The Influence of β–Substituents in Aldol Reactions of Boron Enolates of β–alkoxy Methylketones

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General Informations

Unless noted, all reactions were carried out under an atmosphere of argon in flame-dried glassware with magnetic stirring. Dichloromethane, triethylamine, 2,6-lutidine and dimethylformamide were distilled from CaH_2. Dimethyl sulfoxide was distilled under reduced pressure from CaH_2 and stored over molecular sieves. THF and diethylether were distilled from sodium/benzophenone ketyl. Oxalyl chloride was distilled immediately prior to use. Purification of reaction products was carried out by flash column chromatography using silica gel (230-400 mesh). Analytical thin layer chromatography was performed on silica gel 60 and GF (5-40-μm thickness) plates. Visualization was accomplished with UV light and phosphomolybdic acid followed by heating.

Optical rotations were measured on a LEP A2 with a sodium lamp and are reported as follows: $[\alpha]_{\lambda}^{T^{\circ}C}$ (c = g/100 mL, solvent).

Melting points were measured with a Microquímica MQAPF-301 equipment and are uncorrected.

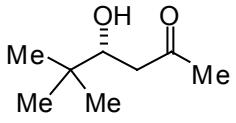
Infrared spectra were recorded on Bomem Hartman & Braun spectrometer. Wavelengths of maximum absorbance (max) are quoted in wavenumbers (cm^{-1}).

^{1}H and proton-decoupled ^{13}C NMR spectra were taken in C_6D_6 or $CDCl_3$ in a Bruker DPX250 at 250 MHz (^{1}H) and 62.5 MHz (^{13}C) or in a Varian INOVA at 500 MHz (^{1}H) and 125 MHz (^{13}C). The chemical shifts (δ) are reported in ppm using

solvent as an internal standard (C_6D_6 at 7.16 ppm and $CDCl_3$ at 7.26 ppm). Data are reported as: s = singlet, d = doublet, t = triplet, q = quartet, quint = quintuplet, sext = sextet, br s = broad singlet, dd = doublet of doublets, dt = doublet of triplets, ddd = doublet of doublet of doublets, tt = triplet of triplets, m = multiplet; coupling constant(s) in Hz; integration. The signals of the minor isomer are shown between brackets.

High resolution mass spectrometry (HRMS) was recorded by the Waters Xevo Q-Tof using Electrospray Ionisation (ESI). The parent ion ($[M+Na]^+$) is quoted.

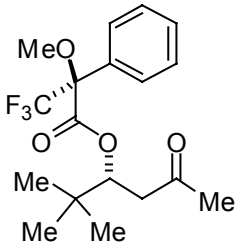
Preparation of (+)-(*R*)-4-hydroxy-5,5-dimethylhexan-2-one (5)



5

a) List, B. *Tetrahedron* **2002**, *58*, 5573. b) List, B.; Pojarliev, P.; Castello, C. *Org. Lett.* **2001**, *3*, 573. c) List, B.; Lerner, R. A.; Barbas, C. F., III *J. Am. Chem. Soc.* **2000**, *122*, 2395.

Preparation of (*S*)-((*R*)-2,2-dimethyl-5-oxohexan-3-yl) 3,3,3-trifluoro-2-methoxy-2-phenylpropanoate (5a)



5a

Alcohol **5** (20 mg, 0.13 mmol) was dissolved in CH_2Cl_2 (0.6 mL) and DMAP (16 mg, 0.13 mmol), (*S*)-α-methoxy-α-trifluoromethylphenylacetic acid (0.026 mL, 0.14 mmol) and Et_3N (0.11 mL, 0.78 mmol) were added. The mixture was stirred at room temperature for 15 min. Then, the reaction medium was applied directly to a flash column chromatography (silica gel 200-400 mesh) and purified using a

mixture of hexane/ethyl acetate (70:30) as eluent, providing 46 mg (98%) of **5a** as a yellow oil (95:5 diastereoselectivity).

R*f* 0.79 (30% EtOAc in hexane)

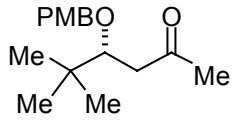
IR (neat) 3061, 2970, 2876, 2851, 1749, 1724, 1568, 1481, 1470, 1452, 1423, 1400, 1369, 1265, 1180, 1122, 1082, 1047, 1016, 995, 966, 924, 816, 764, 739, 704, 640 cm^{-1}.

^{1}H NMR (500 MHz; $CDCl_3$) δ 0.92 (s, 9H); (2.05 (s, 3H)); 2.08 (s, 3H); 2.60 (dd, *J* = 3.5 and 16.9 Hz, 1H); 2.66 (dd, *J* = 8.0 and 16.9 Hz, 1H); 3.49-3.50 (m, 3H); (3.53-3.54 (m. 3H)); 5.36 (dd, *J* = 3.5 and 8.0 Hz, 1H); 7.37-7.39 (m, 3H); 7.50-7.54 (m, 2H).

^{13}C NMR (125 MHz; $CDCl_3$) δ 25.8; 30.2; 34.5; 44.0; (52.6); 55.3 (q, *J* = 1.4 Hz); 79.4; 84.5 (q, *J* = 27.2 Hz); 123.3 (q, *J* = 288.6 Hz); 127.7; 128.3; 129.5; 131.9; 165.7; 205.0.

HRMS (ESI TOF-MS): calcd. for $C_{18}H_{23}F_3O_4Na$: 383.1446; found: 383.1361.

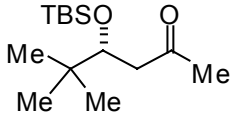
Preparation of (+)-(*R*)-4-(4-methoxybenzyloxy)-5,5-dimethylhexan-2-one (6)



6

Doi, T.; Numajiri, Y.; Munakata, A.; Takahashi, T. *Org. Lett.* **2006**, *8*, 531.

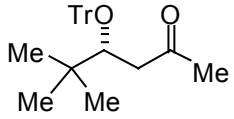
Preparation of (+)-(*R*)-4-(*tert*-butyldimethylsilyloxy)-5,5-dimethylhexan-2-one (7)



7

Zou, B.; Wei, J.; Cai, G.; Ma.; D. *Org. Lett.* **2003**, *5*, 3503.

Preparation of (–)-(*R*)-5,5-dimethyl-4-(trityloxy)hexan-2-one (17)



17

A solution of alcohol **5** (1.01 g, 7.00 mmol), AgOTf (2.15 g, 8.3 mmol), and 2.6-lutidine (1.2 mL, 10.2 mmol) in anhydrous CH_2Cl_2 (12 mL) was cooled to 0 °C. Trityl chloride (2.33 g, 8.3 mmol) was added and the resulting suspension was stirred for 5 min at 0 °C and 1 h at room temperature. After this period, the crude reaction was filtered through a pad of Celite®. The filtrate was washed with saturated aqueous $NaHCO_3$ followed by brine. Subsequently, the organic phase was dried over $MgSO_4$ and concentrated. The residue was purified by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (95:5) as eluent, providing 2.40 g (88%) of **17** as a white solid.

$[a]_D^{20}$ –16.0 (c = 0.98, $CHCl_3$)

R*f* 0.49 (5% EtOAc in hexane)

mp 78-80 °C

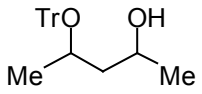
IR (neat) 3088, 3059, 3020, 2961, 2910, 2870, 1718, 1597, 1489, 1448, 1364, 1217, 1059, 758, 706, 669 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ 0.87 (s, 9H); 1.35 (s, 3H); 2.44 (dd, *J* = 7.4 and 18.1 Hz, 1H); 2.63 (dd, *J* = 3.1 and 18.1 Hz, 1H); 3.93 (dd, *J* = 3.1 and 7.4 Hz, 1H); 7.02 (tt, *J* = 1.2 and 7.3 Hz, 3H); 7.12 (tt, *J* = 2.0 and 8.0 Hz, 6H); 7.57-7.60 (m, 6H).

^{13}C NMR (125 MHz; C_6D_6) δ 26.5; 29.4; 36.3; 46.4; 76.3; 86.9; 127.2; 127.9; 129.7; 145.7; 204.2.

HRMS (ESI TOF-MS): calcd. for $C_{27}H_{30}O_2Na$: 409.2144; found: 409.2180.

Preparation of 4-(trityloxy)pentan-2-ol (19)



19

A solution of alcohol **18** (730 mg, 7.00 mmol), AgOTf (1.80 g, 7.0 mmol) and 2.6-lutidine (1.0 mL, 8.6 mmol) in anhydrous CH_2Cl_2 (12 mL) was cooled to 0 °C. Trityl chloride (1.95 g, 7.0 mmol) was added and the resulting suspension was

sttired for 5 min at 0 °C and 1 h at room temperature. After this period, the crude reaction was filtered through a pad of Celite® and the filtrate was washed with saturated aqueous $NaHCO_3$ followed by brine. Subsequently, the organic phase was dried over $MgSO_4$ and concentrated. The residue was purified by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (95:5) as eluent, providing 1.88 g (78%) of **19** as a pale yellow viscous oil.

R*f* 0.74 (5% EtOAc in hexane)

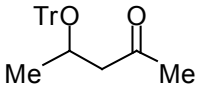
IR (neat) 3501, 3088, 3055, 3036, 2972, 2932, 1597, 1491, 1448, 1421, 1377, 1265, 1221, 1151, 1117, 1086, 1028, 1016, 1001, 951, 920, 899, 775, 741, 708, 648, 633 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 0.93 (d, J = 6.3 Hz, 6H); (1.02 (d, J = 6.2 Hz, 6H)); 1.12-1.22 (m, 1H); 1.32 (ddd, J = 5.0, 9.2 and 14.2 Hz, 1H); (1.57 (ddd, J = 6.0, 9.1 and 14.0 Hz, 1H)); (1.83 (br s, 1H)); 2.67 (br s, 1H); 3.57-3.83 (m, 1H); 3.98-4.08 (m, 1H); 6.97-7.13 (m, 9H); 7.56-7.63 (m, 6H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 21.5; (22.2); 24.0; (24.4); 45.8; (47.2); 64.4; (65.9); 69.5; (69.8); (87.2); 87.6; (127.1); 127.3; 128.0; 129.3; 145.4; (145.8).

HRMS (ESI TOF-MS): calcd. for $C_{24}H_{26}O_2Na$: 369.1830; found: 369.1836.

Preparation of (*RS*)-4-(trityloxy)pentan-2-one (20)



20

DMSO (0.52 mL, 7.30 mmol) was added dropwise to a stirred solution of oxalyl chloride (0.33 mL, 3.74 mmol) in CH_2Cl_2 (19.0 mL) at −78 °C and the mixture was stirred for 30 min. A solution of the alcohol **19** (1.05 g, 3.04 mmol) in CH_2Cl_2 (7.6 mL) was added dropwise *via* cannula and the mixture stirred at −78 °C for 30 min. Triethylamine (2.15 mL, 15.2 mmol) was added dropwise and the suspension was allowed to warm to room temperature slowly and stirred for 1 h. The reaction was quenched with the addition of a saturated aqueous NH_4Cl solution (10 mL). The phases were separated and the aqueous phase was extracted with EtOAc (3 x 20 mL). The organic phase was washed with water (2 x 25 mL), brine (2 x 25 mL), dried over $MgSO_4$, filtered and concentrated under reduced pressure. The residue

was purified by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (90:10) as eluent, providing 906 mg (86%) of **20** as a white solid.

R*f* 0.48 (10% EtOAc in hexane)

mp 115-117°C

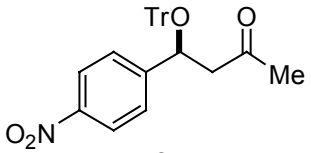
IR (neat) 3088, 3055, 2988, 2934, 1711, 1597, 1491, 1448, 1421, 1375, 1364, 1265, 1219, 1128, 1076, 1024, 897, 750, 708, 650, 633 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 1.14 (d, J = 6.2 Hz, 3H); 1.48 (s, 3H); 1.79 (dd, J = 3.6 and 16.3 Hz, 1H); 1.98 (dd, J = 8.2 and 16.3 Hz, 1H); 4.10-4.22 (m, 1H); 6.97-7.12 (m, 9H); 7.53-7.58 (m, 6H).

^{13}C NMR (125 MHz; C_6D_6) δ 22.6; 30.0; 51.5; 67.1; 87.4; 127.2; 128.0; 129.3; 145.5; 204.9.

HRMS (ESI TOF-MS): calcd. for $C_{24}H_{24}O_2Na$: 367.1674; found: 367.1701.

Preparation of (*RS*)-4-(4-nitrophenyl)-4-(trityloxy)butan-2-one (16)



16

A solution of alcohol **15** (2.00 g, 9.56), AgOTf (2.70 g, 10.5 mmol), and 2.6-lutidine (1.6 mL, 14.3 mmol) in anhydrous CH_2Cl_2 (19 mL) was cooled to 0 °C. Trityl chloride (2.66 g, 9.56 mmol) was added and the resulting suspension was stirred for 5 min at 0 °C and 1 h at room temperature. After this period, the crude reaction was filtered through a pad of Celite® and the filtrate was washed with saturated aqueous $NaHCO_3$ solution followed by brine. Subsequently, the organic phase was dried over $MgSO_4$ and concentrated. The residue was purified by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/dichloromethane/ethyl acetate (50:40:10) as eluent, providing 2.21 g (51%) of **16** as a white solid.

R*f* 0.79 (40% EtOAc in hexane)

IR (neat) 3055, 2990, 1717, 1607, 1522, 1348, 1265, 856, 744 cm^{-1}.

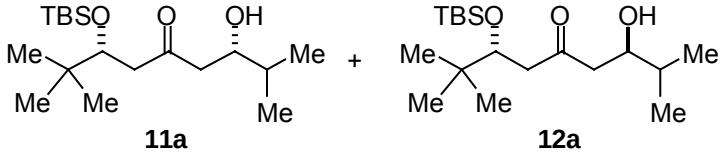
^{1}H NMR (250 MHz; C_6D_6) δ 1.8 (s, 3H); 2.46 (dd, *J* = 3.3 and 17.1 Hz, 1H); 2.74 (dd, *J* = 9.2 and 17.1 Hz, 1H); 5.15 (dd, *J* = 3.3 and 9.3 Hz, 1H); 7.15-7.27 (m, 9H); 7.33-7.46 (m, 8H); 8.01 (d, *J* = 8.8 Hz, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 30.7; 52.3; 71.4; 88.6; 123.1; 127.3; 127.4; 127.9; 128.8; 143.9; 146.6; 151.2; 205.2.

HRMS (ESI TOF-MS): calcd. for $C_{29}H_{25}NO_4Na$: 474.1681; found: 474.1656.

General procedure for methylketone aldol reactions: To a solution of the methylketone (1.0 equiv., 0.21 mmol) in Et_2O (5.5 mL) at –30 °C was added carefully (*c*-Hex)$_2$BCl (2.0 equiv, 0.42 mmol), followed by Et_3N (2.1 equiv, 0.44 mmol). After the addition of Et_3N was complete (the formation of a white cloud was observed at this point), the reaction medium was immediately cooled down to –78 °C. To this slurry, the corresponding aldehyde (4.0 equiv., 0.84 mmol) was added dropwise and the resulting mixture was stirred for 30 min. The reaction was quenched by the addition of MeOH (4.0 mL) and the resulting solution was stirred at room temperature for 30 min. The solvent was removed under reduced pressure and the residue was purified by flash column chromatography (silica gel 200-400 mesh), providing the aldol adducts.

(3*R*,7*S*)-3-(*tert*-butyldimethylsilyloxy)-7-hydroxy-2,2,8-trimethylnonan-5-one (11a) and (3*R*,7*R*)-3-(*tert*-butyldimethylsilyloxy)-7-hydroxy-2,2,8-trimethylnonan-5-one (12a)



11a **12a**

The mixture of aldol adducts **11a** and **12a** (98%, 135 mg, 0.41 mmol) was obtained as a yellow oil (65:35 diastereoselectivity), after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.65 (10% EtOAc in hexane)

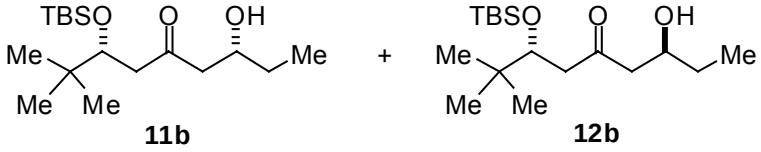
IR (neat) 3479, 2959, 2932, 2895, 2858, 1711, 1472, 1389, 1364, 1256, 1084, 1030, 939, 837, 775, 667 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (0.03 (s, 3H)); 0.06 (s, 3H); 0.13 (s, 3H); (0.14 (s, 3H)); 0.84 (s, 9H); (0.85 (s, 9H)); 0.85 (d, *J* = 6.8 Hz, 3H); 0.90 (d, *J* = 6.8 Hz, 3H); (0.91 (d, *J* = 6.8 Hz, 3H)); (0.96 (s, 9H)); 0.96 (s, 9H); 1.49-1.60 (m, 1H); 2.16-2.27 (m, 2H); 2.29-2.44 (m, 2H); (2.92 (br s, 1H)); 2.98 (br s, 1H); 3.75 (ddd, *J* = 2.9, 5.4 and 8.8 Hz, 1H); (3.82 (ddd, *J* = 2.2, 5.4 and 7.8 Hz, 1H)); 4.09-4.12 (m, 1H).

^{13}C NMR (62.5 MHz; C_6D_6) δ (–4.7); –4.7; (–3.8); –3.8; 17.6; (17.7); 18.5; (18.5); (18.6); 18.7; 26.0; 26.3; (33.4); 33.4; (35.5); 35.6; 47.5; (47.7); 48.3; (48.3); (72.0); 72.2; 74.8; (75.0); 210.2.

HRMS (ESI TOF-MS): calcd. for $C_{18}H_{38}O_3SiNa$: 353.2488; found: 353.2466.

(3*R*,7*R*)-3-(*tert*-butyldimethylsilyloxy)-7-hydroxy-2,2-dimethylnonan-5-one (11b) and (3*R*,7*S*)-3-(*tert*-butyldimethylsilyloxy)-7-hydroxy-2,2-dimethylnonan-5-one (12b)



11b **12b**

The mixture of aldol adducts **11b** and **12b** (92%, 123 mg, 0.39 mmol) was obtained as a yellow oil (74:26 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/dichloromethane/ethyl acetate (55:40:5) as eluent.

R*f* 0.69 (10% EtOAc in hexane)

IR (neat) 3448, 2957, 2930, 2885, 2858, 1713, 1472, 1393, 1364, 1256, 1088, 1032, 937, 837, 775, 733, 669 cm^{-1}.

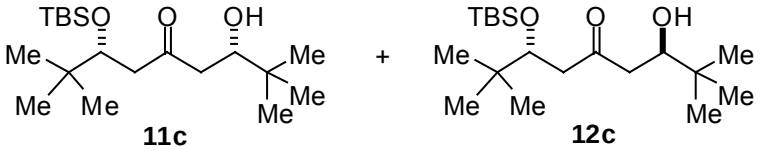
^{1}H NMR (500 MHz; C_6D_6) δ (0.04 (s, 3H)); 0.06 (s, 3H); 0.14 (s, 3H); (0.15 (s, 3H)); (0.84 (s, 9H)); 0.85 (s, 9H); (0.89 (t, *J* = 7.5 Hz, 3H)); 0.90 (t, *J* = 7.5 Hz, 3H); (0.96 (s, 9H)); 0.97 (s, 9H); 1.23-1.31 (m, 1H); 1.35-1.44 (m, 1H); 2.10 (dd, *J* = 3.3 and 17.2 Hz, 1H); (2.12 (dd, *J* = 2.8 and 17.4 Hz, 1H)); 2.18 (dd, *J* = 8.6 and 17.2 Hz, 1H); (2.19 (dd, *J* = 9.1 and 17.4 Hz, 1H)); (2.30 (dd, *J* = 6.0 and 18.0 Hz, 1H)); 2.30 (dd, *J* = 5.8 and 17.8 Hz, 1H); (2.38 (dd, *J* = 4.0 and 18.0 Hz, 1H)); 2.40 (dd, *J* =

4.0 and 17.8 Hz, 1H); (2.88 (br s, 1H)); 2.91 (br s, 1H); 3.81-3.87 (m, 1H); (3.89-3.94 (m, 1H)); 4.11 (dd, *J* = 4.0 and 5.8 Hz, 1H); (4.11 (dd, *J* = 4.0 and 6.0 Hz, 1H)).

^{13}C NMR (62.5 MHz; C_6D_6) *δ* (–4.7); –4.7; (–3.9); –3.8; 10.0; 18.5; 26.0; 26.3; (29.8); 29.8; (35.5); 35.6; 48.2; (48.3); 50.0; (50.2); (68.7); 68.9; 74.7; (74.9); 209.7; (209.8).

HRMS (ESI TOF-MS): calcd. for $C_{17}H_{36}O_3SiNa$: 339.2332; found: 339.2391.

(–)-(3*R*,7*S*)-3-(*tert*-butyldimethylsilyloxy)-7-hydroxy-2,2,8,8-tetramethylnonan-5-one (11c) and (+)-(3*R*,7*R*)-3-(*tert*-butyldimethylsilyloxy)-7-hydroxy-2,2,8,8-tetramethylnonan-5-one (12c)



11c **12c**

The mixture of aldol adducts **11c** and **12c** (98%, 142 mg, 0.41 mmol) was obtained as a yellow oil (66:34 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (90:10) as eluent.

(–)-(3*R*,7*S*)-3-(*tert*-butyldimethylsilyloxy)-7-hydroxy-2,2,8,8-tetramethylnonan-5-one (11c)

$[a]_D^{20}$ –7.0 (c = 1.50, CH_2Cl_2), yellow oil.

R*f* 0.38 (10% EtOAc in hexane)

IR (neat) 3528, 3055, 2959, 2941, 2905, 2858, 1707, 1472, 1364, 1265, 1084, 1030, 939, 837, 775, 741, 667 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) *δ* 0.08 (s, 3H); 0.15 (s, 3H); 0.86 (s, 9H); 0.88 (s, 9H); 0.98 (s, 9H); 2.24 (dd, *J* = 10.0 and 17.2 Hz, 1H); 2.31 (dd, *J* = 2.3 and 17.2 Hz, 1H); 2.35 (dd, *J* = 5.8 and 17.6 Hz, 1H); 2.40 (dd, *J* = 4.1 and 17.6 Hz, 1H); 3.02 (d, *J* = 3.1 Hz, 1H); 3.71 (ddd, *J* = 2.3, 3.1 and 10.0 Hz, 1H); 4.13 (dd, *J* = 4.1 and 5.8 Hz, 1H).

^{13}C NMR (125 MHz; C_6D_6) δ –4.6; –3.8; 18.5; 25.7; 26.1; 26.4; 34.3; 35.6; 45.4; 48.4; 74.9; 75.0; 210.5.

HRMS (ESI TOF-MS): calcd. for $C_{19}H_{40}O_3SiNa$: 367.2644; found: 367.2664.

(+)-(3*R*,7*R*)-3-(*tert*-butyldimethylsilyloxy)-7-hydroxy-2,2,8,8-tetramethylnonan-5-one (12c)

[a]$_D^{20}$ +85.0 (c = 0.80, C_6H_6)

R*f* 0.30 (10% EtOAc in hexane)

mp 42-45°C, flat white solid.

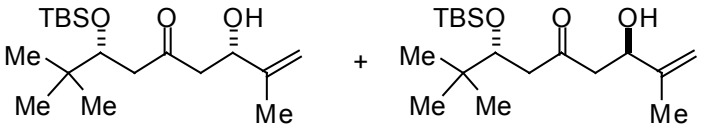
IR (neat) 3535, 2959, 2935, 2907, 2858, 1709, 1474, 1366, 1265, 1082, 1030, 935, 837, 775, 743, 665 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 0.04 (s, 3H); 0.16 (s, 3H); 0.85 (s, 9H); 0.90 (s, 9H); 0.97 (s, 9H); 2.26-2.35 (m, 4H); 2.93 (br s, 1H); 3.78 (dd, *J* = 5.1 and 7.3 Hz, 1H); 4.13 (dd, *J* = 4.7 and 5.4 Hz, 1H).

^{13}C NMR (62.5 MHz; C_6D_6) δ –4.7; –3.8; 18.5; 25.8; 26.1; 26.4; 34.2; 35.5; 45.9; 48.3; 74.6; 75.1; 210.5.

HRMS (ESI TOF-MS): calcd. for $C_{19}H_{40}O_3SiNa$: 367.2644; found: 367.2668.

(3*S*,7*R*)-7-(*tert*-butyldimethylsilyloxy)-3-hydroxy-2,8,8-trimethylnon-1-en-5-one (11d) and (3*R*,7*R*)-7-(*tert*-butyldimethylsilyloxy)-3-hydroxy-2,8,8-trimethylnon-1-en-5-one (12d)



11d **12d**

The mixture of aldol adducts **11d** and **12d** (86%, 119 mg, 0.36 mmol) was obtained as a yellow oil (72:28 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (90:10) as eluent.

R*f* 0.50 (10% EtOAc in hexane)

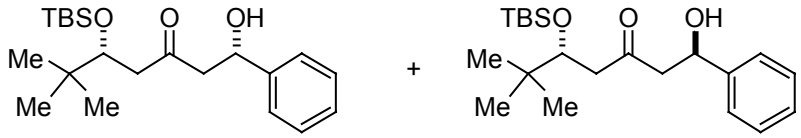
IR (neat) 3454, 2957, 2930, 2858, 1715, 1472, 1393, 1364, 1256, 1088, 1030, 903, 837, 775, 667 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (0.03 (s, 3H)); 0.06 (s, 3H); 0.13 (s, 3H); (0.14 (s, 3H)); 0.84 (s, 9H); (0.95 (s, 9H)); 0.96 (s, 9H); 1.63 (br s, 3H); 2.25-2.46 (m, 4H); 2.97 (br s, 1H); 4.08-4.11 (m, 1H); 4.44 (dd, *J* = 2.6 and 9.2 Hz, 1H); (4.50 (dd, *J* = 2.4 and 9.4 Hz, 1H)); 4.79 (m, 1H); 5.03 (m, 1H); (5.05 (m, 1H)).

^{13}C NMR (62.5 MHz; C_6D_6) δ (–4.7); –4.7; (–3.9); –3.8; 18.3; (18.4); 18.5; (18.5); 26.0; 26.3; (35.5); 35.6; 48.4; (48.4); 48.9; (49.2); (71.1); 71.3; 74.7; (74.9); (110.8); 110.9; 146.5; (146.5); 209.0; (209.1).

HRMS (ESI TOF-MS): calcd. for $C_{18}H_{36}O_3SiNa$: 351.2332; found: 351.2373.

(1*S*,5*R*)-5-(*tert*-butyldimethylsilyloxy)-1-hydroxy-6,6-dimethyl-1-phenylheptan-3-one (11e) and (1*R*,5*R*)-5-(*tert*-butyldimethylsilyloxy)-1-hydroxy-6,6-dimethyl-1-phenylheptan-3-one (12e)



11e **12e**

The mixture of aldol adducts **11e** and **12e** (71%, 55 mg, 0.15 mmol) was obtained as a yellow oil (68:32 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (90:10) as eluent.

R*f* 0.19 (10% EtOAc in hexane)

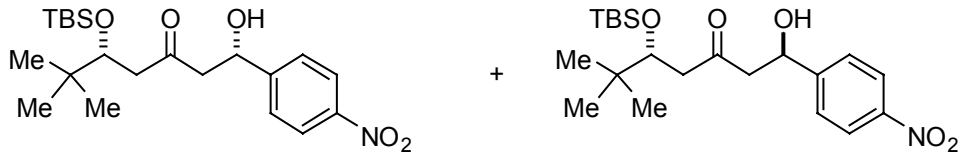
IR (neat) 3475, 3057, 3032, 2957, 2930, 2895, 2858, 1711, 1607, 1472, 1364, 1265, 1086, 932, 837, 775, 741, 702, 667 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (0.03 (s, 3H)); 0.06 (s, 3H); 0.14 (s, 3H); (0.15 (s, 3H)); 0.82 (s, 9H); (0.82 (s, 9H)); (0.95 (s, 9H)); 0.96 (s, 9H); 2.24-2.40 (m, 3H); 2.50-2.64 (m, 1H); 3.25 (br s, 1H); 4.07-4.11 (m, 1H); 5.05 (dd, *J* = 3.4 and 9.2 Hz, 1H); (5.12 (dd, *J* = 2.9 and 9.2 Hz, 1H)); 7.08-7.11 (m, 1H); 7.16-7.20 (m, 2H); 7.28-7.31 (m, 2H).

^{13}C NMR (125 MHz; C_6D_6) δ –4.7; (–4.7); (–3.8); –3.8; 18.5; (18.5); 26.0; (26.0); 26.4; (35.5); 35.6; 48.4; (48.4); 52.7; (52.9); (69.9); 70.1; 74.7; (74.9); (126.0); 126.0; (127.5); 127.6; 128.5; (128.6); 144.0; (144.1); 208.8; (208.9).

HRMS (ESI TOF-MS): calcd. for $C_{21}H_{36}O_3SiNa$: 387.2332; found: 387.2351.

(–)-(1*S*,5*R*)-5-(*tert*-butyldimethylsilyloxy)-1-hydroxy-6,6-dimethyl-1-(4-nitrophenyl)heptan-3-one (11f) and (+)-(1*R*,5*R*)-5-(*tert*-butyldimethylsilyloxy)-1-hydroxy-6,6-dimethyl-1-(4-nitrophenyl)heptan-3-one (12f)



11f **12f**

The mixture of aldol adducts **11f** and **12f** (90%, 77 mg, 0.19 mmol) was obtained as a yellow solid (62:38 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (75:25) as eluent.

(–)-(1*S*,5*R*)-5-(*tert*-butyldimethylsilyloxy)-1-hydroxy-6,6-dimethyl-1-(4-nitrophenyl)heptan-3-one (11f)

$[a]_D^{20}$ –14.0 (c = 1.00, CH_2Cl_2)

R*f* 0.17 (10% EtOAc in hexane)

mp 48-50°C, yellow solid.

IR (neat) 3487, 3055, 2959, 2932, 2858, 1707, 1607, 1524, 1472, 1348, 1265, 1086, 837, 739, 706 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 0.05 (s, 3H); 0.14 (s, 3H); 0.84 (s, 9H); 0.97 (s, 9H); 2.16 (dd, *J* = 3.6 and 17.6 Hz, 1H); 2.22-2.40 (m, 3H); 3.18 (d, *J* = 3.0 Hz, 1H); 4.08 (dd, *J* = 4.2 and 5.7 Hz, 1H); 4.85 (dt, *J* = 3.0 and 8.9 Hz, 1H); 6.99 (d, *J* = 8.6 Hz, 2H); 7.90 (dt, *J* = 2.2 and 8.6 Hz, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ –4.7; –3.8; 18.4; 26.0; 26.3; 35.6; 48.2; 51.7; 69.0; 74.7; 123.6; 126.4; 147.6; 150.3; 208.5.

HRMS (ESI TOF-MS): calcd. for $C_{21}H_{35}NO_5SiNa$: 432.2182; found: 432.2207.

(+)-(1*R*,5*R*)-5-(*tert*-butyldimethylsilyloxy)-1-hydroxy-6,6-dimethyl-1-(4-nitrophenyl)heptan-3-one (12f)

$[a]_D^{20}$ +43.0 (c = 1.00, CH_2Cl_2), yellow oil.

R*f* 0.17 (10% EtOAc in hexane)

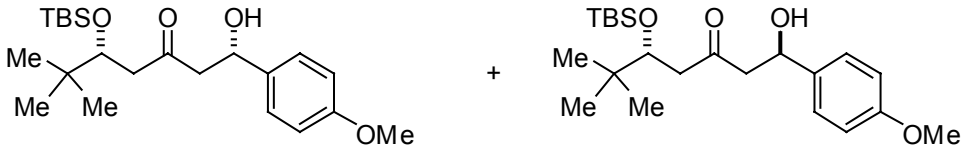
IR (neat) 3452, 2957, 2930, 2856, 1713, 1607, 1524, 1472, 1346, 1256, 1082, 933, 837, 775, 739, 702, 665 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 0.04 (s, 3H); 0.16 (s, 3H); 0.82 (s, 9H); 0.97 (s, 9H); 2.13 (dd, *J* = 3.2 and 17.7 Hz, 1H); 2.19-2.37 (m, 3H); 3.01 (br s, 1H); 4.09 (dd, *J* = 4.4 and 5.7 Hz, 1H); 4.90 (d, *J* = 8.8 Hz, 1H); 6.99 (d, *J* = 9.0 Hz, 2H); 7.90 (dt, *J* = 2.2 and 9.0 Hz, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ –4.7; –3.9; 18.5; 26.0; 26.3; 35.5; 48.2; 51.9; 68.8; 74.9; 123.6; 126.3; 147.6; 150.2; 208.5.

HRMS (ESI TOF-MS): calcd. for $C_{21}H_{35}NO_5SiNa$: 432.2182; found: 432.2216.

(1*S*,5*R*)-5-(*tert*-butyldimethylsilyloxy)-1-hydroxy-1-(4-methoxyphenyl)-6,6-dimethylheptan-3-one (11g) and (1*R*,5*R*)-5-(*tert*-butyldimethylsilyloxy)-1-hydroxy-1-(4-methoxyphenyl)-6,6-dimethylheptan-3-one (12g)



11g **12g**

The mixture of aldol adducts **11g** and **12g** (86%, 71 mg, 0.18 mmol) was obtained as a yellow oil (70:30 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (90:10) as eluent.

R*f* 0.23 (10% EtOAc in hexane)

IR (neat) 3501, 3053, 2957, 2932, 2899, 2856, 1707, 1612, 1587, 1514, 1472, 1364, 1250, 1175, 1086, 1036, 932, 835, 775, 741, 704, 669 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (0.05 (s, 3H)); 0.09 (s, 3H); 0.15 (s, 3H); (0.16 (s, 3H)); 0.83 (s, 9H); (0.84 (s, 9H)); (0.96 (s, 9H)); 0.97 (s, 9H); 2.27-2.44 (m, 3H); 2.58 (dd, *J* = 9.3 and 17.1 Hz, 1H); (2.60 (dd, *J* = 9.5 and 17.1 Hz, 1H)); 3.08 (br s, 1H); 3.34 (s, 3H); (3.34 (s, 3H)); 4.10-4.14 (m, 1H); 5.06 (dd, *J* = 3.4 and 9.0 Hz, 1H); (5.12 (dd, *J* = 2.7 and 9.5 Hz, 1H)); 6.79-6.83 (m, 2H); 7.21-7.24 (m, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ –4.7; (–3.9); –3.8; 18.5; 26.0; 26.3; (35.5); 35.6; 48.4; (48.5); 52.7; (52.9); 54.8; (69.7); 69.8; 74.7; (74.9); 114.0; (127.2); 127.3; 136.1; 159.5; 208.9; (209.0).

HRMS (ESI TOF-MS): calcd. for $C_{22}H_{38}O_4SiNa$: 417.2437; found: 417.2447.

(+)-(3*R*,7*R*)-7-(*tert*-butyldimethylsilyloxy)-3-hydroxy-8,8-dimethyl-1-phenylnonan-5-one (11h) and (+)-(3*S*,7*R*)-7-(*tert*-butyldimethylsilyloxy)-3-hydroxy-8,8-dimethyl-1-phenylnonan-5-one (12h)

11h **12h**

The mixture of aldol adducts **11h** and **12h** (88%, 146 mg, 0:37 mmol) was obtained as a yellow oil (65:35 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (90:10) as eluent.

(+)-(3*R*,7*R*)-7-(*tert*-butyldimethylsilyloxy)-3-hydroxy-8,8-dimethyl-1-phenylnonan-5-one (11h)

$[a]_D^{20}$ +13.0 (c = 0.80, CH_2Cl_2), colorless oil.

R*f* 0.37 (10% EtOAc in hexane)

IR (neat) 3522, 3086, 3055, 3028, 2955, 2930, 2895, 2856, 1707, 1603, 1585, 1497, 1472, 1454, 1408, 1393, 1364, 1296, 1265, 1088, 1030, 1007, 939, 930, 897, 837, 816, 775, 744, 702 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 0.07 (s, 3H); 0.15 (s, 3H); 0.84 (s, 9H); 0.98 (s, 9H); 1.41-1.54 (m, 1H); 1.62-1.77 (m, 1H); 1.99 (dd, *J* = 3.0 and 17.7 Hz, 1H); 2.14 (dd, *J* = 8.9 and 17.7 Hz, 1H); 2.24 (dd, *J* = 3.3 and 17.8 Hz, 1H); 2.33 (dd, *J* = 4.2 and 17.8 Hz, 1H); 2.60-2.85 (m, 2H); 2.97 (br s, 1H); 3.88-3.98 (m, 1H); 4.10 (dd, *J* = 4.3 and 5.4 Hz, 1H); 7.05-7.22 (m, 5H).

^{13}C NMR (62.5 MHz; C_6D_6) δ –4.7; –3.8; 18.5; 26.0; 26.3; 32.0; 35.5; 38.7; 48.1; 50.3; 66.8; 74.7; 126.1; 128.7; 128.8; 142.5; 209.8.

HRMS (ESI TOF-MS): calcd. for $C_{23}H_{40}O_3SiNa$: 415.2644; found: 415.2658.

(+)-(3*S*,7*R*)-7-(*tert*-butyldimethylsilyloxy)-3-hydroxy-8,8-dimethyl-1-phenylnonan-5-one (12h)

$[a]_D^{20}$ +16.0 (c = 0.80, CH_2Cl_2), yellow oil.

R*f* 0.31 (10% EtOAc in hexane)

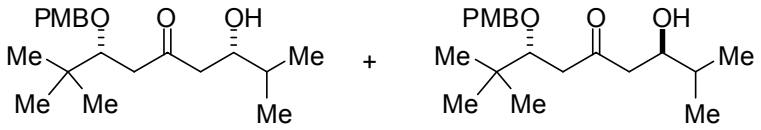
IR (neat) 3483, 3055, 3028, 2957, 2932, 2858, 1707, 1603, 1472, 1364, 1265, 1086, 1030, 837, 741, 704 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 0.03 (s, 3H); 0.15 (s, 3H); 0.83 (s, 9H); 0.97 (s, 9H); 1.43-1.57 (m, 1H); 1.64-1.78 (m, 1H); 2.06 (dd, *J* = 3.2 and 17.6 Hz, 1H); 2.18 (dd, *J* = 8.8 and 17.6 Hz, 1H); 2.25 (dd, *J* = 5.6 and 17.8 Hz, 1H); 2.34 (dd, *J* = 4.2 and 17.8 Hz, 1H); 2.57-2.69 (m, 1H); 2.73-2.85 (m, 1H); 2.93 (br s, 1H); 3.95-4.05 (m, 1H); 4.10 (dd, *J* = 4.2 and 5.6 Hz, 1H); 7.04-7.22 (m, 5H).

^{13}C NMR (62.5 MHz; C_6D_6) δ –4.7; –3.9; 18.5; 26.0; 26.3; 32.1; 35.5; 38.7; 48.2; 50.5; 66.7; 74.9; 126.1; 128.7; 128.8; 142.4; 209.8.

HRMS (ESI TOF-MS): calcd. for $C_{23}H_{40}O_3SiNa$: 415.2644; found: 415.2586.

(3*R*,7*S*)-7-hydroxy-3-(4-methoxybenzyloxy)-2,2,8-trimethylnonan-5-one (9a) and (3*R*,7*R*)-7-hydroxy-3-(4-methoxybenzyloxy)-2,2,8-trimethylnonan-5-one (10a)



9a **10a**

The mixture of aldol adducts **9a** and **10a** (91%, 64 mg, 0.19 mmol) was obtained as a yellow oil (80:20 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.40 (20% EtOAc in hexane)

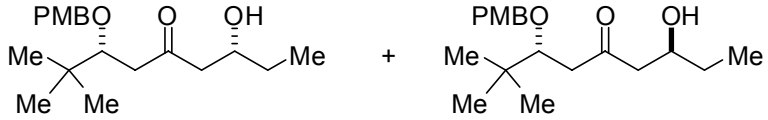
IR (neat) 3520, 3053, 2962, 2908, 2874, 1705, 1612, 1587, 1514, 1468, 1391, 1366, 1340, 1302, 1265, 1248, 1175, 1076, 1036, 895, 824, 739, 704 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (0.84 (d, *J* = 6.8 Hz, 3H)); 0.84 (d, *J* = 6.8 Hz, 3H); 0.88-0.91 (m, 12H); 1.49-1.56 (m, 1H); 2.16 (dd, *J* = 2.4 and 17.2 Hz, 1H); (2.17 (dd, *J* = 2.7 and 17.2 Hz, 1H)); 2.24 (dd, *J* = 2.9 and 16.2 Hz, 1H); 2.30 (dd, *J* = 9.8 and 17.2 Hz, 1H); 2.48 (dd, *J* = 8.3 and 16.2 Hz, 1H); (2.96 (br s, 1H)); 3.05 (br s, 1H); 3.30 (s, 3H); 3.72-3.80 (m, 2H); 4.42 (d, *J* = 10.8 Hz, 1H); (4.46 (d, *J* = 11.0 Hz, 1H)); 4.56 (d, *J* = 10.8 Hz, 1H); 6.77-6.81 (m, 2H); (7.24 (dt, *J* = 2.9 and 9.5 Hz, 2H)); 7.30 (dt, *J* = 2.9 and 9.5 Hz, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 17.7; 18.7; 26.2; (33.4); 33.5; 35.7; 45.4; (45.4); (48.1); 48.2; 54.7; (72.0); 72.2; 74.3; (83.2); 83.2; (114.0); 114.0; (129.4); 129.7; 131.4; (131.6); (159.6); 159.7; (211.2); 211.5.

HRMS (ESI TOF-MS): calcd. for $C_{20}H_{32}O_4Na$: 359.2198; found: 359.2231.

(3*R*,7*R*)-7-hydroxy-3-(4-methoxybenzyloxy)-2,2-dimethylnonan-5-one (9b) and (3*R*,7*S*)-7-hydroxy-3-(4-methoxybenzyloxy)-2,2-dimethylnonan-5-one (10b)



9b **10b**

The mixture of aldol adducts **9b** and **10b** (85%, 57 mg, 0.18 mmol) was obtained as a yellow oil (82:18 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.37 (20% EtOAc in hexane)

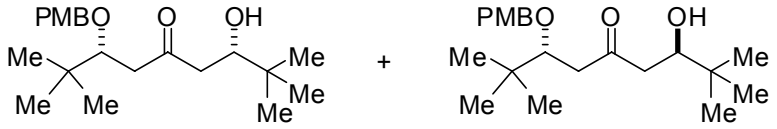
IR (neat) 3497, 3053, 2962, 2937, 2874, 1705, 1612, 1587, 1514, 1466, 1391, 1366, 1302, 1265, 1248, 1175, 1080, 1036, 897, 824, 739, 704 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ 0.87-0.91 (m, 12H); 1.22-1.30 (m, 1H); 1.35-1.44 (m, 1H); 2.10 (dd, *J* = 2.7 and 17.1 Hz, 1H); (2.12 (dd, *J* = 3.2 and 17.3 Hz, 1H)); 2.17-2.28 (m, 2H); (2.42 (dd, *J* = 8.2 and 16.6 Hz, 1H)); 2.44 (dd, *J* = 8.2 and 16.4 Hz, 1H); (2.99 (br s, 1H)); 3.04 (br s, 1H); 3.30 (s, 3H); 3.72 (dd, *J* = 3.2 and 8.2 Hz, 1H); (3.73 (dd, *J* = 3.2 and 8.2 Hz, 1H)); 3.84-3.91 (m, 1H); 4.40 (d, *J* = 10.7 Hz, 1H); (4.44 (d, *J* = 11.0 Hz, 1H)); 4.56 (d, *J* = 10.7 Hz, 1H); 6.77-6.81 (m, 2H); (7.24 (dt, *J* = 2.7 and 8.5 Hz, 2H)); 7.28 (dt, *J* = 2.9 and 9.5 Hz, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 10.0; 26.2; (29.8); 29.8; 35.7; 45.3; (45.3); (50.6); 50.7; 54.7; (68.9); 69.0; 74.2; 83.1; (114.0); 114.0; (129.4); 129.7; 131.5; (131.6); (159.6); 159.7; (210.8); 211.1.

HRMS (ESI TOF-MS): calcd. for $C_{19}H_{30}O_4Na$: 345.2042; found: 345.1998.

(3*S*,7*R*)-3-hydroxy-7-(4-methoxybenzyloxy)-2,2,8,8-tetramethylnonan-5-one (9c) and (3*R*,7*R*)-3-hydroxy-7-(4-methoxybenzyloxy)-2,2,8,8-tetramethylnonan-5-one (10c)



9c **10c**

The mixture of aldol adducts **9c** and **10c** (80%, 60 mg, 0.17 mmol) was obtained as a yellow oil (78:22 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (90:10) as eluent.

R*f* 0.44 (15% EtOAc in hexane)

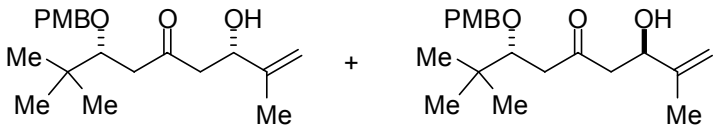
IR (neat) 3539, 3053, 2957, 2939, 2908, 2872, 1705, 1612, 1587, 1514, 1468, 1391, 1366, 1302, 1265, 1248, 1175, 1090, 1080, 1036, 1011, 933, 895, 824, 739, 704 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (0.86 (s, 9H)); 0.87 (s, 9H); (0.89 (s, 9H)); 0.89 (s, 9H); 2.21-2.32 (m, 3H); (2.46 (dd, *J* = 8.5 and 17.0 Hz, 1H)); 2.49 (dd, *J* = 8.5 and 16.2 Hz, 1H); (3.02 (d, *J* = 2.8 Hz, 1H)); 3.14 (d, *J* = 3.2 Hz, 1H); 3.30 (s, 3H); 3.69-3.77 (m, 2H); 4.42 (d, *J* = 10.8 Hz, 1H); (4.46 (d, *J* = 11.0 Hz, 1H)); 4.55 (d, *J* = 10.5 Hz, 1H); (4.56 (d, *J* = 11.3 Hz, 1H)); 6.77-6.82 (m, 2H); (7.24 (dt, *J* = 2.9 and 9.5 Hz, 2H)); 7.30 (dt, *J* = 2.7 and 9.3 Hz, 2H).

^{13}C NMR (125 MHz; C_6D_6) δ (25.8); 25.8; (26.2); 26.2; (34.2); 34.3; (35.7); 35.7; 45.5; (45.6); (46.0); 46.1; 54.7; (74.3); 74.3; (74.8); 75.0; (83.2); 83.4; (114.0); 114.0; (129.4); 129.7; 131.4; (131.6); (159.6); 159.7; (211.5); 211.9.

HRMS (ESI TOF-MS): calcd. for $C_{21}H_{34}O_4Na$: 373.2355; found: 373.2328.

(3*S*,7*R*)-3-hydroxy-7-(4-methoxybenzyloxy)-2,8,8-trimethylnon-1-en-5-one (9d) and (3*R*,7*R*)-3-hydroxy-7-(4-methoxybenzyloxy)-2,8,8-trimethylnon-1-en-5-one (10d)



9d **10d**

The mixture of aldol adducts **9d** and **10d** (86%, 61 mg, 0.18 mmol) was obtained as a yellow oil (81:19 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.47 (20% EtOAc in hexane)

IR (neat) 3495, 3053, 2961, 2910, 2872, 2839, 1709, 1653, 1612, 1587, 1514, 1466, 1391, 1366, 1302, 1265, 1248, 1175, 1084, 1036, 905, 824, 739, 704 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (0.87 (s, 9H)); 0.88 (s, 9H); (1.59 (m, 3H)); 1.61 (m, 3H); 2.22-2.29 (m, 2H); 2.36-2.48 (m, 2H); (2.82 (d, *J* = 3.2 Hz, 1H)); 2.90 (d, *J* = 3.4 Hz, 1H); (3.29 (s, 3H)); 3.30 (s, 3H); 3.73 (dd, *J* = 3.2 and 8.1 Hz, 1H); 4.41 (d, *J* = 10.7 Hz, 1H); 4.44-4.48 (m, 1H); (4.56 (d, *J* = 11.0 Hz, 1H)); 4.57 (d, *J* = 11.0 Hz, 1H); 4.79-4.80 (m, 1H); 5.04-5.05 (m, 1H); (5.05-5.06 (m, 1H)); 6.77-6.82 (m, 2H); (7.25 (dt, *J* = 2.9 and 8.8 Hz, 2H)); 7.29 (dt, *J* = 2.9 and 8.8 Hz, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 18.4; 26.2; 35.7; 45.5; (45.6); 49.5; 54.7; (71.2); 71.4; 74.0; (74.1); 82.9; (83.0); (110.7); 110.8; 114.0; (129.4); 129.7; 131.5; (131.6); (146.6); 146.6; (159.6); 159.6; (210.1); 210.3.

HRMS (ESI TOF-MS): calcd. for $C_{20}H_{30}O_4Na$: 357.2042; found: 357.2125.

(1*S*,5*R*)-1-hydroxy-5-(4-methoxybenzyloxy)-6,6-dimethyl-1-phenylheptan-3-one (9e) and (1*R*,5*R*)-1-hydroxy-5-(4-methoxybenzyloxy)-6,6-dimethyl-1-phenylheptan-3-one (10e)

9e **10e**

The mixture of aldol adducts **9e** and **10e** (95%, 74 mg, 0.20 mmol) was obtained as a yellow oil (83:17 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (70:30) as eluent.

R*f* 0.44 (30% EtOAc in hexane)

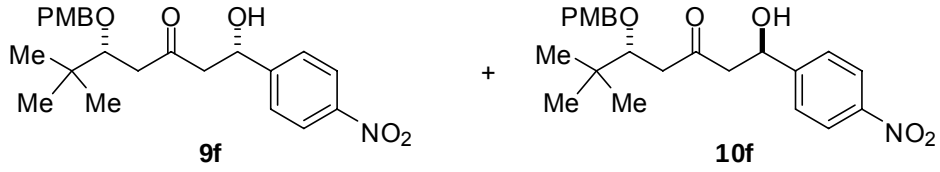
IR (neat) 3481, 3055, 3034, 2961, 2908, 2872, 2837, 1709, 1612, 1585, 1514, 1466, 1391, 1366, 1302, 1265, 1248, 1175, 1086, 1036, 895, 824, 737, 702 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ (0.85 (s, 9H)); 0.86 (s, 9H); (2.16 (dd, *J* = 3.2 and 16.4 Hz, 1H)); 2.17 (dd, *J* = 3.3 and 16.3 Hz, 1H); 2.30-2.48 (m, 2H); 2.58 (dd, *J* = 9.5 and 17.4 Hz, 1H); 3.19 (d, *J* = 3.0 Hz, 1H); 3.30 (s, 3H); (3.70 (dd, *J* = 3.0 and 8.1 Hz, 1H)); 3.70 (dd, *J* = 3.3 and 8.1 Hz, 1H); 4.39 (d, *J* = 10.9 Hz, 1H); 4.56 (d, *J* = 10.7 Hz, 1H); 5.07 (dt, *J* = 3.0 and 9.5 Hz, 1H); 6.77-6.84 (m, 2H); 7.06-7.22 (m, 5H); 7.26-7.31 (m, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 26.2; 35.6; 45.4; 53.0; (53.1); (53.3); 54.7; (69.9); 70.1; 74.0; (74.1); 82.9; (83.1); 114.0; (126.0); 126.1; (127.5); 127.6; (128.5); 128.5; (129.4); 129.6; 131.4; (131.6); 144.0; (159.6); 159.6; 210.1; (210.2).

HRMS (ESI TOF-MS): calcd. for $C_{23}H_{30}O_4Na$: 393.2042; found: 393.2073.

(1*S*,5*R*)-1-hydroxy-5-(4-methoxybenzyloxy)-6,6-dimethyl-1-(4-nitrophenyl)heptan-3-one (9f) and (1*R*,5*R*)-1-hydroxy-5-(4-methoxybenzyloxy)-6,6-dimethyl-1-(4-nitrophenyl)heptan-3-one (10f)



9f **10f**

The mixture of aldol adducts **9f** and **10f** (85%, 75 mg, 0.18 mmol) was obtained as a yellow solid (75:25 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.16 (20% EtOAc in hexane)

mp 55-57°C

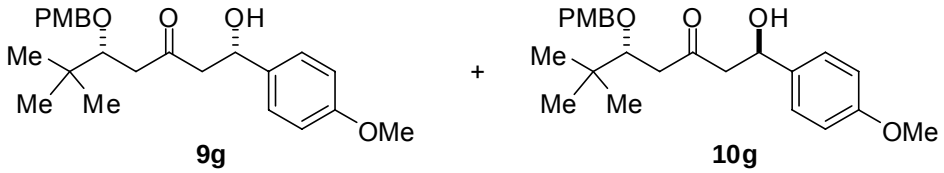
IR (neat) 3533, 3055, 2962, 2908, 2872, 2839, 1709, 1610, 1587, 1516, 1466, 1421, 1393, 1348, 1302, 1265, 1250, 1175, 1109, 1082, 1036, 1014, 897, 856, 824, 741, 704 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ (0.86 (s, 9H)); 0.88 (s, 9H); 2.11-2.48 (m, 4H); (3.31 (s, 3H)); 3.32 (s, 3H); (3.38 (d, *J* = 2.8 Hz, 1H)); 3.44 (d, *J* = 3.1 Hz, 1H); 3.63-3.68 (m, 1H); 4.38-4.50 (m, 2H); 4.85-4.91 (m, 1H); 6.74-6.84 (m, 2H); 6.95-7.01 (m, 2H); 7.21-7.27 (m, 2H); 7.87-7.91 (m, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ (26.1); 26.2; 35.7; (45.1); 45.2; 52.3; (52.5); 54.8; (68.8); 69.0; 74.4; (74.5); 83.4; (83.7); 114.0; (123.5); 123.5; (126.4); 126.4; (129.2); 129.5; 131.2; (131.4); 147.5; 150.4; (159.7); 159.7; 209.9.

HRMS (ESI TOF-MS): calcd. for $C_{23}H_{29}NO_6Na$: 438.1893; found: 438.1944.

(1*S*,5*R*)-1-hydroxy-5-(4-methoxybenzyloxy)-1-(4-methoxyphenyl)-6,6-dimethylheptan-3-one (9g) and (1*R*,5*R*)-1-hydroxy-5-(4-methoxybenzyloxy)-1-(4-methoxyphenyl)-6,6-dimethylheptan-3-one (10g)



9g **10g**

The mixture of aldol adducts **9g** and **10g** (86%, 72 mg, 0.18 mmol) was obtained as a yellow oil (79:21 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.12 (20% EtOAc in hexane)

IR (neat) 3508, 3055, 2961, 2937, 2910, 2872, 2839, 1707, 1612, 1587, 1514, 1466, 1391, 1366, 1302, 1265, 1250, 1175, 1082, 1036, 895, 833, 739, 704 cm^{-1}.

^{1}H NMR (500 MHz; $CDCl_3$) δ 0.92 (s, 9H); 2.55 (dd, *J* = 3.0 and 16.3 Hz, 1H); (2.68 (dd, *J* = 8.2 and 16.1 Hz, 1H)); 2.70 (dd, *J* = 8.6 and 16.3 Hz, 1H); (2.76 (dd, *J* = 2.8 and 17.6 Hz, 1H)); 2.78 (dd, *J* = 3.3 and 17.4 Hz, 1H); (2.86 (dd, *J* = 9.2 and 17.7 Hz, 1H)); 2.90 (dd, *J* = 9.4 and 17.4 Hz, 1H); (3.26 (br s, 1H)); 3.34 (br s, 1H); 3.68-3.71 (m, 1H); 3.79 (s, 3H); 3.79 (s, 3H); 4.43-4.50 (m, 2H); 5.05-5.07 (m, 1H); 8.84-8.87 (m, 4H); 7.19-7.26 (m, 4H).

^{13}C NMR (125 MHz; $CDCl_3$) δ (26.1); 26.1; 35.7; (35.7); (45.3); 45.3; 52.6; 55.2; 55.2; (69.4); 69.6; 74.0; (74.0); 83.1; (83.1); (113.6); 113.6; (113.8); 113.8; (126.8); 126.9; (129.1); 129.3; 130.8; (131.0); (134.9); 134.9; (159.0); (159.0); 159.0; 159.0; (211.0); 211.3.

HRMS (ESI TOF-MS): calcd. for $C_{24}H_{32}O_5Na$: 423.2148; found: 423.2170.

(3*R*,7*S*)-7-hydroxy-2,2,8-trimethyl-3-(trityloxy)nonan-5-one (23a) and (3*R*,7*R*)-7-hydroxy-2,2,8-trimethyl-3-(trityloxy)nonan-5-one (24a)

23a **24a**

The mixture of aldol adducts **23a** and **24a** (71%, 68 mg, 0.15 mmol) was obtained as a yellow oil (50:50 ratio) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.94 (20% EtOAc in hexane)

IR (neat) 3501, 3088, 3057, 3034, 2962, 2908, 2874, 1707, 1595, 1489, 1468, 1448, 1393, 1366, 1265, 1229, 1182, 1149, 1080, 1055, 1028, 1003, 972, 930, 897, 768, 741, 708, 633 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ 0.78 (d, J = 6.8 Hz, 3H); (0.80 (d, J = 6.7 Hz, 3H)); 0.84 (d, J = 6.8 Hz, 3H); (0.85 (s, 9H)); (0.86 (d, J = 6.7 Hz, 3H)); 0.89 (s, 9H); 1.38-1.46 (m, 1H); 1.74 (dd, J = 2.0 and 17.3 Hz, 1H); (1.74-1.83 (m, 2H)); 1.88 (dd, J = 10.0 and 17.3 Hz, 1H); 2.44 (dd, J = 6.6 and 18.1 Hz, 1H); (2.48 (dd, J = 7.3 and 18.1 Hz, 1H)); 2.67 (dd, J = 2.8 and 13.5 Hz, 1H); (2.70 (dd, J = 3.4 and 13.7 Hz, 1H)); 2.76 (br s, 1H); (2.80 (br s, 1H)); 3.41-3.44 (m, 1H); (3.54-3.59 (m, 1H)); (3.92 (dd, J = 2.8 and 7.3 Hz, 1H)); 3.99 (dd, J = 3.4 and 6.6 Hz, 1H); 6.99-7.04 (m, 3H); 7.10-7.14 (m, 6H); 7.57-7.60 (m, 6H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 17.6; (17.7); 18.6; (18.6); 26.5; 33.1; (33.2); 36.2; (36.4); 46.1; (46.2); 46.3; (46.7); 71.8; (71.8); 75.7; (76.1); 87.0; (87.0); 127.2; (127.3); 127.9; (128.0); 129.6; (129.8); 145.6; (145.7); 209.4.

HRMS (ESI TOF-MS): calcd. for $C_{31}H_{38}O_3Na$: 481.2719; found: 481.2756.

(1*S*,5*R*)-1-hydroxy-6,6-dimethyl-1-phenyl-5-(trityloxy)heptan-3-one (23e) and (1*R*,5*R*)-1-hydroxy-6,6-dimethyl-1-phenyl-5-(trityloxy)heptan-3-one (24e)

23e **24e**

The mixture of aldol adducts **23e** and **24e** (95%, 98 mg, 0.20 mmol) was obtained as a white oil (50:50 ratio) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.60 (20% EtOAc in hexane)

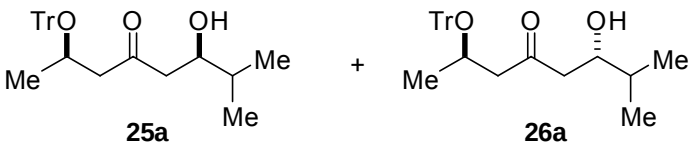
IR (neat) 3555, 3088, 3055, 3034, 2982, 2961, 2908, 2872, 1707, 1595, 1491, 1479, 1468, 1448, 1421, 1408, 1394, 1364, 1317, 1265, 1227, 1184, 1151, 1084, 1055, 1028, 1003, 970, 930, 897, 743, 706, 642, 633 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ 0.84 (s, 9H); (0.86 (s, 9H)); 1.94 (dd, *J* = 2.7 and 17.3 Hz, 1H); (2.01 (dd, *J* = 2.4 and 17.1 Hz, 1H)); 2.08 (dd, *J* = 8.8 and 17.3 Hz, 1H); (2.18 (dd, *J* = 9.5 and 17.3 Hz, 1H)); 2.42 (dd, *J* = 7.3 and 18.1 Hz, 1H); 2.62 (dd, *J* = 2.7 and 18.1 Hz, 1H); (2.67 (dd, *J* = 3.4 and 18.3 Hz, 1H)); (3.13 (s, 1H)); 3.23 (s, 1H); (3.87-3.89 (m, 1H)); 3.99-4.01 (m, 1H); 4.76 (d, *J* = 9.8 Hz, 1H); (4.83 (d, *J* = 7.3 Hz, 1H)); 6.99-7.02 (m, 3H); 7.08-7.22 (m, 11H); 7.56-7.59 (m, 6H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 26.4; 36.2; (36.3); 46.2; (46.6); 51.2; 69.6; (69.7); 75.5; (75.9); 86.9; (87.0); 125.9; (126.1); 127.2; (127.3); 127.4; (127.5); 127.9; (128.0); 128.4; 129.6; (129.7); 143.7; (143.9); 145.6; (145.7); 208.1; (208.2).

HRMS (ESI TOF-MS): calcd. for $C_{34}H_{36}O_3Na$: 515.2562; found: 515.2596.

(2*RS*,6*RS*)-6-hydroxy-7-methyl-2-(trityloxy)octan-4-one (25a) and (2*RS*,6*SR*)-6-hydroxy-7-methyl-2-(trityloxy)octan-4-one (26a)



25a **26a**

The mixture of aldol adducts **25a** and **26a** (95%, 83 mg, 0.20 mmol) was obtained as a yellow oil (50:50 ratio) after purification by flash column

chromatography (silica gel 200-400 mesh) using a mixture of chloroform/methanol (95:5) as eluent.

R*f* 0.90 (5% methanol in chloroform)

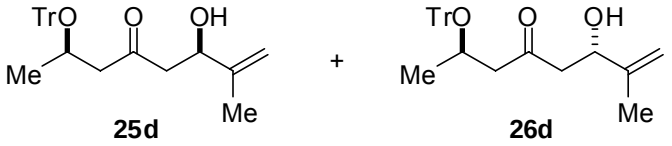
IR (neat) 3531, 3080, 3057, 3036, 3024, 2964, 2932, 2876, 1703, 1597, 1491, 1468, 1448, 1408, 1377, 1319, 1265, 1221, 1151, 1126, 1074, 1036, 1024, 1003, 951, 930, 899, 775, 743, 708, 648, 631 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (0.81 (d, J = 6.7 Hz, 3H)); 0.81 (d, J = 6.7 Hz, 3H); 0.87 (d, J = 6.7 Hz, 3H); (0.88 (d, J = 6.7 Hz, 3H)); 1.14 (d, J = 6.0 Hz, 3H); 1.45-1.52 (m, 1H); 1.79-2.13 (m, 4H); 2.92 (br s, 1H); 3.61-3.68 (m, 1H); 4.10-4.17 (m, 1H); 7.00-7.04 (m, 3H); 7.07-7.12 (m, 6H); 7.54-7.57 (m, 6H).

^{13}C NMR (125 MHz; C_6D_6) δ 17.7; (17.7); 18.6; (18.7); 22.6; (22.7); (33.4); 33.4; (47.0); 47.1; 51.6; (67.0); 67.0; 71.9; (72.0); (87.4); 87.4; 127.3; (127.3); 128.0; (128.1); (129.3); 129.3; (145.4); 145.4; (209.9); 209.9.

HRMS (ESI TOF-MS): calcd. for $C_{28}H_{32}O_3Na$: 439.2249; found: 439.2313.

(2*RS*,6*RS*)-6-hydroxy-7-methyl-2-(trityloxy)oct-7-en-4-one (25d) and (2*RS*,6*SR*)-6-hydroxy-7-methyl-2-(trityloxy)oct-7-en-4-one (26d)



25d **26d**

The mixture of aldol adducts **25d** and **26d** (95%, 84 mg, 0.20 mmol) was obtained as a yellow oil (50:50 ratio) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.41 (20% EtOAc in hexane)

IR (neat) 3528, 3088, 3055, 2984, 2934, 1703, 1653, 1597, 1491, 1448, 1421, 1377, 1317, 1265, 1221, 1184, 1151, 1119, 1084, 1036, 1024, 1003, 951, 930, 901, 771, 739, 708, 648, 631 cm^{-1}.

^{1}H NMR (500 MHz; C_6D_6) δ (1.12 (d, J = 6.1 Hz, 3H)); 1.14 (d, J = 5.8 Hz, 3H); 1.58 (s, 3H); 1.85-1.92 (m, 1H); 1.99-2.06 (m, 1H); 2.12-2.14 (m, 1H); (2.22-2.27 (m, 1H)); 2.91 (br s, 1H); 4.09-4.18 (m, 1H); 4.32-4.37 (m, 1H); 4.77 (m, 1H); 5.00-5.01 (m, 1H); 6.99-7.03 (m, 3H); 7.08-7.11 (m, 6H); 7.53-7.57 (m, 6H).

^{13}C NMR (125 MHz; C_6D_6) δ (18.4); 18.4; 22.6; (48.4); 48.6; (51.6); 51.6; 66.9; (71.0); 71.1; 87.4; (87.4); 110.7; (110.7); 127.3; (127.3); 128.0; (128.1); (129.3); 129.3; (145.3); 145.4; 146.4; (146.5); 208.9.

HRMS (ESI TOF-MS): calcd. for $C_{28}H_{30}O_3Na$: 437.2093; found: 437.2068.

(1*RS*,5*RS*)-1-hydroxy-1-phenyl-5-(trityloxy)hexan-3-one (25e) and (1*SR*,5*RS*)-1-hydroxy-1-phenyl-5-(trityloxy)hexan-3-one (26e)

25e **26e**

The mixture of aldol adducts **25e** and **26e** (77%, 74 mg, 0.16 mmol) was obtained as a white solid (50:50 ratio) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent.

R*f* 0.47 (20% EtOAc in hexane)

mp 46-48°C

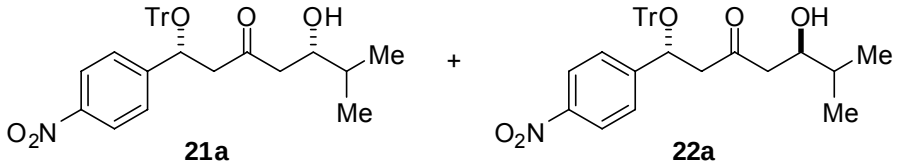
IR (neat) 3541, 3088, 3055, 3036, 2986, 2932, 1703, 1597, 1491, 1448, 1421, 1408, 1377, 1319, 1265, 1221, 1151, 1119, 1086, 1065, 1034, 1024, 1003, 897, 739, 706, 648, 633 cm^{-1}.

^{1}H NMR (500 MHz; $CDCl_3$) δ (1.10 (d, J = 6.3 Hz, 3H)); 1.12 (d, J = 6.6 Hz, 3H); (1.90 (dd, J = 3.4 and 13.3 Hz, 1H)); 1.93 (dd, J = 3.9 and 13.3 Hz, 1H); 2.19 (dd, J = 8.2 and 16.3 Hz, 1H); 2.44 (dd, J = 3.0 and 17.6 Hz, 1H); (2.47 (dd, J = 9.0 and 18.5 Hz, 1H)); 2.58 (dd, J = 3.4 and 18.1 Hz, 1H); (2.62 (dd, J = 9.5 and 17.6 Hz, 1H)); (3.20 (d, J = 3.0 Hz, 1H)); 3.24 (d, J = 3.0 Hz, 1H); 4.01-4.08 (m, 1H); 4.97 (dt, J = 2.2 and 9.5 Hz, 1H); (5.00 (dt, J = 2.4 and 9.3 Hz, 1H)); 7.21-7.34 (m, 14H); 7.46-7.49 (m, 6H).

^{13}C NMR (125 MHz; $CDCl_3$) δ 22.5; 51.3; (51.3); (51.4); 51.5; 66.5; (66.5); (69.6); 69.6; (87.1); 87.1; (125.5); 125.6; (127.1); 127.1; (127.5); 127.6; 127.8; (127.8); (128.4); 128.4; (128.8); 128.8; (142.6); 142.6; (144.6); 144.7; 209.9; (210.0).

HRMS (ESI TOF-MS): calcd. for $C_{31}H_{30}O_3Na$: 473.2093; found: 473.2113.

(1*SR*,5*RS*)-5-hydroxy-6-methyl-1-(4-nitrophenyl)-1-(trityloxy)heptan-3-one (21a) and (1*SR*,5*SR*)-5-hydroxy-6-methyl-1-(4-nitrophenyl)-1-(trityloxy)heptan-3-one (22a)



21a **22a**

The mixture of aldol adducts **21a** and **22a** (69%, 110 mg, 0.21 mmol) was obtained as a yellow oil (73:27 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/dichloromethane/ethyl acetate (50:40:10) as eluent.

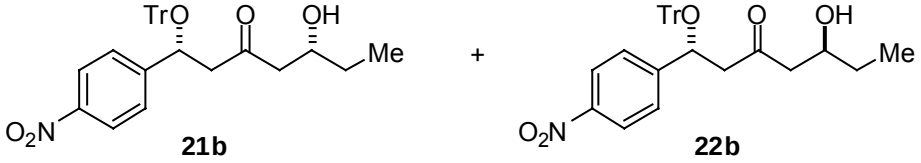
R*f* 0.62 (10% EtOAc in hexane)

IR (neat) 3566, 3055, 2966, 1707, 1607, 1524, 1346, 1265, 856, 741 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ (0.70 (d, J = 6.7 Hz, 3H)); 0.71 (d, J = 6.8 Hz, 3H); (0.76 (d, J = 6.79 Hz, 3H)); 0.77 (d, J = 6.8 Hz, 3H); 1.26-1.44 (m, 2H); (1.71 (dd, J = 2.53 and 17.2 Hz, 1H)); 1.81-1.89 (m, 2H); (1.96 (dd, J = 9.8 and 17.2 Hz, 1H)); (2.24-2.51 (m, 4H)); 2.32 (dd, J = 4.0 and 17.1 Hz, 1H); 2.44 (dd, J = 8.2 and 16.9 Hz, 1H); 3.42-3.58 (m, 2H); (5.10-5.19 (m, 1H)); 5.15 (dd, J = 4.0 and 8.2 Hz, 1H); 6.09-7.07 (m, 22H); 7.38-7.43 (m, 12H); 7.75 (d, J = 8.8 Hz, 4H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 17.4; 18.4; (33.2); 33.3; 47.2; 52.5; (52.6); 71.8; 72.0; 88.9; 123.2; 127.4; 128.1; 128.5; 129.2; 144.5; 147.0; 151.0; (151.1); (208.0); 208.0.

(1*SR*,5*SR*)-5-hydroxy-1-(4-nitrophenyl)-1-(trityloxy)heptan-3-one (21b) and (1*SR*,5*RS*)-5-hydroxy-1-(4-nitrophenyl)-1-(trityloxy)heptan-3-one (22b)



21b **22b**

The mixture of aldol adducts **21b** and **22b** (55%, 85 mg, 1.47 mmol) was obtained as a yellow oil (60:40 diastereoselectivity) after purification by flash

column chromatography (silica gel 200-400 mesh) using a mixture of hexane/dichloromethane/ethyl acetate (50:40:10) as eluent.

R*f* 0.43 (10% EtOAc in hexane)

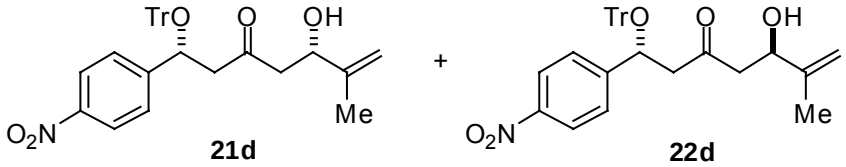
IR (neat) 3554, 3055, 2935, 2966, 1707, 1607, 1524, 1348, 1265, 856, 741 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ (0.75 (t, J = 7.4 Hz, 3H)); 0.76 (t, J = 7.3 Hz, 3H); 1.00-1.29 (m, 4H); (1.66 (dd, J = 2.7 and 17.2 Hz, 1H)); 1.75-1.84 (m, 2H); (1.90 (dd, J = 9.5 and 17.4 Hz, 1H)); 2.25-2.50 (m, 6H); 3.59 (m, 2H); 5.08-5.20 (m, 2H); 6.88-7.08 (m, 22H); 7.35-7.50 (m, 12H); 7.74 (d, J = 8.7 Hz, 4H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 9.8; (29.6); 29.7; (49.7); 49.8; 52.4; (52.5); (68.6); 68.7; (71.7); 71.8; 88.9; 123.5; 127.4; 127.8; 128.1; 128.5; 129.2; 144.5; 146.9; 151.0; (151.1).

HRMS (ESI TOF-MS): calcd. for $C_{32}H_{31}NO_5Na$: 532.2100; found: 532.2108.

(1*SR*,5*SR*)-5-hydroxy-6-methyl-1-(4-nitrophenyl)-1-(trityloxy)hept-6-en-3-one (21d) and (1*SR*,5*RS*)-5-hydroxy-6-methyl-1-(4-nitrophenyl)-1-(trityloxy)hept-6-en-3-one (22d)



21d **22d**

The mixture of aldol adducts **21d** and **22d** (98%, 256 mg, 0:49 mmol) was obtained as a yellow oil (70:30 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/dichloromethane/ethyl acetate (50:40:10) as eluent.

R*f* 0.59 (10% EtOAc in hexane)

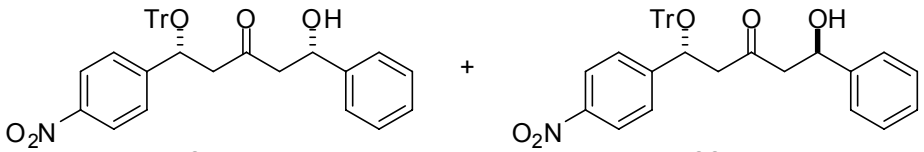
IR (neat) 3500, 3055, 1709, 1607, 1524, 1348, 1265, 897, 739 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ (1.46 (s, 3H)); 1.48 (s, 3H); (1.86 (dd, J = 3.0 and 16.7 Hz, 1H)); 1.96 (dd, J = 3.8 and 16.6 Hz, 1H); 2.07 (dd, J = 8.9 and 16.6 Hz, 1H); (2.14 (dd, J = 9.3 and 16.7 Hz, 1H)); 2.29-2.57 (m, 6H); 4.14-4.24 (m, 2H); 4.69 (br s, 2H); 4.89 (br s, 2H); 5.10-5.21 (m, 2H); 6.90-7.08 (m, 22H); 7.38-7.47 (m, 12H); 7.74 (d, J = 8.7 Hz, 4H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 18.1; (18.1); 48.7; 52.6; (52.7); (71.0); 71.2; 71.7; 88.9; 110.9; (123.1); 123.1; 127.5; 128.1; 128.5; 129.2; 144.5; (146.1); 146.3; 146.9; 151.0; (151.1); (206.8); 206.9.

HRMS (ESI TOF-MS): calcd. for $C_{33}H_{31}NO_5Na$: 544.2100; found: 544.2120.

(1*SR*,5*SR*)-1-hydroxy-5-(4-nitrophenyl)-1-phenyl-5-(trityloxy)pentan-3-one (21e) and (1*RS*,5*SR*)-1-hydroxy-5-(4-nitrophenyl)-1-phenyl-5-(trityloxy)pentan-3-one (22e)



21e **22e**

The mixture of aldol adducts **21e** and **22e** (76%, 140 mg, 0.25 mmol) was obtained as a yellow oil (67:33 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/dichloromethane/ethyl acetate (50:40:10) as eluent.

R*f* 0.68 (10% EtOAc in hexane)

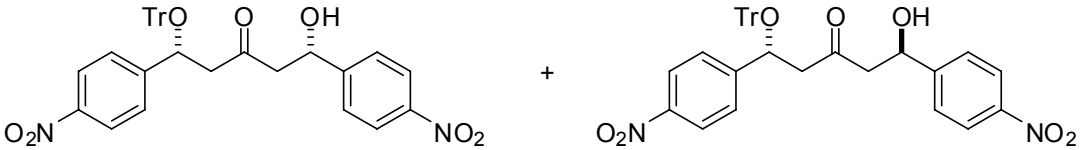
IR (neat) 3547, 3059, 2926, 1607, 1522, 1346, 1265, 856, 739 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ (2.05 (dd, J = 3.6 and 17.1 Hz, 1H)); 2.16 (dd, J = 4.0 and 16.9 Hz, 1H); 2.19-2.45 (m, 5H); 2.28 (dd, J = 8.5 and 17.1 Hz, 1H); 2.60 (d, J = 3.5 Hz, 1H); (2.62 (d, J = 3.8 Hz, 1H)); 4.83-4.94 (m, 2H); 5.15-5.24 (m, 2H); 6.98-7.25 (m, 32H); 7.45-7.57 (m, 12H); 7.77-7.84 (m, 4H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 52.5; (52.3); 52.4; (52.5); (69.8); 70.0; 71.6; (71.7); 88.9; (123.1); 123.2; (125.8); 125.8; 127.4; 127.8; 128.1; 128.5; 128.6; 129.2; (143.5); 143.6; 144.4; 147.0; 150.8; (150.9); (206.6); 206.7.

HRMS (ESI TOF-MS): calcd. for $C_{36}H_{30}NO_5Na$: 580.2100; found: 580.2104.

(1*SR*,5*SR*)-1-hydroxy-1,5-bis(4-nitrophenyl)-5-(trityloxy)pentan-3-one (21f) and (1*RS*,5*SR*)-1-hydroxy-1,5-bis(4-nitrophenyl)-5-(trityloxy)pentan-3-one (22f)



21f **22f**

The mixture of aldol adducts **21f** and **22f** (76%, 202 mg, 0.34 mmol) was obtained as a yellow oil (70:30 diastereoselectivity) after purification by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/dichloromethane/ethyl acetate (50:40:10) as eluent.

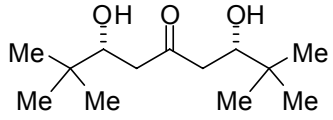
R*f* 0.44 (20% EtOAc in hexane)

IR (neat) 3522, 3057, 2926, 1711, 1607, 1522, 1348, 1265, 856, 739 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ (1.79 (dd, *J* = 3.2 and 17.5 Hz, 1H)); 1.91 (dd, *J* = 4.1 and 17.2 Hz, 1H); 2.01 (dd, *J* = 8.2 and 17.2 Hz, 1H); (2.07 (dd, *J* = 9.3 and 17.5 Hz, 1H)); 2.25 (dd, *J* = 3.8 and 16.9 Hz, 1H); (2.30-2.34 (m, 2H)); 2.41 (dd, *J* = 8.5 and 16.9 Hz, 1H); 2.62 (br s, 1H); (2.74 (br s, 1H)); 4.59-4.70 (m, 2H); 5.07-5.16 (m, 2H); (6.83 (d, *J* = 8.5 Hz, 2H)); 6.85 (d, *J* = 8.5 Hz, 2H); 6.90-7.07 (m, 22H); 7.37-7.46 (m, 12H); 7.75 (d, *J* = 8.7 Hz, 4H); (7.82 (d, *J* = 8.7 Hz, 2H)); 7.83 (d, *J* = 8.8 Hz, 2H).

HRMS (ESI TOF-MS): calcd. for $C_{36}H_{30}N_2O_7Na$: 625.1951; found: 625.2042.

(3*R*,7*S*)-3,7-dihydroxy-2,2,8,8-tetramethylnonan-5-one (13)



13

Aldol adduct **11c** (10 mg, 0.03 mmol) was dissolved in 0.5 mL of acetonitrile at 0 °C. To the resulting solution were added four drops of aqueous 48% HF solution. The mixture was stirred for 5 min at 0 °C, for 3 h at room temperature and quenched by the addition of solid $NaHCO_3$, filtered and concentrated under reduced pressure to give 7 mg (100%) of **13** as a yellow solid.

R*f* 0.32 (20% EtOAc in hexane)

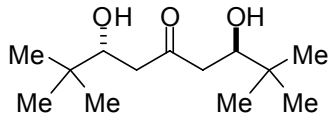
mp 126-129°C

IR (neat) 3464, 3055, 2961, 2935, 2908, 2872, 1703, 1634, 1479, 1366, 1265, 1086, 1068, 1013, 897, 837, 739, 704 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 0.87 (s, 18H); 2.14 (dd, *J* = 2.2 and 16.7 Hz, 2H); 2.26 (dd, *J* = 10.0 and 16.7 Hz, 2H); 3.01 (br s, 2H); 3.70 (dd, *J* = 2.2 and 10.0 Hz, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 25.7; 34.4; 45.6; 75.2; 213.5.

(+)-(3*R*,7*R*)-3,7-dihydroxy-2,2,8,8-tetramethylnonan-5-one (14)



14

Aldol adduct **12c** (10 mg, 0.03 mmol) was dissolved in 0.5 mL of acetonitrile at 0 °C. To the resulting solution were added four drops of aqueous 48% HF solution. The mixture was stirred for 5 min at 0 °C, for 3 h at room temperature and quenched by the addition of solid $NaHCO_3$, filtered and concentrated under reduced pressure to give 7 mg (100%) of **14** as a yellow solid.

$[a]_D^{20}$ +50.0 (c = 0.45, CH_2Cl_2).

R*f* 0.38 (20% EtOAc in hexane)

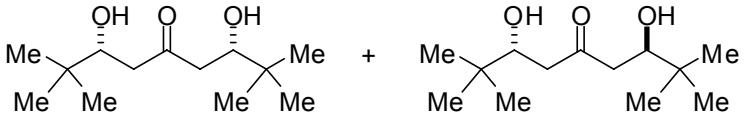
mp 98-100°C

IR (neat) 3504, 3055, 2986, 2964, 2934, 2872, 1703, 1607, 1479, 1468, 1421, 1366, 1265, 1068, 1013, 897, 739, 706 cm^{-1}.

^{1}H NMR (250 MHz; C_6D_6) δ 0.85 (s, 18H); 2.12 (dd, *J* = 3.3 and 16.9 Hz, 2H); 2.22 (dd, *J* = 9.2 and 16.9 Hz, 2H); 2.79 (br s, 2H); 3.68 (dd, *J* = 3.3 and 9.2 Hz, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ 25.7; 34.3; 45.3; 74.9; 213.2.

(3*R*,7*S*)-3,7-dihydroxy-2,2,8,8-tetramethylnonan-5-one (13) and (+)-(3*R*,7*R*)-3,7-dihydroxy-2,2,8,8-tetramethylnonan-5-one (14)



13 **14**

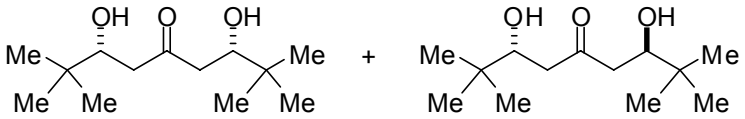
Aldol adducts **11c** and **12c** (20 mg, 0.06 mmol) were dissolved in 1.0 mL of acetonitrile at 0 °C. To the resulting solution were added four drops of aqueous 48% HF solution. The mixture was stirred for 5 min at 0 °C, for 3 h at room temperature and quenched by the addition of solid $NaHCO_3$, filtered and concentrated under reduced pressure to give 14 mg (100%) of **13** and **14** as a yellow solid.

R*f* 0.38 (20% EtOAc in hexane)

^{1}H NMR (250 MHz; C_6D_6) δ (0.87 (s, 18H)); 0.89 (s, 18H); 2.16 (dd, *J* = 2.0 and 16.4 Hz, 2H); 2.22-2.38 (m, 2H); (3.08 (br s, 2H)); 3.35 (br s, 2H); 3.69-3.77 (m, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ (25.8); 25.8; (34.4); 34.4; (45.4); 45.8; (74.8); 75.1; (213.1); 213.5.

(3*R*,7*S*)-3,7-dihydroxy-2,2,8,8-tetramethylnonan-5-one (13) and (+)-(3*R*,7*R*)-3,7-dihydroxy-2,2,8,8-tetramethylnonan-5-one (14)



13 **14**

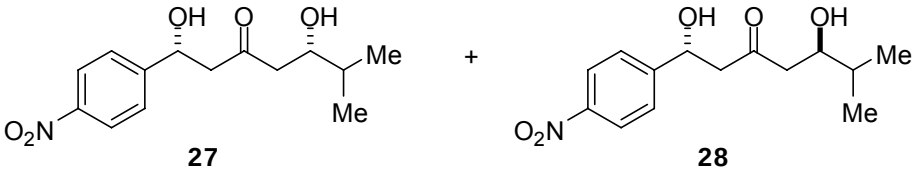
To a stirring solution of a mixture of PMB ethers **9c** and **10c** (20 mg, 0.06 mmol), in CH_2Cl_2 (1.0 mL), containing buffer pH 7 (0.2 mL) at 0 °C, was added DDQ (21 mg, 0.09 mmol). The reaction was stirred at 0 °C for 30 min. After this period, the reaction medium was applied directly to a flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (80:20) as eluent, providing 11 mg (78%) of **13** and **14** as a yellow solid.

R*f* 0.38 (20% EtOAc in hexane)

^{1}H NMR (250 MHz; C_6D_6) δ (0.86 (s, 18H)); 0.88 (s, 18H); 2.15 (dd, *J* = 2.0 and 16.4 Hz, 2H); 2.20-2.37 (m, 2H); (3.03 (s, 2H)); 3.28 (s, 2H); 3.68-3.76 (m, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ (25.7); 25.8; (34.4); 34.4; (45.4); 45.7; (74.8); 75.1; (213.2); 213.5.

(1*SR*,5*SR*)-1,5-dihydroxy-6-methyl-1-(4-nitrophenyl)heptan-3-one (27) and (1*RS*,5*SR*)-1,5-dihydroxy-6-methyl-1-(4-nitrophenyl)heptan-3-one (28)



27 **28**

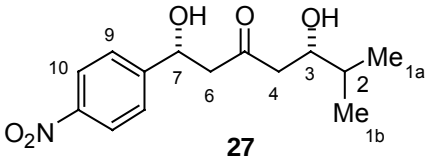
Aldol adducts **21a** and **22a** (21 mg, 0.041 mmol) were dissolved in 1.5 mL of acetonitrile and dichloromethane (4:1) at room temperature. To the resulting solution were added two drops of aqueous 48% HF solution. The mixture was stirred for 1 h at room temperature, filtered and concentrated under reduced pressure. The residue was purified by flash column chromatography (silica gel 200-400 mesh) using a mixture of hexane/ethyl acetate (50:50) as eluent to give 11.4 mg (99%) of **27** and **28** as a yellow oil.

R*f* 0.38 (20% EtOAc in hexane)

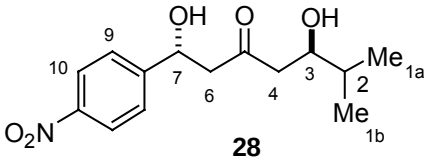
^{1}H NMR (250 MHz; C_6D_6) δ (0.87 (s, 18H)); 0.89 (s, 18H); 2.16 (dd, J = 2.0 and 16.4 Hz, 2H); 2.22-2.38 (m, 2H); (3.08 (br s, 2H)); 3.35 (br s, 2H); 3.69-3.77 (m, 2H).

^{13}C NMR (62.5 MHz; C_6D_6) δ (25.8); 25.8; (34.4); 34.4; (45.4); 45.8; (74.8); 75.1; (213.1); 213.5.

Table 1: ^{1}H NMR (500 MHz, C_6D_6) data of isolated **27** and **28**.[1]



27

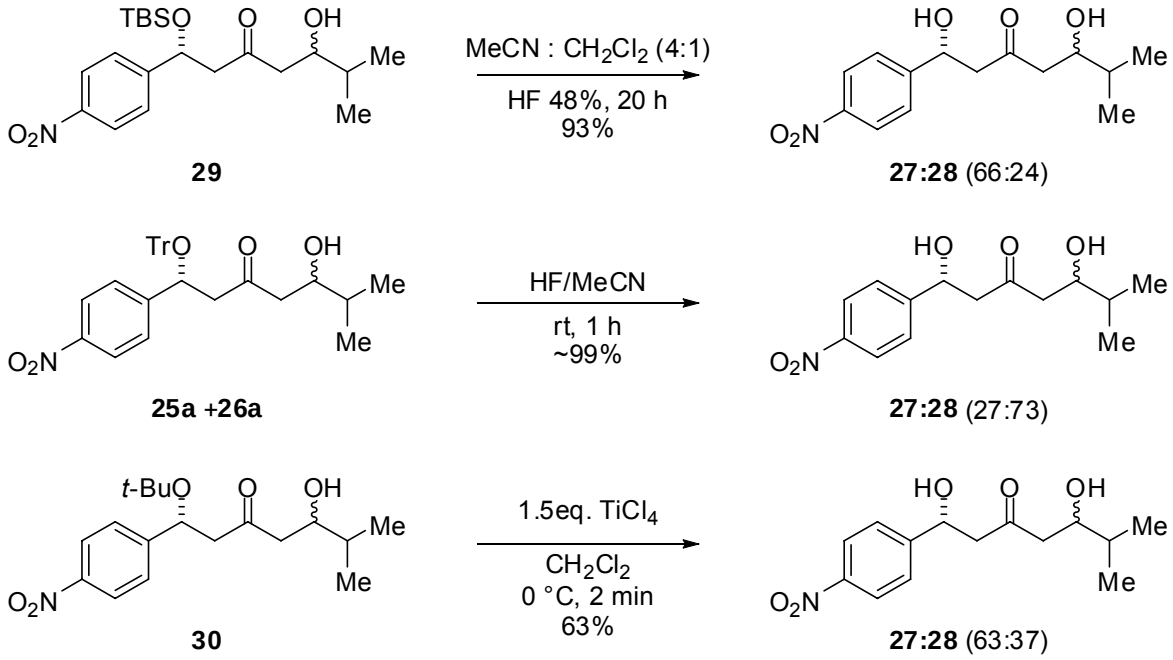


28

		1,5-*ANTI* (28)			**1,5-*SYN* (27)**	
H	**δ H (ppm)**	***J* (Hz)**		**δ H (ppm)**	***J* (Hz)**	
1a	0.77	$J_{1a/2}$ = 6.8	d	0.78	$J_{1a/2}$ = 6.8	d
1b	0.82	$J_{1b/2}$ = 6.8	d	0.83	$J_{1b/2}$ = 6.8	d
2	1.42	$J_{2/1}$ = 6.7; $J_{2/3}$= 5.4	ds	1.38-1.48		m
3	3.63-3.69		m	3.64-3.70		m
OH	2.31	J = 3.4	br s	2.42-2.48		br s
4a	1.94	J_{gem} = 16.5; $J_{4a/3}$ = 2.4	dd	1.96	J_{gem} = 16.5; $J_{4a/3}$ = 2.4	dd
4b	2.14	J_{gem} = 16.5; $J_{4b/3}$ = 10.0	dd	2.17	J_{gem} = 16.5; $J_{7/4}$ = 10.0	dd
6a	2.07	J_{gem} = 17.2; $J_{6a/7}$ = 2.8	dd	2.07	J_{gem} = 17.2; $J_{6a/7}$ = 2.8	dd
6b	2.24	J_{gem} = 17.2; $J_{6b/7}$ = 9.8	dd	2.30	J_{gem} = 17.2; $J_{6b/7}$ = 9.6	dd
7	4.82-4.87		m	4.83-4.90		m
OH	3.13	J = 2.9	d	3.24	J = 3.2	d
9	6.96	$J_{9/10}$ = 8.8	d	6.98	$J_{9/10}$ = 8.7	d
10	7.89	$J_{10/9}$ = 8.8	d	7.89	$J_{10/9}$ = 8.7	d

[1] a) Dias, L. C.; Marchi, A. A.; Ferreira, M. A. B.; Aguilar, A. M. *Org. Lett.* **2007**, *9*, 4869. b) Dias, L. C.; Marchi, A. A.; Ferreira, M. A. B.; Aguilar, A. M. *J. Org. Chem.* **2008**, *73*, 6299.

Scheme 1: Compounds **27** and **28** obtained in different experiments.[1]



29 — **27:28** (66:24)

25a +**26a** — **27:28** (27:73)

30 — **27:28** (63:37)

Table 2: Spectroscopic data of diols mixture obtained in different experiments(500 MHz, C_6D_6).[1]

	***δ* H (ppm)**					
P	***t*-Bu (30)**		**Tr (25a and 26a)**		**TBS (29)**	
H	**1,5-*SYN***	**1,5-*ANTI***	**1,5-*SYN***	**1,5-*ANTI***	**1,5-*SYN***	**1,5-*ANTI***
1a	0.78	0.77	0.78	0.77	0.78	0.77
1a	0.84	0.83	0.83	0.82	0.83	0.82
2	1.39-1.49		1.38-1.49		1.38-1.49	
3	3.65-3.72		3.64-3.71		3.65-3.71	
OH	2.60	2.48	2.53	2.43	2.51	2.40
4a	1.98	1.97	1.98	1.97	1.97	1.96
4b	2.21	2.17	2.20	2.16	2.19	2.16
6a	2.09	2.11	2.09	2.10	2.08	2.09
6b	2.34	2.28	2.33	2.27	2.32	2.26
7	4.86-4.93		4.85-4.92		4.84-4.91	
OH	3.40	3.30	3.33	3.26	3.31	3.23
9	7.00	6.99	6.99	6.98	6.99	6.97
10	7.90		7.90		7.90	

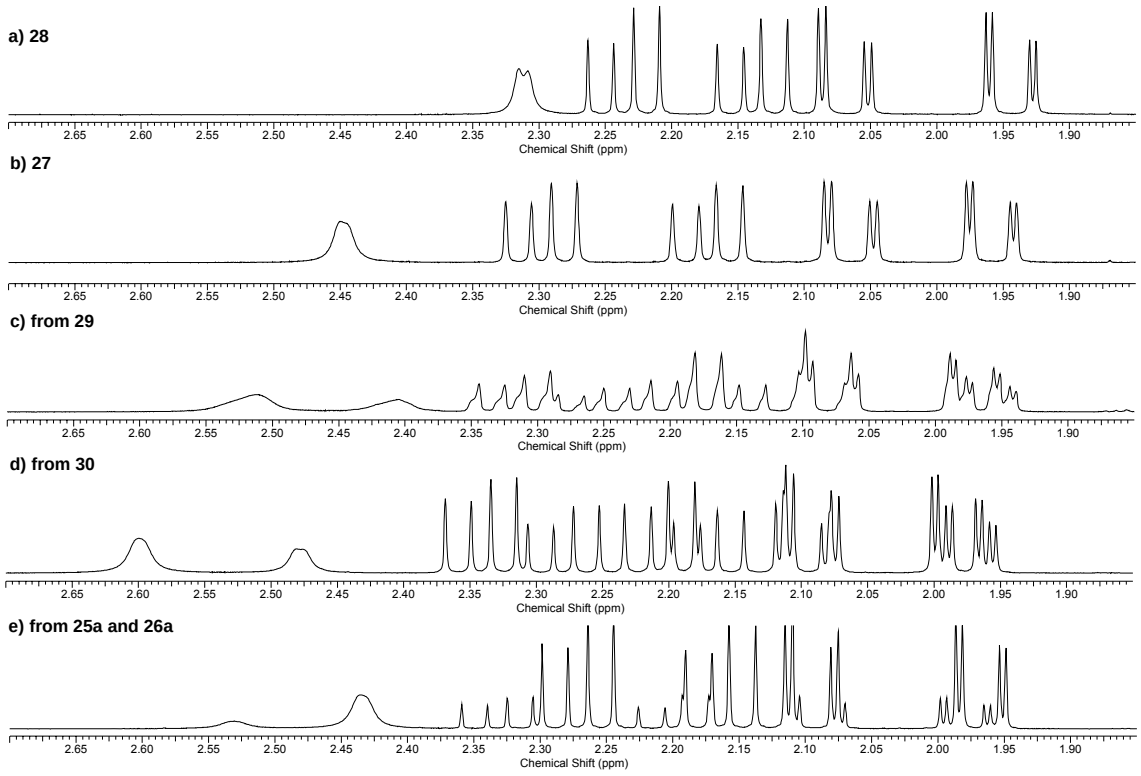


Figure 1: Expansion of ^{1}H NMR (500 MHz, C_6D_6) of mixture of compounds **27** and **28** obtained in different experiments.