Angewandte Chemie
Eine Zeitschrift der Gesellschaft Deutscher Chemiker

Supporting Information

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69451 Weinheim, Germany

Highly Enantioselective Preparation of Alcohols and Amines Attached to a Tertiary Center *via* Copper-Mediated Diastereoselective Allylic S_N2'-Substitutions

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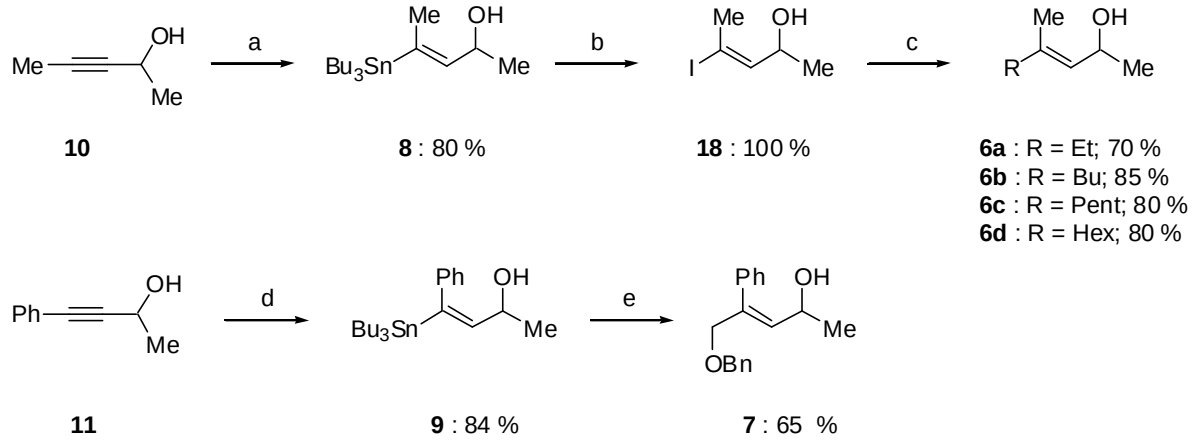
General Details: All reactions were carried out under an argon atmosphere in dried glassware. All NMR spectra were run in $CDCl_3$ and referenced to the solvent peak ($CDCl_3$: ^{13}C NMR, d 77.0; ^1H NMR, d 7.26). The concentrations of diorganozinc reagent solutions were determined by reaction with iodine and back titration with aqueous sodium thiosulfate.

The corresponding allylic alcohols were prepared in enantiomerically enriched form either by a chiral pool synthesis[1] or conveniently by enzymatic resolution.[2] The racemic trisubstituted alcohols **6a-d** and **7** were obtained by stannylcupration[3] (step a of Scheme 1) or palladium-catalyzed hydrostannylation[4] (step d) leading stereoselectively to the stannylated alcohols **8** (80 %) and **9** (84 %) starting from the propargylic alcohols **10** and **11**. The iodolysis of alcohol **8** furnishes the *E*-iodo-allylic alcohol **18** in quantitative yield. Negishi cross-coupling[5,] of **18** with various organozinc halides (RZnX) provides the desired trisubstituted alcohols **6a-d** in 70-85 % yield. Alternatively, the alcohol **9** was treated with *n*-BuLi (2 equiv) and alkylated by $ClCH_2OBn$ affording the *E*-allylic alcohol **7** in 65 % yield; Scheme 1.



Scheme 1. Stereoselective synthesis of the allylic alcohols of type **6** and **7**. Reagents and conditions: a) $Bu_3Sn(CN)(Bu)CuLi_2$, THF:MeOH, -80 °C to –10 °C, 16 h; b) I_2, CH_2Cl_2, 0 °C, 45 min; c) RZnI (3 equiv), $Pd(dba)_2$ (3 mol %), dppf (3.3 mol %), THF, RT, 5 h; d) BuSnH (1.2 equiv), $PdCl_2(PPh_3)_2$ (1 mol %); e) *n*-BuLi (2 equiv), -78 °C to RT, 1 h, $ClCH_2OBn$, RT, 16 h.

TP1: Typical procedure for the copper(I)-mediated allylic substitution of fluorobenzoates with dialkylzincs. Preparation of [(1*R*,2*E*)-1-methyl-1-pentyl-2-butenyl]benzene (4d).[6]

$Pent_2Zn$ (2.35 ml, 11.3 mmol, 2.4 equiv.) was added at –30 °C to a solution of CuCN?2LiCl (5.6 mL, 5.6 mmol, 1.2 equiv., 1 M in THF) stirred under argon. The resulting mixture was stirred for 0.5 h at -30 °C, then the allylic difluorobenzoate 5c (4.7 mmol in THF (2 mL), 1.0 equiv.) was added dropwise. The reaction mixture was allowed to warm to -10 °C within 1.5 h and was stirred at -10 °C for 14 h. The quenched reaction mixture (aq. sat. NH_4Cl (5 mL)) was poured into 25 % aq. ammonia (2 mL), aq. sat. NH_4Cl (100 mL) and Et_2O (100 mL). After extraction with Et_2O (3 x 100 mL) the combined extracts were washed with brine (100 mL) and dried ($MgSO_4$). Evaporation of the solvents and purification by column chromatography yielded desired alkene 4d (855 mg, 3.96 mmol, 85 %) as a colorless liquid.

TP2: Typical procedure for the oxidation[7] **and Baeyer-Villiger rearrangement**[8] **sequence. Preparation of (2*S*)-2-phenyl-heptan-2-ol (1a):**

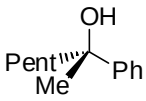
Ozone was led through a solution of alkene 4d (260 mg, 1.20 mmol, 1.0 equiv.) in CH_2Cl_2 (30 mL) at -78 °C under N_2 until the solution turned blue (3 - 10 min); the exess of O_3 was removed by a N_2 current. PPh_3 (408 mg, 1.5 mmol, 1.3 equiv.) was added in one portion and the mixture was warmed to 20 °C within 2 h. It was then diluted with Et_2O (10 mL) and washed with water, then brine, and dried ($MgSO_4$). The solvents were evaporated *in vacuo* and the residue was purified by column chromatography to give 2-methyl-2-phenylheptanal (12a, 194 mg, 0.95 mmol, 80 %, 98 % *ee*) as a colorless liquid. The *ee* was determined by GC analysis (column: Chiraldex B-PH; 100°C (30 min), 0.5°/min until 120°C: t_R/min 78.3 (*R*), 79.7 (*S*)). To a solution of aldehyde 12a (163 mg, 0.80 mmol, 1 equiv.) in CH_2Cl_2 (2mL) was added dry MCPBA (260 mg, 1.2 mmol, 1.5 equiv.). The reaction was stirred at RT for 24 h. It was quenched with water and extracted with Et_2O (3 x 50 mL). The combined organic layers were dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 98/2). (2S)-2-phenylheptan-2-yl formate (123 mg, 70 %) was obtained as a colorless liquid. To a solution of (2S)-2-phenylheptan-2-yl formate (123 mg, 0.56 mmol, 1.0 equiv.) in MeOH (2 mL) was added KOH (62 mg, 2.0 equiv.). It was stirred at 20 °C for 1 h. The reaction mixture was diluted with Et_2O (10 mL), washed with brine, dried ($MgSO_4$) and concentrated *in vacuo*. Purification by flash chromatography (pentane/Et_2O = 9/1) yielded (2*S*)-2-phenyl-heptan-2-ol (1a, 107 mg, 0.56 mmol, quant., 97 % *ee*) as a colourless oil. The *ee* was determined by GC analysis (column: chiraldex B-PH; 100°C (30 min), 0.5°/min, 120°C (60 min)): t_R/min 78.3 (*S*), 79.7 (*R*)). Na_2HPO_4 (1 equiv.) can be used as a buffer in order to enhance the rate of the reaction (reaction time reduced to 2 h at 20 °C) and to improve the *ee*. See the preparation of compounds 1b and 1c.

TP3: Typical Procedure for the oxidation[7] **and Curtius rearrangement.**[9] **Preparation of (1*S*)-1-methyl-1-phenyl-hexylamine (2a):**

Ozone was led through a solution of alkene 4d (432 mg, 2.00 mmol, 1.0 Äquiv.) in acetone (10 mL) at -78 °C under N_2 until the solution turned blue (3 - 10 min); the exess of O_3 was removed by a nitrogen current. At 0 °C Jones reagent (2.0 mL, 2.67 M, 5.4 mmol, 2.7 equiv.) was added dropwise until the orange colour persisted. The mixture was stirred for 1 h at 20 °C, then *i*-PrOH (8 mL) was added until the mixture turned green. The solvents were evaporated and the residue was dissolved in water and ether (1/4). After acid base workup[12c] the desired carboxylic acid 13a (348 mg, 1.58 mmol, 79 %) was obtained as a colorless liquid. A mixture of the acid 13a (124 mg, 0.56 mmol, 1.0 equiv.), diphenyl azidophosphate (231 mg, 0.84 mmol, 1.5 equiv.) and NEt_3 (85 mg, 0.84 mmol, 1.5 equiv.) in toluene (5 mL) was heated at reflux for 2h. After evaporation of the solvent *in vacuo*, the residue was taken up in ether (50 mL) and washed with water (3 x 50 mL). The organic layer was dried

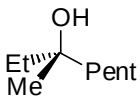
($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 98/2). 1-((2S)-2-Isocyanatoheptan-2-yl)benzene (120 mg, quant., 98 % *ee*) was obtained as a colorless liquid. The *ee* was determined by GC analysis (column: Chiraldex B-PH; 100°C const.: t_R/min 57.8 (*S*), 61.9 (*R*)). 1-((2*S*)-2-isocyanatoheptan-2-yl)benzene (50 mg, 0.23 mmol) was refluxed in 20 % aq. HCl (5 mL) for 24 h. The reaction mixture was partitioned in Et_2O and water (4:1) and the layers were separated. The aqueous layer was basified with NaOH (20 %) and extracted with Et_2O (3 x 80 mL). The organic layer was dried ($MgSO_4$) and the solvent was evaporated *in vacuo*. (1*S*)-1-methyl-1-phenyl-hexylamine (2a, 30 mg, 0.16 mmol, 65 %, 98 % *ee*) was obtained as a colorless oil.

Synthesis of (2*S*)-2-phenyl-heptan-2-ol (1a):



Prepared according to **TP2** from aldehyde **12a** (163 mg, 0.8 mmol), MCPBA (207 mg, 1.2 mmol). Purification by flash chromatography (pentane/Et_2O = 98/2) yielded (2*S*)-2-phenylheptan-2-yl formate (123 mg, 70%) as a colourless liquid.
$[\alpha]_D^{25}$ = +11.6° (c = 1.65, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 8.08 (s, 1H), 7.18-7.27 (m, 5H), 2.0 (m, 2H), 1.79 (s, 3H), 1.15 (m, 6H), 0.76 (t, ^3J(H,H) = 6.9 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 160.9, 144.5, 128.7, 127.6, 125.3, 85.6, 43.0, 32.2, 25.6, 23.6, 22.8, 14.3. **IR** (film) (ν/cm^{-1}): 2932, 1730, 1180, 762, 700. **HRMS** for $C_{14}H_{20}O_2$ (220.1463, [M$^+$]): found: 220.1456. **MS** (EI): 192 ([M]$^+$, 3), 174 (11), 149 (46), 121 (100), 118 (40), 91 (28), 77 (10).
Basic hydrolysis of the formate and purification by flash chromatography (pentane/Et_2O = 9:1) yielded **1a** (107 mg, quant., 97 % *ee*) as a colourless liquid. The *ee* was determined by GC analysis (see appendix).
$[\alpha]_D^{25}$ = +9.3° (c = 1.67, EtOH). **GC** (column: Chiraldex B-PH; 100°C (30 min), 0.5°/min, 120°C (60 min)): t_R/min 78.3 (*R*), 79.7 (*S*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.10-7.36 (m, 5H), 1.70 (m, 2H), 1.57 (s, 3H), 1.13-1.17 (m, 6H), 0.76 (t, ^3J(H,H) = 6.9 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 144.5, 128.9, 127.7, 126.1, 86.9, 40.2, 32.5, 23.9, 22.9, 22.8, 14.4. **IR** (film) (ν/cm^{-1}): 3418, 2954, 1447, 1374, 763, 699. **HRMS** for $C_{13}H_{20}O$ (192.1514, [M]$^+$): found: 192.1511. **MS** (EI): 192 ([M]$^+$, <1), 174 (3), 131 (14), 121 (100), 118 (34), 91 (8), 77 (5), 43 (13).

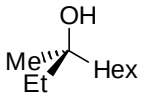
Synthesis of (3*S*)-3-methyl-octan-3-ol (1b):



Prepared according to **TP2** from aldehyde **12b** (260 mg, 1.67 mmol), MCPBA (345 mg, 2.0 mmol) and Na_2HPO_4 (237 mg, 1.67 mmol). Reaction time: 2 h. Basic hydrolysis of (3*S*)-3-methyloctan-3-yl formate and purification by flash chromatography (pentane/Et_2O = 9:1) yielded **1b** (176 mg, 76 %, 92 % *ee*) as a colourless liquid. The *ee* was determined by GC analysis (see appendix).
$[\alpha]_D^{25}$ = -1.5° (c = 1.225, EtOH). **GC** (Chirasil Dex, 70°C const.): t_R/min 27.1 (*S*); 28.5 (*R*).
^{1}H-NMR (δ/ppm, 300 MHz, $CDCl_3$): 1.42-1.21 (m, 10H), 1.07 (s, 3H), 0.75-0.85 (m, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 71.9, 40.3, 33.2, 31.5, 25.4, 22.5, 21.7, 13.0, 7.2. **IR**

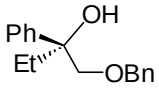
(film) (ν/cm^{-1}): 3390, 2933, 1462, 1377, 1152, 902. **HRMS** for $C_9H_{20}O$ (143.1436, $[M-H]^+$): found: 143.1416. **MS** (EI): 143 ($[M]^+$, <1), 129 (18), 115 (61), 97 (15), 73 (100), 69 (14).

Synthesis of (3*R*)-3-methyl-nonan-3-ol (1c):



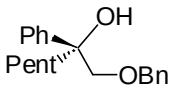
Prepared according to **TP2** from aldehyde **12c** (264 mg, 1.55 mmol), MCPBA (320 mg, 1.86 mmol) and Na_2HPO_4 (219 mg, 1.55 mmol). Reaction time: 2 h. Basic hydrolysis of (3*S*)-3-methylnonan-3-yl formate and purification by flash chromatography (pentane/Et_2O = 9/1) yielded **1c** (166 mg, 68 %, 93 % *ee*) as a colourless liquid. The *ee* was determined by GC analysis (see appendix).
$[a]_D^{25}$ = +1.4° (c = 1.32, CH_2Cl_2). **GC** (column: Chirasil Dex; 90°C const.): t_R/min 17.3 (*S*); 18.2 (*R*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 1.42-1.18 (m, 12H), 1.07 (s, 3H), 0.82 (m, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 71.9, 40.4, 33.2, 30.9, 28.9, 25.4, 22.8, 21.6, 13.1, 7.2. **IR** (film) (ν/cm^{-1}): 3391, 2930, 1462, 1377, 1151, 909. **MS** (EI): 143 ($[M]^+$, <1), 129 (18), 115 (61), 97 (15), 73 (100), 69 (14).

Synthesis of (1*R*)-1-benzyloxy-1-phenyl-propan-1-ol (1d):



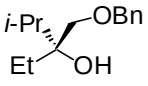
A solution of (2*R*)-2-benzyloxymethyl-2-phenyl-butanal (**12d**) (210 mg, 0.8 mmol. 1 equiv.) in CH_2Cl_2 (10 mL) was added to dried MCPBA (420 mg, 2.5 mmol, 3 equiv.). The reaction mixture was stirred at RT for 40 hours. It was quenched with water (30 mL) and extracted with CH_2Cl_2 (3 x 10 mL). The organic layer was dried (Na_2SO_4), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 95/5). It yielded (1*R*)-[1-benzyloxymethyl-1-phenyl-propan-1-yl] formate (150 mg, 73%) as a colourless oil.
$[a]_D^{20}$: -26°(c = 0.64, CH_2Cl_2). **^{1}H-NMR** (δ/ppm, $CDCl_3$, 300 MHz)): 8.20 (s, 1H), 7.28-7.14 (m, 10H), 4.45 (s, 2H), 3.97 (d, ^3J(H-H) = 9.0 Hz, 1H), 3.90 (d, ^3J(H-H) = 9.0 Hz, 1H), 2.25-2.18 (m, 1H), 2.02-1.95 (m, 1H), 0.70 (t, ^3J(H-H) = 6.0 Hz, 3H). **^{13}C-NMR** (δ/ppm, $CDCl_3$, 75 MHz): 160.3, 139.5, 136.6, 127.4, 127.3, 126.8, 126.5, 124.7, 85.3, 72.5, 65.7, 29.3, 6.4. **IR** (film) (ν/cm^{-1}): 3030, 2960, 2930, 2870, 1730, 1450, 1180, 1110. **HRMS** for $C_{18}H_{20}O_3$ (239.1436, $[M-COOH]^+$): found: 239.1442. **MS** (FAB, Xe, 8 kV): 239 ($[M-COOH]^+$, 3), 135 (11), 105 (14), 91 (100).
To a solution of (1*R*)-[1-benzyloxymethyl-1-phenyl-propan-1-yl] formate (110 mg, 0.4 mmol, 1 equiv.) in MeOH (1 mL) was added KOH (60 mg, 1.1 mmol, 3 equiv.) dissolved in water (0.6 mL). The reaction mixture was stirred at 20 °C for 2 h. The solvents were evaporated *in vacuo* and the residue was purified by flash chromatography (pentane/Et_2O = 8/2). It yielded the desired product **1d** (70 mg, 70 %) as a colourless oil.
$[a]_D^{20}$ = -14° (c = 1.02, CH_2Cl_2). **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 98/2, 0.2 mL/min): t_R/min 49.0 (*R*), 53.3 (*S*). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 7.34-7.15 (m, 10H), 4.45 (s, 2H), 3.58 (d, ^3J(H-H) = 9.0 Hz, 1H), 3.53 (d, ^3J(H-H) = 9.0 Hz, 1H), 2.64 (br. s., 1H), 1.92-1.80 (m, 1H), 1.77-1.68 (m, 1H), 0.67 (t, ^3J(H-H) = 7.2 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 144.1, 138.3, 128.8, 128.4, 128.1, 128.0, 127.1, 125.9, 77.9, 76.8, 73.9, 32.2, 7.9. **IR** (film) (ν/cm^{-1}): 3560, 2930, 1450, 1100. **HRMS** for $C_{17}H_{20}O_2$ (256.1464, M^+): found: 256.1485. **MS** (EI, 70 eV): 256 (M^+, 0.04), 135 (100), 91 (25).

Synthesis of (1*R*)-1-benzyloxy-1-phenyl-heptan-hexan-1-ol (1e):



A solution of of (2*R*)-2-benzyloxymethyl-2-phenyl-butanal **(12e**, 310 mg, 1 mmol, 1 equiv.) in CH_2Cl_2 (10 mL) was added to dried (as a solution in CH_2Cl_2 dried with $MgSO_4$) MCPBA (550 mg, 3.3 mmol, 3.3 equiv.). The reaction mixture was stirred at RT for 40 h. It was quenched with water (30 mL) and extracted with CH_2Cl_2 (3 x 10 mL). The organic layer was dried (Na_2SO_4), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 95/5). (1*R*)-[1-benzyloxymethyl-1-phenyl-hexan-1-yl] formate (225 mg, 68 %) was obtained as a colourless oil.
[a]$_D^{20}$ = -22° (c = 2.0, CH_2Cl_2). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 8.49 (s, 1H), 7.49-7.25 (m, 10H), 4.55 (s, 2H), 4.05 (d, ^3J(H-H) = 10.2 Hz, 1H), 4.00 (d, ^3J(H-H) = 10.2 Hz, 1H), 2.27-2.22 (m, 1H), 2.05-2.02 (m, 1H), 1.26-1.15 (m, 6H), 0.84 (t, ^3J(H-H) = 6.6 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 169.8, 141.3, 138.0, 128.9, 128.8, 128.2, 128.1, 128.0, 126.1, 86.6, 74.0, 73.7, 37.9, 32.3, 23.0, 22.8, 14.4. **IR** (film) (ν/cm^{-1}): 3030, 2960, 2930, 2870, 1730, 1450, 1180, 1110. **MS** (FAB, Xe, 8 kV): 281 ([M-COOH]$^+$, 9), 161 (5), 105 (10), 91 (100). **HRMS** for $C_{21}H_{26}O_3$ (281.1905, ([M-COOH]$^+$)): found: 281.1914.
To a solution of (1*R*)-[1-benzyloxymethyl-1-phenyl-hexan-1-yl] formate (220 mg, 0.6 mmol, 1 equiv.) in MeOH (1 mL) was added KOH (60 mg, 1.1 mmol, 1.8 equiv.) dissolved in water (0.6 mL). The reaction mixture was stirred at RT for 4 h. The solvents were evaporated *in vacuo* and the residue was purified by flash chromatography (pentane/Et_2O = 8/2). It yielded the desired product **1e** (140 mg, 77 %) as a colourless oil. The *ee* of **1e** was determined by HPLC (see appendix).
[a]$_D^{20}$ = -8° (c = 1.1, CH_2Cl_2). **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 98/2, 0.2 mL/min): t_R/min 40.0 (*S*), 42.8 (*R*). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 7.34-7.14 (m, 10H), 4.45 (s, 2H), 3.57 (d, ^3J(H-H) = 9.0 Hz, 1H), 3.52 (d, ^3J(H-H) = 9.0 Hz, 1H), 2.73 (br. s., 1H), 1.84-1.68 (m, 2H), 1.29-1.05 (m, 3H), 1.00-0.89 (m, 1H), 0.73 (t, ^3J(H-H) = 6.6 Hz, 3H). **^{13}C-NMR** (δ/ppm, $CDCl_3$, 75 MHz): 144.5, 138.3, 128.8, 128.4, 128.1, 128.0, 127.0, 125.8, 78.1, 76.6, 73.9, 39.6, 32.6, 23.2, 22.9, 14.4. **IR** (film) (ν/cm^{-1}): 3560, 3480, 2930, 1450. **HRMS** for $C_{20}H_{26}O_2$ (298.1933, M$^+$): found: 298.1957. **MS** (EI, 70 eV): 298 (M$^+$, 0.1); 177 (100); 91 (45).

Synthesis of (1*R*)-1-[(benzyloxy)methyl]-1-ethyl-2-methylpropanol (1f)



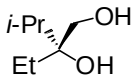
2-[(Benzyloxy)methyl]-2-ethyl-3-methylbutanal (**12f**, 287 mg, 1.22 mmol, 1.0 equiv.) in CH_2Cl_2 (10 mL) was treated with MCPBA (483 mg, 2.80 mmol, 2.3 equiv.) and stirred for 24 h at 25 °C. Then aq. sat. $NaHCO_3$ (50 mL) was added and the aqueous layer was extracted with CH_2Cl_2 (3 x 50 mL). (1*S*)-1-[(Benzyloxy)methyl]-1-ethyl-isobut-3-yl-formate was obtained as a colorless solid.
^{1}H-NMR (δ/ppm, 600 MHz, $CDCl_3$): 8.44 (s, 1H), 7.26-7.39 (m, 5H), 4.51 (s, 2H), 3.72 (s, 2H), 2.34 (sept, ^3J(H,H) = 6.92 Hz, 1H), 1.81-2.00 (m, 2H), 0.83-1.03 (m, 9H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 162.1, 137.7, 128.4 (2C), 127.8 (2C), 127.6, 88.4, 73.5, 71.7, 32.2, 24.9, 17.1, 16.8, 7.6. **IR** (KBr-disk) (ν/cm^{-1}): 2870, 1698, 1575, 1418, 1305, 1264, 750, 720. **HRMS** for $C_{14}H_{20}O$ (204.1514, [M-CH_2O_2]$^+$): found: 204.1511. **MS** (EI): 204 ([M-

$CH_2O_2]^+$, 2), 139 (2), 107 (3), 101 (10), 98 (13), 92 (14), 91 (100), 83 (4), 69 (5),65 (5), 57 (7), 43(8).

The crude 1-isopropyl-1-methylpentylformate (1.10 mmol, 1.0 equiv.) in MeOH (10 mL) was treated with KOH (168 mg, 3.00 mmol, 2.7 equiv.) and stirred for 12 h at 25 °C. Then water (50 mL) was added. After extraction with Et_2O (3 x 80 mL) the organic layer was washed with sat. aq. $NaHCO_3$ (100 mL) and dried ($MgSO_4$). After evaporation of the solvents under reduced pressure, the crude was purified by flash chromatography. (3*R*)-3-[(Benzyloxy)methyl]-2-methylpentan-3-ol (**1f**, 225 mg, 1.01 mmol, 93 %) was obtained as a colourless liquid.

$[\alpha]_D^{25}$ = +0.5° (c = 2.30, $CDCl_3$) (99 % *ee*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.27-7.40 (m, 5H), 4.55 (s, 2H), 3.46 (d, ^3J(H,H) = 9.07 Hz, 1H), 3.37 (d, ^3J(H,H) = 9.07 Hz ,1H), 2.07 (s, 1H), 1.92 (sept, ^3J(H,H) = 6.97 Hz, 1H), 1.47-1.69 (m, 2H), 0.84-0.95 (m, 9H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 138.3, 128.4, 127.6, 127.5, 75.4, 73.5, 73.4, 32.8, 26.8, 17.0, 16.9, 7.7. **IR** (film) (ν/cm^{-1}): 3469, 2964, 1454, 1100, 1028, 698. **HR-MS** for $C_{14}H_{19}O_2$ (219.1386, $[M-3H]^+$): found: 219.1355. **MS** (EI): 219 ($[M-3H]^+$, <1), 204 (1), 179 (3), 122 (6), 101 (64), 91 (100), 65 (1).

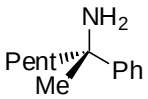
The *ee* of **1f** was determined by GC analysis after transformation into (2*R*)-2-ethyl-3-methylbuta-1,2-diol:



Under an Ar atmosphere Pd/C (40 mg, 20 %) was added to (3*R*)-3-[(benzyloxy)methyl]-2-methylpentan-3-ol (**1f**) (187 mg, 0.84 mmol, 1.0 equiv.) in THF (30 mL). The Ar atmosphere was changed to H_2 (1 atm), and the reaction mixture was stirred for 14 h. After removal of the catalyst by filtration (Celite) and careful evaporation of the solvent under reduced pressure, (2*R*)-2-ethyl-3-methylbutan-1,2-diol (59 mg, 0.45 mmol, 54 %, 96 % *ee*) was obtained as a colorless liquid.

$[\alpha]_D^{25}$ = +1.5° (c = 0.65, $CDCl_3$). **GC** (column: TFA γ-Cyclodextrin; 50 °C (5 min), 0.5 °/min, 140 °C (20 min)): t_R/min 32.6 (*R*), 33.9 (*S*). **^{1}H-NMR** (δ/ppm, 600 MHz, $CDCl_3$): 3.60 (d, ^3J(H,H) = 10.99 Hz, 1H), 3.49 (d, ^3J(H,H) = 11.19 Hz, 1H), 2.11 (s, 2H), 1.88 (sept, ^3J(H,H) = 7.12 Hz, 1H), 1.46-1.63 (m, 2H), 0.82-0.98 (m, 9H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 76.1, 65.4, 32.2, 26.2, 17.0, 16.7, 7.7. **IR** (film) (ν/cm^{-1}): 3401, 2966, 1463, 1044. **HRMS** for $C_7H_{15}O_2$ (131.1150, $[M-H]^+$): found: 131.0717. **MS** (EI): 131 ($[M-H]^+$, <1), 101 (100), 89 (94), 85 (25), 71 (72), 59 (65), 57 (51), 55 (34).

Synthesis of (1*S*)-1-methyl-1-phenyl-hexylamine (2a):



Prepared according to **TP3** from acid **13a** (124 mg, 0.56 mmol), $(PhO)_2P(O)N_3$ (231 mg, 0.84 mmol) and Et_3N (85 mg, 0.84 mmol). Reaction time: 2 h. Purification by flash chromatography (pentane/Et_2O = 98/2) yielded 1-((2*S*)-2-isocyanatoheptan-2-yl)benzene (120 mg, quant., 98 % *ee*) as a colourless liquid. The *ee* was determined by GC analysis (see appendix).

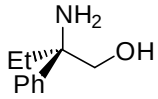
$[\alpha]_D^{25}$ = +14.3° (c = 1.7, EtOH). **GC** (column: Chiraldex B-PH; 100°C const.): t_R/min 57.8 (*S*), 61.9 (*R*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.26-7.29 (m, 5H), 1.78-1.82 (m, 2H), 1.62 (s, 3H), 1.4-1.6 (m, 6H), 0.76 (t, ^3J(H,H) = 6.9 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 143.7, 127.4, 126.0, 123.8, 121.7, 63.4, 44.3, 30.7 (2C), 23.1, 21.4, 12.9. **IR** (film)

(ν/cm^{-1}): 2934, 2261, 763, 698. **HRMS** for $C_{14}H_{19}NO$ (217.1467, $[M]^+$): found: 217.1461. **MS** (EI): 217 ($[M]^+$, <1), 146 (100), 118 (6), 77 (9), 41 (3).

1-((2*S*)-2-isocyanatoheptan-2-yl)benzene (50 mg, 0.23 mmol) was refluxed in 20 % HCl for 24 h to yield **3a** (30 mg, 65 %, 98 % *ee*) as a colourless oil.

$[\alpha]_D^{25}$ = -2.8° (c = 1.4, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.13-7.38 (m, 5H), 1.63-1.65 (m, 4H), 1.62 (s, 3H), 1.38 (s, 3H), 1.13-1.18 (m, 6H), 0.75 (t, ^3J(H,H) = 6.9 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 149.4, 128.5, 126.4, 125.5, 55.4, 45.6, 32.7, 31.4, 24.4, 22.9, 14.4. IR (film) (ν/cm^{-1}): 3085, 2859, 1601, 1445, 820, 764, 699. **HRMS** for $C_{13}H_{21}N$ (190.1596, $[M-H]^+$): found: 190.1594. **MS** (EI): 190 ($[M-H]^+$, <1), 120 (100), 104 (3), 77 (2).

Synthesis of (2*R*)-2-amino-2-phenyl-butan-1-ol (2b)



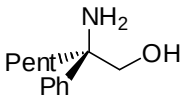
Prepared according to **TP3** from acid **13c** (457 mg, 1.66 mmol), $(PhO)_2P(O)N_3$ (660 mg, 2.4 mmol) and Et_3N (243 mg, 2.4 mmol). Reaction time: 2 h. Purification by flash chromatography (pentane/Et_2O = 98/2) yielded 1-(((2*R*)-2-isocyanato-2-phenylbutoxy)methyl)benzene (382 mg, 85 %, 99 % *ee*) as a colourless liquid. The *ee* was determined by HPLC analysis (see appendix).

$[\alpha]_D^{25}$ = -18.1° (c = 1.58, CH_2Cl_2). **HPLC** (column: AD; *n*-heptane/*i*-PrOH = 99.5/0.5, 0.3 mL/min): t_R/min 19.3 (*R*), 22.1 (*S*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.16-7.30 (m, 10H), 4.50 (s, 2H) 3.59 (d, ^3J(H,H) = 9.3 Hz, 1H), 3.51 (d, ^3J(H,H) = 9.3 Hz, 1H), 2.09 (q, ^3J(H,H) = 7.2 Hz, 1H), 1.82 (q, ^3J(H,H) = 7.2 Hz, 1H), 0.70 (t, ^3J(H,H) = 7.2 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 140.9, 138.1, 128.8 (2C), 128.1, 128.0, 127.8, 126.2, 120.6, 78.3, 73.9, 69.0, 32.8, 8.6. **IR** (film) (ν/cm^{-1}): 2936, 2247, 1093, 698. **HRMS** for $C_{18}H_{19}NO_2$ (281.1416, $[M]^+$): found: 281.1425. **MS** (EI): 281 ($[M]^+$, <1), 252 (1), 160 (100), 91 (43).

1-(((2*R*)-2-isocyanato-2-phenylbutoxy)methyl)benzene (382 mg, 1.4 mmol) was refluxed in 20 % HCl for 24 h to yield **2b** (163 mg, 70 %, 99 % *ee*) as a yellow solid.

$[\alpha]_D^{25}$ = -5.2° (c = 1.345, CH_2Cl_2). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.17-7.34 (m, 5H), 3.60 (s, 2H) 2.09 (broad, 3H), 1.76 (q, ^3J(H,H) = 7.2 Hz, 1H), 1.69 (q, ^3J(H,H) = 7.2 Hz, 1H), 0.63 (t, ^3J(H,H) = 7.2 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 144.7, 128.8, 127.1, 126.2, 71.1, 60.1, 32.1, 8.1. **IR** (film) (ν/cm^{-1}): 3420, 2960, 1043, 764, 703. **HRMS** for $C_{10}H_{15}NO$ (162.0919, $[M-3H]^+$): found: 162.0911. **MS** (EI): 162 ($[M-3H]^+$, 3), 134 (100), 104 (17), 91 (18), 77 (10), 56(10).

Synthesis of (2*R*)-2-amino-2-phenyl-heptan-1-ol (2c):



Prepared according to **TP3** from acid **13d** (360 mg, 1.1 mmol), $(PhO)_2P(O)N_3$ (454 mg, 1.65 mmol) and Et_3N (167 mg, 1.65 mmol). Reaction time: 2 h. Purification by flash chromatography (pentane/Et_2O = 98:2) yielded 1-(((2*R*)-2-isocyanato-2-phenylheptyloxy)methyl)benzene (312 mg, 88%, 99 % *ee*) as a colourless liquid. The *ee* was determined by HPLC analysis (see appendix).

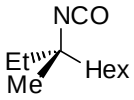
$[\alpha]_D^{25}$ = -5.6° (c = 1.63, CH_2Cl_2). **HPLC** (column: AD, *n*-heptane/*i*-PrOH = 99.5/0.5, 0.3 mL/min): t_R/min 17.6 (*R*), 20.2 (*S*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.16-7.30 (m, 10H),

4.50 (s, 2H) 3.58 (d, ^3J(H,H) = 9.3 Hz, 1H), 3.49 (d, ^3J(H,H) = 9.3 Hz, 1H), 1.98-2.08 (m, 1H), 1.73-1.83 (m, 1H), 1.12-1.18 (m, 6H), 0.73 (t, ^3J(H,H) = 6.6 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 141.2, 138.1, 128.8 (2C), 128.1, 128.0, 127.5, 127.7, 126.0, 78.5, 73.8, 68.5, 39.8, 32.2, 23.8, 22.8, 8.6. **IR** (film) (ν/cm^{-1}): 2931, 2250, 1101, 698. **HRMS** for $C_{21}H_{25}NO_2$ (324.1964, $[M+H]^+$): found: 324.1991. **MS** (EI): 324 ($[M+H]^+$, <1), 202 (100), 91 (75).

1-(((2*R*)-2-isocyanato-2-phenylheptyloxy)methyl)benzene (219 mg, 0.67 mmol) was refluxed in 20 % HCl for 24 h to yield **2c** (124 mg, 88 %, 99 % *ee*) as a yellow solid.

$[a]_D^{25}$ = +9.8° (c = 1.22, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.17-7.34 (m, 5H), 3.60 (s, broad, 2H) 2.09 (broad, 3H), 1.55-1.90 (m, 2H), 1.11-1.19 (m, 6H), 0.74 (t, ^3J(H,H) = 6.6 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 143.7, 127.4, 125.6, 124.7, 70.1, 58.3, 38.2, 31.2, 22.0, 21.4, 13.0. **IR** (film) (ν/cm^{-1}): 3089, 2958, 1601, 760, 702. **HRMS** for $C_{13}H_{21}NO$ (208.1701, $[M+H]^+$): found: 208.1722. **MS** (EI): 208 ($[M+H]^+$, <1), 176 (100), 136 (8), 91 (4).

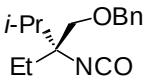
Synthesis of (3*S*)-3-isocyanato-3-methyl-nonane (3a):



Prepared according to **TP3** from acid **13b** (80 mg, 0.43 mmol), $(PhO)_2P(O)N_3$ (140 mg, 0.51 mmol) and Et_3N (65 mg, 0.64 mmol). Reaction time: 2 h. Purification by flash chromatography (pentane/Et_2O = 98/2) yielded **3a** (54 mg, 68 %, 98 % *ee*) as a colourless liquid. The *ee* of **3a** was determined by GC analysis (see appendix).

$[a]_D^{25}$ = -1.0° (c = 0.85, CH_2Cl_2). **GC** (column : Chirasil Dex; 90°C const.): t_R/min 15.5 (*R*), 16.0 (*S*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 1.4-1.6 (m, 4H), 1.84 (s, 3H), 1.22 (m, 8H), 0.8 (m, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 121.1, 60.5, 40.9, 33.9, 30.7, 28.5, 25.9, 23.0, 21.6, 13.0, 7.5. IR (film) (ν/cm^{-1}): 2933, 2259, 1725, 1462, 1260, 1097, 804. **HRMS** for $C_{11}H_{21}NO$ (182.1545, $[M-H]^+$): found: 182.1512. **MS** (EI): 143 ($[M-H]^+$, <1), 154 (43), 98 (100), 69 (28), 55 (21), 41 (8).

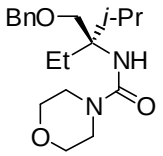
Synthesis of (1*R*)-1-isocyanato-1-[(benzyloxy)methyl]-1-ethyl-2-methyl-propane (3b):



(2*R*)-2-[(Benzyloxy)methyl]-2-ethyl-3-methylbutanoic acid (**13e**) (206 mg, 0.82 mmol, 1.0 equiv.) in toluene (7 mL) was treated with diphenyl phosphorazidate (305 mg, 238 µl, 1.11 mmol, 1.4 equiv.) and NEt_3 (112 mg, 156 µL, 1.11 mmol, 1.4 equiv.). The reaction mixture was heated to 110 °C for 2.5 h. After cooling, Et_2O (80 mL) was added and the organic layer was washed with H_2O (3 x 80 mL) and dried ($MgSO_4$). After evaporation of the solvents under reduced pressure, the crude was purified by flash chromatography. (2*R*)-[(2-Ethyl-2-isocyanato-3-methylbutoxy)methyl]benzene (**2f**, 162 mg, 0.65 mmol, 79 %, > 99 % *ee*) was obtained as a colorless liquid.

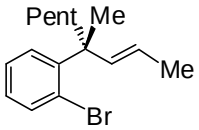
$[a]_D^{27}$ = +0.7° (c = 0.78, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.23-7.45 (m, 5H), 4.48-4.65 (m, 2H), 3.36-3.55 (m, 2H), 1.97 (sept, ^3J(H,H) = 6.86 Hz, 1H), 1.57-1.83 (m, 2H), 0.85-0.96 (m, 9H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 138.0, 128.4, 127.7, 127.5, 124.3, 73.4, 72.3, 67.1, 32.7, 27.5, 17.3, 17.2, 8.3. **IR** (film) (ν/cm^{-1}): 2964, 2252, 1261, 1096, 1020, 800. **HRMS** for $C_{13}H_{16}NO_2$ (218.1181, $[M-C_2H_5]^+$): found: 218.1152. **MS** (EI): 218 ($[M-C_2H_5]^+$, 3), 204 (39), 176 (4), 126 (56), 91 (100), 70 (17), 41 (5).

The *ee* of **2b** was determined by HPLC analysis (see appendix) after transformation into (1*R*)-*N*-{1-[(benzyloxy)methyl]-1-ethyl-2-methylpropyl}morpholine-4-carboxamide:

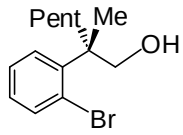


(2*R*)-[(2-Ethyl-2-isocyanato-3-methylbutoxy)methyl]benzene (82 mg, 0.33 mmol, 1.0 equiv.) in CH_2Cl_2 (4 mL) was treated at 0 °C with morpholine (31 mL, 0.36 mmol, 1.2 equiv.), dissolved in CH_2Cl_2 (0.5 mL). After stirring for 5 h at 25 °C, the organic layer was washed with aq. HCl (2 x 20 mL, 10 vol.-%) and H_2O (2 x 20 mL). The organic layer was dried ($NaSO_4$) and the solvents were removed under reduced pressure. The urea derivative (80 mg) was obtained as a colorless oil.
HPLC (column: Chiracel OD; *n*-heptane/*i*-PrOH = 95/5, 0.2 mL/min): t_R/min 59.8 (*R*), 65.7 (*S*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.18-7.30 (m, 5H), 4.90 (br, 1H), 4.42 (s, 2H), 53.56 (t, ^3J(H-H) = 5.09 Hz, 4H), 3.52 (d, ^3J(H-H) = 9.29 Hz, 1H), 3.40 (d, ^3J(H-H) = 9.19 Hz, 1H), 3.19 (t, ^3J(H-H) = 5.08 Hz, 4H), 2.34-2.52 (m, 1H), 1.88-2.09 (m, 1H), 1.43-1.60 (m, 1H), 0.77-0.88 (m, 9H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 157.1, 138.1, 128.3 (2C), 127.6, 127.3 (2C), 73.3, 72.0, 66.5 (2C), 60.2, 44.1 (2C), 33.5, 26.8, 18.2, 17.4, 8.7. **IR** (film) (ν/cm^{-1}): 2963, 2921, 2855, 1644, 1515, 1454, 1386, 1368, 1256, 1119 , 1020, 802, 738, 699. **HRMS** for $C_{19}H_{31}N_2O_3$ (335.2334, $[M+H]^+$): found: 335.2308. **MS** (EI): 335 ($[M+H]^+$, <1), 319 (3), 291 (49), 213 (84), 183 (34), 114 (100), 91 (91), 70 (44).

Synthesis of (2*E*,4*R*)-4-(2-bromophenyl)-4-methyl-non-2-ene (4a):

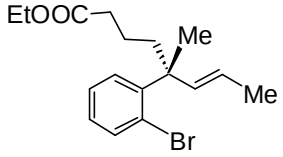


To a precooled (-30 °C) solution of CuCN (120 mg, 1.3 mmol, 1.3 equiv.) of and LiCl (100 mg, 2.6 mmol, 2.6 equiv.) in THF (2 mL) was added $Pent_2Zn$ (0.4 mL, 4.6 M, 2.4 mmol, 2.4 equiv.). The resulting orange solution was stirred for 30 min at -30 °C. Then a solution of **5a** (435 mg, 1.0 mmol, 1 equiv.) in THF (1 mL) was added. It was stirred at -10 °C overnight. The mixture was quenched with water (20 mL) and extracted with Et_2O (3 x 20 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane). It yielded **4a** (200 mg, 70 %) as a colourless oil.
$[a]_D^{20}$ = +15° (c = 0.52, pentane). **^{1}H-NMR** (d/ppm, $CDCl_3$, 600 MHz) 7.60-7.56 (m, 1H), 7.42-7.41 (m, 1H), 7.27-7.25 (m, 1H), 7.07-7.05 (m, 1H), 5.81 (d, ^3J(H,H) = 18.6 Hz, 1H), 5.35-5.30 (m, 1H), 2.28-2.26 (m, 1H), 1.79-1.78 (m, 1H), 1.77-1.73 (m, 3H), 1.51 (s, 3H), 1.29-1.18 (m, 5H), 0.99-0.87 (m, 4H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 150 MHz): 146.5, 139.9, 135.9, 129.9, 127.8, 127.2, 123.8, 122.9, 45.5, 39.5, 32.9, 24.7, 23.0, 18.5, 14.5. **IR** (film) (ν, cm^{-1}): 3060, 2960, 2930, 2870, 1700, 1470. **HRMS** for $C_{16}H_{23}Br$ (294.1035, M^+, ^{79}Br): 294.1009. **MS** (EI, 70 eV): 296 (M^+, ^{81}Br, 7); 294 (M^+, ^{79}Br, 5), 225 (5), 223 (5), 144 (100), 129 (40).
The *ee* was determined by HPLC analysis (see appendix) after transformation into (2*S*)-2-(2-bromophenyl)-2-methyl-heptan-1-ol:

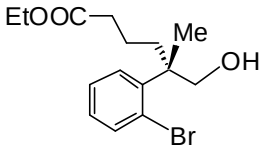


A solution of **4a** (100 mg, 0.3 mmol, 1 equiv.) in CH_2Cl_2 (10 mL) was cooled to -78 °C and ozone was bubbled through it until the solution turned blue. N_2 was then bubbled to remove the excess ozone. The colourless solution was then warmed to RT and $BH_3{\cdot}Me_2S$ (neat, 0.4 mL, 10 M, 4 mmol, 4 equiv.) was added. The solution was stirred at RT for 24 h, then it was carefully quenched with water (50 mL). The mixture was extracted with CH_2Cl_2 (3 x 10 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 7/3). It yielded the desired alcohol (200 mg, 70 %, 96 % *ee*) as a colourless oil.
[a]$_D^{20}$ = +11° (c = 0.69, CH_2Cl_2). **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 97/3, 0.6 mL/min): t_R/min 14.7 (*R*), 16.8 (*S*). **^{1}H-NMR** (δ/ppm, $CDCl_3$, 300 MHz): 7.53-7.50 (m, 1H), 7.32-7.30 (m, 1H), 7.19-7.18 (m, 1H), 6.98 (m, 1H), 4.33 (d, ^3J(H,H)= 10.8 Hz, 1H), 3.57 (d, ^3J(H,H) = 10.8 Hz, 1H), 2.28 (m, 1H), 1.44 (s, 3H), 1.44 (m, 1H), 1.27 (br. s., 1H), 1.19-1.12 (m, 4H), 1.07-0.98 (m, 1H), 0.91-0.81 (m, 1H), 0.75 (m, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 142.7, 136.2, 131.6, 128.4, 127.6, 122.6, 69.6, 46.3, 35.8, 32.9, 24.4, 22.9, 14.4. **IR** (film) (ν/cm^{-1}): 3370, 2960, 1470, 1020. **HRMS** for $C_{14}H_{21}BrO$ (283.0698 ([M-H]$^+$, ^{79}Br)): found: 283.0713. **MS** (CI, isobutane): 283 ([M-H]$^+$, ^{79}Br, 3), 269 (86), 267 (92), 255 (30), 253 (26), 227 (28), 225 (35), 213 (53), 211 (62), 197 (74), 185 (100), 183 (100), 169 (37).

Synthesis of (2*E*,4*R*)-ethyl-5-(2-bromophenyl)-5-methyl-oct-6-enoate (4b):

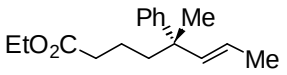


To a precooled (-30 °C) solution of CuCN (120 mg, 1.3 mmol, 1.3 equiv.) and LiCl (100 mg, 2.6 mmol, 2.6 equiv.) in THF (2 mL) was added bis(3-ethoxycarbonylprop-1-yl)zinc (1.9 mL, 1.3 M, 2.4 mmol, 2.4 equiv.). The resulting orange solution was stirred for 30 min at -30 °C. Then a solution of 435 mg (1 mmol, 1 equiv.) of **5a** in THF (1 mL) was added. It was stirred at -10 °C overnight. The mixture was quenched with water (20 mL) and extracted with Et_2O (3 x 20 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane to pentane/Et_2O = 95/5). It yielded the desired product (230 mg, 68 %) as a colourless oil.
[a]$_D^{20}$ = +5° (c = 0.3, pentane). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 7.49-7.47 (m, 1H), 7.33-7.30 (m, 1H), 7.19-7.16 (m, 1H), 6.96-6.95 (m, 1H), 5.70 (m, 1H), 5.28-5.16 (m, 1H), 4.06-4.00 (m, 2H), 2.22-2.15 (m, 2H), 1.74 (m, 1H), 1.64 (m, 4H), 1.58 (s, 3H), 1.28-1.14 (m, 6H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 172.7, 144.4, 137.9, 134.5, 128.5, 126.6, 125.9, 122.3, 121.9, 59.2, 44.0, 37.4, 33.8, 25.6, 19.3, 17.1, 13.2. **IR** (film) (ν/cm^{-1}): 3060, 1740, 1460, 1260. **HRMS** for $C_{17}H_{23}BrO_2$ (338.0839 (M$^+$, ^{79}Br)): found: 338.0855. **MS** (EI, 70 eV): 338 (M$^+$, ^{79}Br, 1), 223 (24), 144 (100), 129 (38).
The *ee* of **4b** was determined by HPLC analysis (see appendix) after transformation to (2*S*)-5-ethoxycarbonyl-2-(2-bromophenyl)-2-methyl-pentan-1-ol:



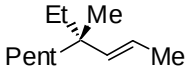
A solution of **4b** (100 mg, 0.3 mmol, 1 equiv.) in CH_2Cl_2 (15 mL) was cooled to -78 °C and ozone was bubbled through it until the solution turned blue. N_2 was then bubbled to remove the excess ozone. The colourless solution was then warmed to RT and $BH_3{\cdot}Me_2S$ (neat, 0.12 mL, 10 M, 1.2 mmol, 4 equiv.) was added. The solution was stirred at RT for 24 h, then the reaction was carefully quenched with water (20 mL). The mixture was extracted with Et_2O (3 x 10 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 1/1). It yielded the desired compound (75 mg, 80%, 96 % *ee*) as a colourless oil.
[a]$_D^{20}$ = +4° (c = 1, CH_2Cl_2). **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 97/3, 0.6 mL/min): t_R/min 30.9 (*R*), 34.5 (*S*)). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 7.53-7.50 (m, 1H), 7.36-7.33 (m, 1H), 7.21-7.19 (m, 1H), 7.01-6.99 (m, 1H), 4.22 (d, ^3J(H,H) = 11.1 Hz, 1H), 4.02 (q, ^3J(H,H) = 6.9 Hz, 2H), 3.67 (d, ^3J(H,H) = 11.1 Hz, 1H), 2.33-2.22 (m, 1H), 2.18 (t, ^3J(H,H) = 7.2 Hz, 2H), 1.60 (m, 2H); 1.44 (s, 3H), 1.41-1.20 (m, 2H), 1.16 (t, ^3J(H,H) = 7.2 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 172.7, 141.0, 134.8, 130.1, 127.1, 126.4, 121.2, 68.1, 59.3, 44.6, 33.6, 33.5, 22.6, 18.8, 13.2. **IR** (film) (ν/cm^{-1}): 3440, 2970, 1730, 1470, 1260, 1190, 1020. **HRMS** for $C_{15}H_{21}BrO_3$ (311.0647 ([M-OH]$^+$)): found: 311.0641. **MS** (EI, 70 eV): 313 ([M-CH_3]$^+$, 0.1); 253 (32); 219 (89); 173 (100); 145 (28); 130 (43); 115 (33).

Synthesis of (5*R*,6*E*)-5-methyl-5-phenyl-6-octenoic acid ethylester (4c):



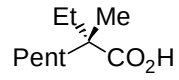
According to **TP1**, **5b** (267 mg, 0.75 mmol) was reacted with $[EtO_2C(CH_2)_3]_2Zn$ (0.6 mL, 1.85 mmol) and CuCN·2LiCl (1.5 mL, 10 M in THF, 1.5 mmol, 1.2 equiv.) to yield **4c** (113 mg, 0.4 mmol, 48 %, 96 % *ee*) as a colorless liquid. The *ee* was determined by HPLC analysis (see appendix).
HPLC (column: OD-H *n*-heptane/*i*-PrOH = 97/3, 0.5 mL/min): t_R/min 6.6 (*S*), 9.7 (*R*). **^{1}H-NMR** (δ/ppm, $CDCl_3$, 300 MHz): 7.28-7.32 (m, 4H), 7.13-7.21 (m, 1H), 5.64 (dq, ^3J(H,H) = 15.6 Hz, ^3J(H,H) = 1.5 Hz, 1H), 5.44 (dq, ^3J(H,H) = 16.2 Hz, ^3J(H,H) = 6.9 Hz, 1 H), 4.11 (q, ^3J(H,H) = 7.2 Hz, 2 H), 2.24 (t, ^3J(H,H) = 7.5 Hz, 2 H), 1.65-1.84 (m, 2H), 1.72 (dd, ^3J(H,H) = 6.0 Hz, ^3J(H,H) = 1.2 Hz, 3 H), 1.39 (m, 2H), 1.36 (s, 3H), 1.24 (t, ^3J(H,H) = 6.9, 3H). **^{13}C-NMR** ((δ/ppm, $CDCl_3$, 75 MHz): 173.7, 148.2, 139.7, 128.1, 126.6, 125.7, 122.3, 60.3, 43.4, 41.2, 34.9, 25.6, 20.3, 18.3, 14.3. **IR** (film) (ν/cm^{-1}): 3086, 3057, 3025, 2965, 2936, 2875, 1738, 1599, 1494, 1446, 1375, 1257, 1192, 1030, 974, 763, 700. HRMS for $C_{17}H_24O_2$ (260.1776, M$^+$): found: 260.1761. **MS** (EI): 260 (M$^+$, 2), 214 (1), 197 (2), 157 (4), 145 (100), 117 (10), 91 (6), 77 (2).

Synthesis of (2*E*,4*S*)-4-ethyl-4-methyl-2-nonene (4e):



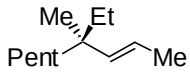
According to **TP1**, compound **5d** (1.052 g, 3.55 mmol, > 99 % *ee*) was reacted with Et_2Zn (892 µl, 8.52 mmol, 2.4 equiv.) and CuCN·2LiCl (4.260 mL, 4.26 mmol, 1.2 equiv.) in THF (5 mL) at -30 °C for 14 h. After workup, the crude product was purified by flash

chromatography (pentane). (2*E*,4*S*)-4-Ethyl-4-methyl-2-nonene (**4e**) (478 mg, 2.84 mmol, 80 %, 96 % *ee*) was obtained as a colorless liquid.
$[\alpha]_D^{24}$ = -6.5° (c = 1.45, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 600 MHz, $CDCl_3$): 5.23-5.31 (m, 2H), 1.65-1.72 (m, 3H), 1.12-1.32 (m, 10H), 0.83-0.91 (m, 6H), 0.76 (t, ^3J(H,H) = 7.4 Hz, 3H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 140.2, 121.3, 40.9, 38.6, 33.5, 32.8, 23.7, 22.9, 22.7, 18.2, 14.1, 8.5. IR (film) (ν/cm^{-1}): 2930, 1462, 1378, 973. **HRMS** for $C_{12}H_{24}$ (168.1878, M^+): found: 168.1891. **MS** (EI): 168 (M^+, 3), 139 (19), 97 (100), 83 (29), 69 (66), 55 (78), 41(35).
The *ee* of **4e** was determined by GC analysis (see appendix) after transformation into (2*S*)-2-Ethyl-2-methylheptanoic acid:

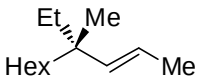


According to **TP2** (2*E*,4*S*)-4-ethyl-4-methyl-2-nonene (**4e**) (84 mg, 0.50 mmol, 1.0 equiv.) in acetone (20 mL) was ozonolyzed at -78 °C. After treatment of the ozonide with Jones reagent**Fehler! Textmarke nicht definiert.** (1.4 mL, 2.7 M, 1.4 mmol, 2.7 equiv.) at 0 °C and stirring for 15 min, the reaction mixture was quenched with *i*-PrOH (5 mL). (2*S*)-2-Ethyl-2-methylheptanoic acid (63 mg, 0.37 mmol, 73 %, 96 % *ee*) was obtained as a colorless liquid. $[\alpha]_D^{25}$ = -4.8° (c = 1.67, $CDCl_3$). **GC** (column: Chiraldex B-PH; 130 °C const.): t_R/min 31.2 (*S*), 32.3 (*R*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 9.98-10.62 (br, 1H), 1.55-1.77 (m, 2H), 1.37-1.55 (m, 2H), 1.16-1.37 (m, 6H), 1.12 (s, 3H), 0.79-0.96 (m, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 184.3, 46.1, 38.7, 32.3, 31.7, 24.1, 22.5, 20.5, 14.0, 8.8. **IR** (film) (ν/cm^{-1}): 2936, 1699, 1464, 1262. **HRMS** for $C_{10}H_{21}O_2$ ([173.1541, M+H]$^+$): found: 173.1547. **MS** (EI): 173 ([M+H]$^+$, 2), 144 (3), 127 (18), 115 (5), 102 (62), 87 (61), 85 (40), 71 (84), 57 (74), 43 (100), 41 (72).

Synthesis of (2*E*,4*R*)-4-ethyl-4-methyl-2-nonene (4f)



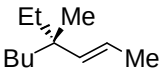
According to **TP1**, **5e** (37 mg, 0.24 mmol, 1.0 equiv.) was reacted with $Pent_2Zn$ (121 µl, 4.8 M, 0.58 mmol, 2.4 equiv.) and CuCN·2LiCl (290 µl, 0.29 mmol, 10 M in THF, 1.2 equiv.) from -30 to -10 °C for 3 d. **4f** (24 mg, 60 %) was obtained as a colorless liquid. The *ee* was determined by GC after transformation into (2*R*)-2-Ethyl-2-methylheptanoic acid (for experimental details, see **4e**).
For analytical data, see compound **4e**.
Synthesis of (2*E*,4*S*)-4-ethyl-4-methyldec-2-ene (4g):



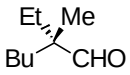
Prepared according to **TP1** from allylic difluorobenzoate **5f** (470 mg, 1.51 mmol), Et_2Zn (0.37 mL, 3.63 mmol) and CuCN·2LiCl (1.81 mL, 1 M in THF, 1.81 mmol). Reaction time: 16 h, -30°C. Purification by flash chromatography (pentane) yielded **4g** (242 mg, 88 %, 98 % *ee*) as a colourless liquid. The *ee* of **4g** was determined by GC analysis (see appendix) after transformation to (2*S*)-2-ethyl-2-methyloctanoic acid **13b.**
$[\alpha]_D^{25}$ = -7.0° (c = 1.35, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 0.75 (t, ^3J(H,H) = 7.2 Hz, 3H), 0.87 (m, 6H), 1.19-1.28 (m, 12H), 1.66 (m, 3H), 5.26 (m, 2H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 140.6, 121.7, 41.3, 39.0, 33.8, 32.3, 30.6, 24.4, 23.3, 23.1, 18.6, 14.5, 8.8. **IR** (film) (ν/cm^{-1}): 2930, 2856, 1461, 1378, 973. **HRMS** for $C_{13}H_{26}$

(182.2035, $[M]^+$): found: 182.2035. **MS** (EI): 182 ($[M]^+$, 3), 153 (33), 111 (7), 97 (100), 83 (20), 69 (57), 55(44), 40 (12).

Synthesis of (2*E*,4*S*)-4-ethyl-4-methyl-2-octene (4h)

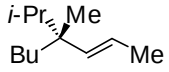


According to **TP1**, **5g** (151 mg, 0.45 mmol, 97 % *ee*) was reacted with Et_2Zn (113 µl, 1.08 mmol, 2.4 equiv.) and CuCN·2LiCl (0.60 mL, 1.2 equiv., 1 M in THF) in a THF/NMP-mixture (2/1) from -30 °C to -10 °C for 14h. After workup, (2*E*,4*S*)-4-ethyl-4-methyl-2-octene (**4h**) (59 mg, 0.38 mmol, 85 %, 90 % *ee*) was obtained as a colorless liquid.
$[\alpha]_D^{25}$ = -4.6° (c = 1.67, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 5.17-5.44 (m, 2H), 1.60-1.75 (m, 3H), 1.07-1.35 (m, 8H), 0.87-0.94 (m, 6H), 0.74-0.81 (m, 3H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 140.3, 121.3, 40.7, 38.6, 33.5, 26.4, 23.6, 22.9, 18.2, 14.2, 8.4. **IR** (film) (ν/cm^{-1}): 2925, 1459, 1378, 968. **HRMS** for $C_{11}H_{22}$ (154.1721, M^+): found: 154.1717.
MS (EI): 154 (M^+, 2), 125 (20), 97 (78), 83 (24), 69 (98), 55(100), 41 (44).
The *ee* of **4h** was determined by GC analysis (see appendix) after transformation to (2*S*, 2*E*)-4-ethyl-4-methyloct-2-enal:

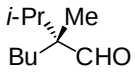


According to **TP2** (2*E*,4*S*)-4-ethyl-4-methyl-2-octene (**4h**) (38 mg, 0.25 mmol, 1.0 equiv.)) in CH_2Cl_2 (30 mL) was ozonolyzed at -78 °C and stirred with PPh_3 (78 mg, 1,2 Äquiv.) at 0 °C for 2 h. (2*S*, 2*E*)-4-ethyl-4-methyloct-2-enal was analyzed by GC/MS und GC.
GC (column: TFA γ-Cyclodextrin; 50 °C const.): t_R/min 25.1 (*S*), 26.3 (*R*). **HRMS** for C_8H_{17} (113.1331, $[M\text{-}CHO]^+$): found: 113.1341. **MS** (EI): 142 (M^+, <1), 113 (15), 86 (42), 71 (100), 57 (94).

Synthesis (2*E*,4*R*)-4-isopropyl-4-methyl-2-octene (4i):

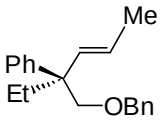


According to **TP1**, **5h** (150 mg, 0.53 mmol, > 99 % *ee*) was reacted with *i*-Pr_2Zn (219 µl, 1.27 mmol, 2.4 Äquiv., 5.8 M in THF) and CuCN·2LiCl (636 µl, 0.64 mmol, 1.2 equiv., 1 M in THF) in THF (1.5 mL) at -30 °C to -10 °C for 14 h. After workup, (2*E*)-4-isopropyl-4-methyloct-2-en (**4h**) (65 mg, 0.39 mmol, 73 %, 95 % *ee*) was obtained as a colorless liquid.
$[\alpha]_D^{25}$ = -10.3° (c = 1.47, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 600 MHz, $CDCl_3$): 5.24-5.32 (m, 2H), 1.69 (d, ^3J(H,H) = 4.9 Hz, 3H), 1.49 (sept, ^3J(H,H) = 6.9 Hz, 1H), 1.20-1.33 (m, 4H), 1.12-1.20 (m, 2H), 0.89 (t, ^3J(H,H) = 7.3 Hz, 3H), 0.85 (s, 3H), 0.82 (d, ^3J(H,H) = 6.9 Hz, 3H), 0.79 (d, ^3J(H,H) = 6.9 Hz, 3H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 139.0, 121.9, 41.1, 39.3, 35.8, 26.4, 23.7, 19.1, 18.3, 17.8, 17.2, 14.2. **IR** (film) (ν/cm^{-1}): 2930, 1467, 1382, 1261, 1099, 1026, 976, 805. **EA** for $C_{12}H_{24}$ (C, 85.63 %; H, 14.37 %): found: C, 85.21 %; H, 14.68 %. **HRMS** for $C_{12}H_{24}$ (168.1878,M^+): found: 168.1884. **MS** (EI): 168 (M+, <1), 125 (28), 111 (9), 95 (3), 83 (23), 69 (100), 55 (33), 41 (22).
The *ee* of **4i** was determined by GC analysis (see appendix) after transformation to (2*R*)-2-isopropyl-2-methylhexanal:

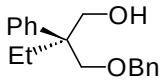


According to **TP2** (2*E*,4*R*)-4-isopropyl-4-methyl-2-octene (**4h**) (70 mg, 0.42 mmol, 1.0 equiv.) was ozonolyzed at -78 °C and stirred with PPh_3 (132 mg, 0.50 mmol, 1.2 equiv.) for 2 h at 0 °C. After workup and purification of the crude product by flash chromatography, isopropyl-2-methylhexanal (39 mg, 0.25 mmol, 60 %, 95 % *ee*) was obtained as a colorless liquid.
[a**]**$_D^{25}$ = -1.8° (c = 1.51, $CDCl_3$). **GC** (column: TFA γ-Cyclodextrin; 50 °C (5 min), 0.5 °/min, 140 °C (20 min)): t_R/min 32.6 (*R*), 33.9 (*S*). **^{1}H-NMR** (δ/ppm, 600 MHz, $CDCl_3$): 9.45 (s, 1H), 1.92 (sept, ^3J(H,H) = 6.88 Hz, 1H), 1.01-1.70 (m, 6H), 0.82-0.96 (m, 12H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 207.7, 51.9, 34.0, 31.6, 29.5, 23.3, 17.8, 16.4, 13.7, 12.9. **IR** (film) (ν/cm-1): 3389, 2932, 1701, 1463, 1380, 1157. **HRMS** for $C_{10}H_{21}O$ (157.1592, $[M+H]^+$): found: 157.1548. **MS** (EI): 156 (M^+, <1), 127 (11), 114 (4), 100 (29), 85 (49), 71 (100), 57 (56).

Synthesis of (2*E*,4*R*)-4-benzyloxymethyl-4-phenyl-hex-2-ene (4j):



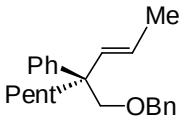
To a precooled (-30 °C) solution of CuCN (480 mg, 5.2 mmol, 1.3 equiv.) and LiCl (420 mg, 10 mmol, 2.6 equiv.) in THF (5 mL) was added Et_2Zn (1 mL, 10 M, 10 mmol, 2.4 equiv.). The resulting orange solution was stirred for 30 min at -30 °C. Then a solution of **5i** (1.8 g, 4 mmol, 1 equiv.) in THF (3 mL) was added. The reaction mixture was stirred at -10 °C for 12 h. The mixture was quenched with water (50 mL) and extracted with Et_2O (3 x 20 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 95/5). It yielded **4j** (690 mg, 69 %, 96 % *ee*) as a colourless oil.
[a]$_D^{20}$ = -13° (c = 0.69, CH_2Cl_2). **^{1}H-NMR** (d/ppm, $CDCl_3$, 400 MHz): 7.36-7.20 (m, 10H), 5.68 (dq, ^3J(H,H) = 1.6 Hz, ^3J(H,H) = 15.6 Hz, 1H), 5.48 (dq, ^3J(H,H) = 6.4 Hz, ^3J(H,H) = 16 Hz, 1H), 4.51 (s, 2H), 3.73 (d, ^3J(H,H) = 9.6 Hz, 1H), 3.65 (d, ^3J(H,H) = 9.2 Hz, 1H), 1.99-1.86 (m, 2H), 1.77 (dd, ^3J(H,H) = 1.6 Hz, ^3J(H,H) = 6.8 Hz, 3H). 0.78 (t, ^3J(H,H) = 7.2 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 100 MHz): 145.0, 138.7, 136.2, 128.2, 127.8, 127.7, 127.4, 127.3, 125.8, 124.2, 75.5, 73.3, 48.4, 28.9, 18.5, 8.7. **IR** (film) (ν/cm^{-1}): 3030, 2960, 2930, 2860, 1740, 1500, 1450, 1100. **HRMS** for $C_{20}H_{24}O$ (280.1823 M^+): 280.1825. **MS** (EI, 70 eV): 280 (M^+, 0.02), 159 (100), 132 (14), 117 (39), 91 (35).
The *ee* of **4j** was determined by HPLC analysis (see appendix) after transformation into (2*S*)-2-benzyloxymethyl-2-phenyl-butan-1-ol:



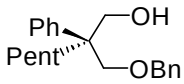
A solution of **4j** (280 mg, 1 mmol, 1 equiv.) in CH_2Cl_2 (15 mL) was cooled to -78 °C and ozone was bubbled through it until the solution turned blue. N_2 was then bubbled to remove the excess ozone. The colourless solution was warmed to RT and $BH_3{\cdot}Me_2S$ (neat, 0.4 mL, 10 M, 4 mmol, 4 equiv.) was added. The solution was stirred at 20 °C for 24 h, then it was carefully quenched with water (30 mL). The mixture was extracted with Et_2O (3 x 10 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash

chromatography (pentane/Et_2O = 7/3). The desired compound (190 mg, 66 %) was obtained as a colourless solid.
m.p. : 56-58 °C. **$[a]_D^{20}$** = -10° (c = 1, CH_2Cl_2). **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 97/3, 0.6 mL/min): t_R/min 28.7 (*S*), 34.5 (*R*). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 7.29-7.15 (m, 10H), 4.50 (d, ^3J(H,H) = 2.7 Hz, 1H), 3.95-3.80 (m, 3H), 3.67 (d, ^3J(H,H) = 9 Hz, 1H), 2.39 (m, 1H), 1.71 (dq, ^3J(H,H) = 2.1 HZ, ^3J(H,H) = 7.5 Hz, 2H), 0.59 (t, ^3J(H,H) = 7.5 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 142.2, 138.3, 128.9, 128.8, 128.2, 128.0, 127.3, 126.7, 76.1, 74.1, 69.4, 47.4, 27.3, 8.3. **IR** (KBr disk) (ν/cm^{-1}): 3430, 3030, 2960, 2880, 1500, 1450, 1090. **HRMS** for $C_{18}H_{22}O_2$ (271.1607, $[M+H]^+$): found: 271.1653 ($[M+H]^+$). **MS** (EI, 70 eV): 271 ($[M+H]^+$, 0.3), 149 (13), 132 (76), 147 (14), 91 (100).

Synthesis of (2*E*,4*R*)-4-benzyloxymethyl-4-phenyl-non-2-ene (4k):



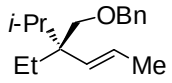
To a precooled (-30 °C) solution of CuCN (120 mg, 1.3 mmol, 1.3 equiv.) and LiCl (100 mg, 2.6 mmol, 2.6 equiv.) in THF (2 mL) was added $Pent_2Zn$ (0.5 mL, 4.5 M, 2.4 mmol, 2.4 equiv.). The resulting orange solution was stirred for 30 min at –30 °C. Then a solution of **5i** (430 mg, 1 mmol, 1 equiv.) in THF (3 mL) was added. The reaction mixture was stirred at –10 °C for 12 h. The mixture was quenched with water (20 mL) and extracted with Et_2O (3 x 10 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 95/5). The desired product 4k (290 mg, 90%, 99 % *ee*) was obtained as a colourless oil.
$[a]_D^{20}$ = -9° (c = 0.68, CH_2Cl_2). **^{1}H-NMR** (d/ppm, $CDCl_3$, 400 MHz): 7.25-7.10 (m, 10H), 5.57 (dq, *J* = 1.5 Hz, *J* = 15.9 Hz, 1H), 5.35 (dq, ^3J(H,H) = 6.3 Hz, ^3J(H,H) = 15.9 Hz, 1H), 4.40 (s, 2H), 3.61 (d, ^3J(H,H) = 8.7 Hz, 1H), 3.54 (d, ^3J(H,H) = 9.0 Hz, 1H), 1.76-1.71 (m, 2H), 1.66 (dd, ^3J(H,H) = 1.5 Hz, ^3J(H,H) = 6.3 Hz, 3H), 1.18-0.93 (m, 6H), 0.76 (t, ^3J(H,H) = 6.6 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 100 MHz): 145.3, 138.7, 136.5, 128.2, 127.8, 127.5, 127.4, 127.3, 125.8, 123.9, 75.9, 73.3, 48.1, 36.5, 32.7, 23.7, 22.6, 18.5, 14.1. **IR** (film) (ν, cm^{-1}): 3030, 2960, 2860, 1740, 1500, 1450, 1100. **HRMS** for $C_{23}H_{30}O$ (322.2297, M^+): found: 322.2317 (M^+). **MS** (EI, 70 eV): 322 ($[M]^+$, 0.02), 201 (100), 145 (33), 131 (100), 91 (91).
The *ee* of **4k** was determined by HPLC analysis (see appendix) after transformation into (2*S*)-2-benzyloxymethyl-2-phenylbutan-1-ol:



A solution of **4k** (342 mg, 1 mmol, 1 equiv.) in CH_2Cl_2 (10 mL) was cooled to -78 °C and ozone was bubbled through it until the solution turned blue. N_2 was then bubbled to remove the excess ozone. The colourless solution was warmed to RT and BH_3·Me_2S (neat, 0.4 mL, 10 M, 4 mmol, 4 equiv.) was added. The solution was stirred at 20 °C for 24 h, then it was carefully quenched with water (30 mL). The mixture was extracted with Et_2O (3 x 10 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 7/3). The desired alcohol (230 mg, 66 %, 99 % *ee*) was obtained as a colourless oil.
$[a]_D^{20}$ = -13° (c = 1, CH_2Cl_2). **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 97/3, 0.6 mL/min): t_R/min 18.8 (*S*), 24.1 (*R*). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 7.30-7.12 (m, 10H), 4.50 (d, ^3J(H,H) = 4.2 Hz, 2H), 3.93-3.79 (m, 3H), 3.65 (d, ^3J(H,H) = 9.0 Hz, 1H), 2.60 (br.

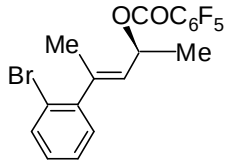
s., 1H), 1.66-1.61 (m, 2H), 1.14-1.08 (m, 4H), 0.94-0.90 (m, 2H), 0.73 (t, ^3J(H,H) = 6.9 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 142.6, 138.3, 128.9, 128.8, 128.2, 128.0, 127.1, 126.7, 76.4, 74.1, 69.8, 47.2, 34.8, 32.9, 23.4, 22.8, 14.4. **IR** (film) (ν/cm^{-1}): 3440, 2950, 1500, 1450, 1100. **HRMS** for $C_{21}H_{28}O_2$ (312.2139, M^+): found: 312.2114.**MS** (EI, 70 eV): 312 (M^+, 0.08); 191 (14); 174 (20); 118 (92); 91 (100).

Synthesis of (2*E*,4*S*)-4-[(benzyloxy)methyl]-4-ethyl-5-methyl-2-hexene (4l):



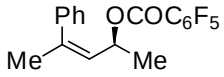
According to **TP1 5j** (779 mg, 1.88 mmol, 1.0 equiv.) was reacted with *i*-Pr_2Zn (940 µL, 4.51 mmol, 2.4 equiv.) and CuCN·2LiCl (2.260 mL, 1 M in THF, 2.26 mmol, 1.2 equiv.) at -30 °C to -10 °C for 14 h. After workup, the crude was purified by flash chromatography and compound **4k** (366 mg, 1.49 mmol, 80 %, > 99 % *ee*) was obtained as a colorless liquid. The *ee* of **4l** was determined by HPLC analysis after transformation into carboxylic acid **13e** (see appendix).
[a]$_D^{25}$ = + 15.2° (c = 2.00, $CDCl_3$). **^{1}H-NMR** (300 MHz, $CDCl_3$): 7.24-7.39 (m, 5H), 5.19-5.39 (m, 2H), 4.50 (s, 2H), 3.33-3.42 (m, 2H), 1.84 (sept, ^3J(H,H) = 6.97 Hz, 1H), 1.70 (d, ^3J(H,H) = 5.0 Hz, 3H), 1.53 (q, ^3J(H,H) = 7.52 Hz, 2H), 0.75-0.84 (m, 9H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 139.0, 133.6, 128.2 (2C), 127.4 (2C), 127.3, 123.9, 73.3, 72.3, 44.9, 31.8, 26.0, 18.7, 17.6, 17.3, 8.3. **IR** (film) (ν/cm^{-1}): 2963, 1454, 1098, 697. **HRMS** for $C_{17}H_{26}O$ (246.1984, M^+): found: 246.1975. **MS** (EI): 246 (M^+, <1), 203 (1), 148 (6), 125 (15), 91 (100), 83 (13), 69 (25), 41 (6).

Synthesis of (2*S*,3*E*)-[4-(2-bromophenyl)-pent-3-en-2-yl] pentafluorobenzoate (5a)



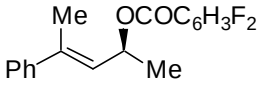
To a precooled (-50°C) solution of DMAP (120 mg, 1mmol, 0.3 equiv.) pyridine (0.4 mL, 5 mmol, 1.6 equiv.) and (4*S*,3*E*)-2-(2-bromophenyl)-pent-2-en-4-ol (710 mg, 2.8 mmol, 1 equiv.) in CH_2Cl_2 (5 mL) was added pentafluorobenzoyl chloride (1.15 g, 5 mmol, 1.6 equiv.). The mixture was stirred at -20 °C for 12 h. It was quenched with water (10 mL) and extracted with of Et_2O (3 x 10 mL). The organic layer was concentrated *in vacuo* at 20 °C. The residue was dissolved in pentane (5 mL) and washed with an aq. sat. solution of $NaHCO_3$ (3 x 20 mL). The organic extract was dried (Na_2SO_4) and concentrated *in vacuo* at 20 °C. Compound **5a** (1.15 g, 97%, 97 % *ee*) was obtained as an orange solid. It was used without further purification.
m.p.: 41-43 °C. **[a]$_D^{20}$** = -8°C (c = 1.11, CH_2Cl_2). **^{1}H-NMR** (d/ppm, C_6D_6, 300 MHz): 7.48-7.45 (m, 1H), 7.07-7.04 (m, 1H), 7.00-6.97 (m, 1H), 6.81-6.78 (m, 1H), 6.02 (m, 1H), 5.49 (m, 1H), 2.12 (d, ^3J(H,H) = 1.5 Hz, 3H), 1.38 (d, ^3J(H,H) = 6.3 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 157.3, 145.0 (m, 2$\underline{C}$F), 143.8, 142.9 (m, $\underline{C}$F), 140.3 (m, 2$\underline{C}$F), 140.0, 131.8, 128.5, 127.9, 127.6, 126.5, 120.8, 70.1, 19.3, 13.0. **IR** (KBr) (ν, cm^{-1}): 3060, 2980, 1730, 1650, 1500, 1240. **HRMS** for $C_{18}H_{22}BrF_5O_2$ (433.9917, M^+, ^{79}Br): found: 433.9929. **MS** (EI, 70 eV): 434 (M^+, ^{79}Br, 0.27), 241 (11), 239 (11), 224 (21), 222 (21), 195 (60), 143 (100), 128 (61).

Synthesis of (1*S*,2*Z*)-1-methyl-3-phenyl-2-butenyl 2,3,4,5,6-pentafluorobenzoic acid ester (5b):



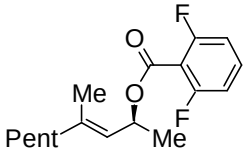
(1*S*,2*Z*) 4-Phenyl 3-penten-2-ol[6] (560 mg, 3.5 mmol), 0.5 mL pyridine and DMAP (45 mg, 0.4 mmol) was dissolved in a dry and argon-flushed 25-mL Schlenk-flask in CH_2Cl_2 (20 mL). The mixture was cooled to -60 °C and pentafluorobenzoyl chloride (1.1 g, 4.8 mmol) was added dropwise. The mixture was warmed up slowly to -20 °C and stirred for 2.5 h, than for 1 h at 0 °C. The reaction conversion was followed by TLC-analysis (CH_2Cl_2). The reaction was quenched by addition of water. The aqueous phase was extracted with Et_2O and the organic phase was washed with sat. $NaHCO_3$ (2 x 50 mL). The organic phase was concentrated in vacuum and the residue was taken up in pentane. The organic phase was washed with sat. $NaHCO_3$ solution (2 x 50 mL) and dried with sat. NaCl (50 mL). The organic phase was concentrated in vacuum to yield the product as a yellow oil (1.1 g, 89 %).
^{1}H-NMR (δ/ppm, $CDCl_3$, 300 MHz): 1.40 (d, ^3J(H,H) = 6.2 Hz, 3 H), 2.08 (d, ^3J(H,H) = 5.3 Hz, 3 H), 5.52-5.57 (m, 1 H), 7.19-7.22 (m, 2 H), 7.30-7.40 (m, 3 H). **^{13}C-NMR** (δ/ppm, $CDCl_3$, 75 MHz): 21.0, 25.8, 72.7, 125.6, 127.3, 127.3, 128.4, 140.7, 142.1. **IR** (film) ($?_{max}$/cm^{-1}): 2978, 1739, 1653, 1524, 1499, 1422, 1377, 1340, 1324, 1234, 1156, 1102, 1033, 997, 943, 859, 767, 702. **EA** for $C_{18}H_{13}F_5O_2$ (C, 60.7 %; H, 3.7 %): C, 60.8 %; H, 3.6 %.

Synthesis of (2*S*,3*E*)-4-phenylpent-3-en-2-yl 2,6-difluorobenzoate (5c):



Prepared from (2*S*,3*E*)-4-phenylpent-3-en-2-ol (370 mg, 2.28 mmol), 2,6-difluorobenzoyl chloride (563 mg, 3.19 mmol), pyridine (0.27 mL, 3.42 mmol) and DMAP (28 mg, 0.2 mmol). Reaction time: 15 h at -10°C. Purification by flash chromatography (pentane/Et_2O = 98/2 + 1% Et_3N) yielded **5c** (647 mg, 94%) as a colourless liquid.
$[a]_D^{25}$ = -13.1° (c = 1.5, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.26-7.45 (m, 3H), 6.90-6.98 (m, 2H), 6.0 (m, 1H), 5.81-5.86 (dq, ^3J(H,H) = 8.0 Hz, ^4J(H,H) = 1.2 Hz, 1H), 2.2 (s, 3H), 1.52 (d, ^3J(H,H) = 6.2 Hz 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 162.7, 161.4, 159.3, 142.6, 139.0, 132.3 (2C), 128.2, 127.5, 126.7, 125.9, 111.8 (2C), 70.4, 20.7, 16.4. **IR** (film) (ν/cm^{-1}): 2932, 1731, 1625, 1470, 1288, 1110, 1013. **HRMS** for $C_{18}H_{16}F_2O_2$ (302.1118, [M$^+$]): found: 302.1108. **MS** (EI): 302 ([M]$^+$, 4), 161 (20), 145 (28), 141 (100), 129 (46), 113 (14), 91 (9).

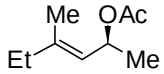
Synthesis of (2*S*,3*E*)-4-methyl-3-nonen-2-yl-2,6-difluorobenzoate (5d)



(2*S*, 3*E*)-4-Methyl-3-nonen-2-ol (**6c**, 654 mg, 4.19 mmol, 1.0 equiv., > 99 % *ee*) was treated at -50 °C with pyridine (541 µL, 6.70 mmol, 1.6 equiv.), DMAP (159 mg, 1.3 mmol, 0.3 equiv.) and 2,6-difluorobenzoyl chloride (1.183 g, 841 µl, 6.70 mmol, 1.6 equiv.) in CH_2Cl_2

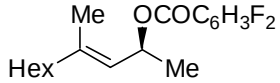
(40 mL) and the reaction mixture was stirred for 10 h at -10 °C. After workup, **5d** (> 1.242 g, 4.19 mmol, quant.) was obtained as a colorless liquid.
$[\alpha]_D^{25}$ = +21.7° (c = 3.15, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.30-7.43 (m, 1H), 6.86-6.99 (m, 2H), 5.88 (dq, ^3J(H,H) = 8.74Hz, ^3J(H,H) = 6.41Hz, 1H), 5.25 (dq, ^3J(H,H) = 8.85 Hz, ^3J(H,H) = 1.33 Hz, 1H), 2.01 (dt, ^3J(H,H) = 7.74 Hz, 0.66 Hz, 2H), 1.76 (d, ^3J(H,H) = 1.33 Hz, 3H), 1.41 (d, ^3J(H,H) = 6.41 Hz, 3H), 1.18-1.48 (m, 6H), 0.88 (t, ^3J(H,H) = 7.08 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 160.5 (dd, ^1J(C,F) = 255.6 Hz, ^1J(C,F) = 6.5 Hz, 2C), 161.0, 141.1, 132.1 (t, ^1J(C,F) = 10.27 Hz, 1C), 123.8, 111.5-112.2 (m, 2C), 70.4, 39.3, 31.3, 27.2, 22.5, 20.9, 16.6, 14.0. **IR** (film) (ν/cm^{-1}): 2932, 1732, 1625, 1593, 1470, 1289,1120, 1037, 795. **HRMS** for $C_{17}H_{22}F_2O_2$ (296.1588, M^+): found: 296.1562. **MS** (EI): 296 (<1, M^+), 225 (1), 158 (18), 141 (100), 95 (34), 82 (43), 67 (27), 55 (11).

Synthesis of (2*S*,3*E*)-4-methyl-3-hexen-2-yl acetate (5e):



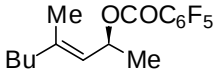
(2*S*,3*E*)-4-Methyl-3-hexen-2-ol (**6a**, 97 % *ee*) (114 mg, 1.00 mmol, 1.0 equiv.) in CH_2Cl_2 (15 mL) at 0 °C was treated with NEt_3 (106 mg, 81 µl, 1.50 mmol, 1.5 equiv.) and acetyl chloride (94 mg, 86 µl, 1.20 mmol, 1.2 equiv.) and stirred for 1.3 h at 0 °C. After workup and purification by flash chromatography with deactivated silica (deactivated by stirring for several min with a solvent (pentane/Et_2O = 99/1) containing 1 vol.-% NEt_3), **5e** (125 mg, 0.80 mmol, 79 %, 97 % *ee*) was obtained as a colorless liquid.
$[\alpha]_D^{25}$ = -30.2° (c = 2.47, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 600 MHz, $CDCl_3$): 5.52-5.66 (m, 1H), 5.09-5.19 (m, 1H), 1.93-2.08 (m, 5H), 1.68 (d, ^3J(H,H) = 1.33 Hz, 3H), 1.24 (d, ^3J(H,H) = 6.41 Hz, 3 H), 0.99 (t, ^3J(H,H) = 7.52, 3H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 170.4, 141.3, 123.2, 68.2, 32.0, 21.4, 20.9, 16.5, 12.2. **IR** (film) (ν/cm^{-1}): 2968, 1736, 1370, 1243, 1042. **HRMS** für $C_7H_{14}O$ (156.1150, M^+): found: 156.1163. **MS** (EI): 156 (M^+, <1), 141 (1), 127 (2), 114 (19), 99 (23), 96 (53), 85 (45), 81 (100), 67 (10), 55 (25), 43 (42).

Synthesis of (2*S*,3*E*)-4-methyldec-3-en-2-yl 2,6-difluorobenzoate (5f):



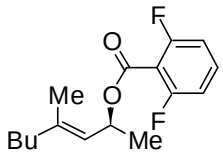
Prepared from (2*S*,4*E*)-4-methyldec-3-en-2-ol **6d** (340 mg, 2.0 mmol), 2,6-difluorobenzoyl chloride (495 mg, 2.8 mmol), pyridine (0.25 mL, 3.0 mmol) and DMAP (24 mg, 0.2 mmol). Reaction time: 15 h at -10°C. Purification by flash chromatography (Pentane/Ether = 98:2 + 1% Et_3N) yielded **5f** (565 mg, 91%) as a colourless liquid.
$[\alpha]_D^{25}$ = +49.0° (c = 1.5, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.26-7.40 (m, 1H), 6.82-6.87 (m, 2H), 5.8 (m, 1H), 5.16-5.20 (dq, ^3J(H,H) = 9.0 Hz, ^4J(H,H) = 3.0 Hz, 1H), 1.91-1.96 (t, ^3J(H,H) = 6.0 Hz, 3H), 1.32 (d, ^3J(H,H) = 6.0 Hz 3H), 1.20-1.23 (m, 8H), 0.80 (t, ^3J(H,H) = 6.0 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 161.2, 160.0, 157.8, 140.1, 131.1, 122.8, 110.7 (2C), 111.8 (2C), 69.4, 38.4, 30.7, 27.8, 26.5, 21.6, 19.9, 15.6, 13.0. **IR** (film) (ν/cm^{-1}): 2930, 1732, 1625, 1470, 1288, 1119, 1013. **HRMS** for $C_{18}H_{24}F_2O_2$ (310.1744, [M^+]): found: 310.1720. **MS** (EI): 310 ([M]$^+$, <1), 152 (18), 141 (100), 95 (25), 82 (32), 69 (11), 55 (7).

Synthesis of (2*S*,3*E*)-4-methyloct-3-en-2-yl pentafluorobenzoate (5g):



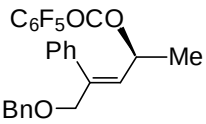
(2*S*,3*E*)-4-Methyl-3-octen-2-ol (**6b**) (281 mg, 1.98 mmol, 1.0 equiv.) in CH_2Cl_2 (15 mL) was reacted at 0 °C with NEt_3 (273 mg, 374 µl, 2.70 mmol, 1.5 equiv.) and 2,6-difluorobenzoyl chloride (388 mg, 2.20 mmol, 1.2 equiv.) for 3.5 h. After workup and purification by flash chromatography with deactivated silica (deactivated by stirring for several min with a solvent (pentane/Et_2O = 99/1) containing 1 vol.-% NEt_3) **5g** (572 mg, 1.70 mmol, 87 %) was obtained as a colorless liquid.
$[\alpha]_D^{24}$ = +40.2° (c = 1.75, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 5.87 (dd, ^3J(H,H) = 8.96 Hz, 6.41 Hz, 1H), 5.22 (dq, ^3J(H,H) = 8.96 Hz, ^3J(H,H) = 1.33 Hz, 1H), 1.99-2.06 (m, 2H), 1.76 (d, ^3J(H,H) = 1.33 Hz, 3H), 1.41 (d, ^3J(H,H) = 6.30 Hz, 3H), 1.21-1.45 (m, 4H), 0.893 (t, ^3J(H,H) = 7.19 Hz, 3H). ^{13}C-NMR (δ/ppm, 75 MHz, $CDCl_3$): 158.4, 141.9, 123.2, 71.7, 39.1, 22.2, 20.8, 16.6, 13.9. (+6C). **IR** (film) (ν/cm^{-1}): 2870, 1736, 1503, 1342, 1236, 1034. **HRMS** for $C_{16}H_{17}F_5O_2$ (336.1149, M^+): found: 336.1143. **MS** (EI): 336 (M^+, <1), 195 (100), 167 (6), 125 (6).

Synthesis of (2*S*,3*E*)-4-methyl-3-octen-2-yl-2,6 difluorobenzoate (5h):



(2*S*,3*E*)-4-methyl-3-octen-2-ol (**6b**, 252 mg, 1.77 mmol, 1.0 equiv., > 99 % *ee*) in CH_2Cl_2 (15 mL) was reacted with NEt_3 (273 mg, 374 µl, 2.70 mmol, 1.5 equiv.) and 2,6-difluorbenzoyl chloride (388 mg, 2.2 mmol, 1.2 equiv.) for 12 h at 0 °C. After workup and purification by flash chromatography with deactivated silica (deactivated by stirring for several min with a solvent (pentane/Et_2O = 99/1) containing 1 vol.-% NEt_3) **5h** (452 mg, 1.60 mmol, 90 %) was obtained as a colorless liquid.
$[\alpha]_D^{25}$ = + 19.3° (c = 0.85, CDCl3). **^{1}H-NMR** (δ/ppm, 600 MHz, $CDCl_3$): 7.33-7.40 (m, 1H), 6.89-6.95 (m, 2H), 5.84-5.93 (m, 1H), 5.22-5.29 (m, 1H), 2.02 (t, ^3J(H,H) = 7.53 Hz, 2H), 1.76 (s, 3H), 1.41 (d, ^3J(H,H) = 6.31 Hz, 3H), 1.23-1.32 (m, 4H), 0.89 (t, ^3J(H,H) = 7.32 Hz, 3H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 161.0, 160.6 (2C), 141.1, 132.1, 123.8, 112.2 111.9 (2C), 70.4, 39.1, 29.7, 22.2, 20.9, 16.6, 13.9. **IR** (film) (ν/cm^{-1}): 3401, 2961, 2931, 2861, 1733, 1626, 1470, 1289, 1265, 1120, 1014, 795. **HRMS** for $C_{16}H_{20}F_2O_2$ (282.1431, M^+): found: 282.0382. **MS** (EI): 282 (M^+, <1), 225 (1), 158 (8), 141 (100), 124 (11), 109 (7), 95 (14), 82 (12), 69 (6).

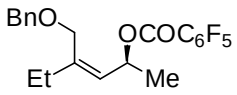
Synthesis of (2*E*,4*S*)-[1-benzyloxy-2-phenyl-pent-2-en-4-yl] pentafluorobenzoate (5i):



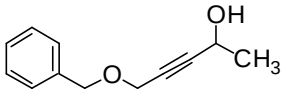
To a precooled (-50°C) solution of DMAP (20 mg, 0.14mmol, 0.1 equiv.) pyridine (0.2 mL, 2.1 mmol, 1.5 equiv.) and allylic alcohol **7** (80 mg, 1.4 mmol, 1equiv.) in CH_2Cl_2 (3 mL) was added pentafluorobenzoyl chloride (460 mg, 2 mmol, 1.4 equiv.). The mixture was stirred at -20 °C for 12 h. It was quenched with water (10 mL) and extracted with Et_2O (3 x 10 mL). The organic layer was concentrated *in vacuo* at 20 °C. The residue was dissolved in pentane (5

mL) and washed with an aq. sat. solution of $NaHCO_3$ (3 x 20 mL). The organic extract was dried (Na_2SO_4) and concentrated *in vacuo* at 20 °C. **5i** (480 mg, 95 %) was obtained as an orange oil. It was used without further purification.
[a]$_D^{20}$ = +8° (c = 0.7, CH_2Cl_2). **^{1}H-NMR** (d/ppm, $CDCl_3$, 400 MHz): 7.44-7.41 (m, 2H), 7.36-7.26 (m, 8H), 6.12-6.05 (m, 1H), 5.94 (m, 1H), 4.66 (m, 1H), 4.56 (m, 1H), 4.46 (d, ^3J(H,H) = 11.6 Hz, 1H), 1.52 (d, ^3J(H,H) = 6.4 Hz, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 100 MHz): 157.3, 145.0 (m, 2CF), 142.9 (m, CF), 140.3 (m, 2CF), 140.3, 140.2, 137.9, 130.4, 128.4 (2 x 2C), 127.9, 127.8, 127.7, 126.6, 72.5, 70.9, 67.4, 20.9. **IR** (film) (ν/cm^{-1}): 3060, 2870, 1740, 1650, 1520, 1500, 1340, 1230. **HRMS** for $C_{24}H_{19}F_5O_3$ (462.1255, M^+): found: 462.1270. **MS** (EI, 70 eV): 462 (M^+, 0.06), 194 (66), 159 (23), 144 (30), 129 (22), 91 (100).

Synthesis of (2*S*,3*Z*)-4-[(benzyloxy)methyl]-3-hexen-2-yl pentafluorobenzoate (5j)

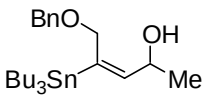


a) Synthesis of 5-(benzyloxy)pent-3-in-2-ol



To LDA (10.71 g, 100 mmol, 1.0 equiv., 1.21 M in hexane) in THF (50 mL) at -80 °C was added 1-propin-1-ylbenzylether (14.6 g, 100 mmol, 1.0 equiv.) and a violet solution was formed. After 20 min of stirring at 20 °C, acetaldehyde (8.4 mL, 150 mmol, 1.5 equiv.) was added at -80 °C, and the solution became colorless. It was allowed to warm to 20 °C within 10 h. Then water (150 mL) was added. After extraction with Et_2O (3 x 100 mL), the organic layer was dried ($MgSO_4$) and the solvents were removed under reduced pressure. The crude reaction mixture was purified by Kugelrohr-distillation (0.1 mbar, 200 °C) and 5-(benzyloxy)pent-3-in-2-ol (25.1 g, 132 mmol, 88 %) was obtained as a pale yellow liquid.
^{1}H-NMR (δ/ppm, 300 MHz, $CDCl_3$): 7.24-7.40 (m, 5H), 4.59 (s, 2H), 4.53-4.65 (m, 1H), 4.20 (d, ^3J(H,H) = 1.66 Hz, 2H), 2.06 (br, 1H), 1.47 (d, ^3J(H,H) = 6.52 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$):137.3, 128.4 (2C), 128.0 (2C), 127.9, 88.5, 79.8, 71.7, 58.3, 57.4, 24.2. **IR** (film) (ν/cm^{-1}): 3392, 2860, 1454, 1357, 1148, 1071, 1028, 997, 742, 699. **HRMS** for $C_{12}H_{13}O_2$ (189.0916 $[M-H]^+$): found: 189.0903. **MS** (EI): 189 ($[M-H]^+$, < 1), 159 (8), 145 (64), 129 (12), 117 (20), 107 (28), 91 (100), 79 (27).

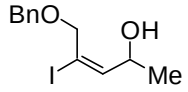
b) Synthesis of (3*E*)-5-(benzyloxy)-4-(tributylstannyl)-3-penten-2-ol[3]



To a precooled suspension of CuCN (14.330 g, 160 mmol, 2.0 equiv.) in THF (150 mL) was added at -80 °C *n*-BuLi (200 mL, 320 mmol, 4.0 equiv.). The mixture was stirred for 10 min at -80 °C and for 10 min at -50 °C, resulting in a golden solution. At -80 °C, Bu_3SnH (85 mL, 320 mmol, 4.0 Äquiv.) was added and the reaction mixture was stirred for 10 min at -80 °C and for 10 min at -50 °C. At -80 °C MeOH (80 mL) was added and the reaction mixture was stirred for 15 min at -80 °C. A red solution was formed. To this solution, (benzyloxy)pent-3-in-2-ol (15.2 g, 80 mmol, 1.0 equiv.), dissolved in THF (40 mL) was added at -80 °C, and the reaction mixture was warmed to -10 °C within 3 h and stirred for further 12 h. Then H_2O (100 mL) was added. After filtration (Celite) and extraction of the aqueous layer with Et_2O (3 x

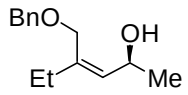
100 mL), the combined organic layers were dried ($MgSO_4$) and the solvents were removed under reduced pressure. The yellowish crude was purified by flash chromatography, and (3*E*)-5-(Benzyloxy)-4-(tributylstannyl)pent-3-en-2-ol (9.64 g, 20.0 mmol, 25 %) was obtained in isomerically pure form.
^{1}H-NMR (δ/ppm, 300 MHz, $CDCl_3$): 7.24-7.41 (m, 5H), 5.55-5-69 (m, 1H), 4.51 (s, 2H), 4.48-4.60 (m, 1H), 4.28-4.40 (m, 1H), 4,10-4.21 (m, 1H), 1.67 (br, 1H), 1.37-1.56 (m, 6H), 1.25-1.36 (m, 6H), 1.23 (d, ^3J(H,H) = 6.31Hz, 3H), 0.82-0.95 (m, 15H). **^{13}C-NMR** (δ/ppm, 150 MHz, $CDCl_3$): 145.3, 143.2, 138.1, 128.3 (2C), 127.8 (2C), 127.6, 72.8, 71.3, 65.0, 29.1 (3C), 27.3 (3C), 23.2, 13.7(3C), 10.1 (3C). **IR** (film) (ν/cm^{-1}): 3339, 2871, 1455, 1090, 698. **HRMS** for $C_{24}H_{42}O_2Sn$ (483.2285, $[M+H]^+$): found: 483.2360. **MS** (EI): 425 ($[M-Bu]^+$, 37), 341 (32), 317 (48), 273 (96), 235 (46), 179 (79), 121 (18), 91 (100).

c) Synthesis of (3*E*)-5-(benzyloxy)-4-iodo-3-penten-2-ol[10]



Under the exclusion of light (3*E*)-5-(benzyloxy)-4-(tributylstannyl)pent-3-en-2-ol (7.07 g, 14.7 mmol, 1.0 equiv.) in CH_2Cl_2 (40 mL) was mixed with I_2 (4.47 g, 17.6 mmol, 1.2 equiv.) at 0 °C and stirred for 1 h. Then sat. aq. KF was added. After workup and purification by flash chromatography, (3*E*)-5-(benzyloxy)-4-iod-3-penten-2-ol) (4.209 g, 13.2 mmol, 90 %) was obtained as a light yellow liquid.
^{1}H-NMR (δ/ppm, 300 MHz, $CDCl_3$): 7.27-7.43 (m, 5H), 6.47 (d, 8.29 Hz, 1H), 4.54 (s, 2H), 4.49-4.60 (m, 1H), 4.24 (dq, ^3J(H,H) = 13.71 Hz, 1.00 Hz, 2H), 2.21 (br, 1H), 1.23 (d, ^3J(H,H) = 6.41 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 148.6, 137.2, 128.5 (2C), 128.0 (3C), 100.1, 72.3, 71.9, 65.9, 22.9. **IR** (film) (ν/cm^{-1}): 3400, 2972, 1454, 1355, 1072, 739, 698. **EA** for $C_{12}H_{15}IO_2$ (C, 45.30 %; H, 4.75 %) found: C, 45.14 %; H, 4.60 %. **HRMS** for $C_{12}H_{13}IO$ (300.0011, $[M-H_2O]^+$): found: 299.9985. **MS** (EI): 300 ($[M-H_2O]^+$, <1), 210 (15), 194 (1), 108 (16), 91 (100), 83 (9).

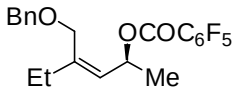
d) Synthesis of (2*S*,3*Z*)-4-[(benzyloxy)methyl]-3-hexen-2-ol[2,5,11]



$Pd(PPh_3)_4$ (1.73 g, 1.5 mmol, 10 mol %) in THF (30 mL) was mixed with (3*E*)-5-(benzyloxy)-4-iodopent-3-en-2-ol (4.77 g, 15 mmol, 1.0 equiv.) and cooled to 0 °C. EtZnI (15 mL, 2.2 M in THF, 2.2 equiv.) was added and the reaction mixture was stirred for 10 h at 25 °C. After workup and purification by flash chromatography of the crude, the racemic allylic alcohol (2.64 g, 12.0 mmol, 80 %) was obtained as a light yellow liquid. For an enzymatic resolution, the racemic allylic alcohol (1.76 g, 8.0 mmol, 1.0 equiv.) was mixed with Amano lipase AK (1.0 g) and vinyl acetate (1.38 g, 1.48 mL, 16.0 mmol, 2.0 equiv.) in pentane and stirred at 40 °C for 26 h. The reaction was followed by GC. The product mixture was purified by flash chromatography with deactivated silica (deactivated by stirring with solvent containing 1 vol.-% of NEt_3). (2*S*,3*Z*)-4-[(Benzyloxy)methyl]-3-hexen-2-ol (0.71 g, 3.2 mmol, 40 %, > 99 % *ee*) was obtained as a colorless liquid.
$[\alpha]_D^{24°C}$ = -6.6° (c = 2.05, CH_2Cl_2). **GC** (column: Chiraldex B-PH; 150 °C const.): t_R/min 39.8 (*S*), 41.5(*R*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.24-7.42 (m, 5H), 5.45 (dd, ^3J(H,H) = 8.40 Hz, 1.00 Hz, 1H), 4.51-4.65 (m, 1H), 4.50-4.51 (m, 2H), 4.11-4.17 (m, 1H), 3.93-3.98 (m, 1H), 2.14 (dq, ^3J(H,H) = 7.41 Hz, 1.33 Hz), 2H), 1.96-2.08 (br, 1H), 1.24 (d, ^3J(H,H) =

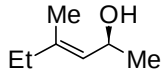
6.30 Hz, 3H), 1.03 (t, ^3J(H,H) = 7.41 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 140.0, 138.0, 132.5, 128.4, 127.8, 127.7, 72.5, 68.1, 63.9, 28.5, 23.4, 12.3. **IR** (film) (ν/cm^{-1}): 3400, 2967, 1367, 1454, 1071, 737, 698. **HRMS** for $C_{14}H_{19}O$ ([203.1463,M-H_2O+H]$^+$): found: 203.1415. **MS** (EI): 203 ([M-H_2O+H]$^+$, 12), 133 (11), 91 (100).

e) Synthesis of (2*S*,3*Z*)-4-[(benzyloxy)methyl]-3-hexen-2-yl pentafluorobenzoate (5j)



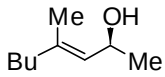
(2*S*,3*Z*)-4-[(Benzyloxy)methyl]hex-3-en-2-ol (124 mg, 0.56 mmol, 1.0 equiv.) was reacted at -10 °C with pentafluorobenzoyl chloride (207 mg, 124 µl, 0.90 mmol, 1.6 equiv.), pyridine (71 mg, 0.90 mmol, 1.6 equiv.) and DMAP (22 mg, 0.17 mmol 0.3 equiv.) in CH_2Cl_2 (10 mL) for 12 h. After workup, (2*S*,3*Z*)-4-[(benzyloxy)methyl]-3-hexen-2-yl pentafluorobenzoate (**5j**) (> 232 mg, 0.56 mmol, quant., > 99 % *ee*) was obtained quantitatively as a colorless liquid.
[a**]$_D^{24}$** = +64.7° (c = 2.55, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.24-7.42 (m, 5H), 5.97 (dd, ^3J(H,H) = 9.18 Hz, ^3J(H,H) = 6.30 Hz, 1H), 5.42 (d, ^3J(H,H) = 9.07 Hz, 1H), 4.49-4.51 (m, 1H), 4.23-4.29 (m, 1H), 4.07 (d, ^3J(H,H) = 11.61 Hz, 1H), 2.14-2.23 (m, 2H), 1.43 (d, ^3J(H,H) = 6.41 Hz, 3H), 1.05 (t, ^3J(H,H) = 7.41 Hz), 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 158.3, 143.1, 138.2, 128.4 (2C), 127.7 (2C), 127.6, 125.9, 72.5, 70.7, 67.9, 27.9, 21.0, 12.1. (+ 6C). **IR** (film) (ν/cm^{-1}): 2970, 1738, 1652, 1504, 1340, 1234, 1031. **HRMS** for $C_{21}H_{18}F_5O_3$ (413.1176, [M-H]$^+$): found: 413.1216. **MS** (EI): 413 ([M-H]$^+$, 5), 307 (18), 195 (53), 91 (100), 55 (19).

Synthesis of (2*S*,3*E*)-4-methyl-3-hexen-2-ol (6a):[2,5]



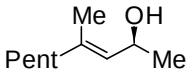
(3*E*)-4-Iodpent-3-en-2-ol (*rac*-**22**) (3.48 g, 16.4 mmol, 1.0 equiv.) was reacted in a *Negishi* cross-coupling reaction with EtZnI for 14 h at 40 °C. The crude was purified by flash chromatography with deactivated silica (deactivated by stirring with a solvent (pentane/Et_2O = 8/2) containing 1 vol.-% of NEt_3). (3*E*)-4-Methyl-3-hexen-2-ol (1.31 g, 11.5 mmol, 70 %) was obtained as a colorless liquid. For an enzymatic resolution, the racemic allylic alcohol (0.97 g, 8.5 mmol, 1.0 equiv.) was mixed with vinyl acetate (1.57 mL, 17.0 mmol, 2.0 equiv.) and Amano lipase AK (1.2 g) in pentane (10 mL) and stirred slowly at 40 °C. After 24 h, the alcohol was resolved according to GC analysis. Purification with deactivated flash silicagel (deactivated by stirring for several min with a solvent (pentane/Et_2O = 8/2) containing 1 vol.-% NEt_3) **6a** (0.42 g, 3.7 mmol, 44 %, 99 % *ee*) was obtained as a colorless liquid.
[a**]$_D^{25}$** = -26.3° (c = 1.47, $CDCl_3$). **GC** (column: Chiraldex B-PH; 100 °C): t_R/min 3.9 (*R*), 4.4 (*S*). **^{1}H-NMR** (δ/ppm, 600 MHz, $CDCl_3$): 5.20 (d, ^3J(H,H) = 8.34 Hz, ^3J(H,H) = 1.00 Hz, 1H), 4.54-4.62 (m, 1H), 1.96-2.05 (m, 2H), 1.6 (s, 3H), 1.38 (br, 1H), 1.23 (d, ^3J(H,H) = 6.10 Hz, 3H), 1.00 (t, ^3J(H,H) = 7.08 Hz, 3H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 139.5, 127.7, 64.8, 32.1, 23.6, 16.3, 12.3. **IR** (film) (ν/cm^{-1}): 3350, 2967, 1454, 1056. **HRMS** for $C_7H_{14}O$ (114.1045, M$^+$): found: 114.1035. **MS** (EI): 114 (M$^+$, 2), 99 (11), 85 (100), 67 (20), 55 (14).

Synthesis of (2*S*,3*E*)-4-methyl-3-octen-2-ol (6b):[5]



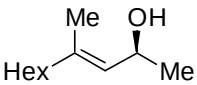
(2*S*,3*E*)-4-Iodpent-3-en-2-ol (3.50 g, 16.5 mmol, 1.0 equiv., > 99 % *ee*) was reacted in a *Negishi* cross-coupling reaction with BuZnCl (50 mmol, 3 equiv., 5 M in THF) for 14 h at 40 °C. The crude was purified by flash chromatography with deactivated silica (deactivated by stirring for several min with a solvent (pentane/Et_2O = 8/2) containing 1 vol.-% NEt_3). **6b** (1.99 g, 14.0 mmol, 85 %, > 99 % *ee*) was obtained as a colorless liquid.
$[\alpha]_D^{24}$ = -23.4° (c = 2.27, $CDCl_3$). **GC** (column: Chiraldex B-PH; 40 °C (5 min), 1°/min, 140 °C (20 min)) t_R/min 33.9 (*R*), 35.7 (*S*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 5.19 (dd, ^3J(H,H) = 8.40 Hz, 1.00 Hz, 1H), 4.56 (dq, ^3J(H,H) = 8.29 Hz, ^3J(H,H) = 6.30 Hz, 1H), 1.96 (t, ^3J(H,H) = 7.85 Hz, 2H), 1.66 (d, ^3J(H,H) = 0.89 Hz, 3H), 1.45 (br, 1H), 1.20-1.45 (m, 6H), 1.22 (d, ^3J(H,H) = 6.19 Hz, 3H), 0.89 (t, ^3J(H,H) = 7.08 Hz, 3H). **^{13}C-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 137.9, 128.9, 64.7, 39.1, 29.8, 23.6, 22.3, 16.3, 13.9. **IR** (film) (ν/cm^{-1}): 3340, 2929, 1455, 1380, 1100, 1058. **EA** for $C_9H_{18}O$ (C, 76.00 %; H, 12.76 %): C, 75.64 %; H, 12.22 %. **HRMS** for $C_9H_{18}O$ (142.1358, M+): found: 142.1358. **MS** (EI): 142 (M^+, <1), 127 (4), 109 (2), 95 (6), 85 (100), 71 (23), 67 (21), 55(11), 43 (25), 41 (19).

Synthesis of (2*S*,3*E*)-4-methyl-3-nonen-2-ol (6c):[2,5]



(3*E*)-4-Iodpent-3-en-2-ol (5.09 g, 24.0 mmol, 1.0 equiv.) was reacted in a *Negishi* cross-coupling reaction with PentZnI (72 mmol, 3 equiv., 5 M in THF) for 14 h at 40 °C. The crude was purified by flash chromatography with deactivated silica (deactivated by stirring for several min with a solvent (pentane/Et_2O = 8/2) containing 1 vol.-% NEt_3). (3*E*)-4-Methyl-3-nonen-2-ol (3.00 g, 19.2 mmol, 80 %) was obtained as a colorless liquid. For an enzymatic resolution the racemic allylic alcohol (3*E*)-4-methylhex-3-en-2-ol (2.81 g, 18.0 mmol, 1.0 equiv.) was mixed with vinyl acetate (3.7 mL, 40.0 mmol, 2.2 equiv.) and Amano lipase AK (3.0 g) in pentane (50 mL) and stirred slowly at 36 °C for 20 h. The reaction was followed by GC analysis. After workup and chromatographical purification with deactivated flash silica (deactivated by stirring for several min with a solvent (pentane/Et_2O = 8/2) containing 1 vol.-% NEt_3) **6c** (1.01 g, 6.4 mmol, 36 %, > 99 % *ee*) was obtained as a colorless liquid. The *ee* of **6c** was determined by GC analysis (see appendix).
$[\alpha]_D^{25}$ = -30.9° (c = 2.07, $CDCl_3$). **GC** (column: Chiraldex B-PH, 100 °C): t_R/min 15.1(*R*), 17.3 (*S*). ^{1}H-NMR (δ/ppm, 300 MHz, $CDCl_3$): 5.14-5.24 (m, 1H), 4.55 (dq, ^3J(H,H) = 8.40 Hz, ^3J(H,H) = 6.19 Hz, 1H), 1.95 (t, ^3J(H,H) = 7.74Hz, 2H), 1.64 (d, ^3J(H,H) = 1.33 Hz, 3H), 1.61 (br, 1H), 1.17-1.43 (m, 6H), 1.21 (d, ^3J(H,H) = 6.19 Hz, 3H), 0.87 (t, ^3J(H,H) = 7.19 Hz, 3H). ^{13}C-NMR (δ/ppm, 75 MHz, $CDCl_3$): 137.8, 128.9, 64.7, 39.4, 31.4, 27.3, 23.6, 22.5, 16.2, 14.0. **IR** (film) (ν/cm^{-1}): 3341, 2929, 1455, 1380, 1103, 1058, 866. **EA** for $C_{10}H_{20}O$ (C, 76.86 %, H, 12.90 %): C, 76.44 %, H 12.46 %. **HRMS** for $C_{10}H_{20}O$ (156.1514, M^+): found: 156.1509. MS (EI): 156 (M^+, 1), 141(5), 95 (6), 85 (100), 82 (6), 71 (11).

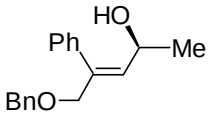
Synthesis of (2*S*,3*E*)-4-methyldec-3-en-2-ol (6d):[2,5]



Prepared from (3*E*)-4-Iodpent-3-en-2-ol **18** (424 mg, 2.0 mmol) and HexZnI (4.6 mL, 1.3 M in THF, 6.0 mmol, 3.0 equiv.) in a *Negishi* cross-coupling reaction. Reaction time: 5 h at RT. Purification by flash chromatography (pentane/Et_2O = 8/2 + 1% Et_3N) yielded **6d** (272 mg,

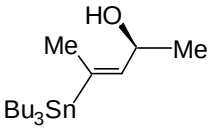
80%) as a pale yellow liquid. Enzymatic resolution in presence of Amano lipase AK from Pseudonomas fluorescens and vinyl acetate (24 h at reflux in pentane) yielded the pure enantiomer. The *ee* of **6d** was determined by GC analysis (see appendix).
$[a]_D^{25}$ = -6.7° (c = 1.5, EtOH). **GC** (column: Chiraldex B-PH, 100 °C): t_R/min 28.1 (*R*), 32.8 (*S*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 55.20 (dq, ^3J(H,H) = 8.6 Hz, ^4J(H,H) = 1.4 Hz, 1H), 4.56 (m, 1H), 1.96 (t, ^3J(H,H) = 8.0 Hz, 3H), 1.65 (s, 3H), 1.20-1.42 (m, 12H), 0.80 (t, ^3J(H,H) = 6.0 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 136.7, 127.5, 63.5, 69.4, 38.1, 30.4, 27.6, 26.3, 22.3, 21.3, 15.0, 12.8. **IR** (film) (ν/cm^{-1}): 3339, 2928, 2857, 1058. **HRMS** for $C_{11}H_{22}O$ (170.1671, $[M]^+$): found: 170.1680. **MS** (EI): 170 ($[M]^+$, <1), 155 (4), 85 (100), 71 (13), 67 (7), 55 (5).

Synthesis of (2*E*,4*S*)-1-benzyloxy-2-phenyl-pent-2-en-4-ol (7):



To a cooled (-50 °C) solution of **9** (4.4 g, 10 mmol, 1 equiv.) in THF (20 mL) was added *n*-BuLi (14 mL, 1.5 M in hexanes, 20 mmol, 2 equiv.). The first equivalent was added very slowly to deprotonate selectively the alcohol without carring out the Sn-Li exchange reaction. After the end of the addition, the mixture was warmed to RT and stirred for 1 h. It was cooled again to –50 °C and benzyl(chloromethyl) ether (2 g, 12 mmol, 1.2 equiv.) was added. The solution was warmed to RT and stirred overnight. It was quenched with water (50 mL) and extracted with Et_2O (3 x 15 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 7/3). It yielded 1.28 g (48%) of the pure product as a yellow oil.
$[a]_D^{20}$ = -13° (c = 1.05, CH_2Cl_2). **^{1}H-NMR** (d/ppm, CDCl3, 300 MHz): 7.34-7.18 (m, 10H), 5.91 (dd, ^3J(H,H) = 0.3 Hz, ^3J(H,H) = 8.1 Hz, 1H),4.64 (m, 1H), 4.49 (s, 2H), 4.42 (d, ^3J(H,H) = 10.2 Hz, 1H), 4.31 (d, ^3J(H,H) = 11.1 Hz, 1H), 2.00 (br. s., 1H), 1.26 (d, ^3J(H,H) = 6.3 Hz, 3H). **^{13}C-NMR** (d(ppm, $CDCl_3$, 75 MHz): 141.1, 138.3, 138.1, 137.7, 128.9, 128.7, 128.4, 128.3, 127.9, 126.7, 73.1, 68.0, 64.7, 23.7. **IR** (film) (ν, cm^{-1}): 3400, 2970, 1490, 1450, 1370, 1090. **HRMS** for $C_{18}H_{20}O$ (265.1229, $[M-3H]^+$): found: 265.1242. **MS** (EI, 70 eV): 265 ($[M-3H]^+$, 0.03); 159 (43), 145 (19), 131 (26), 91 (100).

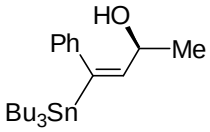
Synthesis of (2*E*,4*S*)-2-tributylstannyl-pent-2-en-4-ol (8)[12]



To a precooled (-80 °C) suspension of CuCN (5.5 g, 60 mmol, 2 equiv.) in THF (100 mL) was added dropwise *n*-BuLi (1.6 M in hexanes, 75 mL, 120 mmol, 4 equiv.). The dark yellow solution was stirred at -80 °C for 20 min. $HSnBu_3$ (40 mL 120 mmol, 4 equiv.) was slowly added. The golden solution was stirred at -80 °C for 20 min, then MeOH (30 mL) was added. The dark red solution was warmed to -50 °C for 10 min, then cooled again to -80 °C. (*S*)-but-3-yn-2-ol (**10**, 2.52 g, 30 mmol, 1 equiv.) in THF (30 mL) was added. The solution was warmed to -10°C and stirred overnight. It was quenched with water (300 mL), filtered (Celite) and extracted with Et_2O (3 x 50 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 100/0 to 1/1). **8** (4.5 g, 60%) was obtained as a colourless oil.

[a]$_D^{20}$ = -22° (c = 0.78, CH_2Cl_2). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 5.51 (dq, ^3J(H,H) = 1.8 Hz, ^3J(H,H) = 8.1 Hz, ^3J(H,Sn) = 67 Hz, 1H), 4.70-4.63 (m, 1H), 1.83 (d, ^3J(H,H) = 1.8 Hz, ^3J(H,Sn) = 48 Hz, 3H), 1.42-1.15 (m, 15H), 0.85-0.80 (m, 15H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 145.1, 140.6, 63.9, 29.5, 28.1, 23.7, 19.7, 14.4, 9.6. **IR** (film) (ν/cm^{-1}): 3330, 2960, 1460. **MS** (EI, 70 eV): 319 ([M-Bu]$^+$, 100), 263 (71), 207 (52), 177 (48). **EA** for $C_{17}H_{36}Osn$ (C, 54.42 %; H, 9.67 %): found: C, 54.36 %; H, 9.70 %).

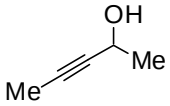
Synthesis of (1*E*,3*S*)-1-tributylstannyl-1-phenyl-but-1-en-3-ol (9):[4]



To a solution of (3*S*)-1-phenyl-but-1-yn-3-ol (45 mmol, 1 equiv.) and bis(triphenylphosphine)palladium chloride (300 mg, 0.5 mmol, 0.01 equiv.) in THF (50 mL) was added dropwise $HSnBu_3$ (15 mL 55 mmol, 1.2 equiv.). The mixture was stirred at RT for 30 min. The solvents were evaporated *in vacuo* and the residue was purified by flash chromatography (pentane/Et_2O = 9/1). It yielded **9** (14 g, 80%) as a single regio- and stereoisomer as a colourless oil.

[a]$_D^{20}$ = -18° (c = 1.03, CH_2Cl_2). **^{1}H-NMR** (d/ppm, CDCl3, 300 MHz): 7.21-7.14 (m, 2H), 7.07-7.02 (m, 1H), 6.87-6.82 (m, 2H), 5.72 (d, ^3J(H,H) = 8.4 Hz, ^3J(H,Sn) = 63 Hz, 1H), 4.34-4.27 (m, 1H), 1.40-1.33 (m, 6H), 1.23-1.13 (m, 9H), 0.84-0.76 (m, 15H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 147.3, 145.2, 144.7, 128.5, 126.8, 125.5, 65.5, 29.3, 27.6, 23.9, 14.0, 10.3. **IR** (film) (ν/cm^{-1}): 3340, 2960, 2930, 1460. **HRMS** for $C_{22}H_{38}Osn$ (381.1240, [M-Bu]$^+$): found: 381.1243. **MS** (EI, 70 eV): 381 ([M-Bu]$^+$, 100), 325 (19), 307 (14), 249 (38), 177 (34), 147 (39), 131 (67).

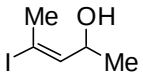
Synthesis of pent-3-in-2-ol (10):[13]



Prepared according to literature.

GC (column: TFA γ-Cyclodextrin; 40 °C (5 min), 1°/min, 120 °C (10 min)) : t_R/min 10.4 (*S*), 12.4 (*R*)). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 4.40-4.50 (m, 1H), 2.29 (br, 1H), 1.80 (d, ^3J(H,H) = 2.10Hz, 3H), 1.38 (d, ^3J(H,H) = 6.52 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 81.4, 79.9, 58.4, 24.5, 3.4. **IR** (film) (ν/cm^{-1}): 3351, 2982, 2922, 1448, 1370, 1160, 1079, 1000, 887. **MS** (EI): 83 ([M-H]$^+$, 3), 69 (100), 51 (4).

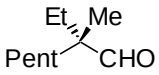
Synthesis of (3*E*)-4-iodopent-3-en-2-ol (18):[10]



Under the exclusion of light, (3*E*)-4-(tributylstannyl)pent-3-en-2-ol (**8**) (3.74 g, 10.0 mmol, 1 equiv.) in CH_2Cl_2 (100 mL) was cooled to 0 °C and I_2 (3.05 g, 12.0 mmol, 1.2 equiv.) was added. After 1 h at 0 °C, sat. aq. KF (50 mL) was added. After workup and purification by flash chromatography with deactivated silica (deactivated by stirring with a solvent (pentane/Et_2O = 7/3) containing 1 vol.-% of NEt_3), (3*E*)-4-iodopent-3-en-2-ol (**12**) (1.91 g, 9.0 mmol, 90 %) was obtained as a colorless liquid.

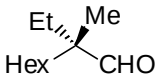
^{1}H-NMR (δ/ppm, 300 MHz, $CDCl_3$): 6.21 (dq, ^3J(H,H) = 8.51, 1.44 Hz, 1H), 4.51 (dq, ^3J(H,H) = 8.51, 6.30 Hz, 1H), 2.44 (d, ^3J(H,H) = 1.44 Hz, 1H), 1.91 (br, 1H), 1.24 (d, ^3J(H,H) = 6.30 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 144.8, 96.9, 65.6, 28.1, 22.9. **IR** (film) (ν/cm-1): 3326, 2972, 2920, 1638, 1428, 1375, 1138, 1061, 1043, 856, 644. **EA** for C_5H_9IO (C, 28.32 %, H, 4.28 %): found: C, 28.47 %; H, 4.29 %. **HRMS** for C_5H_9IO (211,9698, M^+): found: 211.9672. **MS** (EI): 212 (M^+, 2), 197 (12), 170 (2), 127 (9), 85 (28), 69 (18), 57 (7), 43 (100).

Synthesis of (2*S*)-2-ethyl-2-methylheptanal (12b):



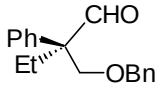
According to **TP2** (4*R*, 2*E*)-4-ethyl-4-methyl-2-nonene (**4e**) (84 mg, 0.50 mmol, 1.0 equiv.) was ozonolyzed at -78 °C and stirred with PPh_3 (315 mg, 1.20 mmol, 1.2 equiv.) at 0 °C for 2 h. After workup and chromatographical purification with flash siligagel **12b** (50 mg, 0.32 mmol, 63 %) was obtained as a colorless liquid.
[a**]$_D^{25}$** = -2.4° (c = 2.43, CH_2Cl_2). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 9.42 (s, 1H), 1.38-1.63 (m, 4H), 1.07-1.36 (m, 6H), 0.99 (s, 6H), 0.76-0.92 (m, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 207.1, 49.3, 35.1, 32.5, 27.9, 23.6, 22.5, 17.6, 14.0, 8.3. **IR** (film) (ν/cm^{-1}): 2932, 1728, 1462, 1384. **HRMS** for $C_{12}H_{25}$ (157.1592, $[M+H]^+$): found: 157.1574. **MS** (EI): 157 ($[M+H]^+$, 2), 127 (26), 86 (56), 85 (73), 71 (100), 57 (56), 55 (13), 42 (46), 39 (24).

Synthesis of (2*S*)-2-ethyl-2-methyloctanal (12c):



According to **TP2** (4*S*,2*E*)-4-Ethyl-4-methyldec-2-ene (**4g**) (350 mg,1.92 mmol) was ozonolyzed at -78 °C and stirred with PPh_3 (553 mg, 2.11 mmol) at 0 °C for 2 h. Purification by flash chromatography (pentane/Et_2O = 98:2) yielded **12c** (212 mg, 65 %, 98 % *ee*) as a colourless liquid.
^{1}H-NMR (δ/ppm, 300 MHz, $CDCl_3$): 9.35 (s, 1H), 1.20-1.45 (m, 4H), 1.18 (m, 8H), 0.92 (s, 3H), 0.80 (m, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 206.1, 48.3, 34.1, 30.7 (2C), 28.9, 26.9, 22.9, 21.6, 16.6, 7.3. **IR** (film) (ν/cm^{-1}): 2929, 1722, 1438, 1183, 1120, 722, 541. **HRMS** for $C_{11}H_{22}O$ (171.1749, $[M+H]^+$): found: 171.1776. **MS** (EI): 171 ($[M+H]^+$, 1.5), 141 (24), 99 (17), 85 (100), 71 (82), 57 (94), 43 (41).

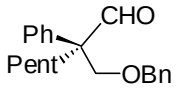
Synthesis of (2*R*)-2-benzyloxymethyl-2-phenyl-butanal (12d):



A solution of **4j** (660 mg, 2.4 mmol, 1 equiv.) in CH_2Cl_2 (20 mL) was cooled to -78 °C and ozone was bubbled through it until the solution turned blue. N_2 was then bubbled to remove the excess ozone. The colourless solution was then warmed to RT and PPh_3 (780 mg, 3 mmol, 1.3 equiv.) was added. The solution was stirred at RT for 24 h, then quenched with water (30 mL). The mixture was extracted with CH_2Cl_2 (3 x 10 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 95/5). It yielded **12d** (365 mg, 58%) as a colourless oil.

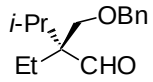
[a]$_D^{20}$ = +18° (c = 1, CH_2Cl_2). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 9.52 (s, 1H), 7.29-7.17 (m, 8H), 7.11-7.08 (m, 2H), 4.46 (s, 2H), 3.96 (d, ^3J(H,H) = 9.3 Hz, 1H), 3.79 (d, ^3J(H,H) = 9.3 Hz, 1H), 2.00 (dq, ^3J(H,H) = 1.8 Hz, ^3J(H,H) = 7.5 Hz, 2H), 0.66 (t, ^3J(H,H) = 7.5 Hz, 3H). **^{13}C-NMR** ($CDCl_3$, 75 MHz): 202.4, 138.3, 137.5, 129.1, 128.8, 128.1, 128.0, 127.9, 127.8, 73.9, 70.6, 59.0, 24.5, 8.4. **IR** (film) (ν/cm^{-1}): 3030, 2970, 2860, 2710, 1730, 1500, 1450. **MS** (EI, 70 eV): 268 (M^+, 0.11), 238 (13), 132 (35), 117 (11), 91 (100). **HRMS** for $C_{18}H_{20}O_2$ (268.1463, M^+): found: 268.1522.

Synthesis of (2*R*)-2-benzyloxymethyl-2-phenyl-butanal (12e):



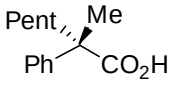
A solution of **4k** (800 mg, 2.5 mmol, 1 equiv.) in CH_2Cl_2 (20 mL) was cooled to -78 °C and ozone was bubbled through it until the solution turned blue. N_2 was then bubbled to remove the excess ozone. The colourless solution was then warmed to RT and PPh_3 (760 mg, 3 mmol, 1.2 equiv.) was added. The solution was stirred at RT for 24 h, then quenched with water (30 mL). The mixture was extracted with CH_2Cl_2 (3 x 10 mL). The organic layer was dried ($MgSO_4$), concentrated *in vacuo* and purified by flash chromatography (pentane/Et_2O = 95/5). The desired compound **12e** (520 mg, 66 %) was obtained as a colourless oil.
[a]$_D^{20}$ = +15° (c = 1.05, CH_2Cl_2). **^{1}H-NMR** (d/ppm, $CDCl_3$, 300 MHz): 9.51 (s, 1H); 7.30-7.08 (m, 10H), 4.45 (s, 2H), 3.95 (d, ^3J(H,H) = 9.3 Hz, 1H), 3.79 (d, ^3J(H,H) = 9.3 Hz, 1H), 1.92 (t, ^3J(H,H) = 6.0 Hz, 2H), 1.17-1.15 (m, 4H), 1.00-0.96 (m, 2H), 0.75 (m, 3H). **^{13}C-NMR** (d/ppm, $CDCl_3$, 75 MHz): 202.4, 138.3, 137.8, 129.1, 128.7, 128.1, 127.9, 127.8, 127.7, 73.9, 71.0, 58.7, 32.7, 23.6, 22.8, 14.4. **IR** (film) (ν/cm^{-1}): 3030, 2930, 2710, 1730, 1450. **HRMS** for $C_{18}H_{20}O_2$ (310.1919, M^+): found: 310.1926.MS (EI, 70 eV): 310 (M^+, 0.05); 118 (39); 91 (100).

Synthesis of (2*R*)-2-[(benzyloxy)methyl]-2-ethyl-3-methylbutanal (12f):



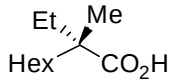
According to **TP2** alkene **4k** (493 mg, 2.00 mmol, 1.0 equiv.) was ozonolysed at -78 °C and subsequently stirred with PPh_3 (787 mg, 3.00 mmol, 1.5 equiv.) at 0 °C for 2 h. After workup and chromatographical purification with flash silicagel (2*R*)-2-[(benzyloxy)methyl]-2-ethyl-3-methylbutanal (**12f**) (332 mg, 1.42 mmol, 71 %, > 99 % *ee*) was obtained as a colorless liquid.
[a]$_D^{27}$ = +0.8° (c = 0.75, $CDCl_3$). **^{1}H-NMR** (δ/ppm, 600 MHz, $CDCl_3$): 9.51 (s, 1H), 7.18-7.32 (m, 5H), 4.42 (s, 2H), 3.58 (d, ^3J(H,H) = 9.77 Hz, 2H), 3.50 (d, ^3J(H,H) = 9.77 Hz, 2H), 2.00 (sept, ^3J(H,H) = 7.12 Hz, 1H), 1.60-1.69 (m, 2H), 0.75 (t, ^3J(H,H) = 7.53 Hz, 3H). **^{13}C-NMR** (δ/ppm, 125 MHz, $CDCl_3$): 206.5, 138.3, 128.3, 127.5, 127.4, 73.5, 69.3, 55.4, 29.7, 21.6, 17.8, 17.6, 8.3. **IR** (ν/cm^{-1}): 2967, 2932, 2879, 1725, 1498, 1103,698. **HRMS** for $C_{15}H_{20}O_2$ (232.1464, $[M-2H]^+$): found: 232.1455. **MS** (EI): 232 (M-2H, <1), 141 (2), 107 (23), 105 (3), 101 (4), 98 (9), 92 (11), 91 (100).

Synthesis of (2*S*)-2-methyl-2-phenylheptanoic acid (13a):



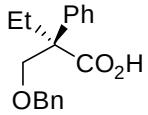
According to **TP3** alkene **4d** (432 mg, 2.0 mmol) was ozonolysed in acetone (10 mL) at -78 °C and subsequently treated with Jones reagent**Fehler! Textmarke nicht definiert.** (1.9 mL, 5.4 mmol, 2.7 equiv.). **13a** (348 mg, 79 %, 98 % *ee*) was obtained as a colourless liquid.
$[a]_D^{25}$ = +8.1° (c = 1.3, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.16-7.32 (m, 5H), 1.80-2.09 (m, 2H), 1.49 (s, 3H), 1.17-1.20 (m, 6H), 0.77 (t, ^3J(H,H) = 6.9 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 183.0, 143.5, 128.8, 127.2, 126.6, 50.4, 39.3, 32.7, 24.7, 22.8 (2C), 14.4. **IR** (film) (ν/cm^{-1}): 2955, 1699, 1273, 697. **HRMS** for $C_{14}H_{20}O_2$ (220.1463, $[M]^+$): found: 220.1466. **MS** (EI): 220 ($[M]^+$, 1.3), 175 (34), 150 (19), 132 (12), 118 (20), 105 (100), 91 (60), 77 (17).

Synthesis of (2*S*)-2-ethyl-2-methyloctanoic acid (13b):



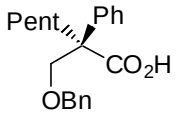
According to **TP3** alkene **4g** (364 mg, 2.0 mmol) was ozonolysed in acetone (10 mL) at -78 °C and subsequently treated with Jones reagent**Fehler! Textmarke nicht definiert.** (1.9 mL, 5.4 mmol, 2.7 equiv.). After acid-base workup **13b** (212 mg, 68 %, 98 % *ee*) was obtained as a colourless liquid.
$[a]_D^{25}$ = -4.0° (c = 1.4, EtOH). **GC** (Chiraldex B-PH; 120 °C (60 min), 1°C/min, 140°C (15min)): t_R/min 78.7 (*S*), 79.9 (*R*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 1.7-1.5 (m, 2H), 1.5-1.3 (m, 2H), 1.19 (m, 4H), 1.05 (s, 3H), 0.79 (m, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 183.4, 45.1, 37.7, 30.7 (2C), 28.8, 22.5, 21.6, 19.5,13.0, 7.8. **IR** (film) (ν/cm^{-1}): 2859, 1698, 1463, 1258, 939. **HRMS** for $C_{11}H_{22}O_2$ (187.16989, $[M+H]^+$): found: 187.1687. **MS** (EI): 187 ($[M+H]^+$, <1), 158 (5), 141 (25), 129 (4.1), 102 (100), 87 (58), 71 (18), 57 (62).

Synthesis of (2*R*)-2-((benzyloxy)methyl)-2-phenylbutanoic acid (13c):



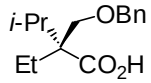
According to **TP3** alkene **4j** (840 mg, 3.0 mmol) was ozonolysed in acetone (10 mL) at -78 °C and subsequently treated with Jones reagent**Fehler! Textmarke nicht definiert.** (2.8 mL, 8.1 mmol, 2.7 equiv.). **13c** (542 mg, 65 %, 99 % *ee*) was obtained as a colourless liquid.
$[a]_D^{25}$ = -8.6° (c = 1.4, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.15-7.27 (m, 10H), 4.47 (s, 2H), 3.98 (d, ^2J(H,H) = 9.0 Hz, 1H), 3.82 (d, ^2J(H,H) = 9.0 Hz, 1H), 2.09 (q, ^3J(H,H) = 7.5 Hz, 2H), 0.68 (t, ^3J(H,H) = 7.5 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 180.1, 140.0, 138.2, 128.8 (2C), 128.1, 128.0, 127.4, 127.1, 74.0, 71.6, 55.6, 26.9, 8.9. **IR** (film) (ν/cm^{-1}): 2972, 1704, 1498, 1259, 1102, 697. **HRMS** for $C_{18}H_{20}O_3$ (284.1412, $[M]^+$): found: 284.1378. **MS** (EI): 284 ($[M]^+$, <1), 254 (10), 163 (14), 132 (13), 107 (19), 91 (100).

Synthesis of (2*R*)-2-((benzyloxy)methyl)-2-phenylheptanoic acid (13d):



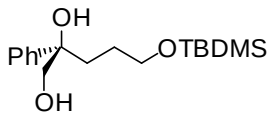
According to **TP3** alkene **4k** (322 mg, 1.4 mmol) was ozonolysed in acetone (10 mL) at -78 °C and subsequently treated with Jones reagent (1.3 mL, 3.78 mmol, 2.7 equiv.). **13d** (273 mg, 60 %, 99 % *ee*) was obtained as a colourless liquid.
$[a]_D^{25}$ = -5.8° (c = 1.95, EtOH). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.15-7.27 (m, 10H), 4.47 (s, 2H), 3.97 (d, ^2J(H,H) = 9.0 Hz, 1H), 3.83 (d, ^2J(H,H) = 9.0 Hz, 1H), 2.02 (m, 2H), 1.13 (m, 6H), (t, ^3J(H,H) = 6.6 Hz, 3H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 179.3, 140.3, 138.12, 128.8 (2C), 128.1, 128.0, 127.3, 127.0, 74.0, 72.0, 55.2, 34.3, 32.6, 24.1, 22.8, 14.4. **IR** (film) (ν/cm^{-1}): 2956, 1703, 1453, 1263, 1099, 697. HR-MS for $C_{21}H_{26}O_3$ (326.1882, $[M]^+$): found: 326.1864. **MS** (EI): 326 ($[M]^+$, <1), 159 (46), 118 (30), 91 (100).

Synthesis of (2*R*)-2-[(benzyloxy)methyl]-2-ethyl-3-methylbutanoic acid (13e)



According to **TP3** alkene **4k** (549 mg, 2.23 mmol, 1.0 equiv.) was ozonolysed in acetone (30 mL) at -78 °C and subsequently treated with Jones reagent**Fehler! Textmarke nicht definiert.** (3.0 mL, 8.01 mmol, 3.6 equiv.). (2*R*)-2-[(benzyloxy)methyl]-2-ethyl-3-methylbutanoic acid (**13e**) (475 mg, 1.90 mmol, 85 %) was isolated as colorless crystals.
[a]$_D^{25}$ = +1.4° (c = 0.7, $CDCl_3$). **HPLC** (column: Chiracel OD-H; *n*-heptane/*i*-PrOH = 99/1, 0.2 mL/min): t_R/min 68.4 (*S*), 72.2 (*R*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 8.75 (br, 1H), 7.24-7.42 (m, 5H), 4.55 (s, 2H), 3.67 (d, ^3J(H,H) = 9.61 Hz, 1H), 3.61 (d, ^3J(H,H) = 9.61 Hz, 1H), 2.12 (sept, ^3J(H,H) = 6.97 Hz, 1H), 1.59-1.91 (m, 2H), 0.96 (t, ^3J(H,H) = 7.16 Hz, 3H), 0.85-1.10 (m, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 180.2, 137.9, 128.4 (2C), 127.7, 126.6 (2C), 73.6, 69.6, 63.4 (C_q), 31.5, 24.0, 18.1, 17.8, 8.9. **IR** (film) (ν/cm^{-1}): 2968, 1694, 1261, 1099, 712. **HRMS** for $C_{14}H_{19}O_2$ (250.1569, M^+): found: 250.1583. MS (EI): 250 (M^+, <1), 141 (2), 107 (22), 91 (100).

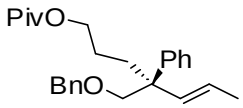
Synthesis of (2*R*)-5-(*tert*-butyl-dimethyl-silanyloxy)-2-phenyl-pentane-1,2-diol (14):



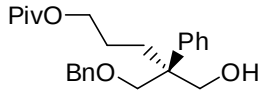
Prepared from **17** (390 mg, 1.36 mmol), tert-butyl-dimethylchlorsilane (245 mg, 1.63 mmol) and imidazole (130 mg, 1.9 mmol) in DMF. Reaction time: 5 h at RT. Standard workup yielded (*R*)-1-benzyloxy-5-(tert-butyl-dimethyl-silanyloxy)-2-phenyl-pentan-2-ol (544 mg, quant., 98 % *ee*) as a colourless liquid.
$[a]_D^{25}$ = +5.8° (c = 2.025, CH_2Cl_2). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.23-7.35 (m, 10H), 4.53 (s, 2H), 3.60 (s, 2H), 3.54 (t, ^3J(H,H) = 6.2 Hz, 2H), 1.93-2.0 (m, 2H), 1.23-1.58 (m, 2H), 0.86 (s, 9H), 0.00 (s, 6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 144.5, 138.5, 128.7, 128.4, 128.0 (2C), 127.0, 126.0, 78.4, 76.4, 73.8, 63.9, 36.0, 27.0, 26.3, 18.7, -5. **IR** (film) (ν/cm^{-1}): 3436, 2953, 2857, 1096, 836, 699. **HRMS** for $C_{24}H_{36}O_3Si$ (401.2512, $[M+H]^+$): found: 401.2518. **MS** (FAB): 401 ($[M+H]^+$, 26), 291 (23), 2791 (303), 251 (43), 161 (34), 147 (44), 91 (100).
Hydrogenation of (2*R*)-1-benzyloxy-5-(tert-butyl-dimethyl-silanyloxy)-2-phenyl-pentan-2-ol (150 mg, 0.37 mmol) with Pd/C in *i*-PrOH yielded **14** (80 mg, 70%, 98%) as a colourless liquid.
$[a]_D^{25}$ = +2.6° (c = 2.32, CH_2Cl_2). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.4 (m, 5H), 4.3 (s (broad), 1H), 3.6 (m, 4H), 2.1 (s, broad, 1H), 2.05 (m, 2H), 1.45 (m, 2H), 0.85 (s, 9H), 0.0 (s,

6H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 144.5, 128.6, 127.2, 126.1, 79.7, 71.6, 64.3, 36.0, 26.8, 26.3, 18.7, -5.1. **IR** (film) (ν/cm^{-1}): 3391, 2954, 1255, 1096, 836, 701.
HRMS for $C_{17}H_{30}O_3$**Si** (333.1862, $[M+Na]^+$): found: 333.1834.
MS (FAB+): 333.2 ($[M+Na]^+$, 36), 301 (38), 279 (100), 262 (28), 201 (27), 161 (67), 91 (22).

Synthesis of (4*R*,5*E*)-4-((benzyloxy)methyl)-4-phenylhept-5-enyl pivalate (15):

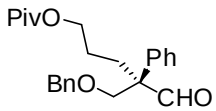


Prepared according to **TP1** from (2*E*,4*S*)-[1-benzyloxy-2-phenyl-pent-2-en-4-yl] pentafluorobenzoate **5i** (930 mg, 2.0 mmol), $[PivO(CH_2)_3]_2Zn$ 2.45 M solution (1.95 mL, 4.8 mmol) and CuCN·2LiCl 1M solution (2.4 mL, 2.4 mmol). Reaction time: 16 h, -30 °C to –10 °C. Purification by flash chromatography (pentane/ether = 98/2) yielded **15** (472 mg, 60 %, 98 % *ee*) as a colourless liquid.
$[a]_D^{25}$ = +7.7° (c = 1.925, CH_2Cl_2). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.19-7.31 (m, 10H), 5.65 (dd, ^3J(H,H) = 15.8 Hz, ^4J(H,H) = 1.2 Hz, 1H), 5.50 (dq, ^3J(H,H) = 15.8 Hz, ^3J(H,H) = 6.0 Hz, 1H), 4.8 (s, 2H), 3.71 (d, ^2J(H,H) = 9.0 Hz, 1H), 3.59 (d, ^2J(H,H) = 9.0 Hz, 1H), 1.88-1.98 (m, 2H), 1.75 (dd, ^3J(H,H) = 7.8 Hz, ^4J(H,H) = 1.2 Hz, 3H), 1.41-1.52 (m, 2H), 1.18 (s, 9H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 178.9, 145.0, 138.9, 136.3, 128.6, 128.4, 127.9, 127.8 (2C), 126.4, 124.8, 76.1, 73.7, 65.2, 48.2, 39.1, 32.9, 27.6, 24.1, 18.8. **IR** (film) (ν/cm^{-1}): 2956, 1727, 1453, 1157, 698. **HRMS** for $C_{26}H_{34}O_3$ (394.2508, $[M]^+$): found: 394.2469. **MS** (EI): 394 ($[M]^+$, 2.8), 171 (100), 91 (60).
The *ee* of **15** was determined by HPLC analysis (see appendix) after transformation into (4*S*)-4-((benzyloxy)methyl)-5-hydroxy-4-phenylpentyl pivalate:



$[a]_D^{25}$ = +8.2° (c = 1.1, CH_2Cl_2). **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 95/5, 0.6 mL/min): t_R/min 27.8 (*R*), 30.5 (*S*). **^{1} ^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.15-7.28 (m, 10H), 4.5 (s, 2H), 3.78-3.93 (m, 5H), 3.6 (d, ^2J(H,H) = 9.2 Hz, 1H), 2.2 (s broad, 1H), 1.8 (m, 2H), 1.3 (m, 2H), 1.09 (s, 9H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 178.9, 142.0, 138.1, 130.0, 128.9 (2C), 128.2, 128.0, 127.0, 76.0, 74.1, 69.4, 65.0, 46.9, 39.1, 30.6, 27.6, 23.4. **IR** (film) (ν/cm^{-1}): 3469, 2958, 1726, 1454, 1160, 698. **HRMS** for $C_{26}H_{34}O_3$ (352.2038, $[M-CH_4O]^+$): found: 352.2031. **MS** (EI): 352.2 ($[M-CH_4O]^+$, <1), 161 (45), 144 (100), 91 (24).

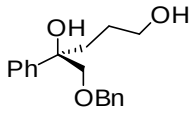
Synthesis of (4*R*)-5-(benzyloxy)-4-formyl-4-phenylpentyl pivalate (16):



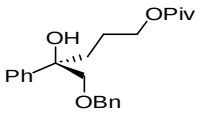
According to **TP2, 15** (700 mg, 1.77 mmol) was ozonolyzed at -78 °C and stirred with PPh_3 (558 mg, 2.13 mmol) at 0 °C for 2 h. Purification by flash chromatography (pentane/Et_2O = 9:1) yielded **16** (212 mg, 76 %, 98 % *ee*) as a colourless liquid.
$[\alpha]_D^{25}$ = -26.5° (c = 1.065, CH_2Cl_2). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 9.05 (s, 1H), 7.06-7.31 (m, 10H), 4.47 (s, 2H), 4.0 (d, ^3J(H,H) = 9.3 Hz, 2H), 3.9 (t, ^3J(H,H) = 6.3 Hz, 2H), 3.8 (d, ^3J(H,H) = 9.3 Hz, 2H), 2.0 (t, ^3J(H,H) = 8.4 Hz, 2H), 1.2 (m, 2H), 1.09 (s, 9H). **^{13}C-NMR**

(δ/ppm, 75 MHz, $CDCl_3$): 201.6, 178.8, 138.1, 137.0, 129.3, 128.8, 128.2, 128.0 (2C), 127.7, 74.0, 70.6, 64.7, 58.3, 39.1, 28.2, 27.6, 23.3. **IR** (film) (ν/cm^{-1}): 2969, 1726, 1285, 1161, 749, 699. HRMS for $C_{24}H_{30}O_4$ (382.2144, $[M]^+$): found: 382.2167. **MS** (EI): 382 ($[M]^+$, <1), 352 (6), 144 (52), 159 (14), 129 (17), 91 (100).

Synthesis of (4*R*)-5-(benzyloxy)-4-phenylpentane-1,4-diol (17):



Prepared according to **TP2** from aldehyde **16** (640 mg, 1.67 mmol), MCPBA (558 mg, 2.17 mmol) and Na_2HPO_4 (237 mg, 1.67 mmol). Reaction time: 2 h. Basic hydrolysis of 2,2-dimethyl-propionic acid (*R*)-5-benzyloxy-4-formyloxy-4-phenyl-pentyl ester and purification by flash chromatography (pentane/ether = 9/1) yield **17** (166 mg, 70 %, 98 % *ee*) as a colourless liquid.
$[a]_D^{25}$ = +8.7° (c = 2.025, CH_2Cl_2). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.14-7.34 (m, 10H), 4.44 (s, 2H), 3.55 (s, 2H), 3.47 (t, ^3J(H,H) = 6.3 Hz, 2H), 2.5 (s (broad), 1H), 1.8-2.0 (m, 2H), 1.2-1.6 (m, 2H), 1.2 (s (broad), 1H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 142.6, 136.8, 127.4, 127.1, 126.8, 126.6, 125.8, 124.4, 76.9, 75.1, 72.5, 62.1, 34.8, 25.6. **IR** (film) (ν/cm^{-1}): 3391, 2927, 1452, 1075, 699. **HRMS** for $C_{18}H_{22}O_3$ (309.1467, $[M+Na]^+$): found: 309.1501. **MS** (FAB): 309 ($[M+Na]^+$, 12), 287 ($[M+H]^+$, 3), 251 (13), 154 (56), 91 (100).
The *ee* of **17** was determined by HPLC analysis (see appendix) from (4*R*)-5-(benzyloxy)-4-hydroxy-4-phenylpentyl pivalate:

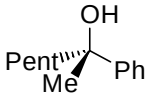


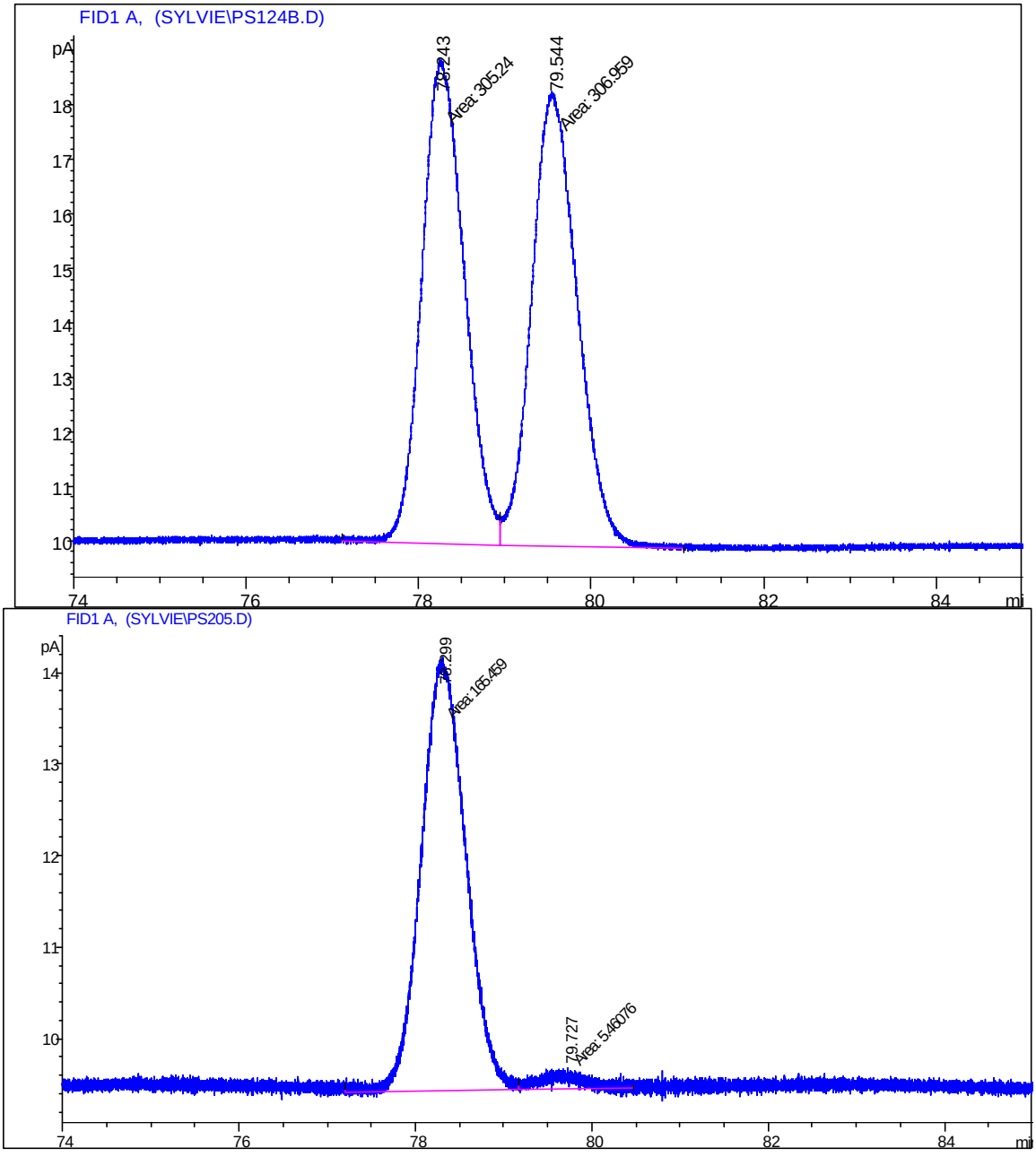
$[a]_D^{25}$ = +3.5° (c = 0.918, CH_2Cl_2). **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 95/5, 0.6 mL/min): t_R/min 15.5 (*R*), 19.4 (*S*). **^{1}H-NMR** (δ/ppm, 300 MHz, $CDCl_3$): 7.14-7.34 (m, 10H), 4.45 (s, 2H), 3.87-3.90 (m, 2H), 3.0 (s broad, 1H), 3.53 (s, 2H), 1.86-1.96 (m, 1H), 1.70-1.80 (m, 1H), 1.52-1.66 (m, 1H), 1.23-1.36 (m, 1H), 1.08 (s, 9H). **^{13}C-NMR** (δ/ppm, 75 MHz, $CDCl_3$): 178.9, 143.8, 138.2, 128.8, 128.6, 128.2, 128.0, 127.3, 125.7, 78.1, 76.3, 73.9, 64.9, 39.1, 35.7, 27.6, 23.1. **IR** (film) (ν/cm^{-1}): 3499, 2960, 1725, 1285, 1161, 700. **HRMS** for $C_{23}H_{30}O_4$ (371.2222, $[M+H]^+$): found: 371.2243. **MS** (EI): 371.1 ($[M+H]^+$, <1), 353 (3), 251 (17), 147 (15), 91 (100).

Appendix: determination of the enantiomeric excesses

(2*S*)-2-Phenyl-heptan-2-ol (**1a**, 97 % *ee*)

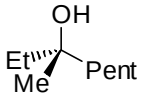
GC (column: Chiraldex B-PH; 100°C (30 min), 0.5°/min, 120°C (60 min)): t_R/min 78.3 (*S*), 79.7 (*R*).

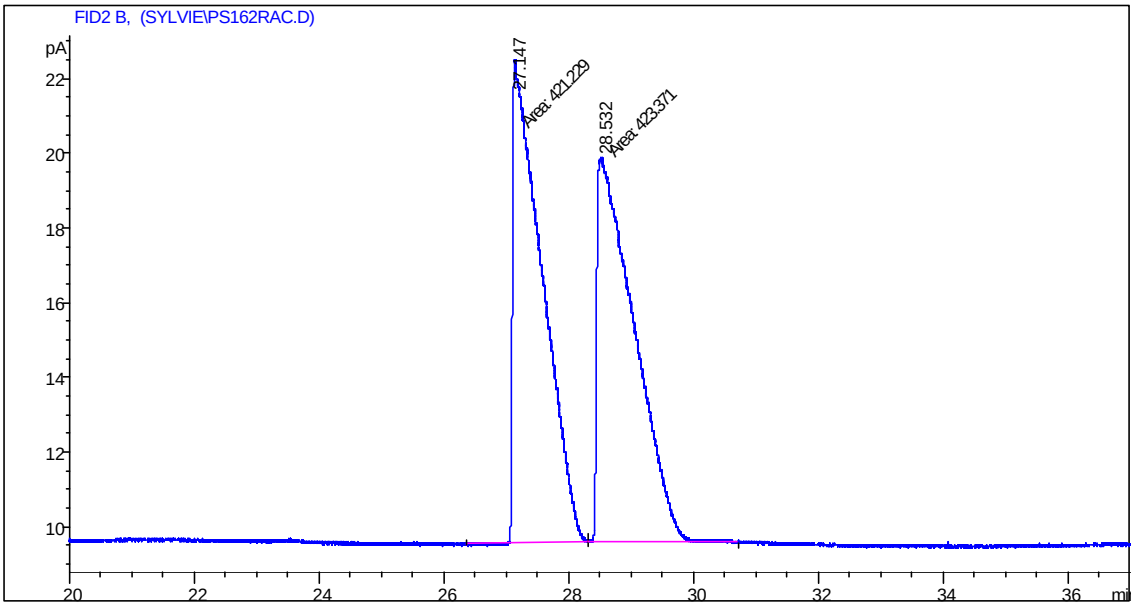


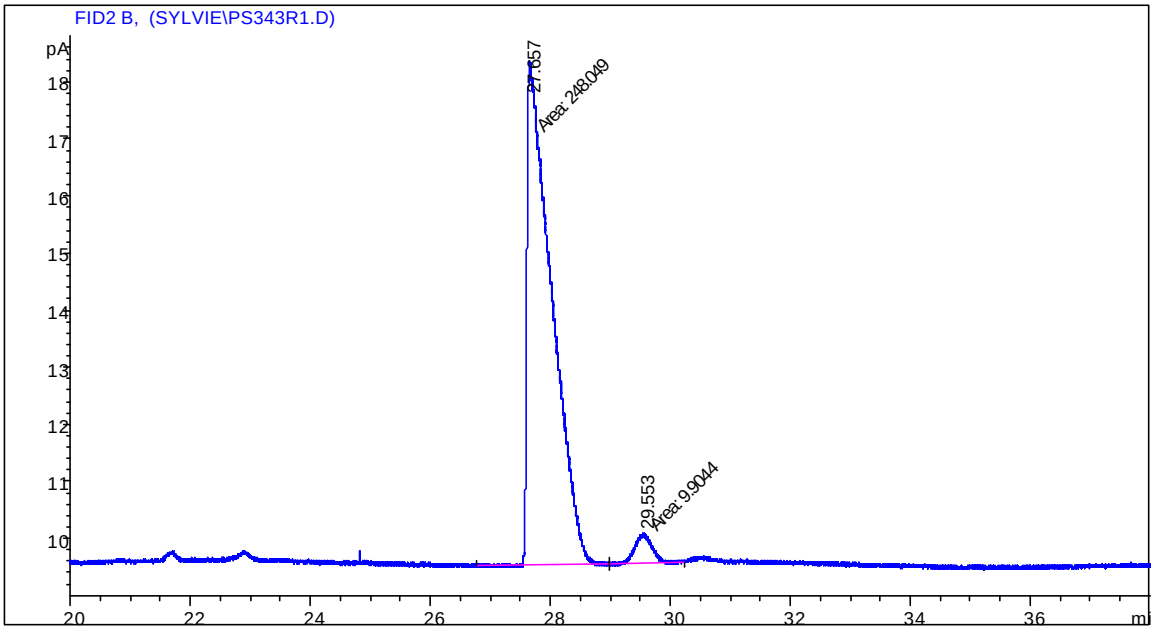


(3*S*)-3-Methyl-octan-3-ol (**1b**, 92 % *ee*)

GC (column: Chirasil Dex; 70°C const.): t_R/min 27.7 (*S*), 29.6 (*R*).

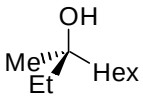


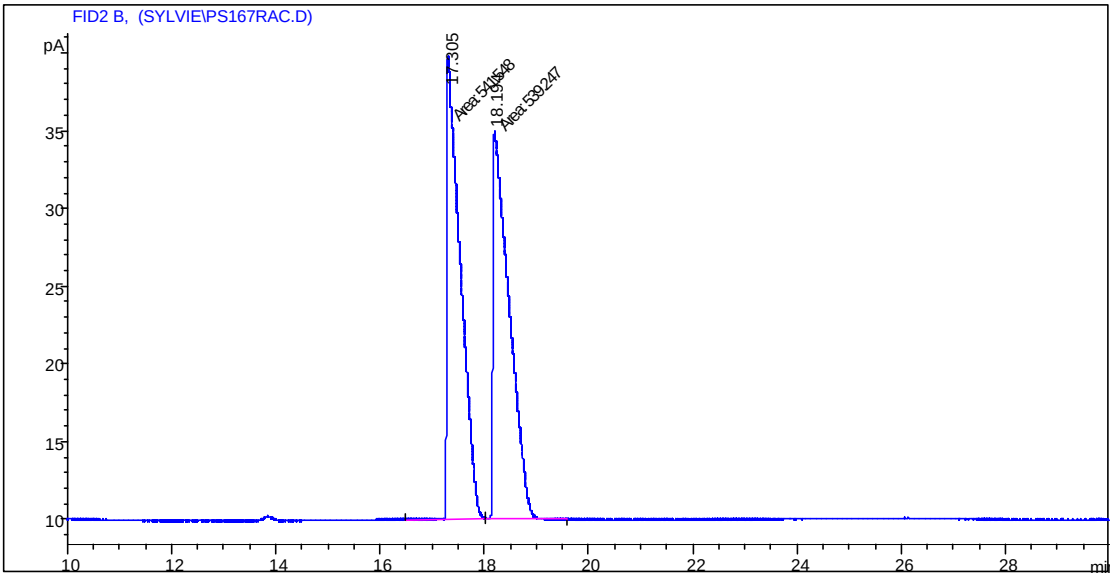


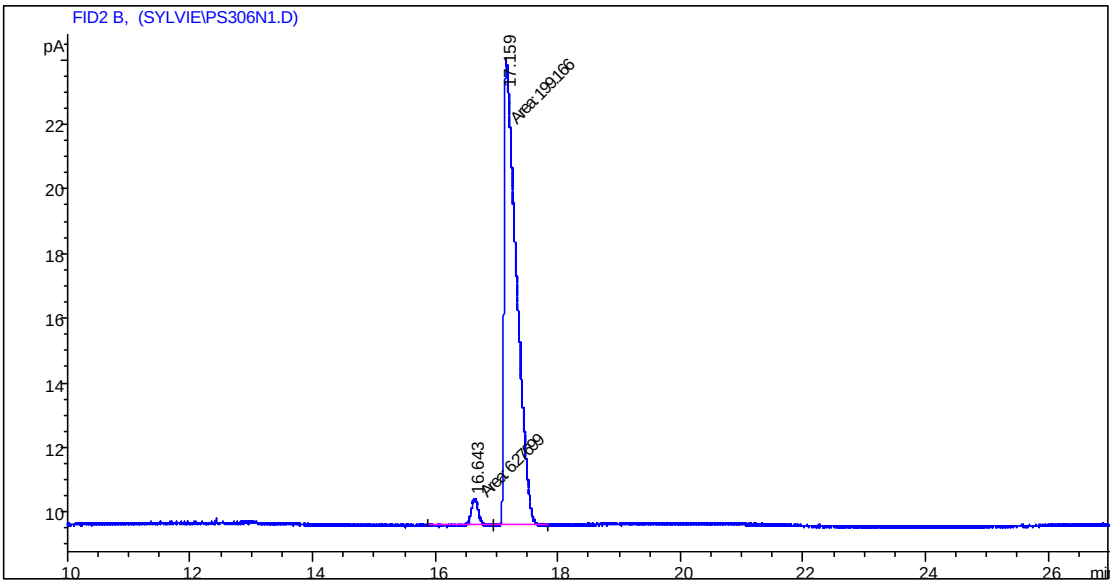


(3*R*)-3-Methyl-nonan-3-ol (**1c**, 93 % *ee*)

GC (column: Chirasil Dex; 90°C const.): t_R/min 16.6 (*S*), 17.2 (*R*).

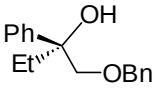


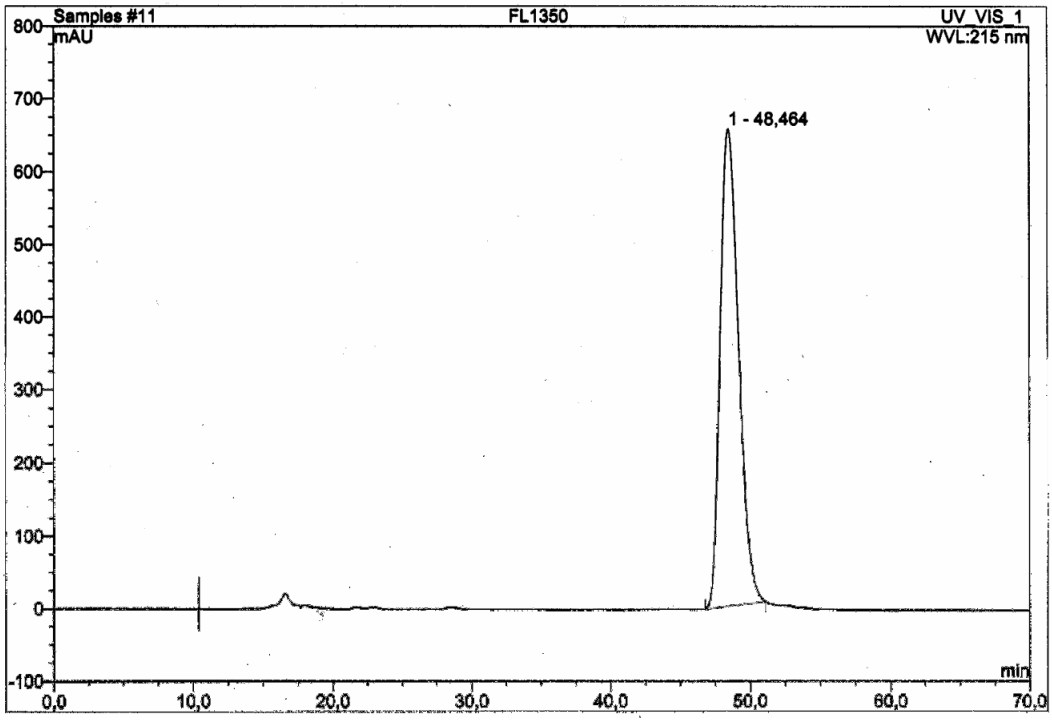




(1*R*)-1-Benzyloxy-1-phenyl-propan-1-ol (**1d**, 99 % *ee*)

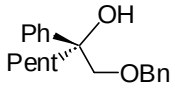
HPLC (column: OD-H; *n*-heptane/*i*-PrOH = 98/2, 0.2 mL/min): t_R/min 49.0 (*R*), 53.3 (*S*) (for a racemic sample, see **1e**).

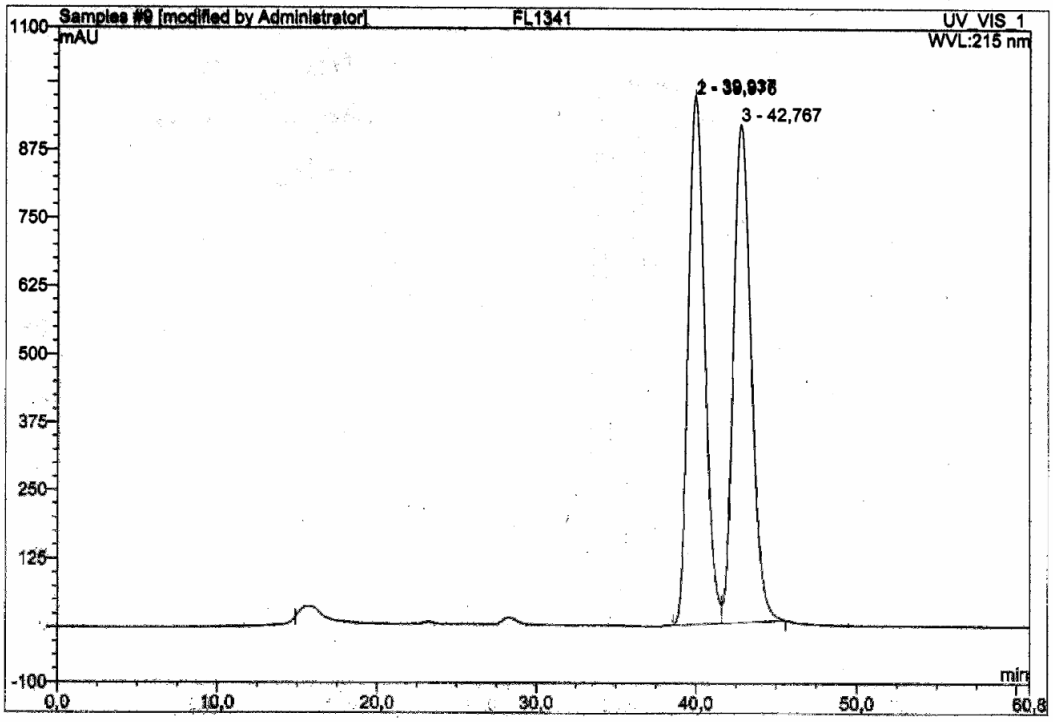


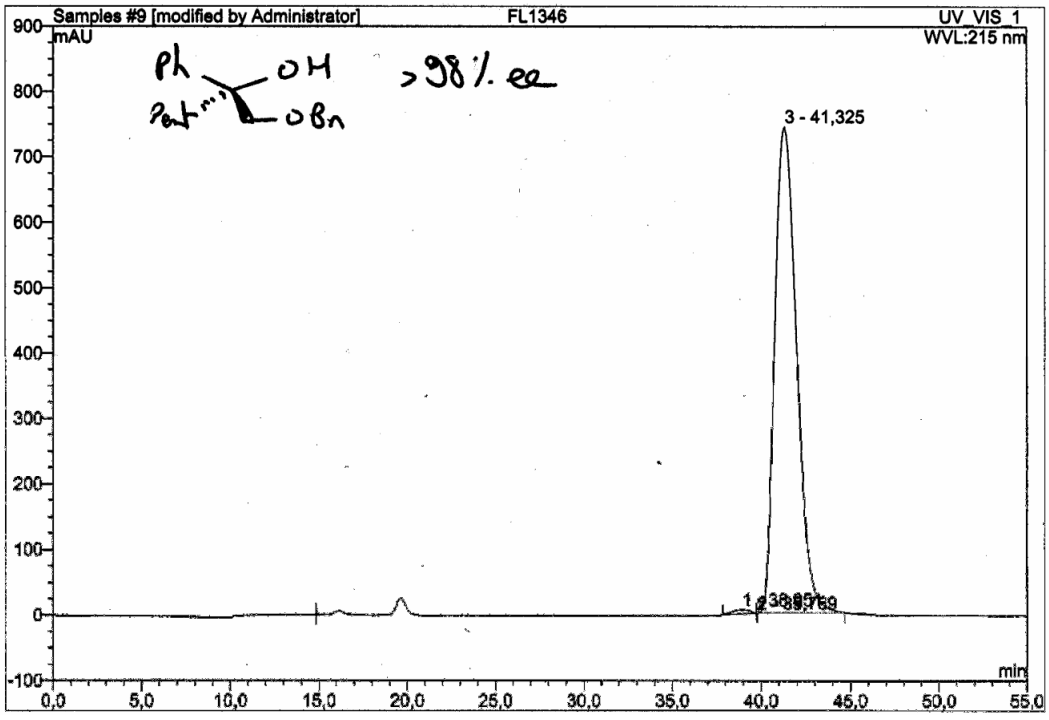


(1*R*)-1-Benzyloxy-1-phenyl-heptan-hexan-1-ol (**1e**, 98 % *ee*)

HPLC (column: OD-H; *n*-heptane/*i*-PrOH = 98/2, 0.2 mL/min): t_R/min 40.0 (*S*), 42.8 (*R*).

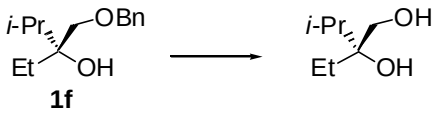


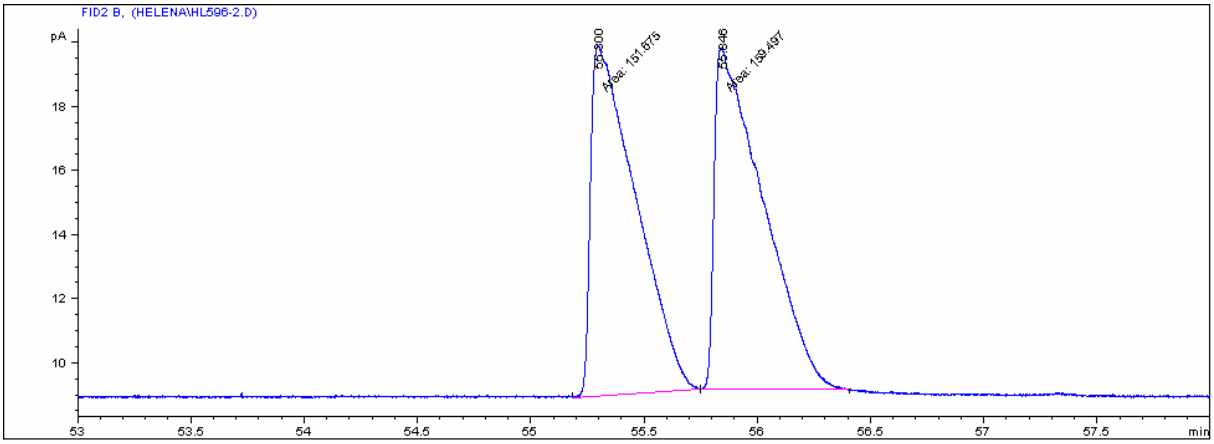


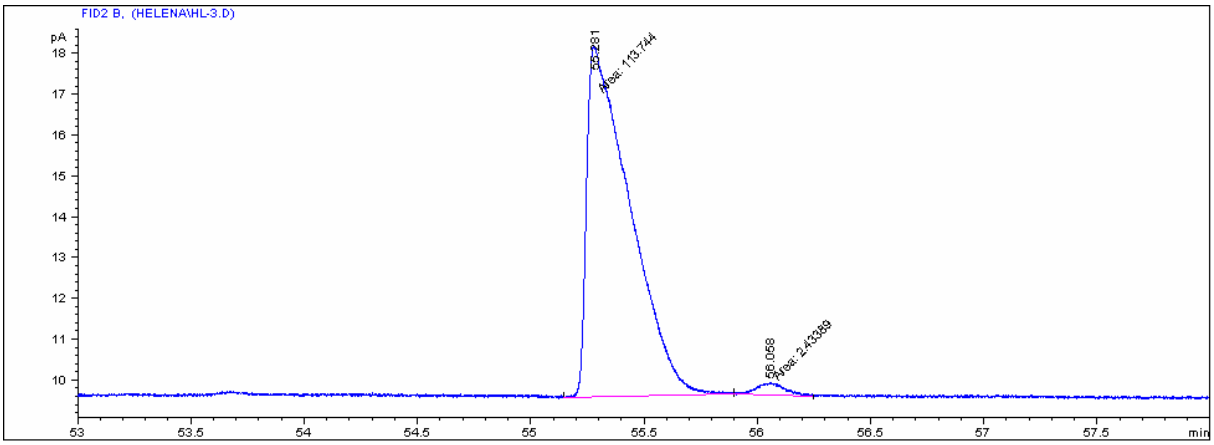


(1*R*)-1-[(Benzyloxy)methyl]-1-ethyl-2-methylpropanol (**1f**, 96 % *ee*)

Determination of the *ee* of **1f** after transformation to the unprotected diol (2*R*)-2-Ethyl-3-methylbuta-1,2-diol. **GC** (column: Chirasil-Dex CB; 60 °C (5 min), 1°/min, 140 °C (20 min)): t_R/min 55.3 (*R*), 55.8 (*S*).

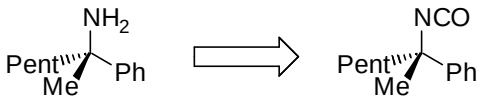




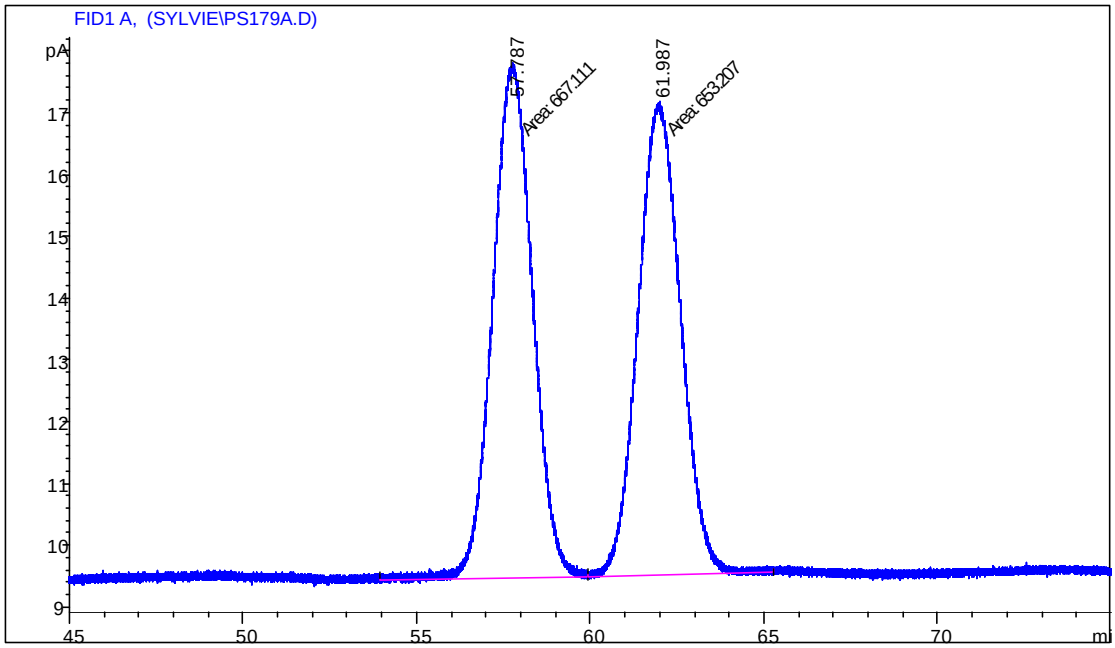


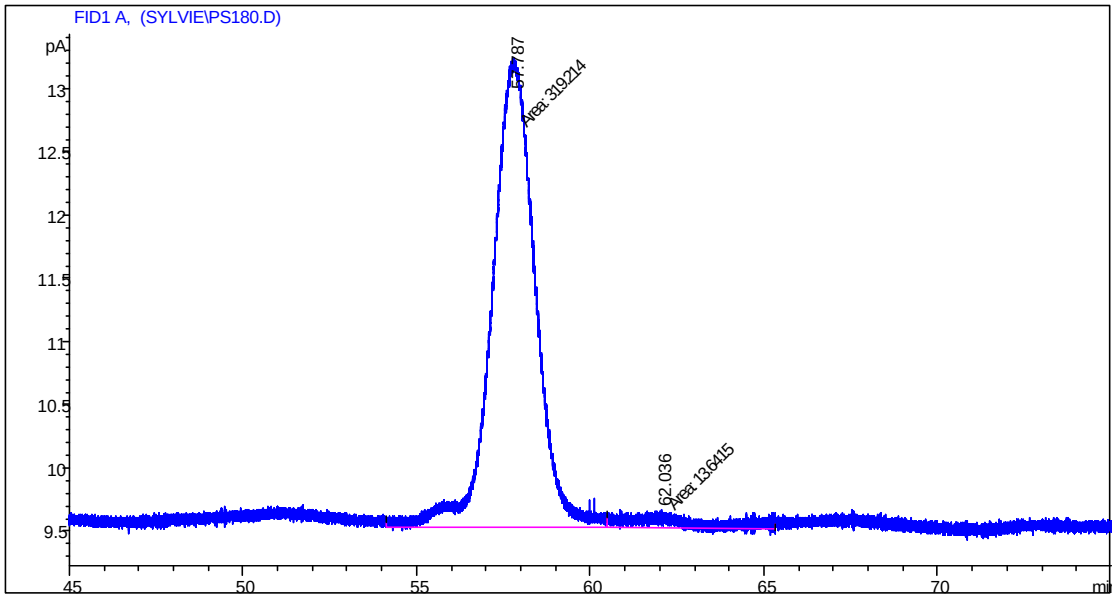
(1*S*)-1-Methyl-1-phenyl-hexylamine (**2a**, 98 % *ee*)

Determination of the *ee* of **2a** from 1-((2*S*)-2-isocyanatoheptan-2-yl)benzene. **GC** (column: Chiraldex B-PH; 100°C const.: t_R/min 57.8 (*S*), 62.0 (*R*).



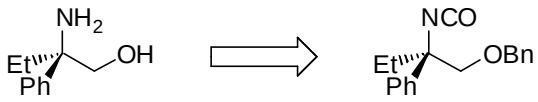
2a



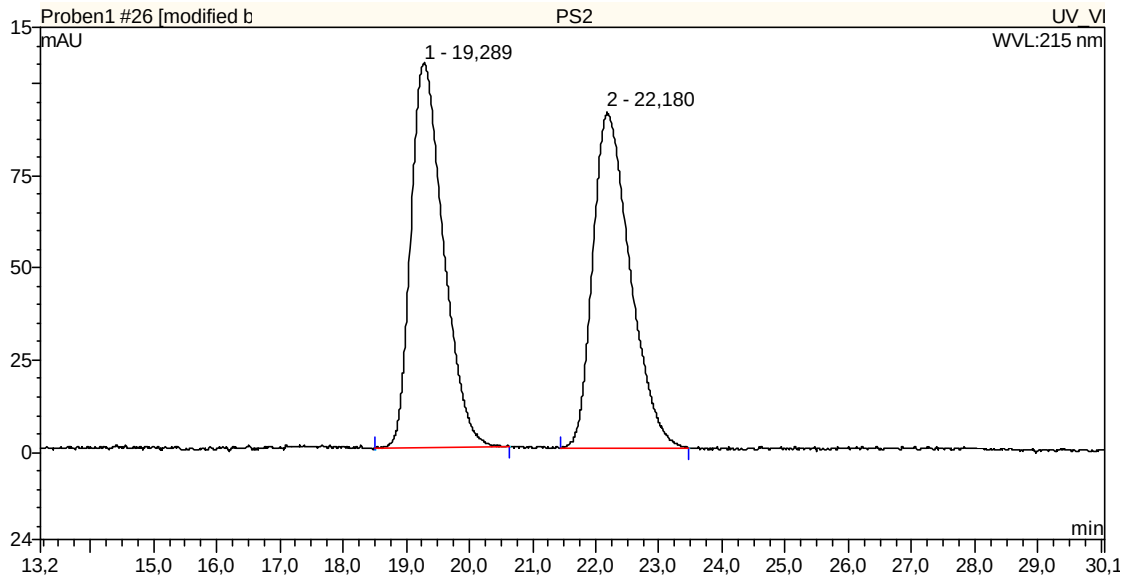


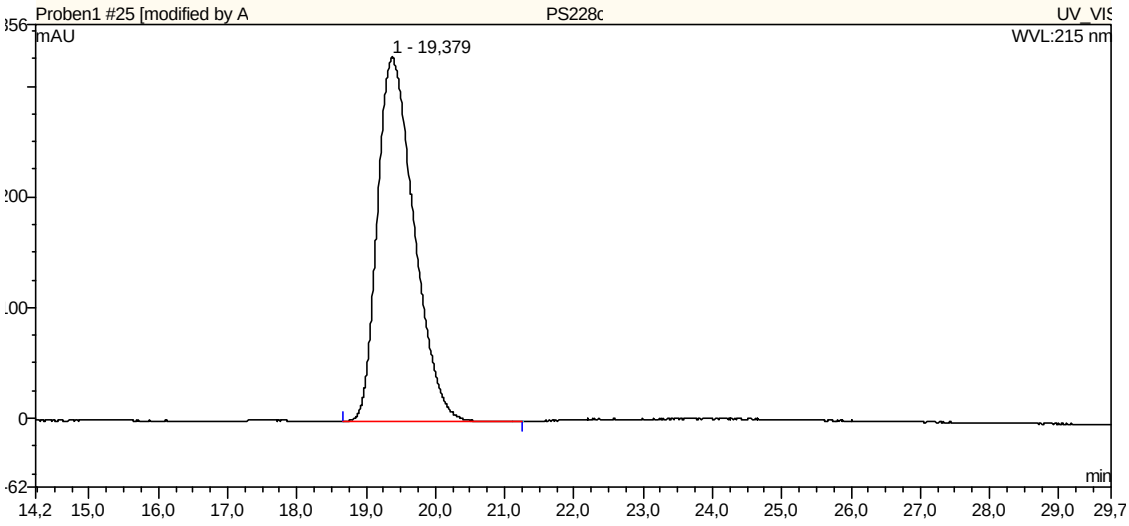
(2*R*)-2-Amino-2-phenyl-butan-1-ol (**2b**, 99 % *ee*)

Determination of *ee* of **2b** from the isocyanate 1-(((2*R*)-2-isocyanato-2-phenylbutoxy)methyl)benzene. **HPLC** (column: AD; Heptane/ *i*-PrOH = 99.5/0.5, 0.3 ml/min): t_R/min 19.4 (*R*), 22.2 (*S*).



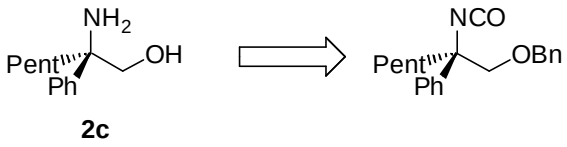
2b



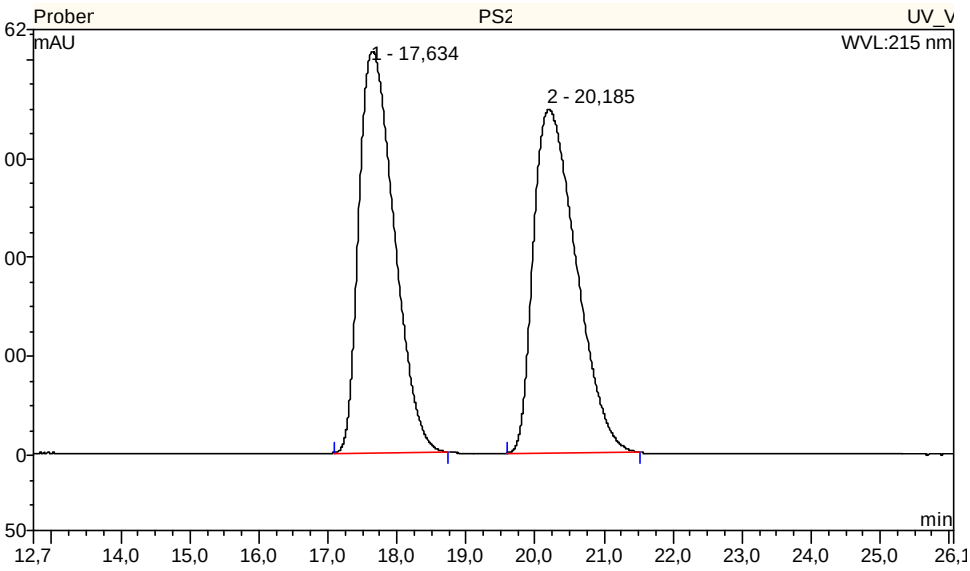


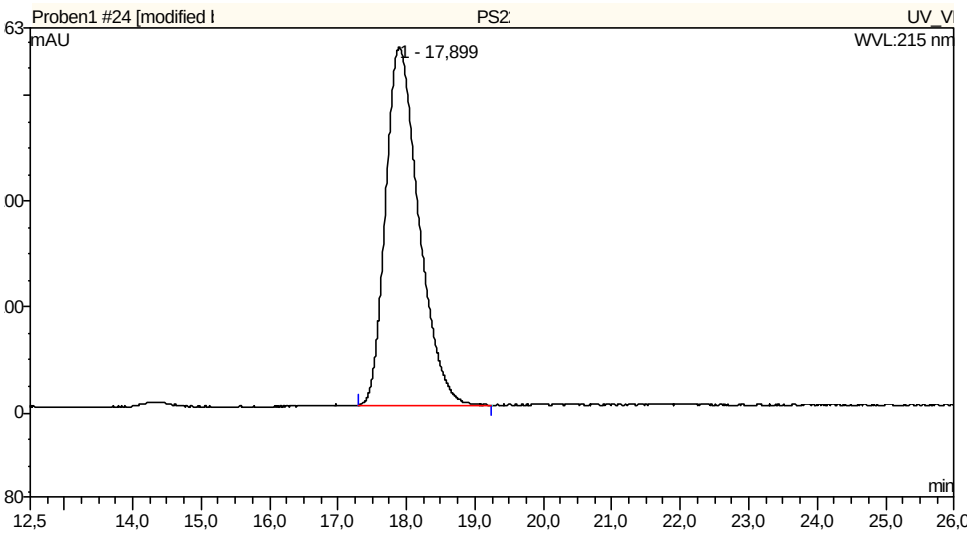
(2*R*)-2-Amino-2-phenyl-heptan-1-ol (**2c**, 99 % *ee*)

Determination of *ee* of **2c** from the isocyanate 1-(((2*R*)-2-isocyanato-2-phenylheptyloxy)methyl)benzene. **HPLC** (column: AD; Heptane/ *i*-PrOH = 99.5/0.5, 0.3 ml/min): t_R/min 17.6 (*R*), 20.2 (*S*).



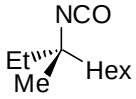
2c

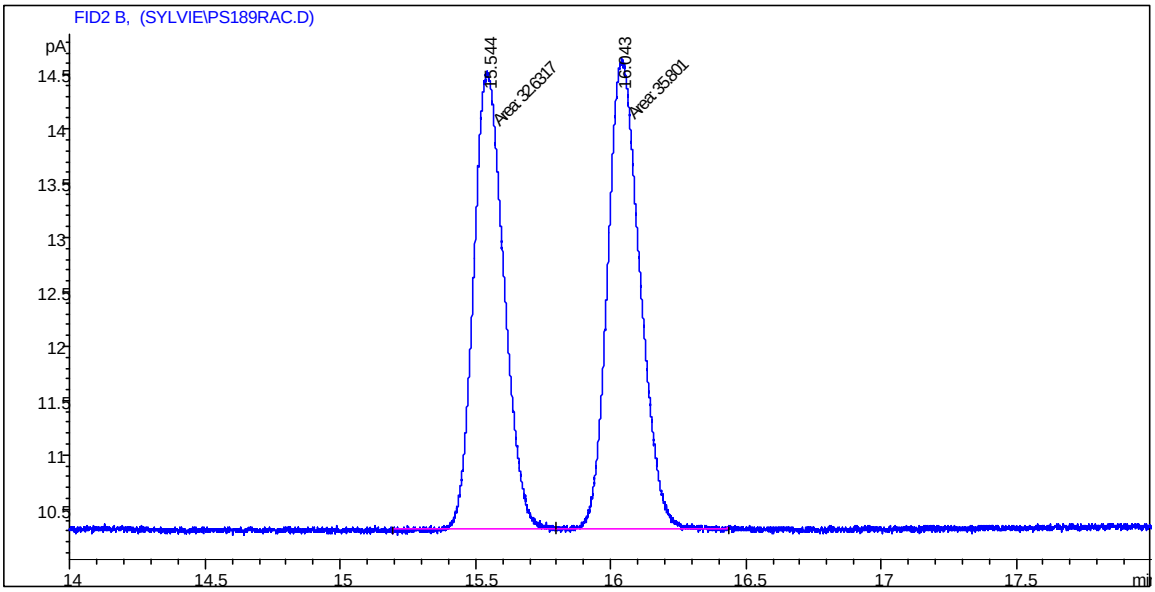


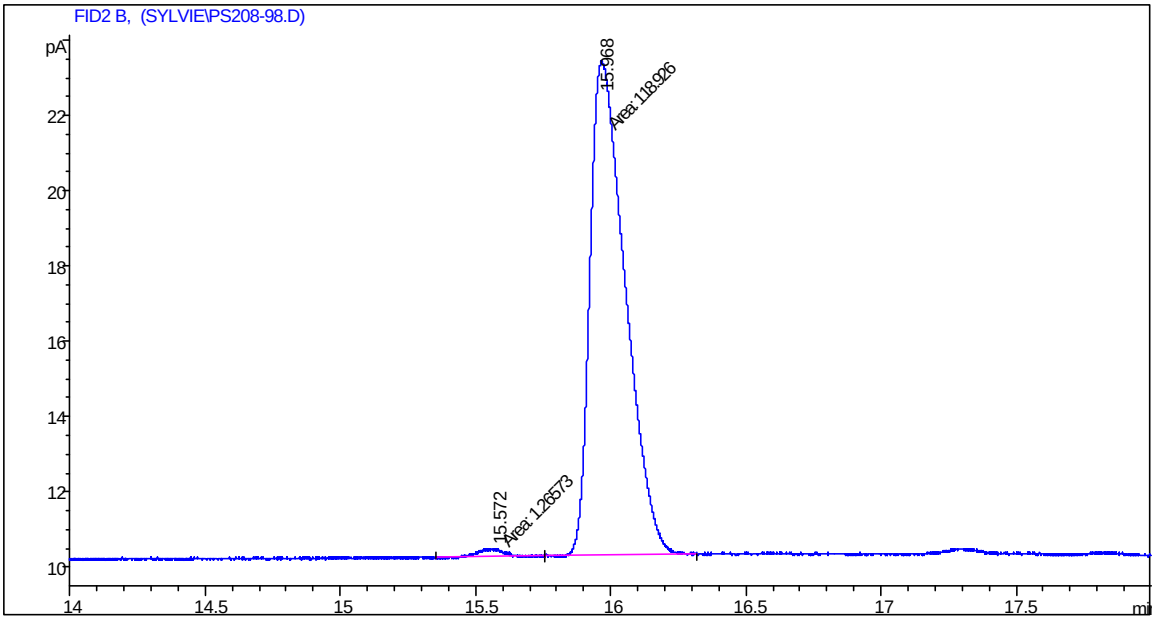


(3*S*)-3-Isocyanato-3-methyl-nonane (**3a**, 98 % *ee*)

GC (column: Chirasil Dex; 90°C const.): t_R/min 15.6 (*R*), 16.0 (*S*).

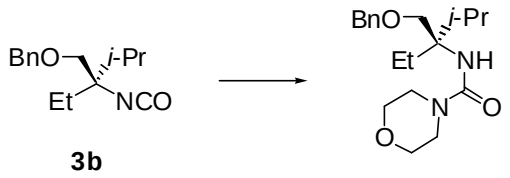




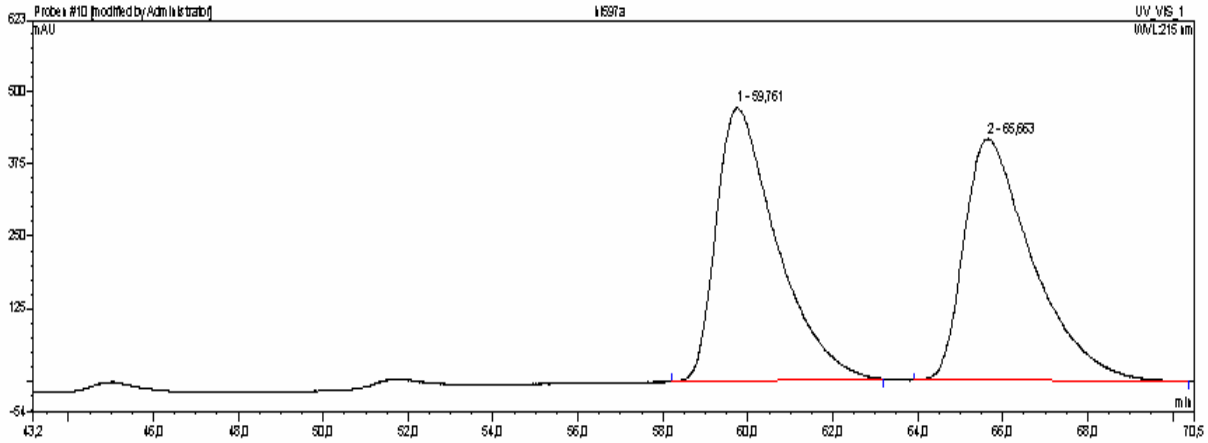


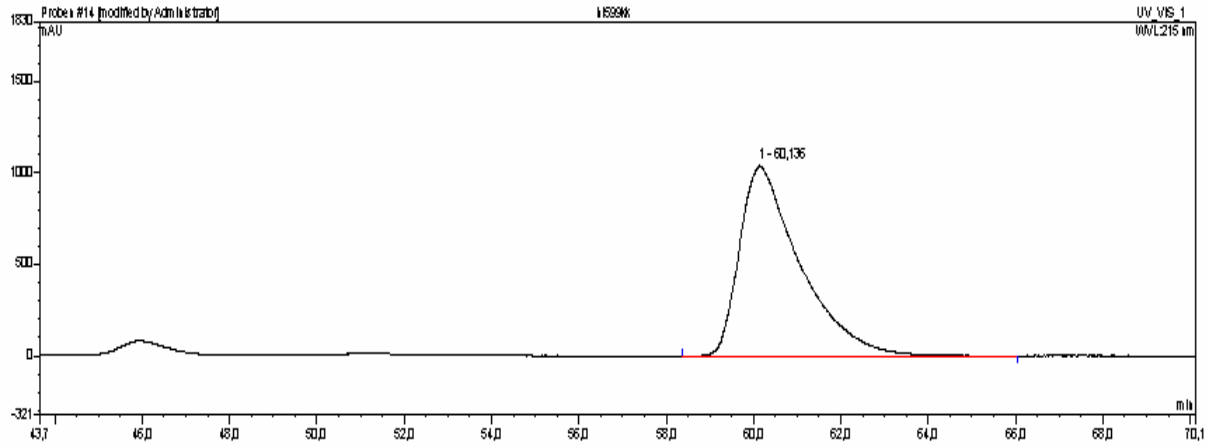
(1*R*)-1-Isocyanato-1-[(benzyloxy)methyl]-1-ethyl-2-methyl-propane (**3b**, 99 % *ee*)

Determination of the *ee* of **3b** after transformation into the urea derivative (1*R*)-*N*-{1-[(benzyloxy)methyl]-1-ethyl-2-methylpropyl}morpholine-4-carboxamide. **HPLC** (column: Chiracel OD; *n*-heptane/*i*-PrOH = 95/5, 0.2 ml/min): t_R/min 59.8 (*R*), 65.7 (*S*).



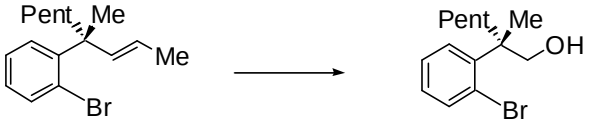
3b



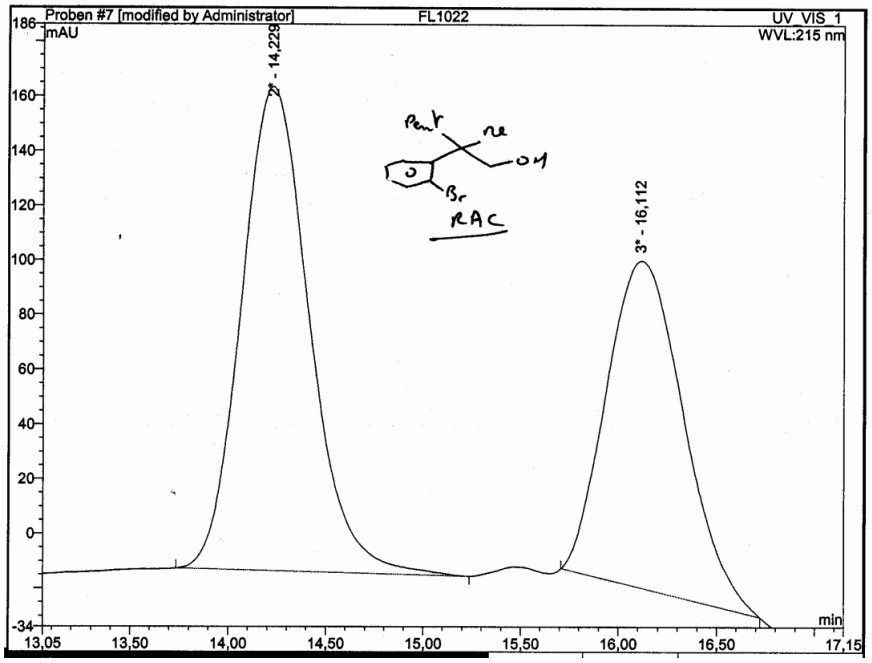


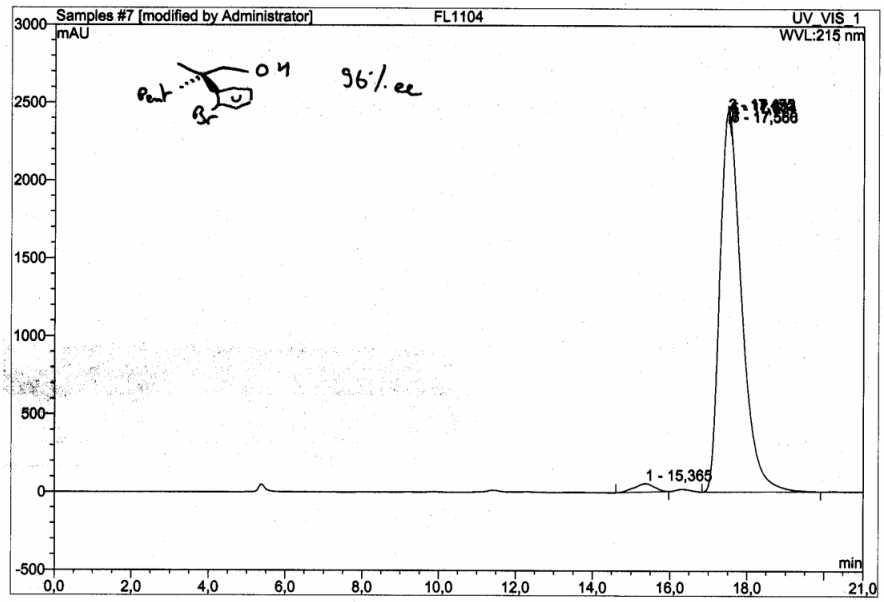
(2*E*,4*R*)-4-(2-Bromophenyl)-4-methyl-non-2-ene (**4a**, 96 % *ee*)

Determination of the *ee* of **4a** after transformation into the alcohol (2*S*)-2-(2-Bromophenyl)-2-methyl-heptan-1-ol. **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 97/3, 0.6 mL/min): t_R/min 14.7 (*R*); 16.8 min (*S*).



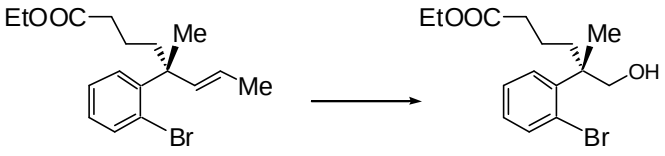
4a



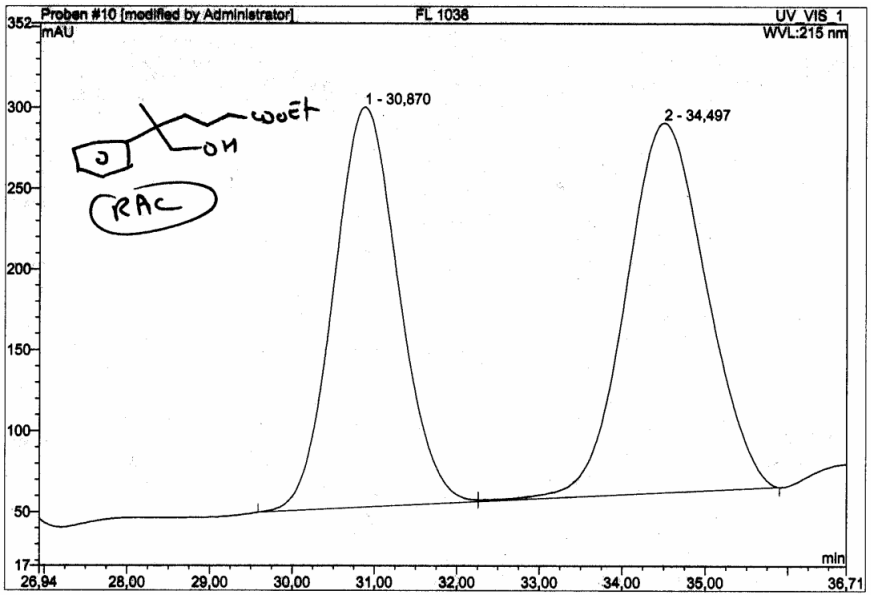


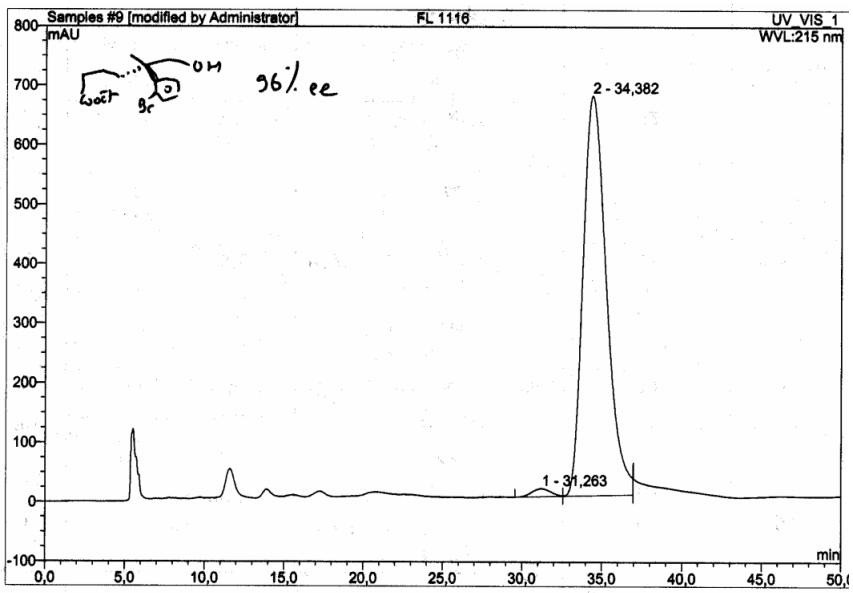
(4*R*,6*E*)-Ethyl-5-(2-bromophenyl)-5-methyl-oct-6-enoate (**4b**, 96 % *ee*)

Determination of the *ee* of **4b** after transformation into the alcohol (2*S*)-5-Ethoxycarbonyl-2-(2-bromophenyl)-2-methyl-pentan-1-ol. **HPLC** (column = OD-H, *n*-heptane/*i*-PrOH, 97/3 = 0.6 mL/min; t_R/min 30.9 min (*R*); 34.5 min (*S*).



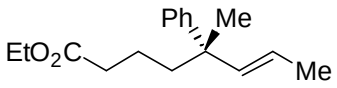
4b

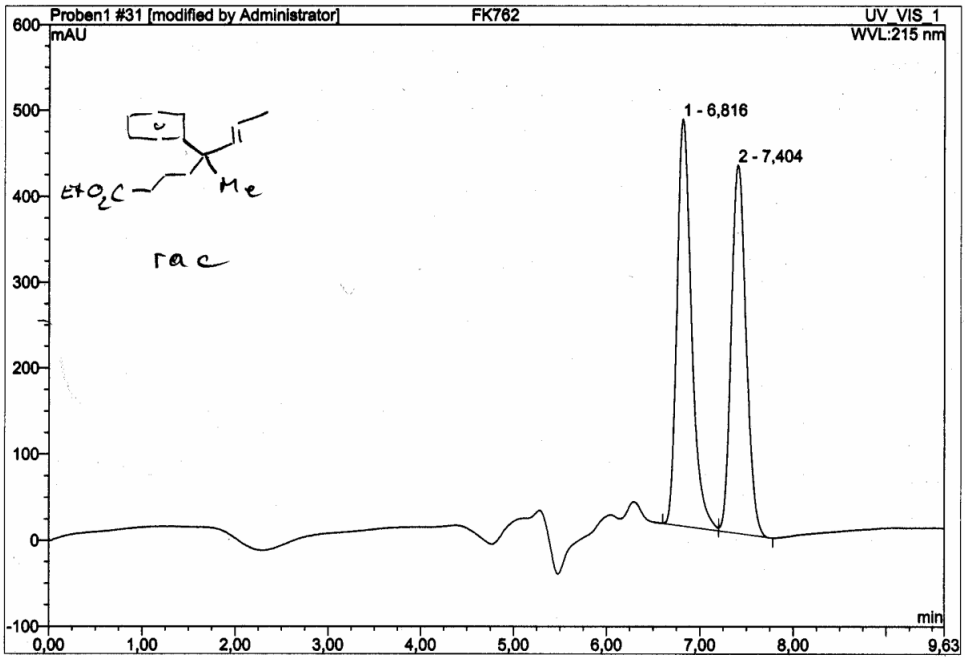


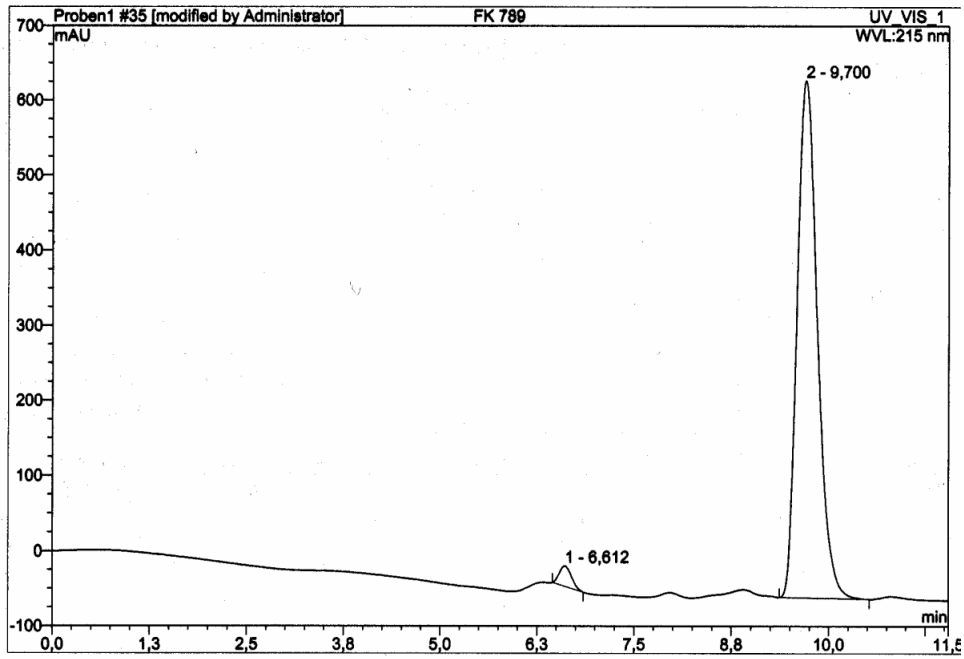


(5*S*,6*E*)-5-Methyl-5-phenyl-6-octenoic acid ethylester (**4c**, 96 % *ee*)

HPLC (column: OD-H; *n*-heptane/*i*-PrOH = 97/3, 0.5 ml/min): t_R/min 6.6 (*S*), 9.7 (*R*).



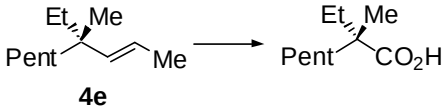




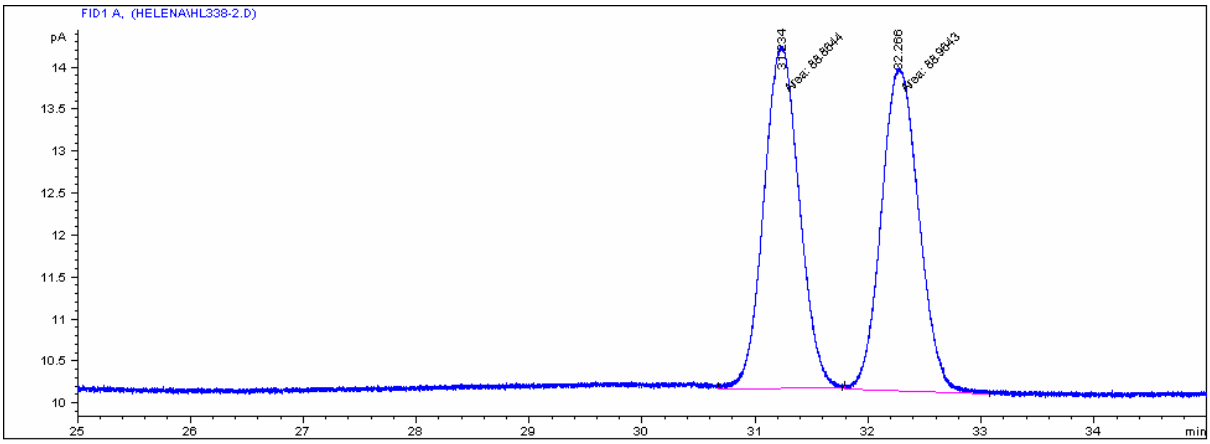
(2*E*,4*S*)-4-Ethyl-4-methyl-2-nonene (**4e**, 96 % *ee*)

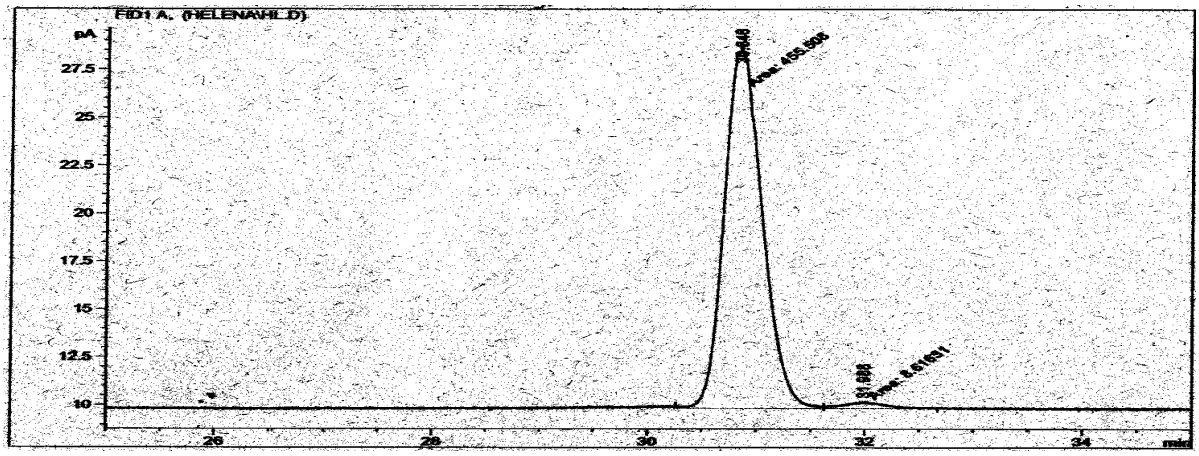
Determination of the *ee* of **4e** after transformation into (2*S*)-2-ethyl-2-methylheptanoic acid.

GC (column: Chiraldex B-PH; 130 °C): t_R/min 31.2 (*S*), 32.3 (*R*).



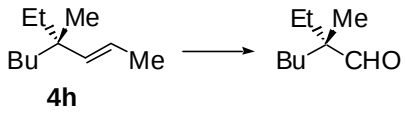
4e



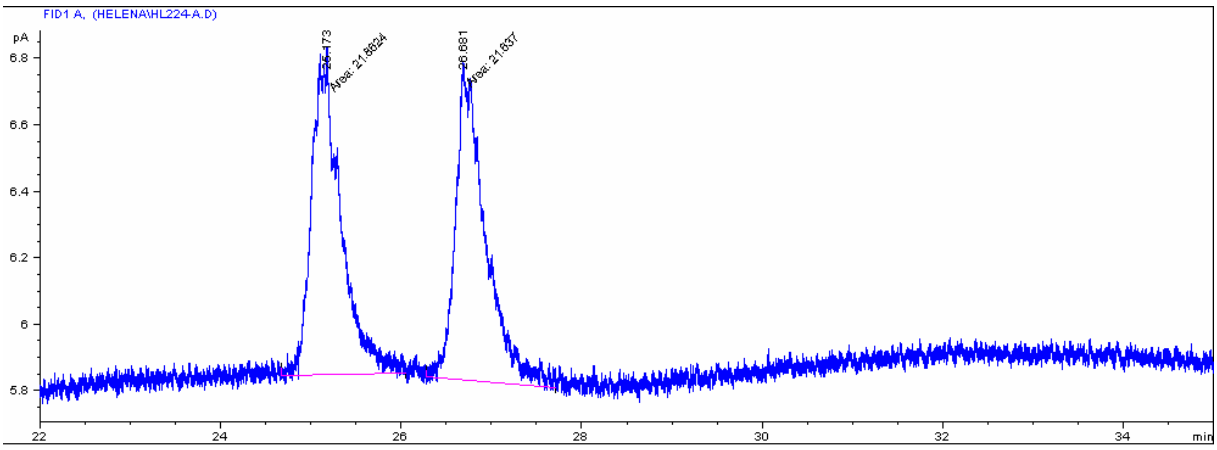


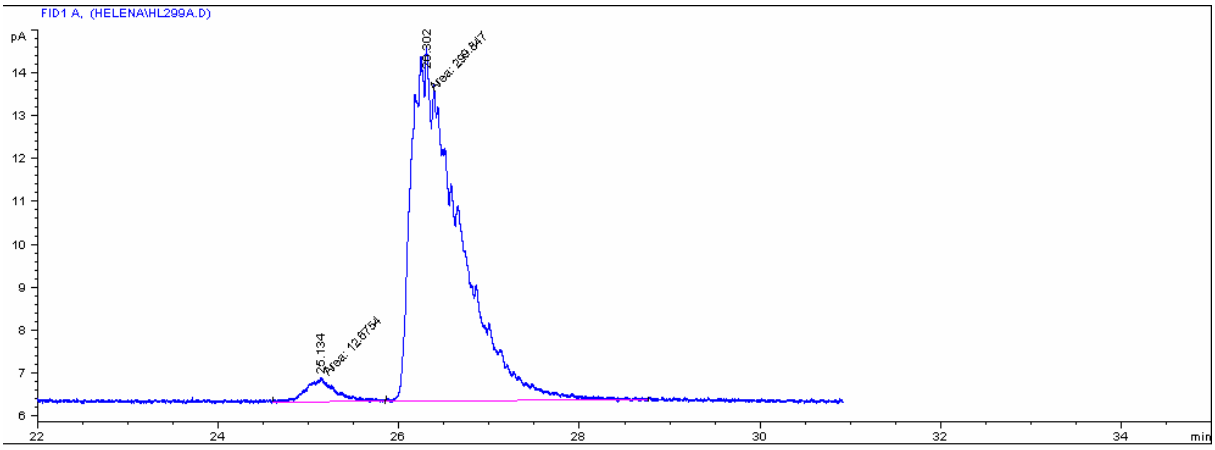
(2*E*,4*S*)-4-Ethyl-4-methyl-2-octene (**4h**, 90 % *ee*)

Determination of the *ee* of **4h** after transformation into the aldehyde (2*S*, 2*E*)-4-ethyl-4-methyloct-2-enal. **GC** (column: TFA-γ-Cyclodextrin; 50 °C): t_R/min 25.1 (*R*), 26.3 (*S*).



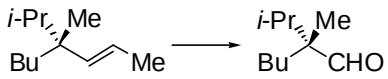
4h



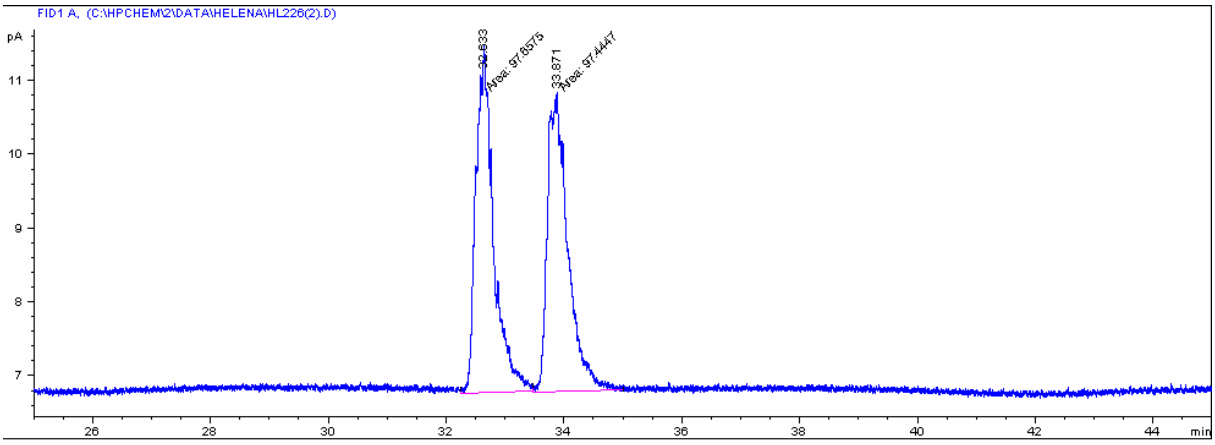


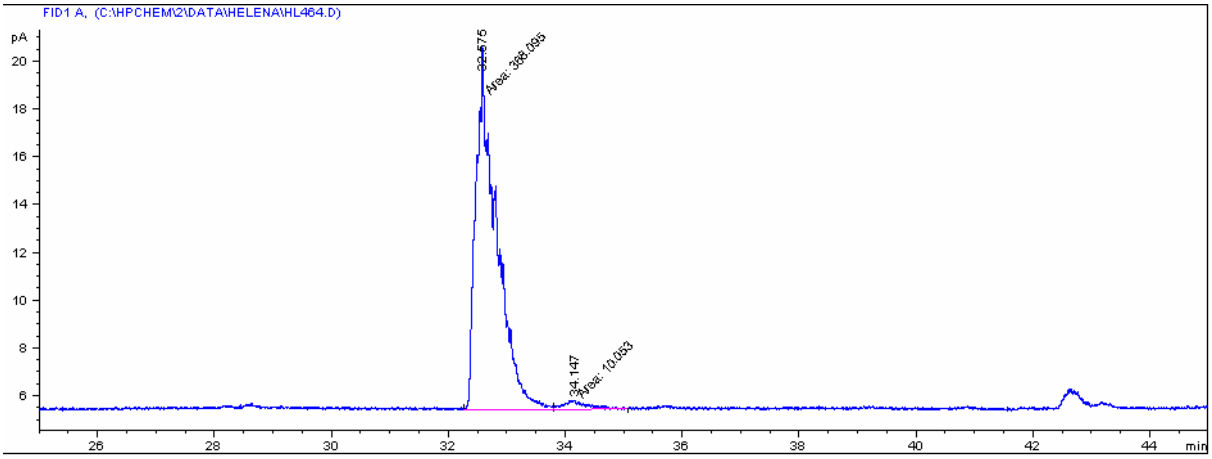
(2*E*,4*R*)-4-Isopropyl-4-methyl-2-octene (**4i**, 95 % *ee*)

Determination of the *ee* of **4i** after transformation into the aldehyde (2*R*)-2-isopropyl-2-methylhexanal. **GC** (column: TFA-γ-Cyclodextrin; 50 °C (5 min), 0.5 °/min, 140 °C (20 min)): t_R/min 32.6 (*R*), 33.9 (*S*).



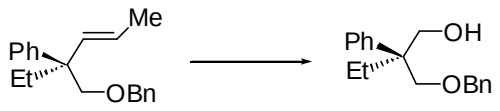
4i



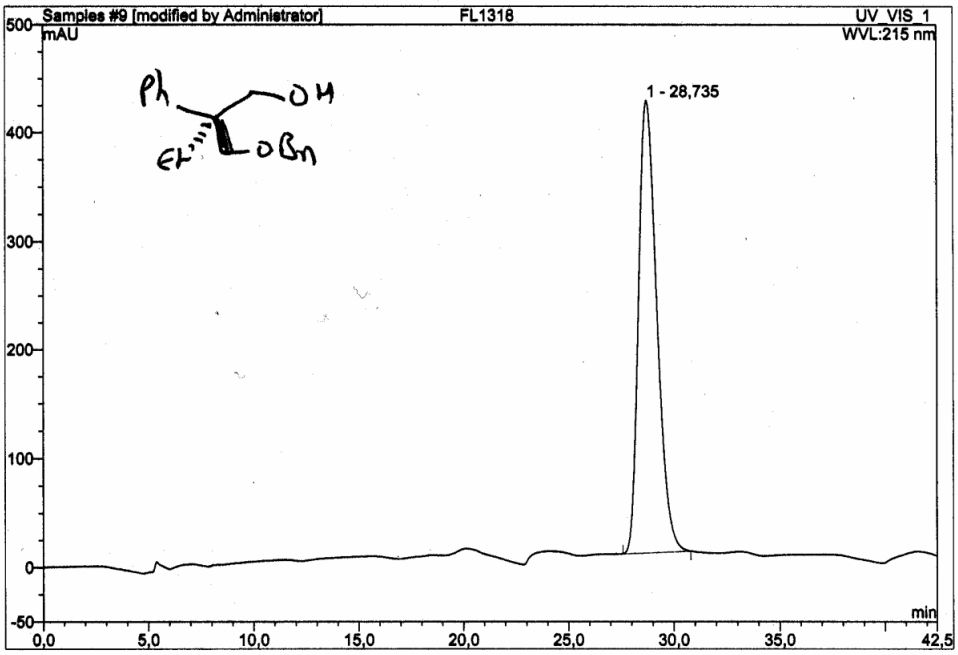


(2*E*,4*R*)-4-Benzyloxymethyl-4-phenyl-hex-2-ene (**4j**, 99 % *ee*)

Determination of the *ee* of **4j** after transformation to the alcohol (2*S*)-2-benzyloxymethyl-2-phenyl-butan-1-ol. **HPLC** (column: OD-H, *n*-heptane/*i*-Pr; 97/3, 0.6 mL/min): t_R/min 28.7 min (*S*); 34.5 min (*R*) (for a racemic sample, see **4k**).

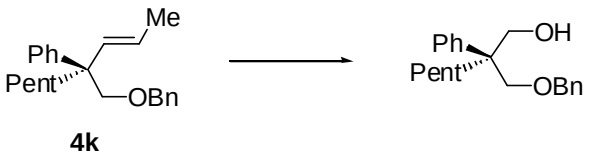


4j

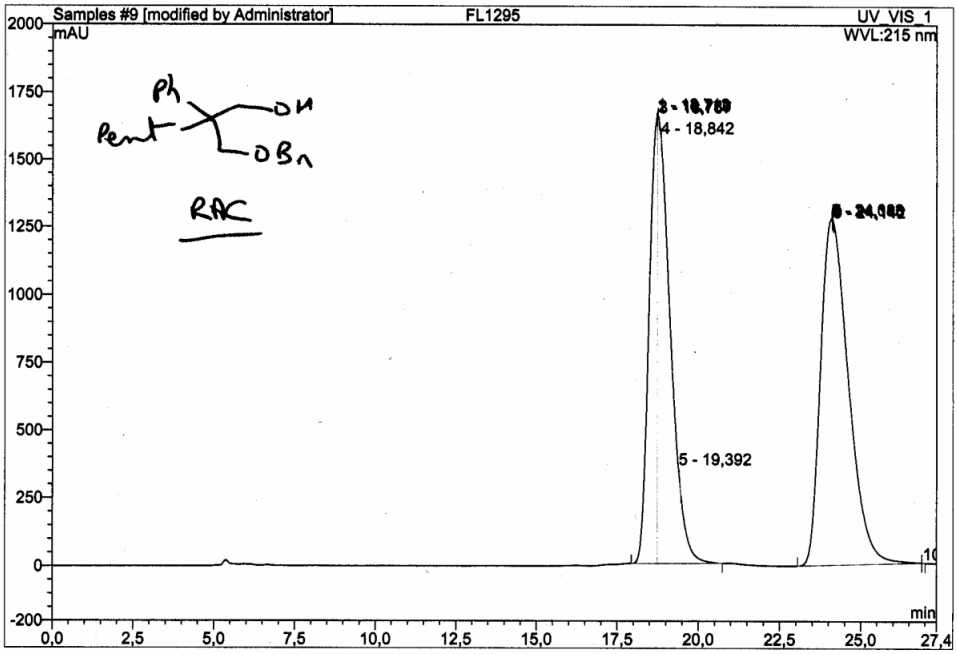


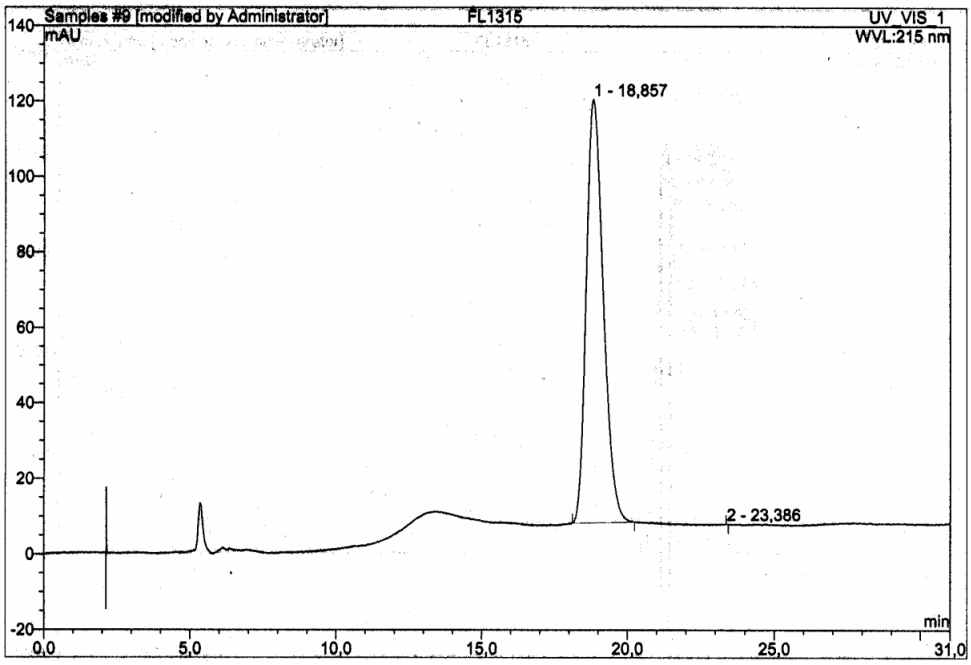
(2*E*,4*R*)-4-Benzyloxymethyl-4-phenyl-non-2-ene (**4k**, 99 % *ee*)

Determination of the *ee* of **4k** after transformation into the alcohol (2*S*)-2-benzyloxymethyl-2-phenyl-heptan-1-ol. **HPLC** (column: OD-H, *n*-heptane/*i*-Pr = 97/3, 0.6 mL/min): t_R/min 18.8 (*R*), 24.1 (*S*))



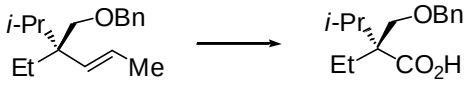
4k



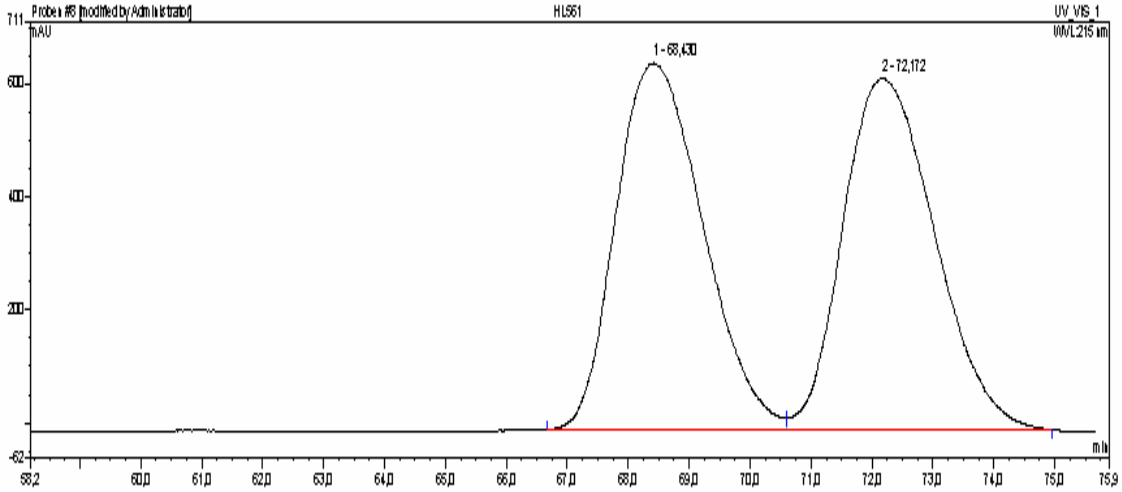


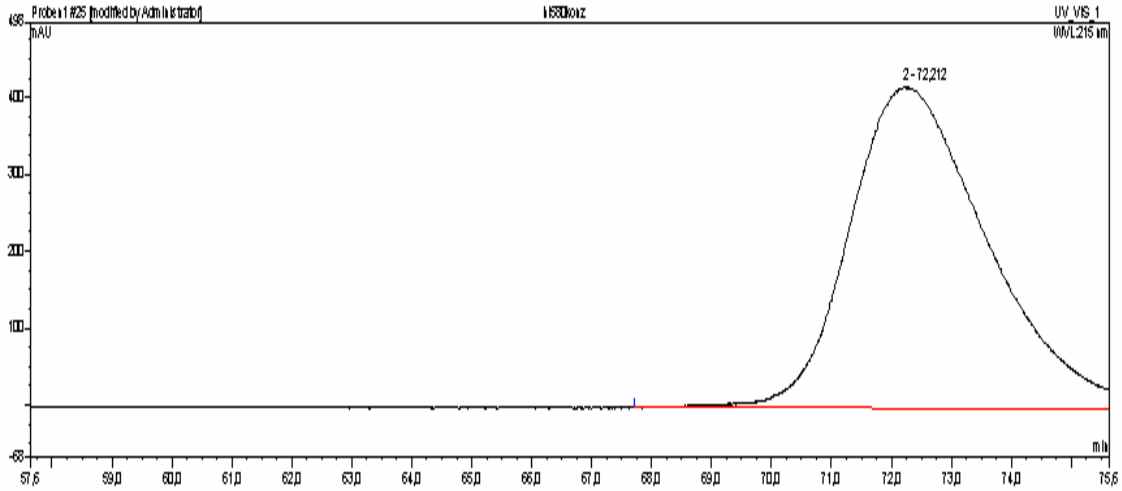
(2*E*,4*S*)-4-[(Benzyloxy)methyl]-4-ethyl-5-methyl-2-hexene (**4l**, 99 % *ee*)

Determination of the *ee* of **4l** after transformation into (2*R*)-2-[(benzyloxy)methyl]-2-ethyl-3-methylbutanoic acid (**13e**). **HPLC** (column: Chiracel OD-H; *n*-heptane/*i*-PrOH = 99/1, 0.2 ml/min): t_R/min 68.4 (*S*), 72.2 (*R*).



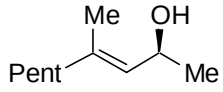
4l **13e**

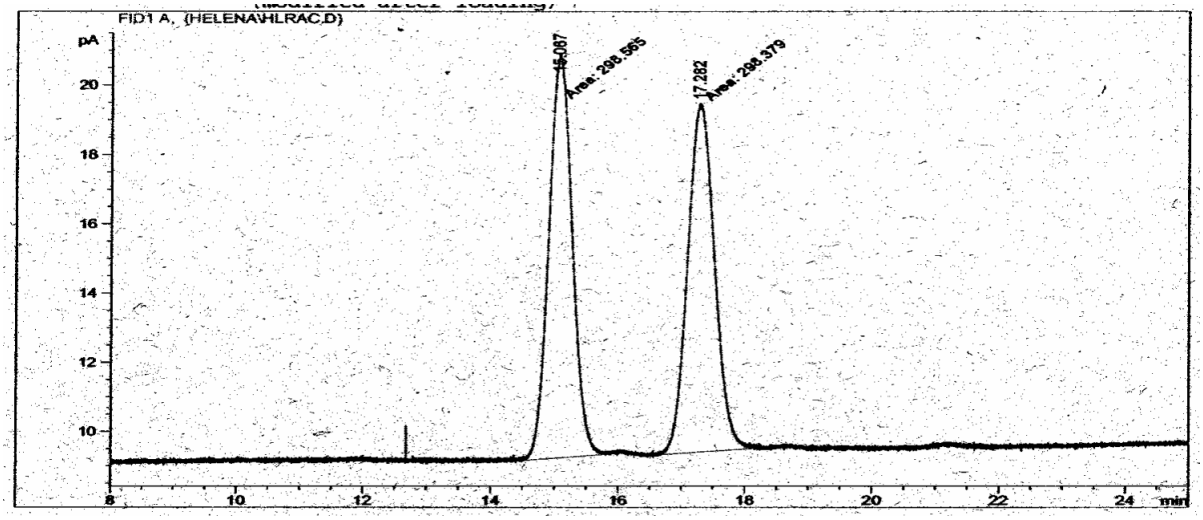


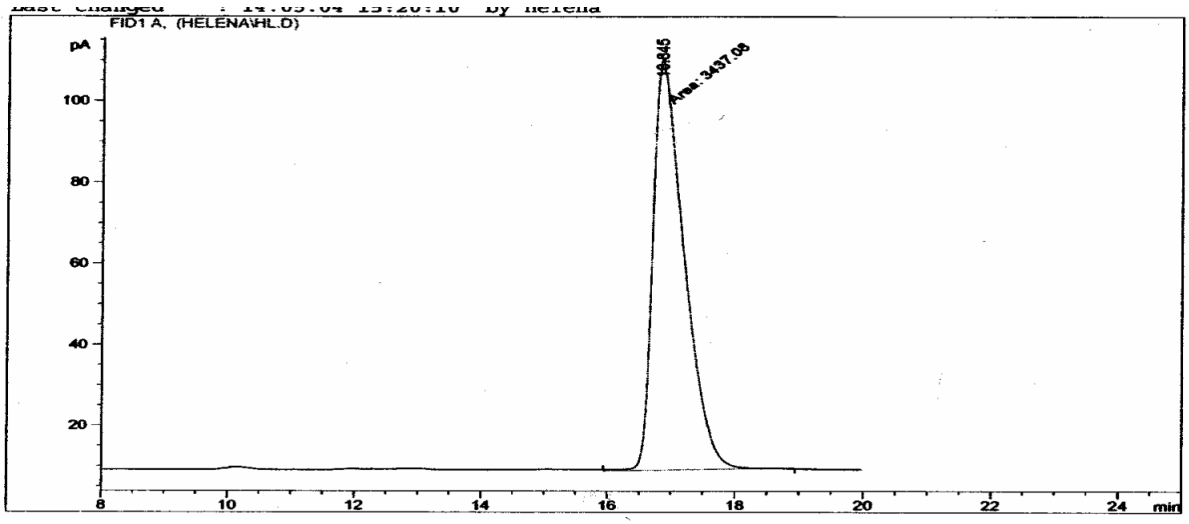


(2*S*,3*E*)-4-Methyl-3-nonen-2-ol (**6c**, 99 % *ee*)

GC (column: Chiraldex B-PH, 100 °C): t_R/min 15.1(*R*), 17.3 (*S*).

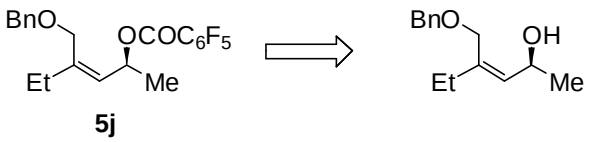




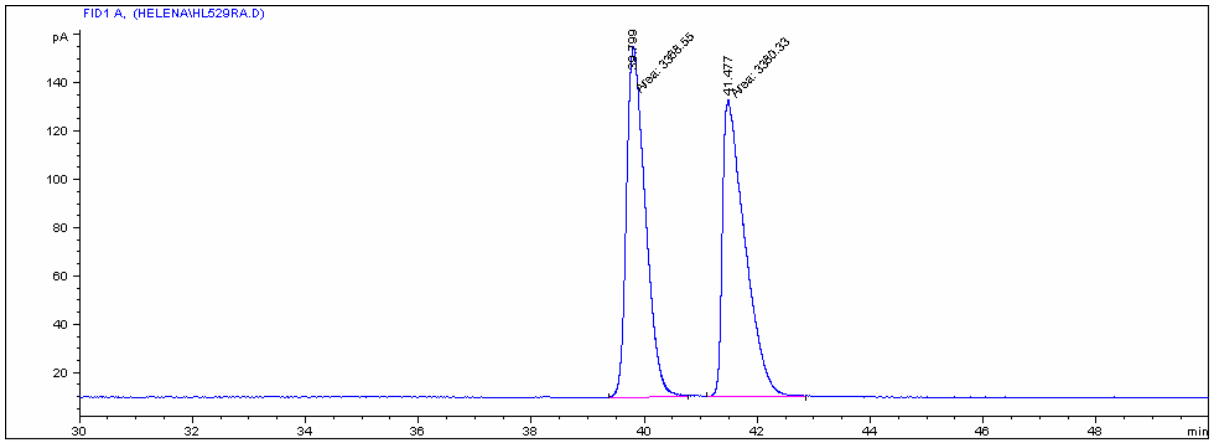


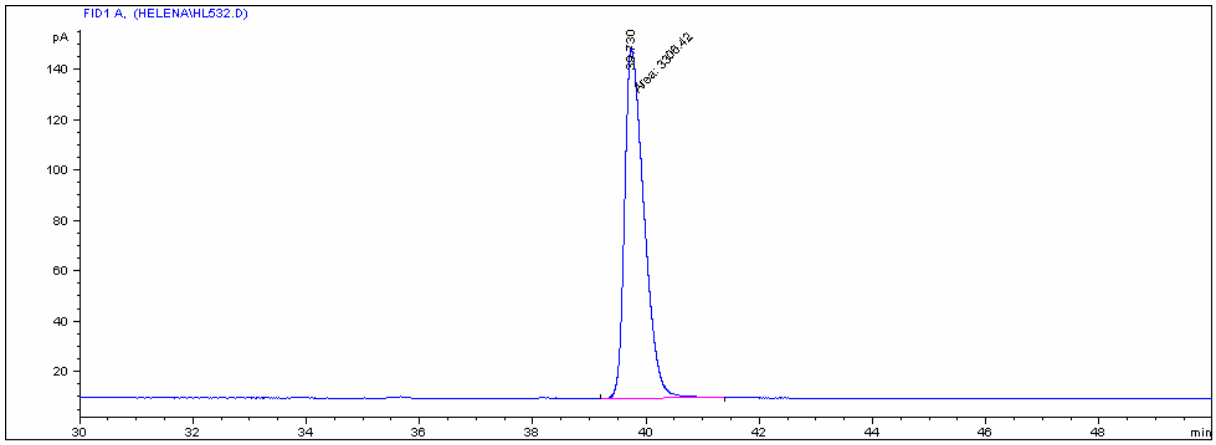
(2*S*,3*Z*)-4-[(Benzyloxy)methyl]-3-hexen-2-ylpentafluorobenzoate (**5j**, 99 % *ee*)

Determination of the *ee* of **5j** with the allylic alcohol (2*S*,3*Z*)-4-[(benzyloxy)methyl]-3-hexen-2-ol. **GC** (column: Chiraldex B-PH; 150 °C): t_R/min 39.8 (*S*), 41.5 (*R*).



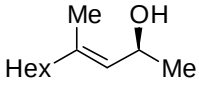
5j

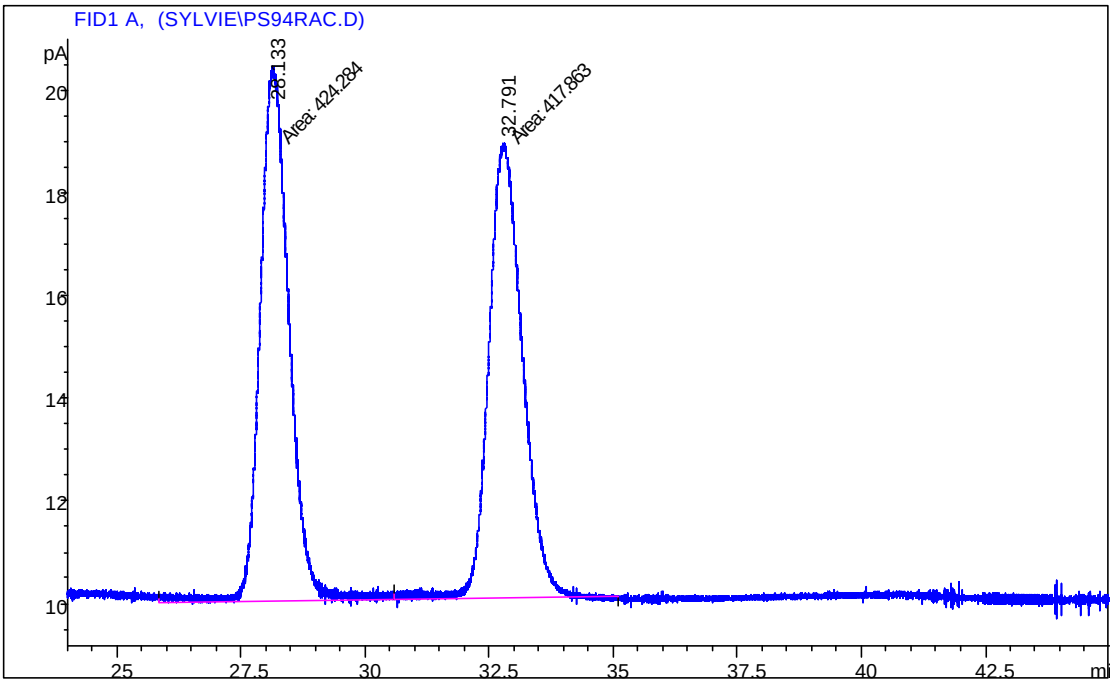


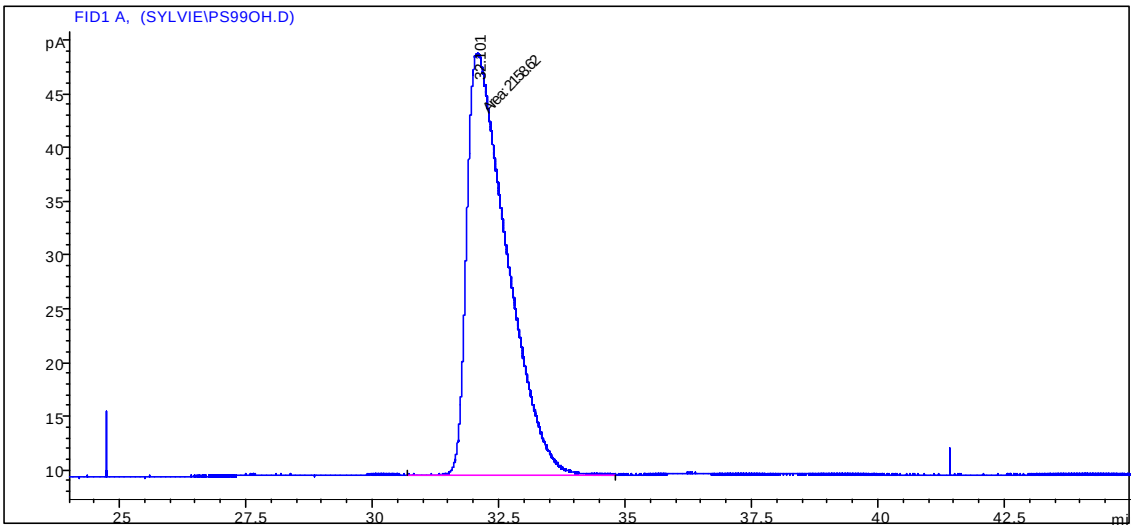


(2*S*,3*E*)-4-Methyldec-3-en-2-ol (**6d**, 99 % *ee*)

GC (column: Chiraldex B-PH ; 100°C const.): t_R/min 28.1 (*R*), 32.8 (*S*).

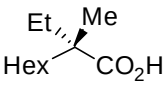


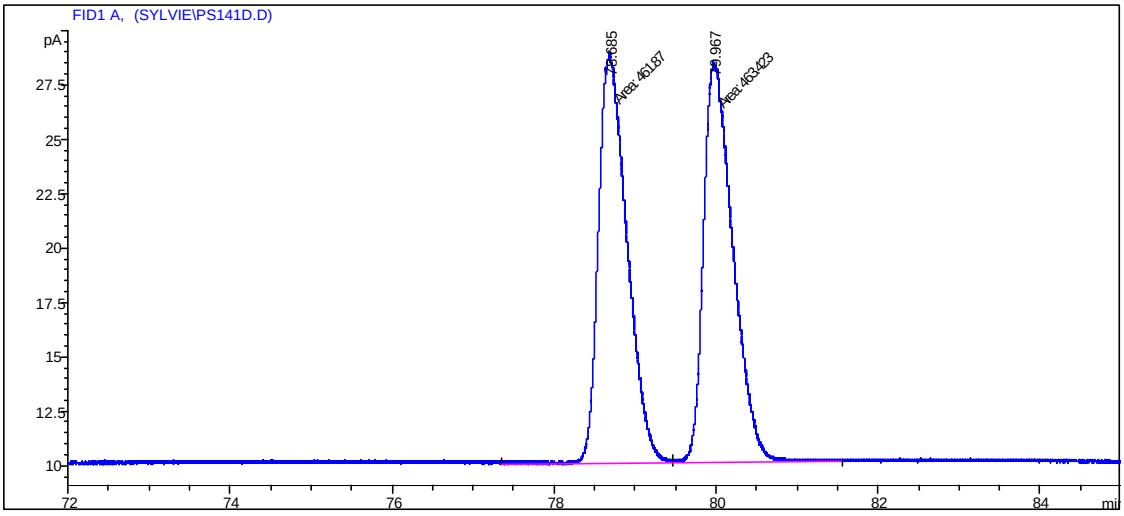


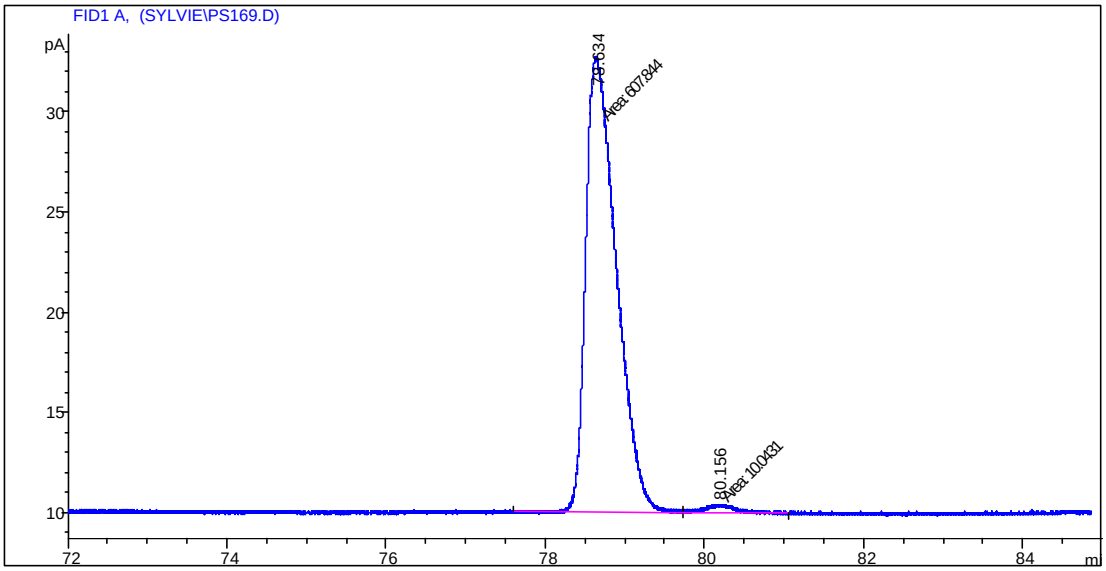


(2*S*)-2-Ethyl-2-methyloctanoic acid (**13b**, 98 % *ee*)

GC (column: Chiraldex B-PH; 120°C (60 min), 1°/min, 140°C (15 min)): t_R/min 78.7 (*S*), 80.0 (*R*).

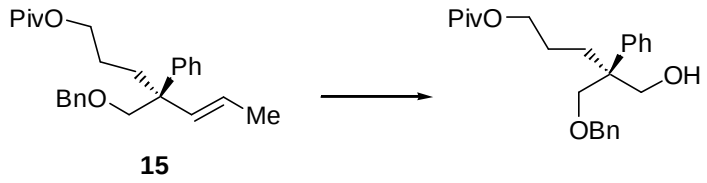




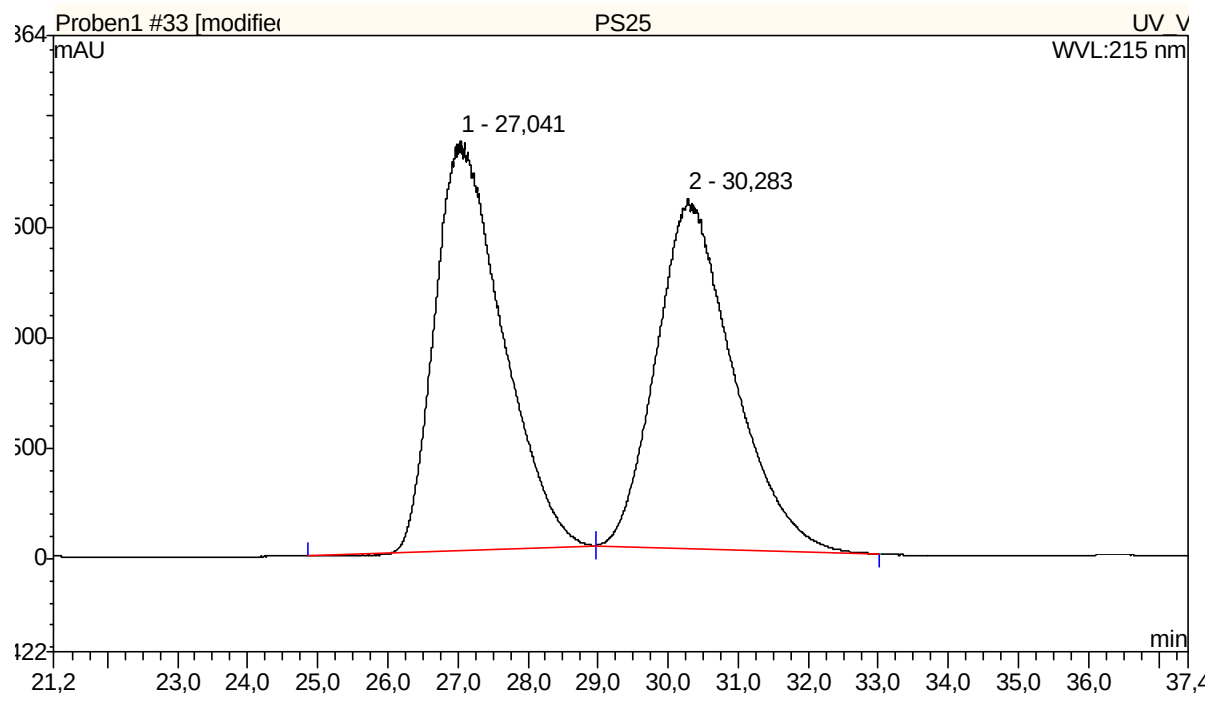


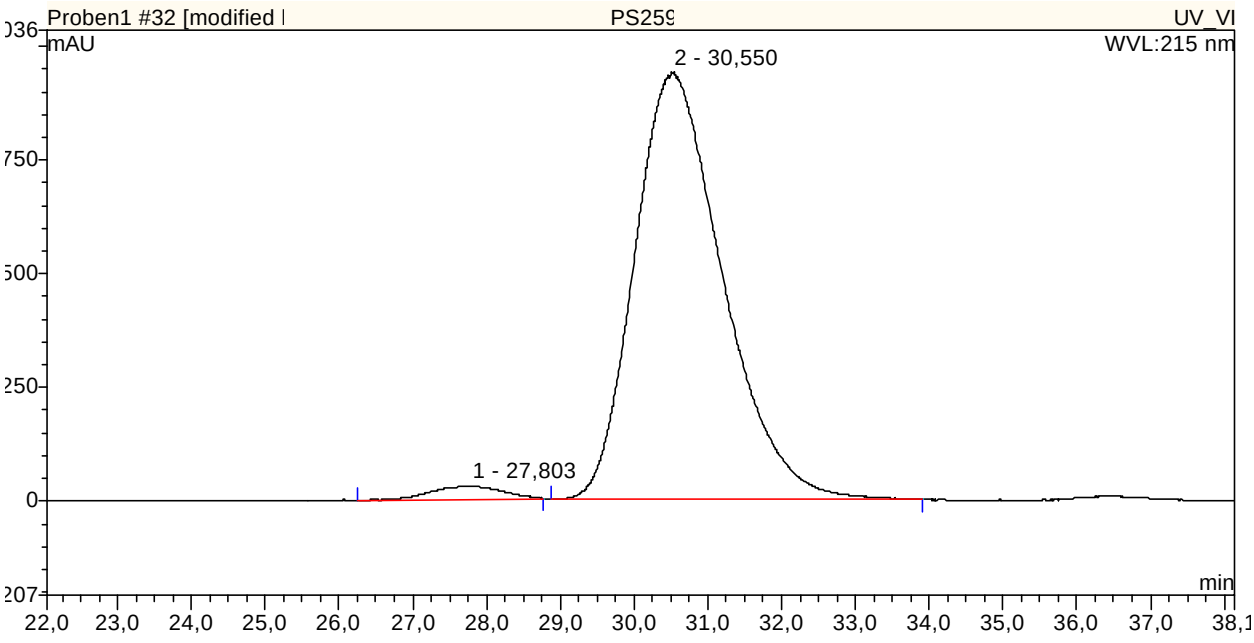
(2*E*,4*R*)-4-((Benzyloxy)methyl)-4-phenylhept-5-enyl pivalate (**15**, 98 % *ee*)

Determination of the *ee* of **15** after transformation into (4*S*)-4-((benzyloxy)methyl)-5-hydroxy-4-phenylpentyl pivalate. **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 95/5, 0.6 ml/min): t_R/min 27.8 (*R*), 30.5 (*S*).



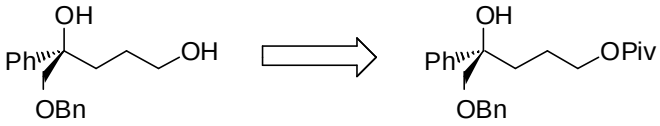
15



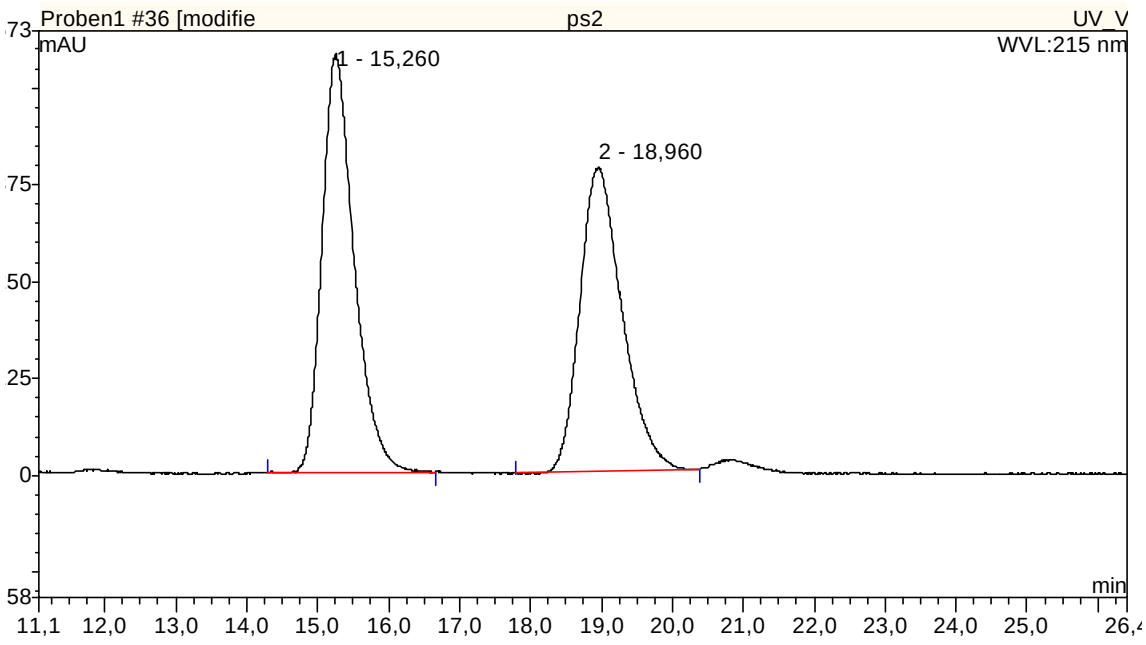


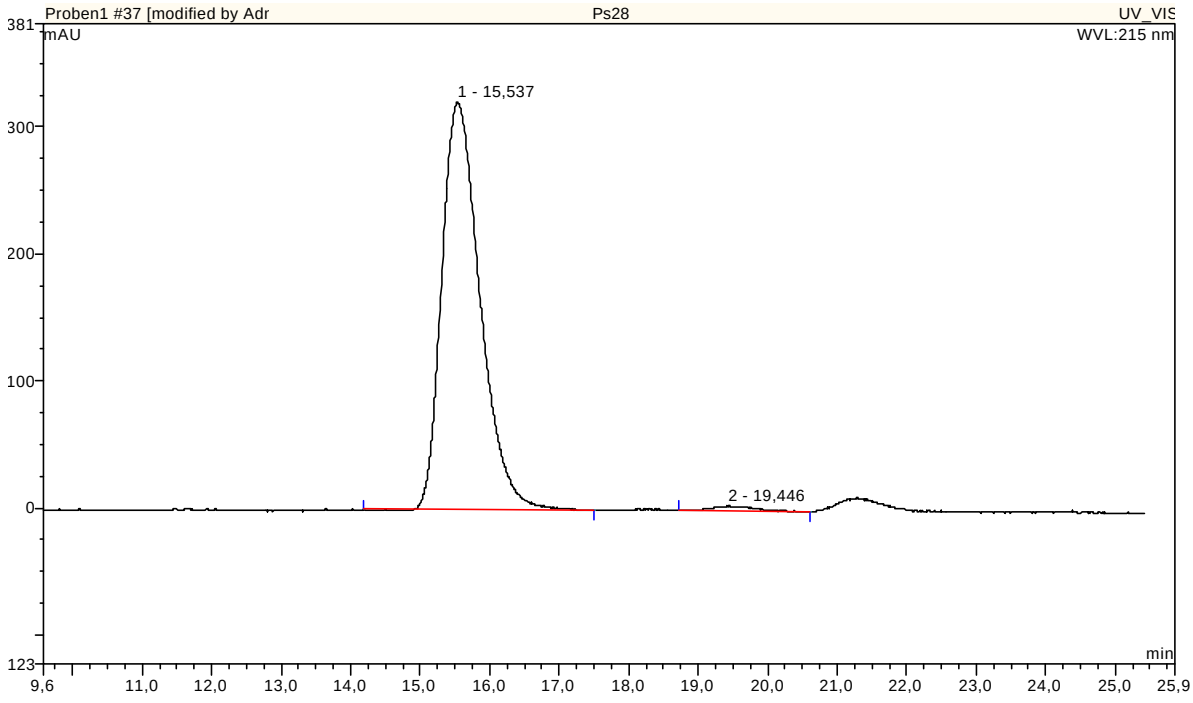
(4*R*)-5-(Benzyloxy)-4-phenylpentane-1,4-diol (**17**, 98 % *ee*)

Determination of the *ee* of **17** from the pivalate (4*R*)-5-(benzyloxy)-4-hydroxy-4-phenylpentyl pivalate. **HPLC** (column: OD-H; *n*-heptane/*i*-PrOH = 95/5, 0.6 ml/min): t_R/min 15.5 (*R*), 19.4 (*S*).



17





Literature:

[1] J. A. Marshall, S. Xie, *J. Org. Chem.* **1995**, *60*, 7230-7237.

[2] According to: a) K. Burgess, L. D. Jennings, *J. Am. Chem. Soc.* **1991**, *113*, 6129. b) U. Kazmaier, F. L. Zumpe, *Eur. J. Org. Chem.* **2001**, *21*, 4067.

[3] J.-F. Betzer, F. Delaloge, B. Muller, A. Pancrazi, J. Prunet, *J. Org. Chem.* **1997**, *62*, 7768.

[4] a) H. X. Zhang, F. Guibé, G. Balavoine, *J. Org. Chem.* **1990**, *55*, 1857; b) S. Braune, M. Pohlman, U. Kazmaier, *J. Org. Chem.* **2004**, *69*, 468; c) S. Braune, U. Kazmaier, *Angew. Chem. Int. Ed.* **2003**, *42*, 306; d) J. Mancuso, M. Lautens, *Org. Lett.* **2003**, *5*, 1653; e) N. D. Smith, J. Mancuso, M. Lautens, *Chem. Rev.* **2000**, *100*, 3257.

[5] a) E. Negishi, L. F. Valente, M. Kobayashi, *J. Am. Chem. Soc.* **1980**, *102*, 3298; b) M. Kobayashi, E. Negishi, *J. Org. Chem.* **1980**, *45*, 5223; c) E. Negishi, *Acc. Chem. Res.* **1982**, *15*, 340; d) Y. Tamaru, H. Ochiai, T. Nakamura, Z. Yoshida, *Tetrahedron Lett.* **1986**, *27*, 955; e) I. Klement, M. Rottländer; C. E. Tucker, T. N. Majid, P. Knochel, P. Venegas, G. Cahiez, *Tetrahedron* **1996**, *52*, 7201. f) H. Matsushita, E. Negishi, *J. Org. Chem.* **1982**, *47*, 4161.

[6] N. Harrington-Frost, H. Leuser, M. I. Calaza, F. F. Kneisel, P. Knochel, *Org. Lett.* **2003**, *5*, 2111.

[7] a) O. Lorenz, C. R. Parks, *J. Org. Chem.* **1965**, *30*, 1976. b) D. P. Higley, R. W. Murray, *J. Am. Chem. Soc.* **1976**, *98*, 4526. c) J. L. Belelie, J. M. Chong, *J. Org. Chem.* **2001**, *66*, 5552.

[8] a) I. M. Godfrey, M. V. Sargent, J. A. Elix, *J. Chem. Soc., Perkin Trans. 1*, **1974**, 1353; b) P. F. Hudelik, G. Nagendrappa, T. Yimenu, E. T. Zeller, E. Chin, *J. Am. Chem. Soc.* **1980**, *102*, 6894.

[9] a) T. Shiori, K. Ninomiya, S. Yamada, *J. Am. Chem. Soc.* **1972**, *94*, 6203; b) J. M. Elliott, M. Jason, J. L. Castro, G. G. Chicchi, L. C. Cooper, K. Dinnell, G. J. Hollingworth, M. P. Ridgill, W. Rycroft, M. M. Kurtz, D. E. Shaw, C. J. Swain, K.-L. Tsao, L. Yang, *Bioorg. Med. Chem. Lett.* **2002**, 12, 1755.

[10] F. Liron, M. Gervais, J.-F. Peyrat, M. Alami, J.-D. Brion, *Tetrahedron Lett.* **2003**, *44*, 2789.

[11] The allylic alcohol is assumed to have (*S*)-configuration due to confirmed results with the same enzyme Amano lipase AK in the enzymatic resolution of known substrates; see: R. J. Kazlauskas, A. N. E. Weissfloch, A. T. Rappaport, L. A. Cuccia, *J. Org. Chem.* **1991**, *56*, 2656-2665.

[12] W. Adam, P. Klug, *Synthesis* **1994**, 567.

[13] J. Suffert, D. Toussaint, *J. Org. Chem.* **1995**, *60*, 3550.