66 mmol, 50% suspension in mineral oil). After 1 h at 0°C the thick solution was stirred at r. t. for additional 2 hrs. The mixture was diluted with $NH_4H_2PO_4$ (5% in H_2O) and extracted with Et_2O. Combined organic extracts were washed with water and brine and finally concentrated *in vacuo*. Chromatography (PE : Et_2O 9:1 → Et_2O) gave the desired product as a colourless oil (4.60 g, 93%, 97% on unrecovered starting material) together with some unreacted starting material (127 mg, 4%). R_f 0.47 (PE : Et_2O 8:2). I.r.: ν_{max} 3679, 3003, 2326, 1600, 1514, 1264, 1027. GC-MS: R_t 8.04; *m/z* 219 ($M^{+\cdot}$ - 107, 0.1), 191 (5), 118 (7), 105 (6), 104 (33), 101 (7), 92 (5), 91 (57), 86 (6), 85 (100), 84 (18), 67 (7), 57 (6), 43 (6), 41 (6). ^{1}H-n.m.r.: δ 1.42-1.82 [6H, m, -C*H*$_2$- of THP]; 3.21 [1H, quintuplet, >C*H*Ph, J=6.2]; 3.38-4.06 [6H, m, -C*H*$_2$OTHP + -C*H*$_2$O- of THP + -C*H*$_2$OBn]; 4.50-4.59 [3H, m, -O-C*H*O- of THP + -C*H*$_2$Ph]; 7.20-7.37 [10H, m, aromatics]. **d**) **2**. The monobenzylether above prepared was dissolved in dry MeOH (100 ml), cooled to 0°C and treated with *p*-toluenesulfonic acid (134 mg, 704.4 μmol). After 1 h the solution was allowed to react at r. t. for 4 hrs. The mixture was neutralized by addition of saturated aqueous $NaHCO_3$ and concentrated in vacuo. The residue was diluted with water and extracted with Et_2O. After solvent removal, chromatography (PE : Et_2O 7:3 → Et_2O) gave the pure product as a colourless oil (3.36 g, 98%). R_f 0.34 (PE : Et_2O 1:1). $[\alpha]_D$ = - 26.7° (c 2.72 $CHCl_3$). Anal. found C, 79.55; H, 7.45. $C_{16}H_{18}O_2$ requires C, 79.31; H, 7.49. I.r.: ν_{max} 3606, 3000, 2932, 1602, 1451, 1315, 1275, 1026. GC-MS: R_t 6.20; *m/z* 242 ($M^{+\cdot}$, 1.2), 194 (6), 121 (38), 120 (10), 107 (6), 105 (12), 104 (100), 103 (31), 92 (17), 91 (89), 79 (8), 77 (10), 65 (12). ^{1}H-n.m.r.: δ 2.44 [1H, dd, -O*H*, J=7.3, 5.0]; 3.22 [1H, centre of m, >C*H*Ph]; 3.73-4.08 [4H, m, -C*H*$_2$OH + -C*H*$_2$OBn]; 4.56 [2H, s, -C*H*$_2$Ph]; 7.19-7.40 [10H, m, aromatics].

General procedure for hydrolysis of acetyl group. Crude O-acetyl, O-protected, 1,3-(2-phenyl)propanediol (10 mmol) was dissolved in dry MeOH (60 ml), cooled to 0°C and treated with KOH (16 ml of 1 N sol in MeOH). After stirring 1 h (or more) at 0°C the mixture was neutralized by addition of $NH_4H_2PO_4$ (5% solution in water) and concentrated *in vacuo*. The residue was diluted with water and extracted with Et_2O. After solvent removal, chromatography (PE : Et_2O 7:3 → Et_2O) gave pure product as a colourless oil .

(*R*)-3-[(Benzyloxy)methoxy]-2-phenylpropan-1-ol 3. **a**) **(*S*)-3-Acetoxy-2-[(benzyloxy)methoxy]-2-phenylpropane**. A solution of **1** (4.42 g, 22.75 mmol) in dry CH_2Cl_2 (65 ml) was treated, at 0°C, with di*iso*propylethylamine (Hünig's base) (5.55 ml, 31.86 mmol) and benzyl chloromethyl ether (3.80 ml, 27.31 mmol). After 18 hrs stirring at r. t., an additional portion of both reagents was added (3.96 ml, 22.73 mmol of Hünig's base & 3.16 ml, 22.73 mmol of BOM-Cl) and the mixture was stirred again for 3 hrs. The solution was diluted with brine and extracted with Et_2O. After solvent removal the brownish oil was used as such in the next reaction. R_f 0.59 (PE : Et_2O 1:1). **b**) **3** Was prepared following the general procedure for removal of acetyl group (see above) in 95% yield from **1**. R_f 0.26 (PE : Et_2O 1:1). $[\alpha]_D$ = + 18.3° (c 3.22, $CHCl_3$). Anal. found C, 74.75; H, 7.35. $C_{17}H_{20}O_3$ requires C, 74.97; H, 7.40. I.r.: ν_{max} 3678, 3003, 1601, 1264. GC-MS: R_t 7.05; *m/z* 212 ($M^{+\cdot}$ - 60, 9), 137 (7), 121 (36), 120 (13), 118 (6), 108 (7), 107 (10), 106 (9), 105 (15), 104 (96), 103 (19), 92 (18), 91 (100), 79 (6), 77 (8), 65 (7). ^{1}H-n.m.r.: δ 2.06 [1H, broad t, -O*H*, J=6.1]; 3.16 [1H, quintuplet, >C*H*Ph, J=6.5]; 3.81-4.04 [4H, m, -C*H*$_2$OH + -C*H*$_2$OBOM]; 4.55 [2H, s, -OC*H*$_2$Ph]; 4.78 [2H, s,

-OCH_2O-]; 7.23-7.35 [10H, m, aromatics].

(*R*)-3-[(*t*-Butyldiphenylsilyl)oxy]-2-phenylpropan-1-ol 4. **a**) **(*R*)-3-Acetoxy-2-[(*t*-butyldiphenylsilyl)oxy]-2-phenylpropane**. A solution of **1** (3.06 g, 15.76 mmol) in dry DMF (20 ml) was treated with *t*-BuPh$_2$SiCl (6.96 ml, 26.80 mmol) and imidazole (2.15 g, 31.52 mmol) and stirred for 2 hrs at r. t.. The solution was diluted with water and extracted with Et$_2$O. Combined organic extracts were washed with water and brine and finally concentrated *in vacuo* to give a pale yellow oil used as such in the next reaction. R_f 0.59 (PE : Et$_2$O 1:1). **b**) **4** Was prepared following the general procedure for removal of acetyl group (see above) in 96% yield from **1**. R_f 0.28 (PE : Et$_2$O 65:35). $[\alpha]_D$ = + 8.4° (c 2.04, CHCl$_3$). Anal. found C, 76.65; H, 7.80. $C_{25}H_{30}O_2Si$ requires C, 76.88; H, 7.74. I.r.: ν_{max} 3690, 3010, 1601, 1262, 1190, 1112. GC-MS: R_t 9.20; *m/z* 333 ($M^{+\cdot}$ - 57, 1.0), 201 (5), 200 (18), 199 (100), 181 (6), 139 (32), 117 (21), 91 (9). ^{1}H-n.m.r. δ 1.05 [9H, s, -C(CH_3)$_3$]; 2.35 [1H, dd, -O*H*, J=6.7, 5.4]; 3.12 [1H, centre of m, >C*H*Ph]; 3.85-4.18 [4H, m, -CH_2OH + -CH_2OTBDPS]; 7.11-7.68 [15H, m, aromatics].

General procedure for Jones oxidation of alcohols 2-4. A solution of alcohol (10 mmol) in dry acetone (60 ml) was cooled to 0°C and treated dropwise with Jones reagent (prepared from 10 g CrO_3, 8.6 ml of 96% H_2SO_4, 14 ml of H_2O, and brought up to 40 ml)[26] until complete reaction [about 40 drops (from a Pasteur pipette)/mmol of substrate usually needed]. After 30 min-1.5 hrs the reaction was quenched with 5% $NH_4H_2PO_4$. After saturation with NaCl, the aqueous phase was extracted with AcOEt. The organic extracts were washed with saturated brine containing 10% Na_2SO_3 solution and solvent removed *in vacuo*. Crude acid (usually a white solid) was used as such in the next reaction.

General procedure for methyl N-methylhydroxamate formation. Crude acid (from 10 mmol of alcohol) was dissolved in THF (200 ml) and treated with a solution of N,O-dimethylhydroxylamine (1.95 g, 20 mmol) in H_2O (50 ml). The pH of the solution was adjusted to 4.5 by addition of 1 M NaOH. A solution of WSC (3.83 g, 20 mmol) in H_2O (75 ml) was added dropwise over a period of about 20 min and the resulting colourless solution was stirred at r. t. for 20-24 hrs. After saturation with NaCl, the aqueous phase was extracted with Et$_2$O and solvent was removed. Chromatography (PE : Et$_2$O 8:2 → 4:6) furnished the corresponding hydroxamates.

(*R*)-Methyl 3-(benzyloxy)-N-methyl-2-phenylpropanohydroxamate 8. Y: 68% from **2** [colourless oil about 90% pure (purity was considered in calculating yield)], used as such for further reaction. R_f 0.30 (PE : Et$_2$O 1:1). $[\alpha]_D$ = + 65.9° (c 1.50, CHCl$_3$). I.r.: ν_{max} 3838, 2997, 2938, 2864, 1714, 1650, 1452, 1386, 1097, 1077. GC-MS: R_t 7.27; *m/z* 299 ($M^{+\cdot}$, 0.02), 208 (6), 193 (4.6), 105 (2.6), 104 (6), 92 (8), 91 (100), 65 (5), 61 (3.0). ^{1}H-n.m.r.: δ 3.19 [3H, s, -NCH_3]; 3.52 [3H, s, -OCH_3]; 3.62 [1H, dd, >C*H*Ph, J=8.9, 5.2]; 4.13 [1H, t, -C*H*HOBn, J=9.1]; 4.34-4.44 [1H, m, -CH*H*OBn]; 4.49 & 4.61 [2H, AB system, -OCH_2Ph, J=12.2] 7.21-7.40 [10H, m, aromatics].

(*S*)-Methyl 2-[(benzyloxy)methoxy)]-N-methyl-2-phenylpropanohydroxamate 9. Y: 65% from **2** (colourless oil). R_f 0.56 (PE : Et$_2$O 2:8). $[\alpha]_D$ = - 63.6° (c 0.85 CHCl$_3$). I.r.: ν_{max} 3853, 2998, 2937, 2887, 1652, 1603, 1453, 1384, 1110, 1045. GC-MS: **9** is not suitable for this analysis. ^{1}H-n.m.r.: δ .3.19 [3H, s, -NCH_3]; 3.52 [3H, s, -OCH_3]; 3.76 [1H, dd, >C*H*Ph, J=9.1, 5.0]; 4.24 [1H, t, -C*H*HOBOM, J=9.3]; 4.30-4.42 [1H, m, -CH*H*OBOM]; 4.51 & 4.55 [2H, AB system, -OCH_2Ph, J=11.8]; 4.74 & 4.78 [2H, AB system, -OCH_2O-, J=6.7]; 7.22-7.39 [10H, m, aromatics].

(*S*)-Methyl 2-[(*t*-butyldiphenylsilyl)oxy)]-N-methyl-2-phenylpropanohydroxamate 10. Y: 55% from **2** (white solid). R_f 0.42 (PE : Et$_2$O 6:4). $[\alpha]_D$ = - 22.2° (c 2.045 CHCl$_3$). I.r.: ν_{max} 3808, 3009, 1600, 1419, 1245, 1191. GC-MS: **10** is not suitable for this analysis. ^{1}H-n.m.r.: δ 1.00 [9H, s, -C(CH_3)$_3$]; 3.19 [3H, s, -NCH_3]; 3.53 [3H, s, -OCH_3]; 3.80 [1H, centre of m, >C*H*Ph]; 4.28-4.38 [2H, m, -CH_2OTBDPS]; 6.80-7.78 [15H, m, aromatics].

General procedure for ketone formation. Compounds **8-10** were dissolved in dry THF (6-12 ml/mmol of substrate) and cooled to -78°C; organometal was added and reaction was stirred until complete at the indicated temperature. Quenching with NH_4Cl (sat. solution), followed by extraction with Et_2O gave, after solvent removal, crude ketone, which was purified by chromatography (PE : Et_2O 100: 0 → 9:1, for TBDPS protected ketones: PE : Et_2O 95:5 → 7:3, for BOM or Bn protected ketones). Except than **11k**, which is a white solid, all other ketones were colourless oils.

(*R*)-1-Benzyloxy-2-phenylhex-5-en-3-one 11a. Organometal: 2 equivalents of allyl-MgBr (1 M in Et_2O). T = -78° → - 65°C. Y: 89%. R_f 0.65 (PE : Et_2O 8:2). $[\alpha]_D$ = + 169.5° (c 2.49, $CHCl_3$). Anal. found C, 81.15; H, 7.22. $C_{19}H_{20}O_2$ requires C, 81.40; H, 7.19. I.r.: ν_{max} 3357, 3021, 1711, 1629, 1584, 1451, 1360, 1099, 1074, 1026. GC-MS: **11a** is not suitable for this analysis. ^{1}H-n.m.r.: δ 3.20 [2H, dt, -COC*H*$_2$CH=CH$_2$, J=6.8, 1.3]; 3.61 [1H, X part of ABX system, >C*H*Ph]; 4.08 & 4.12 [2H, AB part of ABX system, -C*H*$_2$OBn, J_{AB}=8.7, J_{AX} & J_{BX} not determinable]; 4.47 & 4.54 [2H, AB system, -OC*H*$_2$Ph, J=12.1]; 5.04 [1H, dq, -COCH$_2$CH=C*H*H cis to -COCH$_2$-, J=17.1, 1.5]; 5.14 [1H, dq, -COCH$_2$CH=CH*H* trans to -COCH$_2$-, J=10.3, 1.4]; 5.86 [1H, ddt, -COCH$_2$C*H*=CH$_2$, J=17.1, 10.3, 6.9]; 7.20-7.28 [10H, m, aromatics].

(*S*)-1-[(Benzyloxy)methoxy]-2-phenylhex-5-en-3-one 11b. Organometal: 2 equivalents of allyl-MgBr (1 M in Et_2O). T = -78°C. Y: 86%. R_f 0.38 (PE : Et_2O 8:2). $[\alpha]_D$ = - 169.3° (c 2.61, $CHCl_3$). Anal. found C, 77.20; H, 7.16. $C_{20}H_{22}O_3$ requires C, 77.39; H, 7.14. I.r.: ν_{max} 3838, 3001, 2929, 2886, 1713, 1630, 1600, 1452, 1379, 1265, 1163, 1053, 1024. GC-MS: **11b** is not suitable for this analysis. ^{1}H-n.m.r.: δ 3.19 [2H, dt, -COC*H*$_2$CH=CH$_2$, J=6.8, 1.3]; 3.73 [1H, dd, >C*H*Ph, J=9.3, 5.3]; 4.05 [1H, dd, -C*H*HOBOM, J =8.7, 5.3]; 4.24 [1H, t, -CH*H*OBOM, J=9.0]; 4.47 & 4.53 [2H, AB system, -OC*H*$_2$Ph, J=11.8]; 4.70 & 4.74 [2H, AB system, -OC*H*$_2$O- J=6.8]; 5.04 [1H, dq, -COCH$_2$CH=C*H*H cis to -COCH$_2$-, J=17.1, 1.5]; 5.14 [1H, dq, -COCH$_2$CH=CH*H* trans to -COCH$_2$-, J=10.2, 1.4]; 5.86 [1H, ddt, -COCH$_2$C*H*=CH$_2$, J=17.1, 10.2, 6.9]; 7.21-7.39 [10H, m, aromatics].

(*S*)-1-[(Benzyloxy)methoxy]-2-phenylheptan-3-one 11c. Organometal: 2 equivalents of *n*-BuLi (1.6 M in hexanes). T = -78°C. Y: 87%. R_f 0.44 (PE : Et_2O 8:2). $[\alpha]_D$ = - 149.4° (c 2.05, $CHCl_3$). Anal. found C, 77.10; H, 8.10. $C_{21}H_{26}O_3$ requires C, 77.27; H, 8.03. I.r.: ν_{max} 2961, 2875, 1710, 1453, 1380, 1193, 1115, 1054. GC-MS: R_t 7.98; *m/z* 326 ($M^{+\cdot}$, 0.02), 191 (1.3), 181 (1.2), 120 (1.8), 119 (1.8), 108 (1.1), 104 (100), 103 (10), 92 (5), 91 (45), 85 (13), 77 (3.9), 65 (4.4), 57 (14), 41 (7). ^{1}H-n.m.r.: δ 0.81 [3H, t, C*H*$_3$(CH$_2$)$_3$-, J=7.2]; 1.30-1.04 [2H, m, CH$_3$C*H*$_2$CH$_2$CH$_2$-]; 1.42-1.58 [2H, m, CH$_3$CH$_2$C*H*$_2$CH$_2$-]; 2.42 [2H, t, CH$_3$CH$_2$CH$_2$C*H*$_2$-, J=7.3]; 3.72 [1H, dd, >C*H*Ph, J=9.4, 5.4]; 3.99 [1H, dd, -C*H*HOBOM, J =8.7, 5.4]; 4.24 [1H, t, -CH*H*OBOM, J=9.1]; 4.47 & 4.52 [2H, AB system, -OC*H*$_2$Ph, J=11.7]; 4.69 & 4.74 [2H, AB system, -OC*H*$_2$O-, J=6.7]; 7.21-7.38 [10H, m, aromatics].

(*S*)-1-[(*t*-Butyldiphenylsilyl)oxy]-2-phenylheptan-3-one 11d. Organometal: 2 equivalents of *n*-BuLi (1.6 M in hexanes). T = -78°C. Y: 78%. R_f 0.74 (PE : Et_2O 8:2). $[\alpha]_D$ = - 78.7° (c 2.13, $CHCl_3$). Anal. found C, 77.10; H, 8.10. $C_{29}H_{36}O_2Si$ requires C, 78.33; H, 8.16. I.r.: ν_{max} 3680, 2958, 2931, 1710, 1600, 1471, 1422, 1192, 1111. GC-MS: R_t 9.77; *m/z* 388 (16), 387 ($M^{+\cdot}$ - 57, 49), 309 (14), 301 (10), 280 (12), 279 (48), 225 (5), 224 (16), 223 (50), 200 (14), 199 (72), 197 (21), 183 (14), 181 (18), 180 (5), 163 (5), 147 (17), 139 (29), 137 (7), 136 (6), 135 (41), 129 (7), 123 (9), 121 (9), 115 (7), 105 (28), 104 (55), 103 (19), 92 (8), 91 (100), 85 (10), 78 (16), 77 (27), 57 (31), 45 (14), 41 (28). H-n.m.r.: δ 0.83 [3H, t, C*H*$_3$(CH$_2$)$_3$-, J=7.1]; 0.99 [9H, s, -C(C*H*$_3$)$_3$]; 1.14-1.32 [2H, m, CH$_3$C*H*$_2$CH$_2$CH$_2$-]; 1.44-1.60 [2H, m, CH$_3$CH$_2$C*H*$_2$CH$_2$-]; 2.44 [2H, t, CH$_3$CH$_2$CH$_2$C*H*$_2$, J=7.2]; 3.74 [1H, dd, >C*H*Ph, J=9.6, 5.8]; 3.96 [1H, dd, -C*H*HOTBDPS, J=8.3, 5.7]; 4.31 [1H, dd, -CH*H*OTBDPS, J=9.6, 8.4]; 7.13-7.66 [15H, m, aromatics].

(*S*)-3-[(Benzyloxy)methoxy]-1,2-diphenylpropan-1-one 11e. Organometal: 4 equivalents of PhMgBr (3 M in Et_2O). T = -78°C → r. t.. A considerable amount of PhOH was formed during this reaction; its formation can be minimized working under a helium or argon atmosphere instead of nitrogen. Phenol was best eliminated during work-up by rapid treatment of combined organic extracts with 1N NaOH. Y: 93%. R_f 0.58

(PE : Et_2O 8:2). $[\alpha]_D$ = - 138.3° (c 1.50, $CHCl_3$). Anal. found C, 79.85; H, 6.30. $C_{23}H_{22}O_3$ requires C, 79.74; H, 6.40. I.r.: ν_{max} 3596, 3003, 2947, 2886, 1679, 1597, 1448, 1192, 1165, 1114, 1045. GC-MS: R_t 9.89; *m/z* 326 ($M^{+\cdot}$ - 30, 0.9), 240 (2.6), 239 (5) 211 (2.4), 209 (6), 208 (14), 167 (2.4), 165 (9), 120 (3.3), 106 (8), 105 (96), 104 (100), 103 (6), 91 (42), 77 (25), 51 (5). ^{1}H-n.m.r.: δ 3.85 [1H, dd, >C*H*Ph, J=9.6, 5.4]; 4.41 [1H, t, -C*H*HOTBDPS, J=9.2]; 4.45 & 4.52 [2H, AB system, -OCH_2Ph, J=11.8]; 4.72 & 4.77 [2H, AB system, -OCH_2O-, J=6.8]; 4.90 [1H, dd, -CH*H*OTBDPS, J=8.9, 5.4]; 7.19-7.99 [15H, m, aromatics].

(*S*)-3-[(*t*-Butyldiphenylsilyl)oxy]-1,2-diphenylpropan-1-one 11f. Organometal: 4 equivalents of PhMgBr (3 M in Et_2O). T = -78°C → r. t.. Y: 74% (93% on unrecovered **10**; for work-up see also preparation of **11e**). R_f 0.72 (PE : Et_2O 9:1). $[\alpha]_D$ = - 61.0° (c 2.32, $CHCl_3$). Anal. found C, 84.30; H, 6.85. $C_{31}H_{32}O_2Si$ requires C, 84.13; H, 6.94. I.r.: ν_{max} 3581, 2998, 2909, 2862, 1640, 1451, 1364, 1191, 1080, 1026. GC-MS: R_t 11.38; *m/z* 409 (10), 408 (35), 407 ($M^{+\cdot}$ - 57, 100), 377 (8), 330 (6), 329 (20), 301 (10), 300 (20), 299 (75), 251 (6), 224 (7), 223 (20), 200 (8), 199 (46), 197 (16), 181 (11), 178 (11) 168 (10), 167 (68), 135 (18), 105 (41), 104 (24), 103 (7), 91 (6), 78 (10), 77 (40), 51 (7), 45 (7). ^{1}H-n.m.r.: δ 0.95 [9H, s, -C(CH_3)$_3$]; 3.91 [1H, dd, >C*H*Ph, J=9.8, 6.2]; 4.45 [1H, dd, -C*H*HOTBDPS, J=9.8, 8.0]; 4.81 [1H, dd, -CH*H*OTBDPS, J=8.0, 6.2]; 7.18-7.95 [20H, m, aromatics].

(*S*)-5-[(Benzyloxy)methoxy]-4-phenylpent-1-en-3-one 11g. Organometal: 4 equivalents of vinyl-MgBr (1 M in THF). T = -78°C → r. t.. Y: 93%. R_f 0.66 (PE : Et_2O 6:4). $[\alpha]_D$ = - 198.2° (c 1.85, $CHCl_3$). Anal. found C, 77.25; H, 6.85. $C_{19}H_{20}O_3$ requires C, 77.00; H, 6.80. I.r.: ν_{max} 3020, 2943, 2885, 1711, 1452, 1380, 1267, 1163, 1111, 1055, 1024. GC-MS: **11g** is not suitable for this analysis. ^{1}H-n.m.r.: δ 3.79 [1H, X part of ABX system, >C*H*Ph, J_{AX} & J_{BX} not determinable]; 4.25 & 4.29 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=8.5, J_{AX} & J_{BX} not determinable]; 4.48 & 4.52 [2H, AB system, -OCH_2Ph, J=11.7]; 4.71 & 4.76 [2H, AB system, -OCH_2O-, J=6.7]; 5.74 [1H, X part of ABX system, -COCH=C*H*H trans to >CO, J_{AX} & J_{BX}=8.7, 2.9]; 6.30 & 6.36 [2H, AB part of ABX system, COCH=C*H*H cis to >CO & COC*H*=CH_2, J_{AB}=17.3, J_{AX} & J_{BX} not determinable]; 7.21-7.38 [10H, m, aromatics].

(*S*)-5-[(*t*-Butyldiphenylsilyl)oxy]-4-phenylpent-1-en-3-one 11h. Organometal: 4 equivalents of vinyl-MgBr (1 M in THF). T = -78°C → r. t.. Y: 88%. R_f 0.77 (PE : Et_2O 8:2). $[\alpha]_D$ = - 110.1° (c 2.51, $CHCl_3$). Anal. found C, 78.45; H, 7.25. $C_{27}H_{30}O_2Si$ requires C, 78.22; H, 7.30. I.r.: ν_{max} 3052, 2958, 2931, 2857, 1678, 1612, 1453, 1400, 1192, 1106. GC-MS: R_t 9.29; *m/z* 359 (8), 358 (31), 357 ($M^{+\cdot}$ - 57, 100), 327 (16), 280 (10), 279 (41), 261 (6), 251 (8), 250 (21), 249 (91), 224 (9), 223 (26), 201 (15), 200 (18), 199 (93), 197 (20), 183 (8), 181 (18), 180 (6), 141 (7), 139 (7), 135 (27), 129 (8), 128 (8), 123 (6), 121 (8), 118 (6), 117 (67), 115 (6), 105 (20), 104 (34), 103 (18), 91 (14), 78 (14), 77 (26), 57 (9), 55 (34), 51 (6), 45 (13), 41 (9). ^{1}H-n.m.r.: δ 0.97 [9H, s, -C(CH_3)$_3$]; 3.84 [1H, X part of ABX system, >C*H*Ph, J_{AX} & J_{BX}=5.7, 7.8]; 4.21 & 4.34 [2H, AB part of ABX system, -CH_2OTBDPS, J_{AB}=8.6, J_{AX} & J_{BX}=5.7, 7.8]; 5.74 [1H, X part of ABX system, -COCH=C*H*H trans to >CO, J=10.6, 1.1]; 6.25 & 6.36 [2H, AB part of ABX system, -COCH=C*H*H cis to >CO & COC*H*=CH_2, J_{AB}=17.5, J_{AX} & J_{BX}= 1.1, 10.6]; 7.13-7.65 [15H, m, aromatics].

(*S*)-1-[(Benzyloxy)methoxy]-2-phenyldec-4-yn-3-one 11i. Organometal: 4 equivalents of heptynyl-Li [0.83 M in THF; reagent was prepared by addition of an equimolar quantity of *n*-BuLi (1.6 M in hexanes) to a solution of heptyne in THF]. T = -78° → - 40°C. Y: 80%. R_f 0.83 (PE : Et_2O 8:2). $[\alpha]_D$ = - 33.5° (c 3.07, $CHCl_3$). Anal. found C, 79.30; H, 7.72. $C_{24}H_{28}O_3$ requires C, 79.09; H, 7.74. I.r.: ν_{max} 3009, 2972, 2394, 1600, 1419, 1245, 1191. GC-MS: **11i** is not suitable for this analysis. ^{1}H-n.m.r.: δ 0.87 [3H, t, CH_3(CH_2)$_4$-, J=6.9]; 1.22-1.52 [6H, m, CH_3(CH_2)$_3$CH_2-]; 2.27 [2H, t, -CH_2C≡C-, J=7.0]; 3.84 [1H, dd, >C*H*Ph, J=9.5, 5.4]; 4.08 [1H, dd, -C*H*HOBOM, J=8.7, 5.4]; 4.34 [1H, t, -CH*H*OBOM, J=9.1]; 4.51 & 4.56 [2H, AB system, -OCH_2Ph, J=11.8]; 4.74 & 4.77 [2H, AB system, -OCH_2O-, J=6.8]; 7.24-7.38 [10H, m, aromatics].

(*S*)-1-[(*t*-Butyldiphenylsilyl)oxy]-2-phenyldec-4-yn-3-one 11j. Organometal: 4 equivalents of heptynyl-Li (0.83 M in THF, obtained as described in preparation of **11i**). T = -78° → - 40°C. Y: 79%. R_f 0.53 (PE : Et_2O 95:5). $[\alpha]_D$ = - 9.7° (c 2.94, $CHCl_3$). Anal. found C, 79.40; H, 8.10. $C_{32}H_{38}O_2Si$ requires C, 79.62; H, 7.94.

I.r.: ν_{max} 3006, 2956, 2930, 2859, 2207, 1665, 1454, 1185, 1106. GC-MS: R_t 11.55; *m/z* 426 (17), 425 ($M^{+\cdot}$ - 57, 48), 348 (6), 347 (19), 277 (12), 261 (6), 247 (6), 223 (6), 201 (5), 200 (18), 199 (100), 197 (15), 184 (6), 183 (13), 181 (11), 155 (5), 141 (6), 139 (6), 135 (21), 129 (6), 123 (10), 121 (6), 105 (11), 104 (20), 103 (15), 91 (10), 78 (9), 77 (21), 67 (8), 55 (9), 45 (9), 41 (10). ^{1}H-n.m.r.: δ 0.87 [3H, t, $CH_3(CH_2)_4$-, J=7.1]; 1.00 [9H, s, -C(CH_3)$_3$]; 1.21-1.53 [6H, m, $CH_3(CH_2)_3CH_2$-]; 2.29 [2H, t, -CH_2C≡C-, J=7.0]; 3.88 [1H, dd, >C*H*Ph, J=9.6, 5.8]; 4.03 [1H, dd, -C*H*HOTBDPS, J=7.3, 5.7]; 4.38 [1H, dd, -CH*H*OTBDPS, J=9.6, 8.1]; 7.17-7.66 [15H, m, aromatics].

(*S*)-1-[(Benzyloxy)methoxy]-2-phenylpentan-3-one 11k. Organometal: 2 equivalents of EtMgBr (3 M in THF). T = -78° → 0°C. Y: 81% (93 on unrecovered **9**). R_f 0.54 (PE : Et_2O 7:3). $[\alpha]_D$ = - 178.9° (c 1.03, $CHCl_3$). Anal. found C, 76.20; H, 7.46. $C_{19}H_{22}O_3$ requires C, 76.48; H, 7.43. I.r.: ν_{max} 2998, 2980, 2939, 2881, 1712, 1453, 1380, 1193, 1162, 1113, 1026, 969. GC-MS: R_t 7.27; *m/z* 298 ($M^{+\cdot}$, 0.02), 191 (1.6), 181 (6), 161 (1.4), 160 (1.5), 120 (2.2), 119 (2.2), 105 (10), 104 (100), 103 (8), 92 (7), 91 (67), 77 (6), 65 (6), 57 (27). ^{1}H-n.m.r.: δ 0.99 [3H, t, CH_3CH_2-, J=7.2]; 2.46 [2H, centre of m, CH_3CH_2-]; 3.73 [1H, dd, >C*H*Ph, J=9.3, 5.3]; 3.99 [1H, dd, -C*H*HOBOM, J=8.8, 5.3]; 4.25 [1H, t, -CH*H*OBOM, J=9.1]; 4.48 & 4.53 [2H, AB system, -OCH_2Ph, J=11.7]; 4.70 & 4.74 [2H, AB system, -OCH_2O-, J=6.7]; 7.21-7.38 [10H, m, aromatics].

General procedure for the reduction of ketones with L-Selectride™. Ketone (200-300 μmol) was dissolved in dry THF (5-7.5 ml) and cooled to -78°C. L-Selectride™ (1 M in THF, 3 equivalents) was added and the resulting solution was stirred at the same temperature for about 30 min, then quenched with NH_4Cl and extracted with Et_2O. Crude mixture was dissolved in THF (10 ml) and treated with 3 equivalents (based on L-Selectride™) of 0.25 N NaOH and 3 equivalents of 35% H_2O_2. The resulting solution was stirred at r.t. for 2.5 h, neutralized with 5% aqueous $NH_4H_2PO_4$ and extracted with Et_2O. A sample of crude reaction mixture was utilized for d. r. determination by HPLC. Alcohols **12** were isolated by chromatography (PE : Et_2O 9:1 → 8:2, for TBDPS O-protected ketones; PE : Et_2O 8:2 → 6:4, for BOM or Bn O-protected ketones). Yields and $[\alpha]_D$ values for compounds **12** are reported in Table 1. The isolated alcohols were always colourless oils.

(2*R*, 3*R*)-1-Benzyloxy-2-phenylhex-5-en-3-ol 12a. R_f 0.67 (PE : Et_2O 1:1). I.r.: ν_{max} 3581, 3484, 2998, 2909, 2862, 1640, 1602, 1451,1364, 1191, 1080, 1026. GC-MS: R_t 6.97; *m/z* 264 ($M^{+\cdot}$ - 18, 0.01), 144 (1.3), 130 (1.0), 129 (2.7), 121 (1.5), 117 (1.1), 107 (6), 106 (5), 105 (11), 104 (100), 103 (5), 92 (7), 91 (74), 65 (8), 41 (6). ^{1}H-n.m.r.: δ 1.96-2.29 [2H, m, -CH_2CH=CH_2]; 2.01 [1H, d, -O*H*, J=4.9]; 3.01 [1H, centre of m, >C*H*Ph]; 3.76 & 3.93 [2H, AB part of ABX system, -CH_2OBn, J_{AB}=9.2, J_{AX} & J_{BX}=5.4, 7.5]; 4.13 [1H, centre of m, >C*H*OH]; 4.52 & 4.56 [2H, AB system, -OCH_2Ph, J=11.8]; 5.00-5.10 [2H, m, -CH=CH_2,]; 5.84 [1H, ddt, -C*H*=CH_2 , J=17.1, 10.6, 7.1]; 7.25-7.35 [10H, m, aromatics].

(2*S*, 3*S*)-1-[(Benzyloxy)methoxy]-2-phenylhex-5-en-3-ol 12b. R_f 0.59 (PE : Et_2O 8:2). I.r.: ν_{max} 3674, 3580, 3002, 2976, 1639, 1602, 1452, 1379, 1163, 1110, 1039. GC-MS: R_t 7.76; *m/z* 241 ($M^{+\cdot}$ - 71, 0.2), 205 (0.6), 163 (1.4), 137 (11), 133 (2.0), 129 (2.1), 121 (3.2), 120 (1.7), 107 (4.0), 106 (3.4), 105 (12), 104 (100), 103 (5), 92 (8), 91 (68), 65 (5). ^{1}H-n.m.r.: δ 1.84 [1H, d, -O*H*, J=4.9]; 2.14 [2H, centre of m, -CH_2CH=CH_2]; 2.98 [1H, centre of m, >C*H*Ph]; 3.91 & 4.04 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}= 9.6, J_{AX} & J_{BX} =6.2, 7.4]; 4.03-4.15 [1H, m, >C*H*OH]; 4.52 [2H, s, -OCH_2Ph]; 4.77 [2H, s, -OCH_2O-]; 5.02-5.12 [2H, m, -CH=CH_2]; 5.84 [1H, ddt, -C*H*=CH_2 , J=17.0, 10.6, 6.8]; 7.28-7.38 [10H, m, aromatics].

(2*S*, 3*S*)-1-[(Benzyloxy)methoxy]-2-phenylheptan-3-ol 12c. R_f 0.44 (PE : Et_2O 65:35). I.r.: ν_{max} 3670, 3583, 2997, 2936, 2873, 1602, 1453, 1380, 1189, 1164, 1110, 1046. GC-MS: R_t 8.19; *m/z* 241 ($M^{+\cdot}$ - 87, 0.02), 193 (0.5), 177 (0.3), 160 (0.5), 138 (0.7), 137 (7), 105 (11), 104 (100), 92 (5), 91 (38), 41 (6). ^{1}H-n.m.r.: δ 0.87 [3H, t, $CH_3(CH_2)_3$-, J=6.8]; 1.20-1.53 [6H, m, $CH_3(CH_2)_3$-]; 1.69 [1H, d, -O*H*, J=5.9]; 2.96 [1H, centre of m, >C*H*Ph]; 3.91 & 4.03 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=9.6, J_{AX} &

J=6.9]; 7.25-7.38 [10H, m, aromatics].

(2*S*, 3*S*)-1-[(*t*-Butyldiphenylsilyl)oxy]-2-phenylheptan-3-ol 12d. R_f 0.26 (PE : Et_2O 9:1). I.r.: ν_{max} 3681, 3580, 2957, 2930, 2857, 1601, 1589, 1463, 1391, 1111, 1079. GC-MS: R_t 9.93; *m/z* 389 ($M^{+\cdot}$ - 57), 229 (6), 201 (5), 200 (18), 199 (100), 197 (6), 181 (6), 173 (22), 147 (6), 139 (11), 135 (9), 131 (7), 117 (18), 105 (11), 104 (16), 91 (32), 77 (6), 69 (7), 41 (8). ^{1}H-n.m.r.: δ 0.87 [3H, t, $CH_3(CH_2)_3$-, J=6.9]; 1.03 [9H, s, -C(CH_3)$_3$]; 1.22-1.48 [6H, m, $CH_3(CH_2)_3$-]; 1.95 [1H, d, -O*H*, J=5.3]; 2.84 [1H, centre of m, >C*H*Ph]; 3.90 & 4.06 [2H, AB part of ABX system, -CH_2OTBDPS, J_{AB}=10.1, J_{AX} & J_{BX}=5.2, 7.5]; 4.06-4.19 [1H, m, >C*H*OH]; 7.20-7.64 [15H, m, aromatics].

(1*R*, 2*S*)-3-[(Benzyloxy)methoxy]-1,2-diphenylpropan-1-ol 12e. R_f 0.45 (PE : Et_2O 6:4). I.r.: ν_{max} 3601, 3002, 2930, 2876, 1602, 1492, 1452, 1379, 1192, 1112, 1042. GC-MS: R_t 9.25; *m/z* 227 ($M^{+\cdot}$ - 121, 0.03), 213 (0.7), 181 (0.4), 179 (0.3), 178 (0.4), 165 (0.4), 138 (0.8), 137 (8), 121 (1.4), 120 (0.6), 119 (0.3), 108 (0.8), 107 (6), 105 (12), 104 (100), 91 (25), 79 (7), 77 (7). ^{1}H-n.m.r.: δ 2.23 [1H, d, –O*H*, J=3.8]; 3.22 [1H, centre of m, >C*H*Ph]; 3.76 & 3.79 [2H, AB part of ABX system, -CH_2OTBDPS, J_{AB}=9.6, J_{AX} & J_{BX}=6.2, 6.3]; 4.40 [2H, s, -OCH_2Ph]; 4.65 & 4.68 [2H, AB system, -OCH_2O-, J=6.7]; 5.07 [1H, dd, >C*H*OH, J=6.6, 3.6]; 7.19-7.38 [15H, m, aromatics].

(1*R*, 2*S*)-3-[(*t*-Butyldiphenylsilyl)oxy]-1,2-diphenylpropan-1-ol 12f. R_f 0.38 (PE : Et_2O 8:2). I.r.: ν_{max} 3598, 3484, 2959, 2929, 2857, 2351, 1602, 1452, 1391, 1112, 1086, 1028. GC-MS: R_t 11.38; *m/z* 409 ($M^{+\cdot}$ - 57, 6), 305 (9), 230 (5), 229 (29), 211 (5), 201 (5), 200 (18), 199 (100), 197 (6), 193 (6), 167 (8), 135 (8), 105 (5), 104 (16), 91 (9), 77 (9). ^{1}H-n.m.r.: δ 1.03 [9H, s, -C(CH_3)$_3$]; 2.42 [1H, d, -O*H*, J=4.1]; 3.13 [1H, centre of m, >C*H*Ph]; 3.75 & 3.82 [2H, AB part of ABX system, -CH_2OTBDPS, J_{AB}=10.1, J_{AX} & J_{BX}=4.9, 6.3]; 5.30 [1H, dd, >C*H*OH, J=6.4, 4.1]; 7.14-7.55 [20H, m, aromatics].

(3*S*, 4*S*)-5-[(Benzyloxy)methoxy]-4-phenylpent-1-en-3-ol 12g. (This compound was actually isolated from reduction with DIBALH). R_f 0.37 (PE : Et_2O 6:4). ^{1}H-n.m.r.: δ 2.04 [1H, d, -O*H*, J=5.5]; 3.09 [1H, centre of m, >C*H*Ph]; 3.89 & 4.02 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=9.6, J_{AX} & J_{BX}=6.2, 7.4]; 4.45-4.53 [1H, m, >C*H*OH]; 4.50 [2H, s, -OCH_2Ph]; 4.74 & 4.76 [2H, AB system, -OCH_2O-, J=6.9]; 5.16 [1H, dt, -CH=C*H*H cis to -C*H*=CH_2, J=10.3, 1.4]; 5.25 [1H, dt, -CH=CH*H* trans to -C*H*=CH_2, J=17.3, 1.5]; 5.85 [1H, ddd, -C*H*=CH_2, J=16.7, 10.3, 6.2]; 7.27-7.38 [10H, m, aromatics].

(3*S*, 4*S*)-5-[(*t*-Butyldiphenylsilyl)oxy]-4-phenylpent-1-en-3-ol 12h. (This compound was actually isolated from reduction with DIBALH). R_f 0.25 (PE : Et_2O 8:2). ^{1}H-n.m.r.: δ 1.03 [9H, s, -C(CH_3)$_3$]; 2.39 [1H, d, -O*H*, J=5.3]; 3.03 [1H, centre of m, >C*H*Ph]; 3.88 & 4.08 [2H, AB part of ABX system, -CH_2OTBDPS, J_{AB}=10.1, J_{AX} & J_{BX}=5.1, 7.8]; 4.64 [1H, centre of m, >C*H*OH]; 5.15 [1H, dt, -CH=C*H*H cis to -C*H*=CH_2, J=10.4, 1.4]; 5.28 [1H, dt, -CH=CH*H* trans to -C*H*=CH_2, J=17.1, 1.5]; 5.85 [1H, ddd, -C*H*=CH_2, J=17.1, 10.5, 6.1]; 7.06-7.68 [15H, m, aromatics].

(2*S*, 3*R*)-1-(Benzyloxy)methoxy-2-phenyldec-4-yn-3-ol 12i. R_f 0.50 (PE : Et_2O 6:4). I.r.: ν_{max} 3687, 3007, 2954, 2925, 2398, 1601, 1452, 1378, 1187, 1037. ^{1}H-n.m.r.: δ 0.88 [3H, t, $CH_3(CH_2)_4$-, J=7.0]; 1.21-1.52 [6H, m, $CH_3(CH_2)_3CH_2$-]; 2.18 [2H, dt, -CH_2C≡C-, J=6.9, 2.0]; 2.74 [1H, d, -O*H*, J=8.0]; 3.26 [1H, centre of m, >C*H*Ph]; 3.94 [1H, dd, -C*H*HOBOM, J=9.5, 5.5]; 4.27 [1H, t, -CH*H*OBOM, J=9.1]; 4.63-4.71 [1H, m, >C*H*OH]; 4.57 & 4.60 [2H, AB system, -OCH_2Ph, J=11.9]; 4.78 & 4.80 [2H, AB system, -OCH_2O-, J=6.8]; 7.28-7.36 [10H, m, aromatics].

(2*S*, 3*R*)-1-[(*t*-Butyldiphenylsilyl)oxy]-2-phenyldec-4-yn-3-ol 12j. R_f 0.42 (PE : Et_2O 8:2). I.r.: ν_{max} 3676, 3595, 2956, 2930, 2859, 2395, 1599, 1463, 1391, 1112, 1054. GC-MS: R_t 11.47; *m/z* 427 ($M^{+\cdot}$ - 57, 0.5), 289 (11), 253 (6), 229 (7), 223 (6), 211 (8), 201 (5), 200 (19), 199 (100), 197 (7), 181 (5), 155 (21), 137 (7), 135 (12), 105 (6), 104 (15), 91 (9), 77 (6). ^{1}H-n.m.r.: δ 0.88 [3H, t, $CH_3(CH_2)_4$-, J=6.8]; 1.05 [9H, s, -C(CH_3)$_3$]; 1.23-1.52 [6H, m, $CH_3(CH_2)_3CH_2$-]; 2.23 [2H, dt, -CH_2C≡C-, J=7.0, 2.1]; 3.24 [1H, d, -O*H*, J=8.3]; 3.25 [1H, centre of m, >C*H*Ph]; 3.92 [1H, dd, -C*H*HOBOM, J=9.9, 4.7]; 4.36 [1H, t, -CH*H*OBOM, J=9.6]; 4.79[1H, centre of m, >C*H*OH]; 7.22-7.69 [15H, m, aromatics].

General procedure for the reduction of ketones with a) DIBALH/$MgBr_2$ and b) DIBALH. Ketone (200-300 μmol) was dissolved in dry Et_2O (5-7.5 ml) and stirred 15 min at r. t. in the presence of 24-37 mg of powdered 4Å molecular sieves, before being cooled to -50°C. At this point in procedure a) 5 equivalents of $MgBr_2 \cdot Et_2O$ were added and the mixture was stirred for 15 min at the same temperature; in procedure b) the solution was stirred for 15 min at -50°C, without any addition of reagents. Both reactions were then cooled to -78°C and treated with DIBALH (1 M in toluene, 2 equivalents). After stirring for 15-30 min saturated NH_4Cl was added; then the mixture was diluted with Et_2O and Rochelle's salt (aqueous saturated solution) and stirred at r. t. until two clear phases were obtained; finally, extraction with Et_2O and solvent removal gave crude alcohols **12** and **13**, purified as above described. Yields are reported in Table 1.

Reduction of 11a with $NaBH_4$. A solution of **11a** (128 mg, 456.54 μmol) in dry MeOH (4 ml) was cooled to -78°C and treated with $NaBH_4$ (86 mg, 2.28 mmol). After 30 min saturated aqueous NH_4Cl was added and the mixture was extracted with Et_2O. Preparative chromatography (PE : Et_2O 65:35) gave a mixture of **12a** and **13a** (see Table 1).

Reduction of 11a with $NaBH_4/CeCl_3$. Procedure as above, but adding first an equimolar quantity of anhydrous) $CeCl_3$,[27] followed by 1 eq of $NaBH_4$.

Reduction of 11a with $Zn(BH_4)_2$. A solution of **11a** (106 mg, 378.08 μmol) in dry Et_2O (5 ml) was stirred for 15 min at r. t. in the presence of 25 mg of powdered 4Å molecular sieves, then cooled to -20°C and treated with $Zn(BH_4)_2$ (7.56 ml of a 0.15 M sol in Et_2O). After 30 min work-up as above.

General procedure for Mosher's esters formation. Alcohol (4-6 mg) was dissolved in dry CH_2Cl_2 (0.5-1 ml) and treated with 6 equivalents of 4-N,N-dimethylaminopyridine and 3 equivalents of (*R*)- or (*S*)-Mosher chloride. After 1 h the solution was directly purified by preparative chromatography (usually using PE : Et_2O 8:2), without aqueous work-up.

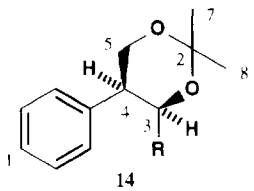
General procedure for transformation of -OBn & -OBOM into -OH. A solution of **12** in EtOH (5 ml / 50 mg of substrate) was treated with 10% Pd/C (about 150 mg of catalyst / mmol of substrate) and hydrogenated overnight. The catalyst was filtered off and the solution concentrated *in vacuo* to give the corresponding diol as a white solid, used as such for the next reaction. Of course, during this reaction also double and triple bonds were idrogenated to give the corresponding saturated compounds (see alcohols **12** & **13a**, **b**, **g**, **i**).

General procedure for transformation of -OTBDPS into -OH. A solution of **12** or **13** (200-300 μmol) in dry THF (5 ml) was treated with 3 equivalents of *n*-$Bu_4N^+F^-$ (0.5 M in THF) and the resulting solution was stirred at r. t. for 30 min. The mixture was partitioned between brine and Et_2O and extracted. Crude product was purified by preparative chromatography (PE : Et_2O 3:7) to give a white solid. Yield: about 85%.

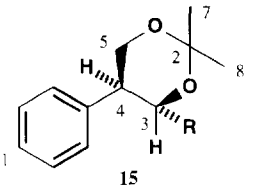
General procedure for O,O-*iso*-propylidene formation. A solution of diol from the above described reactions (200-300 μmol) in dry CH_2Cl_2 (5 ml) was cooled to 0°C and treated with 3 equivalents of 2-methoxypropene, followed by 0.02 equivalents of *p*-TSA (0.1 M sol in THF). After 10 min the reaction was usually complete. Triethylamine (3.5 equivalents) was added and the mixture was concentrated and directly purified by preparative chromatography (PE : Et_2O 95:5) to give the corresponding O,O-*iso*-propylidene derivative. Yield: 54-85% (see Table 3 for selected spectroscopic data).

General procedure for organometal addition to ketones 11 b-f, k. A solution of ketone (250-380 μmol) in dry THF (5 ml) was cooled to -78°C and treated with an excess of the desired organometal (3-5 equivalents; see preparation of 11a-k for employed organometal solutions; propargyl-MgBr used was a 1.36 M sol in Et_2O). After 1 h quenching with aqueous saturated NH_4Cl and extraction with Et_2O furnished the crudeproduct. Chromatography (PE : Et_2O 8:2 → 1:1) gave a mixture of **16** and **17**. For determination of $[\alpha]_D$ the mixture of epimeric alcohols was purified again by preparative chromatography. Yields and $[\alpha]_D$ values

Table 3: selected ^{1}H-n.m.r. & ^{13}C-n.m.r. data of O,O-*iso*-propylidene derivatives



14



15

^{1}H-n.m.r.

parent alcohol; product	*R*	H_3 (*J*)	H_4 (*J*)	H_{5a} (*J*)	H_{5b} (*J*)	H_7 (H_8)	H_8 (H_7)
12a,b; 14	*n*-Pr	4.19 dt; 6.1, 3.4	2.50 dt ; 3.6, 1.7	3.88 dd; 11.7, 1.7	4.36 dd; 11.7, 4.0	1.55 s	1.54 s
12c,d; 14	*n*-Bu	4.16 dt; 6.2, 3.3	2.51 dt; 3.6, 1.6	3.87 dd; 11.6, 1.7	4.35 dd; 11.6, 3.8	1.54 s	1.54 s
12e,f; 14	Ph	5.43 d; 3.4	2.83 dt; 3.6, 1.2	4.10 dd; 11.7, 1.4	4.57 dd; 11.8, 3.7	1.66 s	1.66 s
12g; 14	Et	4.08 dt; 6.7, 3.4	2.54 dt; 3.8, 1.8	3.88 dd; 11.7, 1.8	4.36 dd; 11.7, 4.0	1.56 s	1.56 s
12h; 14	vinyl	4.76 dd; 6.2, 3.7	2.62 dt; 3.7, 1.5	3.92 dd; 11.8, 1.6	4.42 dd; 11.7, 3.8	1.60 s	1.57 s
12i; 14	*n*-heptyl	4.16 dt; 6.2, 3.4	2.51 dt; 3.6, 1.7	3.87 dd; 11.7, 1.7	4.35 dd; 11.7, 4.0	1.55 s	1.55 s
12j; 14	heptynyl	5.07 dt; 4.0, 2.0	2.85 q; 4.0	4.06 dd; 11.8, 3.8	4.27 dd; 11.9, 4.1	1.60 s	1.55 s
13a, b; 15	*n*-Pr	4.00-4.08[a]	2.75 dt; 10.9, 5.5	3.82 dd; 11.7, 5.5	3.96 t; 11.4	1.58 s	1.46 s
13c, d; 15	*n*-Bu	4.01 dt; 10.3, 5.1	2.75 dt; 10.8, 5.5	3.82 dd; 11.7, 5.4	3.96 t; 11.3	1.58 s	1.46 s
13e, f; 15	Ph	5.02 d; 10.5	3.06 dt; 10.8, 5.2	3.97 dd; 11.8, 5.2	4.23 t; 11.6	1.72 s	1.58 s
13g; 15	Et	3.96[a]	2.77 dt; 10.9, 5.5	3.83 dd; 11.6, 5.4	3.98 t; 11.4	1.59 s	1.46 s
13h; 15	vinyl	4.54 dd; 10.5, 5.0	2.82 dt; 10.8, 5.8	3.87 dd; 11.6, 5.6	4.05 t; 11.5	1.64 s	1.51 s
13i; 15	*n*-heptyl	4.13 dt; 10.2, 5.1	2.75 dt; 10.9, 5.4	3.82 dd; 11.7, 5.5	3.96 t; 11.4	1.58 s	1.46 s
13j; 15	heptynyl	4.78 dt; 10.7, 1.9	3.06 dt; 10.8, 5.3	3.90 dd; 11.9, 5.3	4.04 t; 11.4	1.60 s	1.52 s

^{13}C-n.m.r.

parent alcohol; product	*R*	C_1	C_2	C_3	$C_{3'}$	C_4	C_5	C_7 (C_8)	C_8 (C_7)
12a,b; 14	*n*-Pr	126.46	98.88	70.94	35.66	43.95	65.59	29.40	19.14
12c,d; 14	*n*-Bu	126.46	98.88	71.30	33.24	43.89	65.60	29.43	19.15
12e,f; 14	Ph	126.76[b]	99.36	73.40	139.76	45.46	65.37	29.66	18.92
12g; 14	Et	126.50	98.91	72.86	26.52	43.48	65.57	29.44	19.15
12h; 14	vinyl	126.53	98.98	72.85	137.15	44.26	65.18	29.48	19.09
12i; 14	*n*-heptyl	126.46	98.88	71.28	33.52	43.84	65.59	29.43	19.14
12j; 14	heptynyl	126.75	99.45	64.35	88.49	44.32	63.86	28.01	21.21
13a, b; 15	*n*-Pr	127.03	98.36	73.03	35.55	47.59	65.78	29.71	19.47
13c, d; 15	*n*-Bu	127.02	98.37	73.26	33.17	47.57	65.76	29.71	19.47
13e, f; 15	Ph	127.05[c]	98.89	77.21	137.98	49.21	65.35	29.83	19.37
13g; 15	Et	127.06	98.39	74.57	26.32	47.10	65.65	29.72	19.49
13h; 15	vinyl	127.20	98.44	74.66	136.32	47.39	65.31	29.72	19.39
13i; 15	*n*-heptyl	127.03	98.38	73.28	33.47	47.60	65.78	29.72	19.49
13j; 15	heptynyl	127.36	98.94	65.79	86.89	47.93	64.89	29.55	19.16

Note: a) molteplicity can not be determinated because of overlapping of signals; b) interchangeable with 126.17 of the other Ph; c) interchangeable with 127.05 of the other Ph.

for compounds **16** are reported in Table 2. The isolated alcohols were always colourless oils.

(3*R*, 4*S*)-5-[(Benzyloxy)methoxy]-3-ethyl-4-phenylpent-1-en-3-ol 16a (R^1 = Et, R^2 = vinyl). R_f 0.39 (PE : Et_2O 7:3). I.r.: ν_{max} 3599, 3505, 2970, 2936, 2881, 1601, 1490, 1452, 1380, 1192, 1164, 1107. GC-MS: R_t 7.90; *m/z* 326 ($M^{+\cdot}$ - 30, 0.01), 191 (0.7), 189 (0.7), 188 (0.3), 175 (0.2), 159 (0.4), 145 (0.4), 143 (0.4), 138 (0.5), 137 (6), 105 (10), 104 (100), 92 (5), 91 (40), 43 (8). ^{1}H-n.m.r.: δ 0.78 [3H, t, CH_3CH_2-, 7.4]; 1.41 [2H, q, CH_3CH_2-, J=7.4]; 2.48 [1H, s, -OH]; 2.93 [1H, X part of ABX system, >CHPh, J_{AX} & J_{BX}=4.1, 7.3]; 3.97 & 4.09 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=9.7, J_{AX} & J_{BX}=4.1, 7.3]; 4.40 [2H, s, -OCH_2Ph]; 4.65 & 4.70 [2H, AB system, -OCH_2O-, J=6.8]; 5.24 [1H, dd, -CH=CHH cis to -CH=CH_2, J=10.6, 1.7]; 5.35 [1H, dd, -CH=CHH trans to -CH=CH_2, J=17.2, 1.7]; 5.84 [1H, dd, -CH=CH_2, J=17.2, 10.7]; 7.22-7.42 [10H, m, aromatics]. ^{13}C-n.m.r.: δ 7.57 [CH_3CH_2-]; 31.82 [CH_3CH_2-]; 53.74 [>CHPh]; 69.39 & 69.67 [-CH_2OBOM & -OCH_2Ph]; 76.39 [probable location of >C(OH)Et together with one signal of $CDCl_3$]; 94.62 [-OCH_2O-]; 114.00 [-CH=CH_2]; 126.84 & 127.66 [2 >CH- para in both aromatics]; 127.87, 128.06, 128.34 & 129.89 [2 >CH- ortho & meta in both aromatics]; 137.59 [*C* ipso of -OCH_2Ph]; 139.64 [*C* ipso of Ph-CH(CH_2OBOM)-]; 142.49 [-CH=CH_2].

(2*S*, 3*R*)-1-[(Benzyloxy)methoxy]-3-ethyl-2-phenylhex-5-en-3-ol 16b (R^1 = Et, R^2 = allyl) or 17g (R^1 = allyl, R^2 = Et). R_f 0.37 (PE : Et_2O 7:3). I.r.: ν_{max} 3519, 3001, 2936, 2882, 1639, 1601, 1452, 1380, 1110, 1041. GC-MS: R_t 8.25; *m/z* 281 ($M^{+\cdot}$ - 59, 0.03), 251 (1.0), 233 (0.7), 191 (4.3), 161 (1.8), 143 (1.1), 137 (6), 130 (2.7), 121 (1.9), 119 (1.2), 107 (1.6), 105 (10), 104 (100), 92 (6), 91 (54), 57 (26). ^{1}H-n.m.r. : δ 0.86 [3H, t, CH_3CH_2-, J=7.4]; 1.37 [2H, q, CH_3CH_2-, J=7.4]; 2.36-2.42 [3H, m, -CH_2CH=CH_2 + -OH]; 3.02 [1H, X part of ABX system, >CHPh, J_{AX} & J_{BX}=4.5, 7.5]; 4.08 & 4.11 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=9.9, J_{AX} & J_{BX}=4.5, 7.5]; 4.46 [2H, s, -OCH_2Ph]; 4.70 & 4.73 [2H, AB system, -OCH_2O-, J=6.9]; 5.06-5.17 [2H, m, -CH=CH_2]; 5.88 [1H, ddt, -CH=CH_2, J=16.1, 11.4, 7.3]; 7.24-7.39 [10H, m, aromatics].

(2*S*, 3*R*)-1-[(Benzyloxy)methoxy]-3-ethyl-2-phenylheptan-3-ol 16c (R^1 = Et, R^2 = *n*-Bu) or 17h (R^1 = *n*-Bu, R^2 = Et). R_f 0.27 (PE : Et_2O 8:2). I.r.: ν_{max} 3515, 2955, 2940, 2874, 1601, 1453, 1380, 1192, 1107, 1039. GC-MS: R_t 8.60; *m/z* 281 ($M^{+\cdot}$ - 75, 0.01), 251 (0.4), 221 (0.5), 219 (0.8), 191 (2.1), 161 (0.5), 145 (0.5), 138 (0.4), 137 (3.7), 131 (0.4), 121 (1.3), 115 (4.5), 107 (1.3), 105 (10), 104 (100), 92 (3.8), 91 (32), 57 (4.4), 55 (4.4). ^{1}H-n.m.r.: δ 0.82 [3H, t, CH_3CH_2-, J=7.4]; 0.92 [3H, t, $CH_3(CH_2)_3$-, J=6.2]; 1.24-1.61 [8H, m, -CH_2- of Et & *n*-Bu]; 2.20 [1H, s, -OH]; 3.00 [1H, X part of ABX system, >CHPhJ_{AX} & J_{BX}=4.6, 7.4]; 4.04 & 4.12 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=9.8, J_{AX} & J_{BX}=4.6, 7.4,]; 4.45 [2H, s, -OCH_2Ph]; 4.70 & 4.72 [2H, AB system, -OCH_2O-, J=6.9]; 7.24-7.39 [10H, m, aromatics]. ^{13}C-n.m.r.: δ 7.64 [CH_3CH_2-]; 14.11 [$CH_3(CH_2)_3$-]; 23.32 [$CH_3CH_2CH_2CH_2$-]; 25.86 [$CH_3CH_2CH_2CH_2$-]; 29.50 [CH_3CH_2-]; 36.07 [$CH_3CH_2CH_2CH_2$-]; 51.71 [>CHPh]; 69.07 & 69.49 [-CH_2OBOM & -OCH_2Ph]; 76.16 [>C(OH)Et]; 94.67 [-OCH_2O-]; 126.64 & 127.67 [2 >CH- para in both aromatics]; 128.09, 128.31, 128.36 & 129.66 [2 >CH- ortho & meta in both aromatics]; 137.61 [*C* ipso of -OCH_2Ph]; 140.46 [*C* ipso of Ph-CH(CH_2OBOM)-].

(1*S*, 2*S*)-3-[(Benzyloxy)methoxy]-1-ethyl-1,2-diphenylpropan-1-ol 16d (R^1 = Et, R^2 = Ph) or 17i (R^1 = Ph, R^2 = Et). Also in this case some PhOH was obtained and eliminated as above described for compound **11e**. R_f 0.28 (PE : Et_2O : CH_2Cl_2 8:1:1). I.r.: ν_{max} 3498, 2964, 2932, 2878, 1953, 1718, 1600, 1452, 1380, 1245, 1112, 1050. GC-MS: R_t 9.42; *m/z* 299 ($M^{+\cdot}$ - 77, 0.06), 241 (0.5), 137 (4.2), 135 (9), 105 (13), 104 (100), 103 (3.0), 92 (2.6), 91 (22), 77 (4.1), 57 (9). ^{1}H-n.m.r.: δ 0.99 [3H, t, CH_3CH_2-, J=7.2]; 1.62 [2H, centre of m, CH_3CH_2-]; 3.05 [1H, s, -OH]; 3.27 [1H, dd, >CHPh, J=7.0, 3.4]; 3.65 [1H, dd, -CHHOBOM, J=9.8, 3.4]; 3.89 [1H, dd, -CHHOBOM, J=9.8, 7.1]; 4.26 [2H, s, -OCH_2Ph]; 4.50 & 4.55 [2H, AB system, -OCH_2O-, J=6.8]; 7.10-7.53 [15H, m, aromatics].

(2*S*, 3*S*)-1-[(Benzyloxy)methoxy]-3-ethyl-2-phenylhept-5-yn-3-ol 16e (R^1 = Et, R^2 = propargyl). R_f 0.46 (PE : Et_2O 7:3). I.r.: ν_{max} 3499, 3304, 3002, 2967, 2944, 2395, 1602, 1453, 1380, 1110, 1042, 1026. GC-MS: R_t 11.25; *m/z* 281 ($M^{+\cdot}$ - 57, 0.02), 251 (0.6), 233 (0.5), 203 (0.5), 191 (3.1), 181 (0.6), 170 (0.6), 161 (1.1), 143 (1.8), 141 (1.2), 137 (6), 105 (10), 104 (100), 92 (6), 91 (49), 57 (16). ^{1}H-n.m.r.: δ 0.89 [3H, t, CH_3CH_2-,

J=7.4]; 1.53 [2H, q, CH_3CH_2- , J=7.5]; 2.10 [1H, t, -C≡C*H*]; 2.39 & 2.53 [2H, AB part of ABX system, -CH_2C≡CH, J_{AB}=16.9, J_{AX} & J_{BX}=2.7, 2.6]; 2.81 [1H, s, -O*H*]; 3.31 [1H, t, >C*H*Ph, J=6.0]; 4.13 [2H, d, -CH_2OBOM, J=6.2]; 4.48 [2H, s, -OCH_2Ph]; 4.73 & 4.75 [2H, AB system, -OCH_2O-, J=6.9]; 7.25-7.41 [10H, m, aromatics].

(2*S*, 3*S*)-1-[(Benzyloxy)methoxy]-3-ethyl-2-phenyldec-5-yn-3-ol 16f (R^1 = Et, R^2 = heptynyl) or 17j (R^1 = heptynyl, R^2 = Et). R_f 0.73 (PE : Et_2O 6:4). I.r.: ν_{max} 3492, 3003, 2957, 2931, 2238, 1601, 1453, 1380, 1111, 1041. GC-MS: R_t 9.42; *m/z* 317 ($M^{+\cdot}$ - 77, 0.02), 256 (3.7), 185 (1.6), 153 (5), 137 (1.8), 121 (1.3), 107 (1.3), 105 (10), 104 (100), 103 (4.0), 92 (3.5), 91 (30), 57 (11), 55 (3.3). ^{1}H-n.m.r.: δ 0.90 [3H, t, C*H*$_3$(CH$_2$)$_4$-, J=7.0]; 1.03 [3H, t, C*H*$_3$CH$_2$-, J=7.3]; 1.25-1.59 [8H, m, CH_3CH_2- & $CH_3(CH_2)_3CH_2$C≡]; 2.22 [2H, t, -CH_2C≡, J=7.0]; 2.79 [1H, s, -O*H*]; 3.04 [1H, X part of ABX system, >C*H*Ph, J_{AX} & J_{BX}=3.7, 7.3]; 4.12 & 4.38 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=9.7, J_{AX} & J_{BX}=7.3, 3.7]; 4.45 [2H, s, -OCH_2Ph]; 4.73 [2H, s, -OCH_2O-]; 7.22-7.48 [10H, m, aromatics].

(2*S*, 3*S*)-1-[(Benzyloxy)methoxy]-3-ethyl-2-phenylhex-5-en-3-ol 16g (R^1 = allyl, R^2 = Et) or 17b (R^1 = Et, R^2 = allyl). R_f 0.31 (PE : Et_2O 7:3). I.r.: ν_{max} 3473, 2939, 2873, 2234, 1953, 1809, 1730, 1602, 1453, 1380, 1164, 1105, 1045. GC-MS: R_t 8.28; *m/z* 281 ($M^{+\cdot}$ - 59, 0.04), 251 (1.0), 233 (0.7), 205 (0.6), 203 (0.6), 191 (3.7), 161 (1.8), 145 (0.7), 143 (1.2), 138 (0.6), 137 (6), 105 (11), 104 (100), 92 (6), 91 (55), 57 (25). ^{1}H-n.m.r.: δ 0.94 [3H, t, C*H*$_3$CH$_2$-, J=7.4]; 1.56-1.67 [2H, m, CH_3CH_2-]; 2.09-2.17 [2H, m, -CH_2CH=CH_2]; 2.38 [1H, s, -O*H*]; 3.04 [1H, X part of ABX system, >C*H*Ph, J_{AX} & J_{BX}=4.6, 7.6]; 4.06 & 4.10 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=9.8, J_{AX} & J_{BX}=4.6, 7.6]; 4.45 [2H, s, -OCH_2Ph]; 4.70 & 4.72 [2H, AB system, -OCH_2O-, J=6.9]; 4.49-5.08 [2H, m, -CH=CH_2]; 5.81 [1H, ddt, -C*H*=CH_2, J=17.5, 10.3, 7.3]; 7.22-7.38 [10H, m, aromatics].

(2*S*, 3*S*)-1-[Benzyloxy)methoxy]-3-ethyl-2-phenylheptan-3-ol 16h (R^1 = *n*-Bu, R^2 = Et) or 17c (R^1 = Et, R^2 = *n*-Bu). R_f 0.36 (PE : Et_2O 7:3). I.r.: ν_{max} 3520, 2960, 2939, 2872, 1492, 1453, 1380, 1041, 1026. GC-MS: R_t 8.55; *m/z* 281 ($M^{+\cdot}$ - 59, 0.02), 219 (1.2), 191 (1.4), 145 (0.5), 137 (3.8), 121 (1.3), 120 (0.6), 119 (0.5), 117 (0.5), 115 (4.5), 105 (10), 104 (100), 92 (3.6), 91 (32), 59 (3.3), 57 (4.2), 55 (4.2). ^{1}H-n.m.r.: δ 0.83 [3H, t, C*H*$_3$(CH$_2$)$_3$-, J=6.8]; 0.91 [3H, t, C*H*$_3$CH$_2$-, J=7.4]; 1.34-1.30 [6H, m, $CH_3(CH_2)_3$-]; 1.62 [2H, q, CH_3CH_2-, J=7.8]; 2.21 [1H, s, -O*H*]; 3.01 [1H, X part of ABX system, >C*H*Ph, J_{AX} & J_{BX}=4.9, 7.4]; 4.04 & 4.10 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=10.0, J_{AX} & J_{BX}=4.9, 7.4]; 4.45 [2H, s, -OCH_2Ph]; 4.70 & 4.72 [2H, AB system, -OCH_2O-, J=6.9]; 7.24-7.39 [10H, m, aromatics]. ^{13}C-n.m.r.: δ 8.06 [*C*H$_3$CH$_2$-]; 14.03 [*C*H$_3$(CH$_2$)$_3$-]; 23.18 [$CH_3CH_2CH_2CH_2$-]; 25.44 [$CH_3CH_2CH_2CH_2$-]; 29.45 [CH_3CH_2-]; 36.19 [$CH_3CH_2CH_2CH_2$-]; 51.78 [>CHPh]; 69.11 & 69.54 [-CH_2OBOM & -OCH_2Ph]; 76.16 [>C(OH)Et]; 94.72 [-OCH_2O-]; 126.66 & 127.68 [2 >CH- para in both aromatics]; 127.84, 128.10, 128.38 & 129.66 [2 >CH- ortho & meta in both aromatics]; 137.67 [*C* ipso of -OCH$_2$Ph]; 140.45 [*C* ipso of Ph-CH(CH$_2$OBOM)-].

(1*R*, 2*S*)-3-[(Benzyloxy)methoxy]-1-ethyl-1,2-diphenylpropan-1-ol 16i (R^1 = Ph, R^2 = Et) or 17d (R^1 = Et, R^2 = Ph). R_f 0.37 (PE : Et_2O 7:3). I.r.: ν_{max} 3492, 3000, 2938, 2882, 1600, 1452, 1380, 1163, 1110, 1041. GC-MS: R_t 9.40; *m/z* 299 (M^+ - 77, 0.1), 241 (0.5), 239 (0.7), 137 (4.1), 136 (1.0), 135 (9), 121 (0.9), 120 (0.4), 117 (0.5), 115 (0.6), 107 (1.0), 106 (1.0), 105 (13), 104 (100), 103 (2.8), 92 (2.5), 91 (22), 57 (8). ^{1}H-n.m.r.: δ 0.74 [3H, t, C*H*$_3$CH$_2$-, J=7.4]; 1.95 [2H, centre of m, CH_3CH_2-]; 3.33 [1H, X part of ABX system, >C*H*Ph, J_{AX} & J_{BX}=5.7, 7.1]; 3.69 [1H, s, -O*H*]; 3.90 & 4.00 [2H, AB part of ABX system, -CH_2OBOM, J_{AB}=9.8, J_{AX} & J_{BX}=5.7, 7.1]; 4.54 [2H, s, -OCH_2Ph]; 4.77 [2H, s, -OCH_2O-]; 6.88-7.38 [15H, m, aromatics].

(2*S*, 3*S*)-1-[(Benzyloxy)methoxy]-3-ethyl-2-phenyldec-5-yn-3-ol 16j (R^1 = heptynyl, R^2 = Et) or 17f (R^1 = Et, R^2 = heptynyl). R_f 0.55 (PE : Et_2O 7:3). I.r.: ν_{max} 3473, 2939, 2873, 2234, 1953, 1809, 1602, 1453, 1380, 1105, 1045. GC-MS: R_t 9.44; *m/z* 317 ($M^{+\cdot}$ - 77, 0.03), 256 (3.8), 153 (5), 137 (1.9), 129 (1.1), 121 (1.4), 107 (1.3), 105 (11), 104 (100), 103 (4.1), 92 (3.9), 91 (32), 77 (3.1), 65 (3.2), 57 (10), 55 (3.6). ^{1}H-n.m.r.: δ 0.89 [3H, t, C*H*$_3$4CH$_2$)$_4$-, J=7.2]; 0.97 [3H, t, C*H*$_3$CH$_2$-, J=7.7]; 1.21-1.56 [8H, m, CH_3CH_2- &

$CH_3(CH_2)_3CH_2C\equiv$]; 2.25 [2H, t, -$CH_2C\equiv$, J=7.0]; 3.12 [1H, dd, >CHPh, J=10.2, 4.9]; 3.85 [1H, dd, -CHHOBOM, J=9.5, 4.9]; 4.33 [1H, s, -OH]; 4.50 [1H, t, -CHHOBOM, J=9.9]; 4.59 & 4.69 [2H, AB system, -OCH_2Ph, J=11.8]; 4.79 & 4.84 [2H, AB system, -OCH_2O-, J=6.8]; 7.26-7.40 [10H, m, aromatics].

General procedure for β-lactons & olefin formation from 16d and 16i.

1) (2*R*, 3*R*)-3-Hydroxy-2,3-diphenylpentanoic acid 18 and (2*R*, 3*R*)-3-hydroxy-2,3-diphenylpentanoic acid 21. They were prepared by catalytic hydrogenation, followed by Jones oxidation of crude diol as reported in the general procedures above described starting from **16d** and **16i** respectively. The acids were purified by chromatography [PE : AcOEt 7:3 → 1:1; then PE : AcOEt 1:1 with increasing amounts of AcOH (1-2%)]. Compound **18**: white solid, yield: 73% from **16d**. R_f 0.41 (PE : Et_2O 2:8). ^{1}H-n.m.r.: (DMSO-d_6) δ 0.50 [3H, t, CH_3CH_2-, J=7.3]; 1.53 [2H, centre of m, CH_3CH_2-]; 4.32 [1H, s, >CHPh]; 5.27 [1H, broad s, -CO_2H]; 7.30-7.79 [10H, m, aromatics]. Compound **21**: white solid, yield: 57% from **16i**. R_f 0.33 (PE : Et_2O 2:8). ^{1}H-n.m.r. (DMSO-d_6): δ 0.70 [3H, t, CH_3CH_2-, J=7.3]; 2.15 [2H, centre of m, CH_3CH_2-]; 4.11 [1H, s, >CHPh]; 5.20 [1H, broad s, -CO_2H]; 7.11-7.38 [10H, m, aromatics].

2) (3*R*, 4*S*)-4-Ethyl-3,4-diphenyloxetan-2-one 19 and (3*R*, 4*R*)-4-ethyl-3,4-diphenyloxetan-2-one 22. A solution of acid **18** or **21** (50 mg, 184.96 μmol) in dry pyridine (1 ml) was cooled at 0°C and treated with benzenesulfonylchloride (118 μl, 0.93 mmol). After 2 hrs the solution was diluted with H_2O/Et_2O and extracted. Combined organic phases were acidified to pH 2 by careful addition of 1 N HCl, then immediately washed with 5% $NaHCO_3$ and brine. Both **19** and **22** were characterized as crude products. Compound **19**: R_f 0.68 (PE : Et_2O 9:1). I.r.: ν_{max} 1796. ^{1}H-n.m.r.: δ 0.68 [3H, t, CH_3CH_2-, J=7.3]; 1.75 [2H, centre of m, CH_3CH_2-]; 4.94 [1H, s, >CHPh]; 7.35-8.13 [10H + 5H, m, aromatics of **19** & $PhSO_2Cl$]. Compound **22**: R_f 0.57 (PE : Et_2O 9:1). I.r.: ν_{max} 1795. ^{1}H-n.m.r.: δ 0.94 [3H, t, CH_3CH_2-, J=7.3]; 2.34 [2H, centre of m, CH_3CH_2-]; 4.86 [1H, s, >CHPh]; 7.58-8.08 [10H + 5H, m, aromatics of **22** & $PhSO_2Cl$].

3) (*E*)-1,2-diphenylbut-1-ene 20 and (*Z*)-1,2-diphenylbut-1-ene 23. Crude lactons were dissolved again in dry pyridine (1 ml). **19** Was heated at 60° 3 hrs, while **22** did not eliminate at the same temperature and had to be warmed to 110°C for 9 hrs. After above described work-up best results were obtained by characterization of crude mixture. From **19** we obtained a 87.4 : 12.6 mixture of **20** and **23** and from **22** we obtained a 83.7 : 16.3 mixture of **23** and **20** respectively. Compound **20**: R_f 0.58 (PE). ^{1}H-n.m.r.: δ 1.06 [3H, t, CH_3CH_2-, J=7.5]; 2.75 [2H, q, CH_3CH_2-, J=7.6]; 6.69 [1H, s, >CHPh]; 7.21-8.10 [10H + 5H, m, aromatics of **20** & $PhSO_2Cl$]]. Compound **23**: R_f 0.59 (PE). ^{1}H-n.m.r.: δ 1.06 [3H, t, CH_3CH_2-, J=7.5]; 2.51 [2H, q, CH_3CH_2-, J=7.3]; 6.42 [1H, s, >CHPh]; 7.21-8.10 [10H + 5H, m, aromatics of **23** & $PhSO_2Cl$].

REFERENCES AND NOTES

1. Harada, T.; Oku, A. *Synlett.* **1994**, 95-104.
2. Some selected examples: **a**) Terao, Y.; Akamatsu, M.; Achiwa, K. *Chem. Pharm. Bull.* **1991**, *39*, 823-825; **b**) Banfi, L.; Guanti, G.; Narisano, E. *J. Org. Chem.* **1992**, *57*, 1540-1554 and references therein; **c**) Itoh, T.; Chika, J.; Takagi, Y.; Nishiyama, S. *J. Org. Chem.* **1993**, *58*, 5717-5723; **d**) Guanti, G.; Banfi, L.; Brusco, S.; Riva, R. *Tetrahedron Lett.* **1993**, *34*, 8549-8552; **e**) Guanti, G.; Banfi, L.; Brusco, S.; Narisano, E. *Tetrahedron: Asymm.* **1994**, *5*, 537-540; **f**) Guanti, G.; Riva, R. *Tetrahedron Lett.*, **1995**, *36*, 3933-3936.
3. Banfi, L.; Guanti, G. *Synthesis* **1993**, 1029-1056.
4. Some examples: **a**) Guanti, G.; Banfi, L.; Riva, R.; Zannetti, M. T. *Tetrahedron Lett.* **1993**, *34*, 5483-5486; **b**) Guanti, G.; Banfi, L.; Zannetti, M. T. *Tetrahedron Lett.* **1993**, *34*, 5487-5490; **c**) Guanti, G.; Banfi, L.; Merlo, V.; Narisano, E. *Tetrahedron* **1994**, *50*, 2219-2230.
5. Banfi, L.; Guanti, G.; Riva, R. *Tetrahedron: Asymm.* **1995**, *6*, 1345-1356.

6. **a**) Didier, E.; Loubinoux, B.; Ramos Tombo, G. M.; Rihs, G. *Tetrahedron* **1991**, *47*, 4941-4958; **b**) Chênevert, R.; Desjardins, M. *Can. J. Chem*, **1994**, *72*, 2312-2317.
7. It must be pointed out that both enantiomers of alcohols **3**, **4** can be obtained either: a) starting from (*S*) or (*R*) **1** or b) by a longer protection-deprotection strategy (similar to that employed for the synthesis of **2**.
8. The (*R*) enantiomer could be however synthesized starting from easily available (*R*)-**1**.
9. Employed reaction conditions represent the best compromise between chemical yield and minimization of elimination side reaction to give 2-substituted styrene derivatives.
10. Nahm, S.; Weinreb, S. M. *Tetrahedron Lett.* **1981**.
11. **a**) Wong, S. S.; Paddon-Row, M. N. *J. Chem. Soc., Chem. Commun.* **1990**, 456-458; **b**) Wu, Y.-D.; Tucker, J. A.; Houk, K. N. *J. Am. Chem. Soc.* **1991**, *113*, 5018-5027.
12. **a**) Midland, M. M.; Kwon, Y. C. *J. Am. Chem. Soc.* **1983**, *105*, 3725-3727; for the related reduction of α-alkenyl-α-methyl ketones see **b**) Suzuki, K.; Katayiama, E.; Tsuchihashi, G. *Tetrahedron Lett.* **1984**, *25*, 2479-2482.
13. For definition of "chelating" and "non-chelating" protecting group see ref. 4a.
14. A characteristic trend was observed for chemical shifts (^{1}H and ^{13}C-n.m.r.) and coupling constants for some selected protons and carbons as reported in Table 3. Our findings are in line with previous reported data (see ref. 4a).
15. Notice that **16b** ≡ **17g**, **16c** ≡ **17h**, **16d** ≡ **17i**, **16f** ≡ **17j**, **16g** ≡ **17b**, **16h** ≡ **17c**, **16i** ≡ **17d**, **16j** ≡ **17f**.
16. Banfi, L.; Guanti, G.; Narisano, E. *Tetrahedron* **1993**, *49*, 7385-7392. Further modifications of this procedure were explored, using different tertiary amines, but only with limited success.
17. To our knowledge only few examples of addition of organometals to β-hydroxy ketones bearing a chiral centre in the α position have been published until now: **a**) Maurer, P. J.; Knudsen, C. G.; Palkowitz, A. D.; Rapoport, H. *J. Org. Chem.* **1985**, *50*, 325-332; **b**) Chikashita, H.; Nakamura, Y.; Uemura, H.; Itoh, K. *Chem. Lett.* **1992**, 439-440; **c**) Maruoka, K.; Oishi, M.; Shiohara, K.; Yamamoto, H. *Tetrahedron* **1994**, *50*, 8983-8996; **d**) Paterson, I.; Wallace, D. J. *Tetrahedron Lett.* **1994**, *35*, 9087-9090; **e**) Guanti, G., Ageno, G.; Banfi, L.; Riva, R.; Rocca, V.; Cascio, G.; Manghisi, E. *Tetrahedron*, in the press.
18. Not always we got complete reaction; a possible explanation is probably the different tendency to enolization of these compounds, which probably occurs at the less hindered position, as demonstrated by the fact that unreacted recovered ketone maintained its optical purity.
19. Adam, W.; Baeza, J.; Liu, J.-C. *J. Am. Chem. Soc.* **1972**, *94*, 2000-2006.
20. James, B. G.; Pattenden, G. *J. Chem. Soc., Perkin Trans 1*, **1974**, 1205-1208.
21. Mulzer, J. in *Comprehensive Organic Synthesis*, Pergamon Press Ed., Oxford, **1991**, *6*, p. 346.
22. Noyce, D. S.; Banitt, E. H. *J. Org. Chem.* **1966**, *31*, 4043-4047.
23. Nagao, Y.; Lee, W.-S.; Kim, K. *Chem. Lett.* **1994**, 389-392.
24. Still, W. C.; Kahn, M.; Mitra, A. *J. Org. Chem.* **1978**, *43*, 2923-2925.
25. Guanti, G.; Narisano, E.; Podgorski, T.; Thea, S.; Williams, A. *Tetrahedron* **1990**, *46*, 7081-7092.
26. Bowers, A.; Halsall, T. G.; Jones, E. R. H.; Lemin, A. J. *J. Chem. Soc.*, **1953**, 2548-2560.
27. Imamoto, T.; Takiyama, N.; Nakamura, K. *Tetrahedron Lett.*, **1985**, *26*, 4763-4766.

(*Received in UK* 30 *May* 1995; *revised* 19 *July* 1995; *accepted* 21 *July* 1995)