

## Supporting Information for

### Use of alkyl 2,4,6-triisopropylbenzoates in the asymmetric homologation of challenging boronic esters.

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## 1. General information

All required fine chemicals were used directly without purification unless mentioned. Compounds lacking experimental details were prepared according to the literature as cited and are in agreement with published spectra. All air- and water-sensitive reactions were carried out in flame-dried glassware under argon atmosphere using standard Schlenk manifold technique.  $^1\text{H}$ - and  $^{13}\text{C}$ - Nuclear Magnetic Resonance (NMR) spectra were acquired at various field strengths as indicated, and were referenced to  $\text{CHCl}_3$  (7.27 and 77.0 ppm for  $^1\text{H}$  and  $^{13}\text{C}$  respectively) or TMS (0.00 ppm for  $^1\text{H}$  and  $^{13}\text{C}$ ).  $^1\text{H}$  NMR coupling constants are reported in Hertz and refer to apparent multiplicities and not true coupling constants. Data are reported as follows: chemical shift, multiplicity (s = singlet, br s = broad singlet, d = doublet, t = triplet, q = quartet, qi = quintet, sx = sextet, sp = septet, m = multiplet, dd = doublet of doublet, etc.) and integration.  $^{11}\text{B}$ -NMR spectra were recorded with complete proton decoupling using  $\text{BF}_3\cdot\text{Et}_2\text{O}$  (0.0 ppm) as an external standard. High resolution mass spectra were recorded using Electronic Ionization (EI), Electron Spray Ionization (ESI) or Chemical Ionization (CI). For CI, methane or  $\text{NH}_4\text{OAc}/\text{MeOH}$  was used. All IR data was obtained on a Perkin-Elmer Spectrum One FT-IR spectrometer. Optical rotations were obtained on a Perkin-Elmer 241MC polarimeter. Analytical TLC: aluminium backed plates pre-coated (0.25 mm) with Merck Silica Gel 60 F<sub>254</sub>. Compounds were visualized by exposure to UV-light or by dipping the plates in either a 5% solution of  $(\text{NH}_4)_2\text{Mo}_7\text{O}_{24}\cdot 4 \text{H}_2\text{O}$  or  $[\text{MoO}_3]_{12}[\text{PO}_4\text{H}_3]$  in EtOH followed by heating. Flash column chromatography was performed using Merck Silica Gel 60 (40-63  $\mu\text{m}$ ). All mixed solvent eluents are reported as v/v solutions. Melting points were determined with a Boetius hot stage apparatus and were not corrected. Chiral HPLC was performed using a Diacel Chiralpak IB column (4.6  $\times$  250 mm  $\times$  5  $\mu\text{m}$ ) fitted with a guards (4  $\times$  10 mm), and monitored by DAD (Diode Array Detector). Solvents were purified by standard methods.<sup>1</sup> TMEDA was distilled over  $\text{CaH}_2$ . (-)-Sparteine was obtained from the commercially available sulfate pentahydrate salt (99%, Acros) and

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<sup>1</sup> A. B. Pangborn, M. A. Giardello, R. M. Grubbs, R. K. Rosen and F. T. Timmers, *Organometallics*, 1996, **15**, 1518-1520.

isolated according to the literature procedure.<sup>2</sup> The (-)-sparteine free base readily absorbs atmospheric carbon dioxide (CO<sub>2</sub>) and should be stored under argon at -20 °C in a schlenk tube. *s*-BuLi was purchased from Acros. The molarity of organolithium solutions was determined by titration using salicylaldehyde phenylhydrazone as indicator.<sup>3</sup>

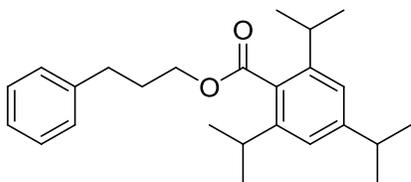
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<sup>2</sup> N. A. Nikolic and P. Beak, *Org. Synth.*, 1997, **74**, 23.

<sup>3</sup> B. E. Love and E. G. Jones, *J. Org. Chem.*, 1999, **64**, 3755.

## 2. Preparation of starting materials

### 3-Phenylpropyl 2,4,6-triisopropylbenzoate (7a)



NaH (60% in mineral oil, 1.44g, 35.9 mmol) was introduced into a 100 mL sealable reaction vessel and THF (50 mL) was added. The resulting mixture was cooled to 0 °C and 3-phenylpropan-1-ol (6.10 mL, 45.0 mmol) was added dropwise. The heterogeneous mixture was stirred for 1 h at 0 °C and 2 h at room temperature, and 2,4,6-triisopropylbenzoyl chloride (8.00 g, 30.0 mmol) was added portion-wise over 5 min. When the initial exotherm ended, the reaction flask was sealed, placed into an oil bath equilibrated at 90 °C and stirred for 18 h. The reaction mixture was allowed to warm to room temperature and quenched with water. EtOAc was added, the layers were separated and the aqueous phase was extracted with EtOAc. The combined organic layers were washed with 1 N HCl, 1 N NaOH, water and brine, dried (MgSO<sub>4</sub>), concentrated and purified by column chromatography (SiO<sub>2</sub>, 98:2 to 97:3 petroleum ether/EtOAc) to obtain the desired benzoate **7a** (8.77 g, 80%) as a light yellow oil.

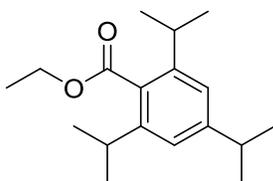
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 1.26 (6 H, d, *J* = 7.0 Hz), 1.27 (12 H, d, *J* = 7.0 Hz), 2.09-2.03 (2 H, m), 2.77-2.73 (2 H, m), 2.95-2.83 (3 H, m), 4.33 (2 H, t, *J* = 6.5 Hz), 7.02 (2 H, s), 7.25-7.18 (3 H, m), 7.34-7.28 (2 H, m).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 23.9 (1 CH<sub>3</sub>), 24.2 (2 CH<sub>3</sub>), 30.4 (1 CH<sub>2</sub>), 31.5 (2 CH), 32.3 (1 CH<sub>2</sub>), 34.4 (1 CH), 64.3 (1 CH<sub>2</sub>), 120.8 (1 CH), 126.1 (1 CH), 128.4 (1 CH), 128.5 (1 CH), 130.6 (1 C), 141.1 (1 C), 144.7 (2 C), 150.1 (1 C), 170.9 (1 C).

IR (film): ν (cm<sup>-1</sup>) 2960, 2928, 1726, 1606, 1461, 1283, 1251, 1137, 1103, 1075, 877, 699.

HRMS (EI) calcd. for C<sub>25</sub>H<sub>34</sub>O<sub>2</sub> [M]<sup>+</sup> 366.2559, found 366.2552.

### Ethyl 2,4,6-triisopropylbenzoate (7b)



NaH (60% in mineral oil, 655 mg, 16.4 mmol) was introduced into a 100 mL sealable reaction vessel and THF (14 mL) was added. The resulting mixture was cooled to 0 °C and ethanol

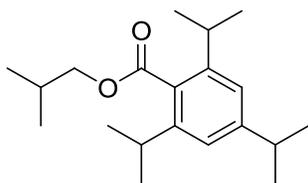
(1.2 mL, 20.5 mmol) was added dropwise. The heterogeneous mixture was stirred for 1 h at room temperature, and 2,4,6-triisopropylbenzoyl chloride (3.64 g, 13.6 mmol) was added portion-wise over 5 min. When the initial exotherm ended, the reaction flask was sealed, placed into an oil bath equilibrated at 90 °C and stirred for 18 h. The reaction mixture was allowed to warm to room temperature and quenched with water. EtOAc was added, the layers were separated and the aqueous phase was extracted with EtOAc. The combined organic layers were dried (MgSO<sub>4</sub>), concentrated and purified by column chromatography (SiO<sub>2</sub>, 98:2 to 97:3 petroleum ether/EtOAc) to obtain the desired benzoate **7b** (2.84 g, 76%) as a light yellow oil.

Data recorded for this compound were in accordance with literature values.<sup>4</sup>

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 1.26 (6 H, d, *J*=7.0 Hz), 1.26 (12 H, d, *J*=6.9 Hz), 1.38 (3 H, t, *J*=7.2 Hz), 2.80-2.96 (3 H, m), 4.39 (2 H, q, *J*=7.3 Hz), 7.02 (2 H, s).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 14.2 (1 CH<sub>3</sub>), 23.9 (1 CH<sub>3</sub>), 24.1 (1 CH<sub>3</sub>), 31.4 (1 CH), 34.4 (1 CH), 60.7 (1 CH<sub>2</sub>), 120.8 (1 CH), 130.6 (1 C), 144.7 (1 C), 150.0 (1 C), 170.8 (1 C).

### Isobutyl 2,4,6-triisopropylbenzoate (**7c**)



NaH (60% in mineral oil, 1.09 g, 27.0 mmol) was introduced into a 100 mL sealable reaction vessel and THF (14 mL) was added. The resulting mixture was cooled to 0 °C and isobutanol (2.5 mL, 27.0 mmol) was added dropwise. The

heterogeneous mixture was stirred for 1 h at room temperature, and 2,4,6-triisopropylbenzoyl chloride (3.64 g, 13.6 mmol) was added portion-wise over 5 min. When the initial exotherm ended, the reaction flask was sealed, placed into an oil bath equilibrated at 90 °C and stirred for 18 h. The reaction mixture was allowed to warm to room temperature and quenched with water. EtOAc was added, the layers were separated and the aqueous phase was extracted with EtOAc. The combined organic layers were dried (MgSO<sub>4</sub>), concentrated and purified by column chromatography (SiO<sub>2</sub>, 98:2 to 97:3 petroleum ether/EtOAc) to obtain the desired benzoate **7c** (3.66 g, 88%) as a light yellow oil.

<sup>4</sup> V. Martin and S. Blakey, *Tetrahedron Lett.*, 2008, **49**, 6800.

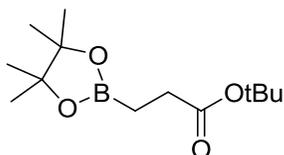
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 1.00 (6 H, d,  $J=6.6$  Hz), 1.26 (18 H, d,  $J=6.8$  Hz), 2.04 (1 H, sp,  $J=6.6$  Hz), 2.87 (2 H, sp,  $J=6.8$  Hz), 2.92 (1 H, sp,  $J=6.8$  Hz), 4.10 (2 H, d,  $J=6.6$  Hz), 7.02 (2 H, s).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 19.3 (2  $\text{CH}_3$ ), 23.9 (2  $\text{CH}_3$ ), 24.2 (4  $\text{CH}_3$ ), 27.7 (1 CH), 31.5 (1 CH), 34.4 (1 CH), 71.3 (1 CH), 120.8 (2 CH), 130.8 (1 C), 144.7 (1 C), 150.0 (1 C), 171.1 (1 C).

IR (film):  $\nu$  ( $\text{cm}^{-1}$ ) 2960, 2872, 1724, 1607, 1462, 1283, 1247, 1136, 1103, 1074, 980, 876, 769.

HRMS (CI) calcd. for  $\text{C}_{20}\text{H}_{32}\text{O}_2$   $[\text{M}]^+$  305.2481, found 305.2469.

### ***tert*-Butyl 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propanoate (9e)**



THF (1 mL) was added to a flask under nitrogen containing copper chloride (4 mg, 0.04 mmol), sodium *tert*-butoxide (12 mg, 0.12 mmol) and DPEPhos (22 mg, 0.04 mmol) and stirred at room temperature for 30 minutes.

Bis(pinacolato)diboron (364 mg, 1.44 mmol) dissolved in THF (1 mL) was added dropwise *via* syringe and the flask was washed with further THF (1 mL). This mixture was stirred for 30 minutes at room temperature before *tert*-butyl acrylate (0.20 mL, 1.37 mmol) and methanol (0.1 mL) were added and the mixture stirred at room temperature for a further 3 h. The resultant slurry was filtered through Celite®, washed with ethyl acetate and concentrated *in vacuo*. The crude oil was purified by flash column chromatography ( $\text{SiO}_2$ , 98:2 Petroleum ether/EtOAc) to give boronic ester **9e** (1.15 g, 84%) as a colourless liquid.

Data recorded for this compound were in accordance with literature values.<sup>5</sup>

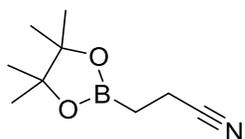
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 0.95 (2 H, t,  $J=7.4$  Hz), 1.23 (12 H, s), 1.35 (9 H, s), 2.34 (8 H, t,  $J=7.4$  Hz).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 24.8 (4  $\text{CH}_3$ ), 28.1 (3  $\text{CH}_3$ ), 29.9 (1  $\text{CH}_2$ ), 79.7 (2 C), 83.1 (1 C), 174.0 (1 C).

$^{11}\text{B}$  NMR (129 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 32.9.

<sup>5</sup> M. Gao, S. B. Thorpe and W. L. Santos; *Org. Lett.*, 2009, **11**, 3478.

### 3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)propanenitrile (**9f**)



THF (22 mL) was added to a flask under nitrogen containing copper chloride (65 mg, 0.66 mmol), sodium *tert*-butoxide (190 mg, 1.98 mmol) and DPEPhos (356 mg, 0.66 mmol) and stirred at room temperature for 30 minutes. Bis(pinacolato)diboron (5.87 g, 23.1 mmol) dissolved in THF (22 mL) was added dropwise *via* syringe and the flask was washed with further THF (10 mL). This mixture was stirred for 30 minutes at room temperature before acrylonitrile (1.45 mL, 22 mmol) and methanol (2.2 mL) were added and the mixture stirred at room temperature for 16 h. The resultant slurry was filtered through Celite®, washed with ethyl acetate and concentrated *in vacuo*. The crude oil was purified by flash column chromatography (SiO<sub>2</sub>, 95:5 CH<sub>2</sub>Cl<sub>2</sub>/EtOAc) to give boronic ester **9f** (3.64 g, 91%) as a colourless liquid.

Data recorded for this compound were in accordance with literature values.<sup>5</sup>

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 1.17 (2 H, t, *J*=8.0 Hz), 1.25 (12 H, s), 2.40 (2 H, t, *J*=7.8 Hz).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 11.9 (1 CH), 24.7 (4 CH<sub>3</sub>), 83.9 (2 C), 120.0 (1 C).

<sup>11</sup>B NMR (129 MHz, CDCl<sub>3</sub>) δ ppm 32.9.

### 3. *General Procedures*

#### **GP1: Lithiation-Borylation of primary 2,4,6-triisopropylbenzoates.**

To a solution of primary 2,4,6-triisopropylbenzoate (0.8 mmol) and (–)-sparteine (0.96 mmol) in Et<sub>2</sub>O (4 mL) at –78 °C was added *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.88 mmol) dropwise. The resulting brown mixture was stirred for 4 h at –78 °C before boronic ester (0.96 mmol) was added (neat for liquid boronic ester or as a 1 M Et<sub>2</sub>O solution for solid boronic ester). The reaction mixture was further stirred at –78 °C for 1 h, allowed to warm to room temperature and refluxed until analysis of the reaction mixture by <sup>11</sup>B NMR showed no more boron-ate complex peak (typically ~5-8 ppm). The reaction mixture was cooled to 0 °C and a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) was added dropwise and allowed to stir at room temperature for 2 h. After this time the layers were separated and the aqueous phase was extracted with Et<sub>2</sub>O (2 × 10 mL). The combined organic layers were dried (MgSO<sub>4</sub>), concentrated and purified by column chromatography (SiO<sub>2</sub>) to obtain the pure secondary alcohols.

Racemic alcohols were obtained by substituting (–)-sparteine by TMEDA.

#### **GP2: Lithiation-Borylation of primary *N,N*-diisopropylcarbamates.<sup>6</sup>**

To a solution of primary carbamate (0.8 mmol) and (–)-sparteine (0.96 mmol) in Et<sub>2</sub>O (4 mL) at –78 °C was added *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.88 mmol) dropwise. The resulting yellow mixture was stirred for 5 h at –78 °C before boronic ester (0.96 mmol) was added (neat for liquid boronic ester or as a 1 M Et<sub>2</sub>O solution for solid boronic ester). The reaction mixture was further stirred at –78 °C for 1 h, before being allowed to warm to room temperature. The reaction mixture was refluxed for >16 h until analysis of the reaction mixture by <sup>11</sup>B NMR showed no more boron-ate complex peak (typically at ~5-8 ppm). The reaction mixture was cooled to 0 °C and a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) was added dropwise and allowed to stir at room temperature for 2 h. After this time the layers were separated and the aqueous phase was extracted with Et<sub>2</sub>O (2 × 10 mL). The combined organic layers were dried (MgSO<sub>4</sub>),

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<sup>6</sup> (a) J. L. Stymiest, G. Dutheuil, A. Mahmood and V. K. Aggarwal, *Angew. Chem. Int. Ed.*, 2007, **46**, 7491; (b) M. P. Webster, B. M. Partridge and V. K. Aggarwal, *Org. Synth.* 2011, **88**, 247.

concentrated and purified by column chromatography (SiO<sub>2</sub>) to obtain the pure secondary alcohols.

Racemic alcohols were obtained by substituting (–)-sparteine by TMEDA.

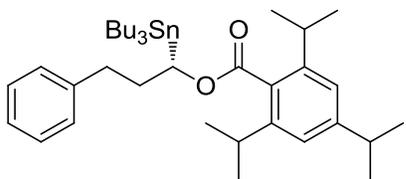
**GP3: Lithiation-Borylation of primary *N,N*-diisopropylcarbamates using magnesium bromide etherate.<sup>6</sup>**

To a solution of primary carbamate (0.8 mmol) and (–)-sparteine (0.96 mmol) in Et<sub>2</sub>O (4 mL) at –78 °C was added *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.88 mmol) dropwise. The resulting yellow mixture was stirred for 5 h at –78 °C before boronic ester (0.96 mmol) was added (neat for liquid boronic ester or as a 1 M Et<sub>2</sub>O solution for solid boronic ester). The reaction mixture was further stirred at –78 °C for 1 h, before being allowed to warm to room temperature. At this point, both layers of a biphasic mixture of MgBr<sub>2</sub>·OEt<sub>2</sub> [freshly made from stirring Mg turnings (2.4 mmol) and 1,2-dibromoethane (1.6 mmol) in Et<sub>2</sub>O (4 mL) at room temperatures for 2 h] was added *via* syringe. The reaction mixture was refluxed for >16 h until analysis of the reaction mixture by <sup>11</sup>B NMR showed no more boron-ate complex peak (typically at ~5-8 ppm). The reaction mixture was cooled to 0 °C and a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) was added dropwise and allowed to stir at room temperature for 2 h. After this time the layers were separated and the aqueous phase was extracted with Et<sub>2</sub>O (2 × 10 mL). The combined organic layers were dried (MgSO<sub>4</sub>), concentrated and purified by column chromatography (SiO<sub>2</sub>) to obtain the pure secondary alcohols.

Racemic alcohols were obtained by substituting (–)-sparteine by TMEDA.

#### 4. Preparation of secondary alcohols

##### (S)-3-Phenyl-1-(tributylstannyl)propyl 2,4,6-triisopropylbenzoate (**8**)



*s*-BuLi (1.43 M in 92:8 cyclohexane/hexane, 0.4 mL, 0.57 mmol) was added dropwise to a solution of 3-phenylpropyl 2,4,6-triisopropylbenzoate (**7a**) (200 mg, 0.55 mmol) and (–)-sparteine (0.14 mL, 0.60 mmol) in

Et<sub>2</sub>O at –78 °C. The brown solution was stirred at that temperature for 4 h before tributyltin chloride (178 μL, 0.66 mmol) was added dropwise. The reaction mixture was stirred for 30 min at –78 °C before being warmed to room temperature and quenched with water. Et<sub>2</sub>O was added, the layers were separated and the aqueous phase was extracted with Et<sub>2</sub>O. The combined organic layers were dried (MgSO<sub>4</sub>), concentrated and purified by column chromatography (SiO<sub>2</sub>, 17:3 pentane/toluene) to obtain the desired  $\alpha$ -stannyl benzoate (*S*)-**8** (1.13 g, 95%) as a colourless oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  ppm 0.91 (9 H, t, *J*=7.3 Hz), 0.96-1.04 (6 H, m), 1.24-1.40 (24 H, m), 1.42-1.64 (6 H, m), 2.10-2.33 (2 H, m), 2.63-2.75 (1 H, m), 2.76-2.85 (1 H, m), 2.86-2.97 (3 H, m), 5.16-5.24 (1 H, m), 7.04 (2 H, s), 7.16-7.24 (3 H, m), 7.28-7.34 (2 H, m).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>)  $\delta$  ppm 171.2 (1 C), 149.9 (1 C), 144.8 (1 C), 141.8 (1 C), 130.9 (1 C), 128.4 (1 CH), 128.3 (1 CH), 125.9 (1 CH), 120.8 (1 CH), 71.6 (1 CH), 36.7 (1 CH<sub>2</sub>), 34.8 (1 CH<sub>2</sub>), 34.4 (1 CH), 31.6 (1 CH), 29.1 (1 CH<sub>2</sub>), 27.5 (1 CH<sub>2</sub>), 24.6 (1 CH<sub>3</sub>), 24.2 (1 CH<sub>3</sub>), 24.0 (1 CH<sub>3</sub>), 13.7 (1 CH<sub>3</sub>), 9.9 (1 CH<sub>2</sub>).

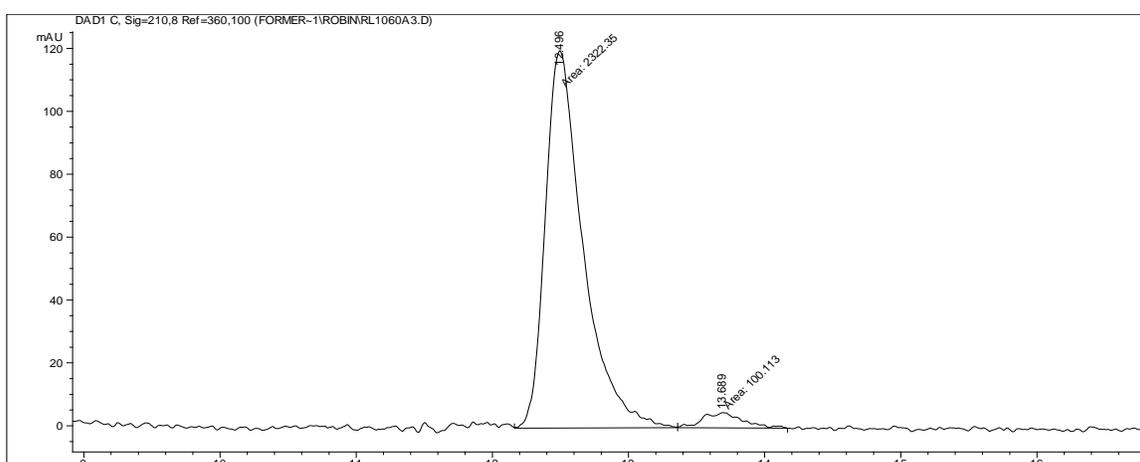
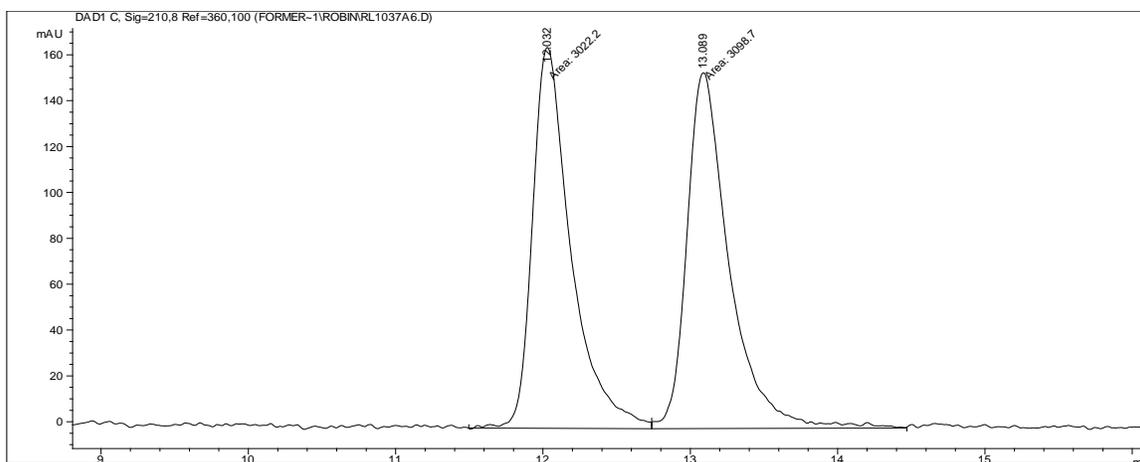
IR (film):  $\nu$  (cm<sup>-1</sup>) 2960, 1706, 1607, 1463, 1384, 1285, 1250, 1074.

HRMS (CI): calcd. for C<sub>37</sub>H<sub>61</sub>O<sub>2</sub>Sn [M]<sup>+</sup> 657.3694, found 657.3710.

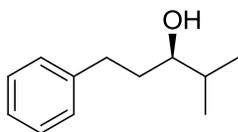
$[\alpha]_D^{23} = +31$  (*c* 1.00, CHCl<sub>3</sub>).

HPLC separation conditions: Chiralpak IB column with guard, hexane, flow rate: 0.5 mL/min, 0 °C; *t*<sub>R</sub> 12.5 min for (*S*)-enantiomer (major) and *t*<sub>R</sub> 13.5 min for (*R*)-enantiomer (minor).

e. r. = 96:4.



### **(R)-4-Methyl-1-phenylpentan-3-ol 10a**



*n*BuLi (1.62 M in hexanes, 0.27 mL, 0.44 mmol, 1.05 eq.) was added dropwise to a solution of (*S*)-3-phenyl-1-(tributylstannyl)propyl 2,4,6-triisopropylbenzoate (**8**) (329 mg, 0.50 mmol, 1.2 eq.) in Et<sub>2</sub>O (6 mL) at -78 °C. The resulting mixture was stirred for 1 h at -78 °C before isopropyl boronic acid pinacol ester (86 μL, 0.42 mmol, 1 eq.) was added. The reaction mixture was stirred for 2 h at -78 °C and 2 h at room temperature and water was added. The layers were separated and the aqueous phase extracted with Et<sub>2</sub>O. The combined organic phases were washed with brine, dried (MgSO<sub>4</sub>) and concentrated and purified by column chromatography (SiO<sub>2</sub>, 7:3 petroleum ether/EtOAc) to obtain the boronic ester (95 mg, 79%). Et<sub>2</sub>O (4 mL) was added, the solution cooled to 0 °C and a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 3.0 mL) was added dropwise and allowed to stir at room temperature for 2 h. After this time the layers were separated and the aqueous phase was

extracted with Et<sub>2</sub>O (2 × 10 mL). The combined organic layers were dried (MgSO<sub>4</sub>), concentrated and purified by column chromatography (SiO<sub>2</sub>, 10:90 EtOAc:petroleum ether) to give the desired alcohol **10a** (49 mg, 83%).

Data recorded for this compound were in accordance with literature values.<sup>6</sup>

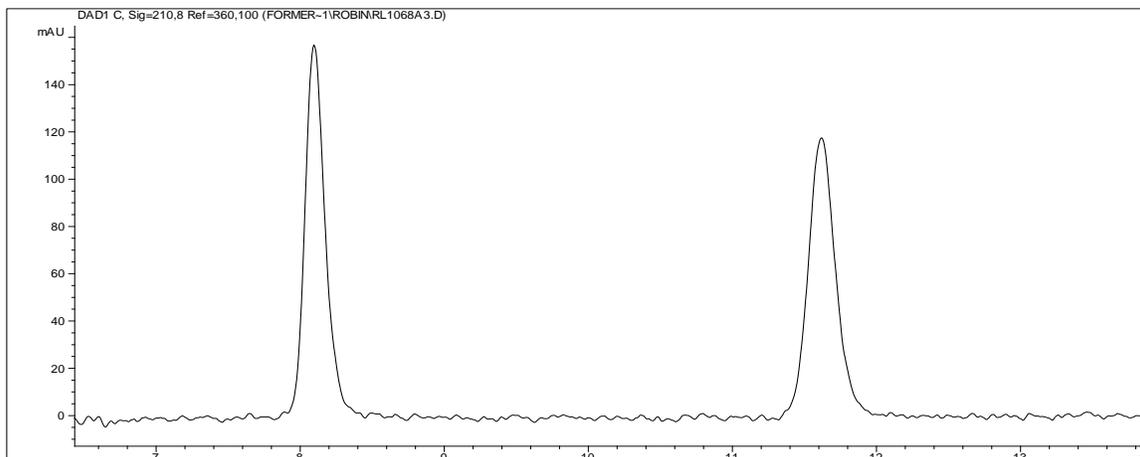
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 0.92 (3 H, d, *J*=6.8 Hz), 0.92 (3 H, d, *J*=6.8 Hz), 1.32 (1 H, d, *J*=5.1 Hz), 1.63-1.75 (2 H, m), 1.74-1.85 (1 H, dddd, *J*=13.9, 10.0, 6.6, 3.2 Hz), 2.65 (1 H, ddd, *J*=13.7, 9.7, 6.6 Hz), 2.85 (1 H, ddd, *J*=13.7, 10.3, 5.4 Hz), 3.36-3.45 (1 H, m), 7.15-7.24 (3 H, m), 7.25-7.33 (2 H, m).

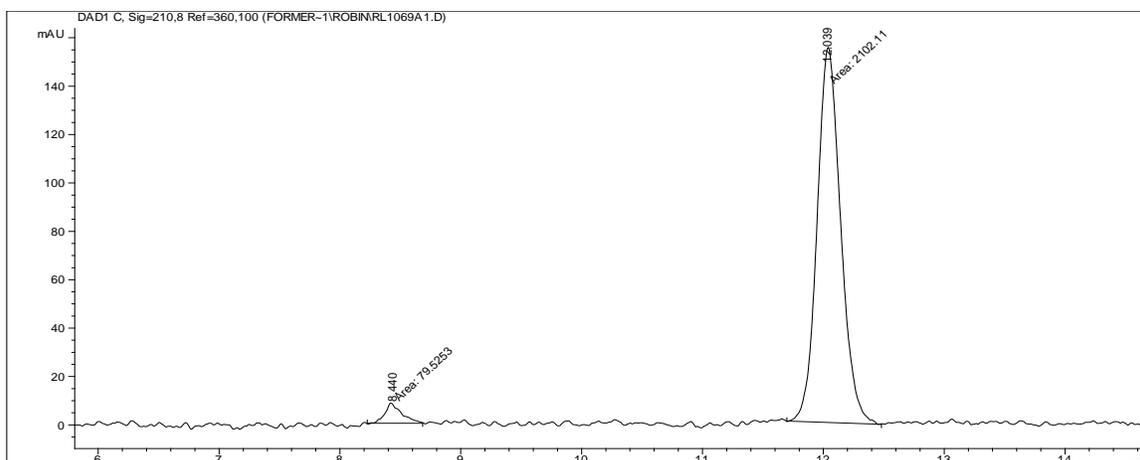
<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 17.1 (1 CH<sub>3</sub>), 18.7 (1 CH<sub>3</sub>), 32.4 (1 CH<sub>2</sub>), 33.7 (1 CH), 35.9 (1 CH<sub>2</sub>), 76.1 (1 CH), 125.7 (1 CH), 128.35 (2 CH), 128.40 (2 CH), 142.3 (1 C).

[α]<sub>D</sub><sup>21</sup> = +31 (*c* 1.00, MeOH). Lit. [α]<sub>D</sub><sup>22</sup> +35.5 (*c* = 0.9, MeOH for 98:2 e.r.).

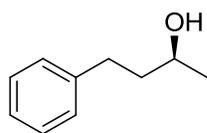
HPLC separation conditions: Chiralpak IB column with guard, 3.0% *i*PrOH in hexane, flow rate: 0.7 mL/min, 20 °C; *t*<sub>R</sub> 8.4 min for (*S*)-enantiomer (minor) and *t*<sub>R</sub> 12.0 min for (*R*)-enantiomer (major).

96:4 from 96:4.





### (S)-4-Phenylbutan-2-ol (**10b**)



According to GP1, 3-phenylpropyl 2,4,6-triisopropylbenzoate (**7a**) (293 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and methylboronic acid pinacol ester (136 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL) and refluxed for 2 h, followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10b** (92 mg, 76%) as a colourless oil.

According to GP2, 3-phenylpropyl diisopropylcarbamate (**1a**) (210 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and methylboronic acid pinacol ester (136 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL) and refluxed for 16 h, followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10b** (11 mg, 9 %) as a colourless oil.

According to GP3, 3-phenylpropyl diisopropylcarbamate (**1a**) (210 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and methylboronic acid pinacol ester (136 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL), followed by MgBr<sub>2</sub>·OEt<sub>2</sub> (4 mL), refluxed for 16 h, and subsequent oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to

give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10b** (61 mg, 50%) as a colourless oil.

Data recorded for this compound were in accordance with literature values.<sup>7</sup>

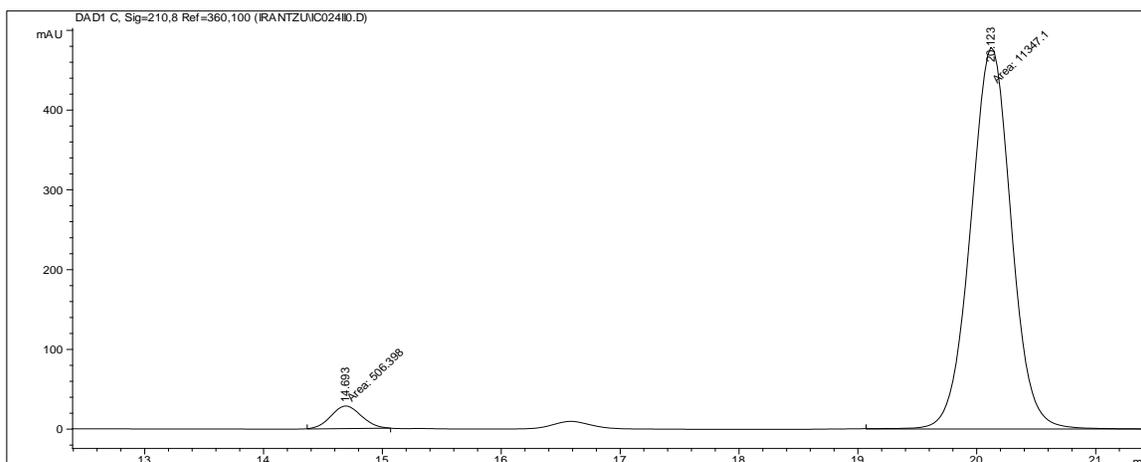
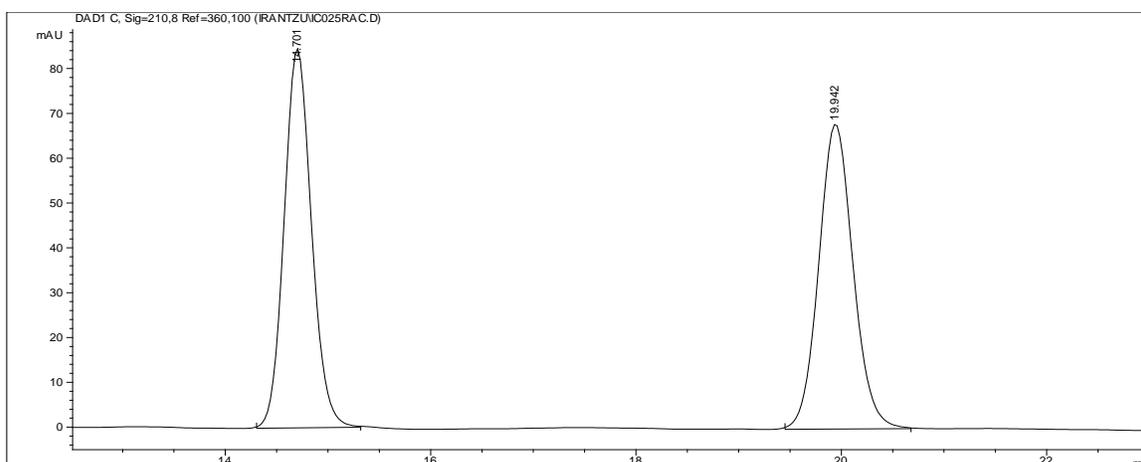
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 7.32-7.27 (m, 2 H), 7.22-7.17 (m, 3 H), 3.88-3.80 (m, 2 H), 2.81-2.64 (m, 2 H), 1.85-1.72 (m, 2 H), 1.45 (br s, 1 H), 1.24 (d, *J* = 6.0 Hz, 3 H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 142.0 (1C), 128.4 (4CH), 125.8 (1CH), 67.5 (1CH), 40.8 (1CH<sub>2</sub>), 32.1 (1CH<sub>2</sub>), 23.6 (1CH<sub>3</sub>).

[α]<sub>D</sub><sup>25</sup> +16 (*c* 1.00, CHCl<sub>3</sub>). Lit. [α]<sub>D</sub><sup>20</sup> +13.8 (*c* = 1.7, CHCl<sub>3</sub> for 79% *ee*).

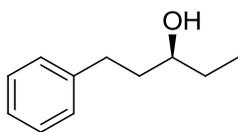
HPLC separation conditions: Chiralpak IB column with guard, 3.0% *i*PrOH in hexane, flow rate: 0.7 mL/min, 20 °C; *t*<sub>R</sub> 14.7 min for (*R*)-enantiomer (minor) and *t*<sub>R</sub> 19.9 min for (*S*)-enantiomer (major).

e.r. = 96:4.



<sup>7</sup> D. R. Li, A. He, and J. R. Falck, *Org. Lett.*, 2010, **12**, 1756.

**(S)-1-Phenylpentan-3-ol (10c)**



According to GP1, 3-phenylpropyl 2,4,6-triisopropylbenzoate (**7a**) (293 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and ethylboronic acid pinacol ester (150 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL) and refluxed for 2 h, followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10c** (110 mg, 84%) as a white solid.

According to GP2, 3-phenylpropyl diisopropylcarbamate (**1a**) (210 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and ethylboronic acid pinacol ester (150 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL) and refluxed for 16 h, followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10c** (96 mg, 73%) as a white solid.

According to GP3, 3-phenylpropyl diisopropylcarbamate (**1a**) (210 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and ethylboronic acid pinacol ester (150 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL), followed by MgBr<sub>2</sub>·OEt<sub>2</sub> (4 mL), refluxed for 16 h, and subsequent oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10c** (92 mg, 70%) as a white solid.

Data recorded for this compound were in accordance with literature values.<sup>6</sup>

Mp 36 – 39 °C. Lit. 34 – 36 °C.

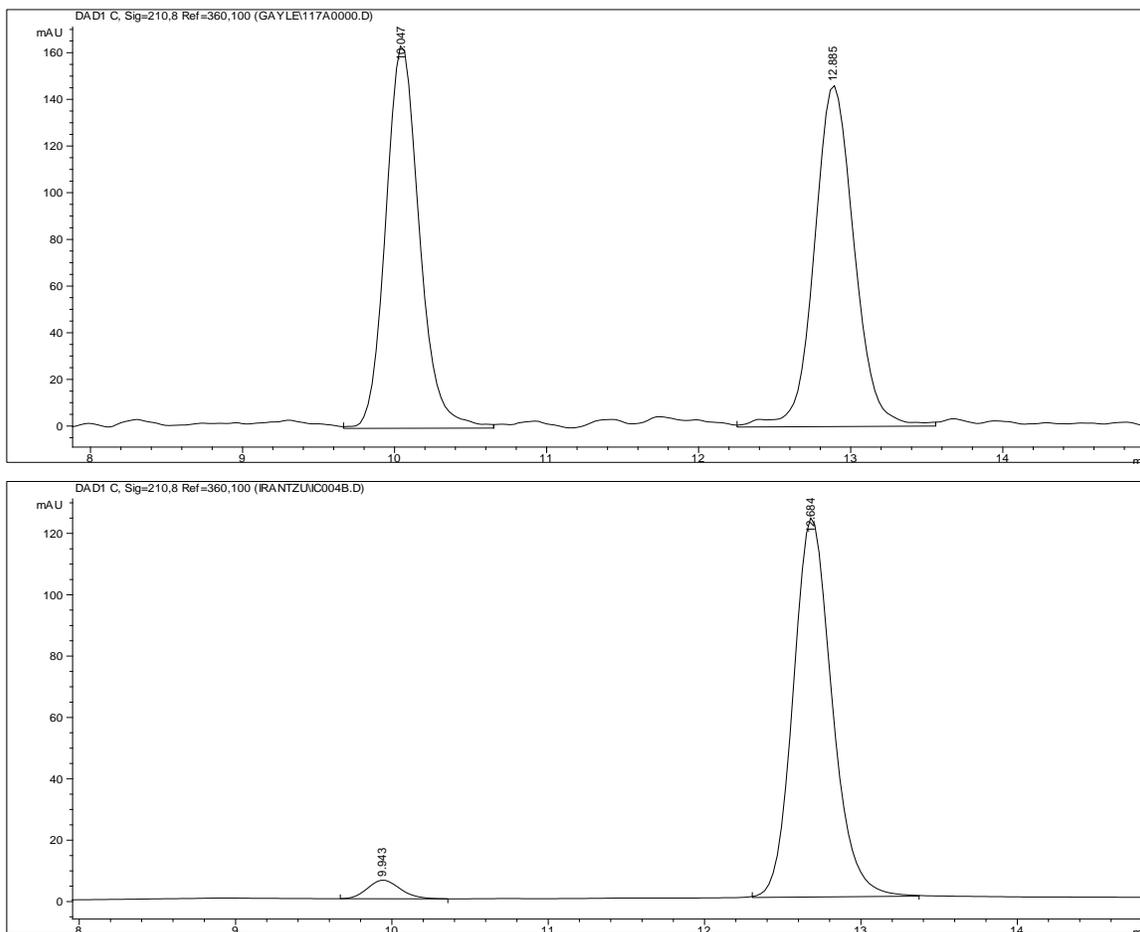
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 0.96 (3 H, t, *J*=7.5 Hz), 1.34 (1 H, d, *J*=4.7 Hz), 1.42-1.62 (1 H, m), 1.68-1.87 (1 H, m), 2.69 (1 H, ddd, *J*=13.9, 9.5, 6.6 Hz), 2.81 (1 H, ddd, *J*=14.0, 9.8, 5.2 Hz), 3.52-3.63 (1 H, m), 7.16-7.26 (3 H, m), 7.26-7.33 (2 H, m).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 9.8 (1 CH<sub>3</sub>), 30.2 (1 CH<sub>2</sub>), 32.0 (1 CH<sub>2</sub>), 38.5 (1 CH<sub>2</sub>), 72.6 (1 CH), 125.7 (1 CH), 128.3 (2 CH), 128.4 (2 CH), 142.2 (1 C).

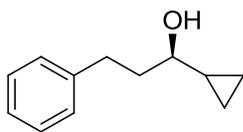
[α]<sub>D</sub><sup>24</sup> +25 (*c* 1.00, CH<sub>2</sub>Cl<sub>2</sub>). Lit. [α]<sub>D</sub><sup>22</sup> +25.0 (*c* = 0.95, CH<sub>2</sub>Cl<sub>2</sub> for 98:2 e.r.).

HPLC separation conditions: Chiralpak IB column with guard, 3.0% *i*PrOH in hexane, flow rate: 0.7 mL/min, 20 °C;  $t_R$  9.9 min for (*R*)-enantiomer (minor) and  $t_R$  12.7 min for (*S*)-enantiomer (major).

e.r. = 96:4.



### (*R*)-1-Cyclopropyl-3-phenylpropan-1-ol (**10d**)



According to GP1, 3-phenylpropyl 2,4,6-triisopropylbenzoate (**7a**) (293 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (–)-sparteine (0.22 mL, 0.96 mmol) and cyclopropylboronic acid pinacol ester (161 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL) followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10d** (120 mg, 86%) as a white solid.

According to GP2, 3-phenylpropyl diisopropylcarbamate (**1a**) (210 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (–)-sparteine (0.22 mL, 0.96 mmol) and methylboronic acid pinacol ester (136 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL) followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10d** (99 mg, 71%) as a white solid.

Data recorded for this compound were in accordance with literature values.<sup>8</sup>

Mp 33 – 34 °C.

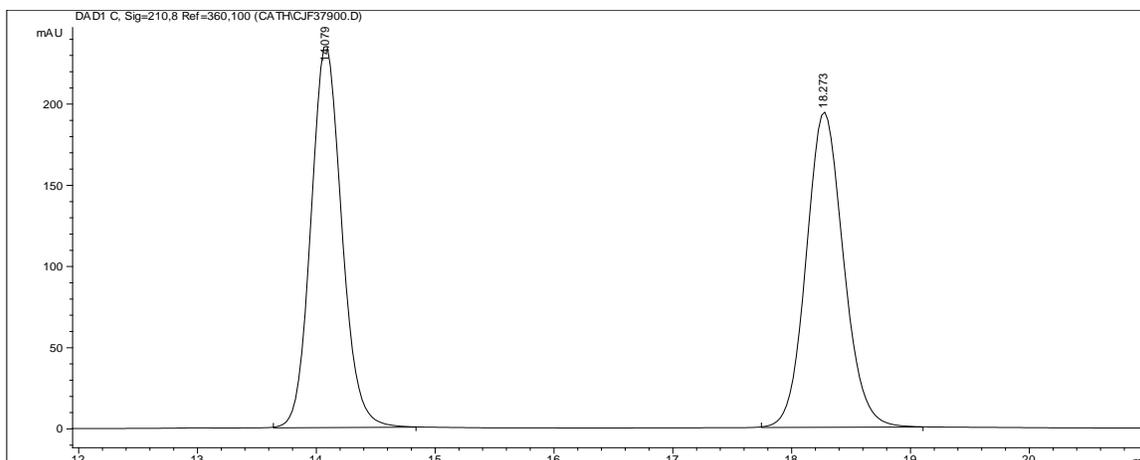
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 0.18-0.33 (2 H, m), 0.47-0.60 (2 H, m), 0.96 (1 H, qt, *J*=8.2, 5.0 Hz), 1.63 (1 H, s), 1.91-1.99 (2 H, m), 2.74 (1 H, ddd, *J*=13.7, 8.7, 8.3 Hz), 2.84 (1 H, ddd, *J*=13.7, 8.5, 7.5 Hz), 2.91 (1 H, dt, *J*=7.9, 6.4 Hz), 7.16-7.26 (3 H, m), 7.27-7.33 (2 H, m).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 2.5 (1 CH<sub>2</sub>), 2.7 (1 CH<sub>2</sub>), 18.0 (1 CH), 32.0 (1 CH<sub>2</sub>), 38.6 (1 CH<sub>2</sub>), 76.1 (1 CH), 125.7 (1 CH), 128.3 (2 CH), 128.4 (2 CH), 142.2 (1 C).

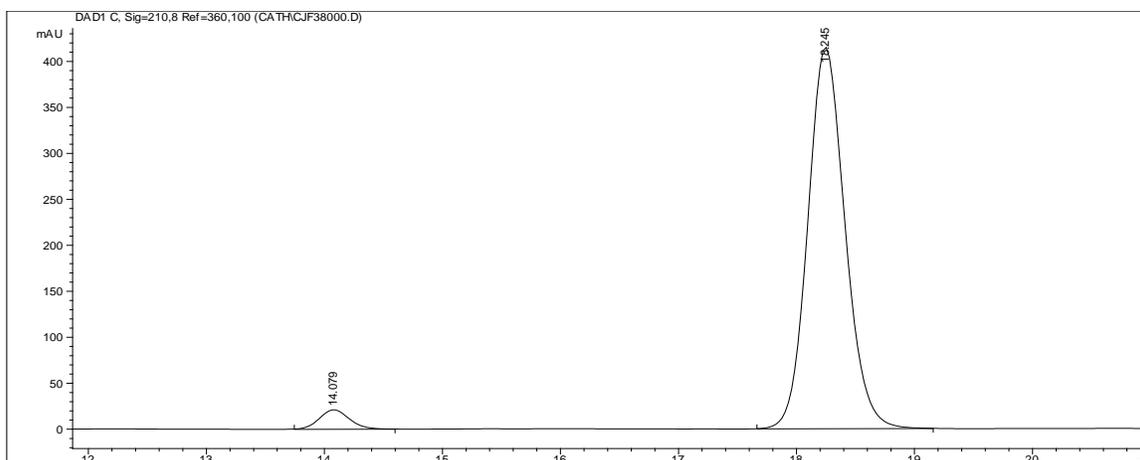
[α]<sub>D</sub><sup>25</sup> +54 (*c* 1.00, CHCl<sub>3</sub>).

HPLC separation conditions: Chiralpak IB column with guard, 3.0% *i*PrOH in hexane, flow rate: 0.7 mL/min, 20 °C; *t*<sub>R</sub> 14.1 min for (*R*)-enantiomer (minor) and *t*<sub>R</sub> 18.2 min for (*S*)-enantiomer (major).

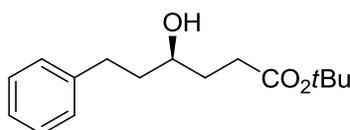
e.r. = 96:4.



<sup>8</sup> S. Harada, N. Kowase, N. Tabuchi, T. Taguchi, Y. Dobashi, A. Dobashi and Y. Hanzawa, *Tetrahedron*, 1998, **54**, 753.



**(R)-tert-Butyl 4-hydroxy-6-phenylhexanoate (10e)**



According to GP1, 3-phenylpropyl 2,4,6-triisopropylbenzoate (**7a**) (293 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and *tert*-butylpropionyl boronic acid pinacol ester (246 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL) and refluxed for 16 h, followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10e** (134 mg, 63%) as a colourless liquid.

According to GP3, 3-phenylpropyl diisopropylcarbamate (**1a**) (210 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and *tert*-butylpropionyl boronic acid pinacol ester (246 mg, 0.96 mmol) in Et<sub>2</sub>O (4 mL), followed by MgBr<sub>2</sub>·OEt<sub>2</sub> (4 mL), refluxed for 5 days, and subsequent oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10e** (74 mg, 35%) as a colourless oil.

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 7.30-7.26 (m, 2 H), 7.21-7.16 (m, 3 H), 3.64 (br s, 1 H), 2.84-2.77 (m, 1 H), 2.68 (dt, *J* = 14.0, 8.0 Hz, 1 H), 2.37 (t, *J* = 7.0 Hz, 2 H), 2.05-2.04 (m, 1 H), 1.86-1.67 (m, 4 H), 1.44 (s, 9 H).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 173.6 (1C), 142.0 (1C), 128.4 (2CH), 128.4 (2CH), 125.8 (1CH), 80.5 (1C), 70.7 (1CH), 39.2 (1CH<sub>2</sub>), 32.3 (1CH<sub>2</sub>), 32.1 (1CH<sub>2</sub>), 32.0 (1CH<sub>2</sub>), 28.1 (3CH<sub>3</sub>).

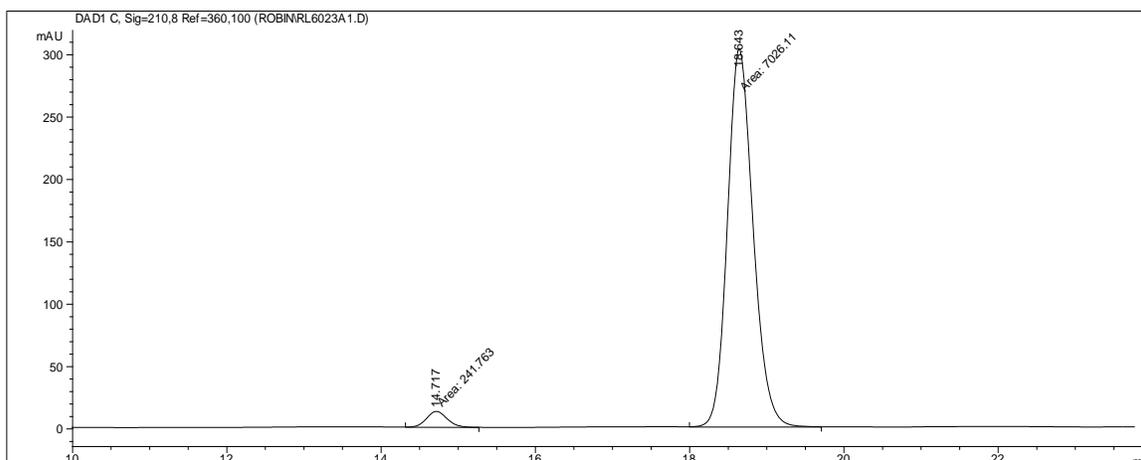
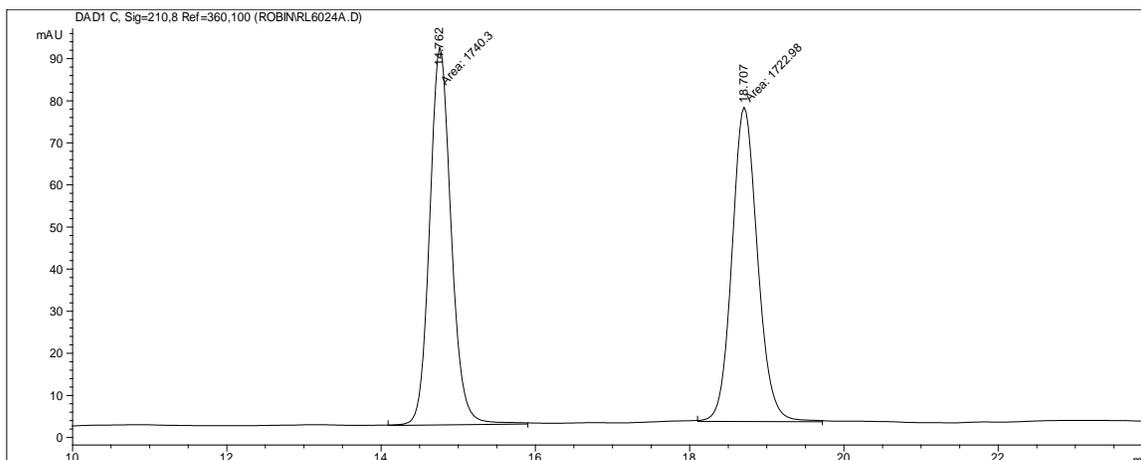
IR (film):  $\nu$  ( $\text{cm}^{-1}$ ) 3424 (br), 2970, 2930, 1727, 1496, 1455, 1393, 1367, 1250, 1146, 1086, 955, 846, 747, 699.

HRMS (ESI) calcd. for  $\text{C}_{16}\text{H}_{24}\text{O}_3\text{Na}$   $[\text{M}+\text{Na}]^+$  287.1617, found 287.1609.

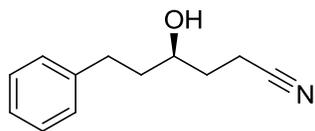
$[\alpha]_{\text{D}}^{20}$  +15 ( $c$  0.60,  $\text{CHCl}_3$ ).

HPLC separation conditions: Chiralpak IB column with guard, 3.0% *i*PrOH in hexane, flow rate: 0.7 mL/min, 20 °C;  $t_{\text{R}}$  14.8 min for (*S*)-enantiomer (minor) and  $t_{\text{R}}$  18.7 min for (*R*)-enantiomer (major).

e.r. = 96:4.



### (*R*)-4-Hydroxy-6-phenylhexanenitrile (10f)



To a solution of primary 2,4,6-triisopropylbenzoate (263 mg, 0.80 mmol) and (–)-sparteine (0.22 mL, 0.96 mmol) in  $\text{Et}_2\text{O}$  (4 mL) at  $-78$  °C was added *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.88 mmol) dropwise. The resulting brown mixture was stirred for

4 h at  $-78\text{ }^{\circ}\text{C}$  propionitrile boronic acid pinacol ester (174 mg, 0.96 mmol) was added. The reaction mixture was further stirred at  $-78\text{ }^{\circ}\text{C}$  for 1 h, allowed to warm to room temperature and refluxed for 16 h. The reaction mixture was cooled to room temperature and water (4 mL) was added. The layers were separated and the aqueous phase was extracted with  $\text{Et}_2\text{O}$  ( $2 \times 10\text{ mL}$ ). The combined organic layers were dried ( $\text{MgSO}_4$ ), concentrated and purified by column chromatography ( $\text{SiO}_2$ , 10:90 EtOAc/petroleum ether) to obtain the pure secondary boronic ester (129 mg, 54%, 69% brsm) as a colourless oil.  $\text{Et}_2\text{O}$  (4 mL) was added followed by sodium perborate tetrahydrate (80 mg, 0.52 mmol) and water (4 mL) and allowed to stir at room temperature for 24 h. After this time the layers were separated and the aqueous phase was extracted with  $\text{Et}_2\text{O}$  ( $2 \times 10\text{ mL}$ ). The combined organic layers were dried ( $\text{MgSO}_4$ ), concentrated and purified by column chromatography ( $\text{SiO}_2$ , 30:70 EtOAc/petroleum ether) to obtain the pure alcohol **10f** (69 mg, 84%) as a colourless oil (46% over two steps, 58% brsm).

Although the data for this compound does not match the reported literature data<sup>9</sup> (only  $^1\text{H}$  NMR and IR provided), our full characterisation confirms the structure of nitrile **10f**.

$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 1.68-1.91 (4 H, m), 2.08 (1 H, br. s), 2.50 (2 H, dd,  $J=7.8, 6.6\text{ Hz}$ ), 2.70 (1 H, ddd,  $J=13.7, 8.5, 7.3\text{ Hz}$ ), 2.80 (1 H, ddd,  $J=13.9, 7.9, 7.3\text{ Hz}$ ), 3.76 (1 H, dtd,  $J=9.4, 6.1, 6.1, 3.3\text{ Hz}$ ), 7.18-7.25 (3 H, m), 7.28-7.35 (2 H, m).

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm 13.6 (1  $\text{CH}_2$ ), 31.9 (1  $\text{CH}_2$ ), 32.6 (1  $\text{CH}_2$ ), 38.9 (1  $\text{CH}_2$ ), 69.4 (1 CH), 119.8 (1 C), 126.1 (1 CH), 128.3 (2 CH), 128.5 (2 CH), 141.2 (1 C).

IR (film):  $\nu$  ( $\text{cm}^{-1}$ ) 3430 (br), 3027, 2930, 2247, 1603, 1496, 1454, 1423, 1089, 919, 749, 700, 520.

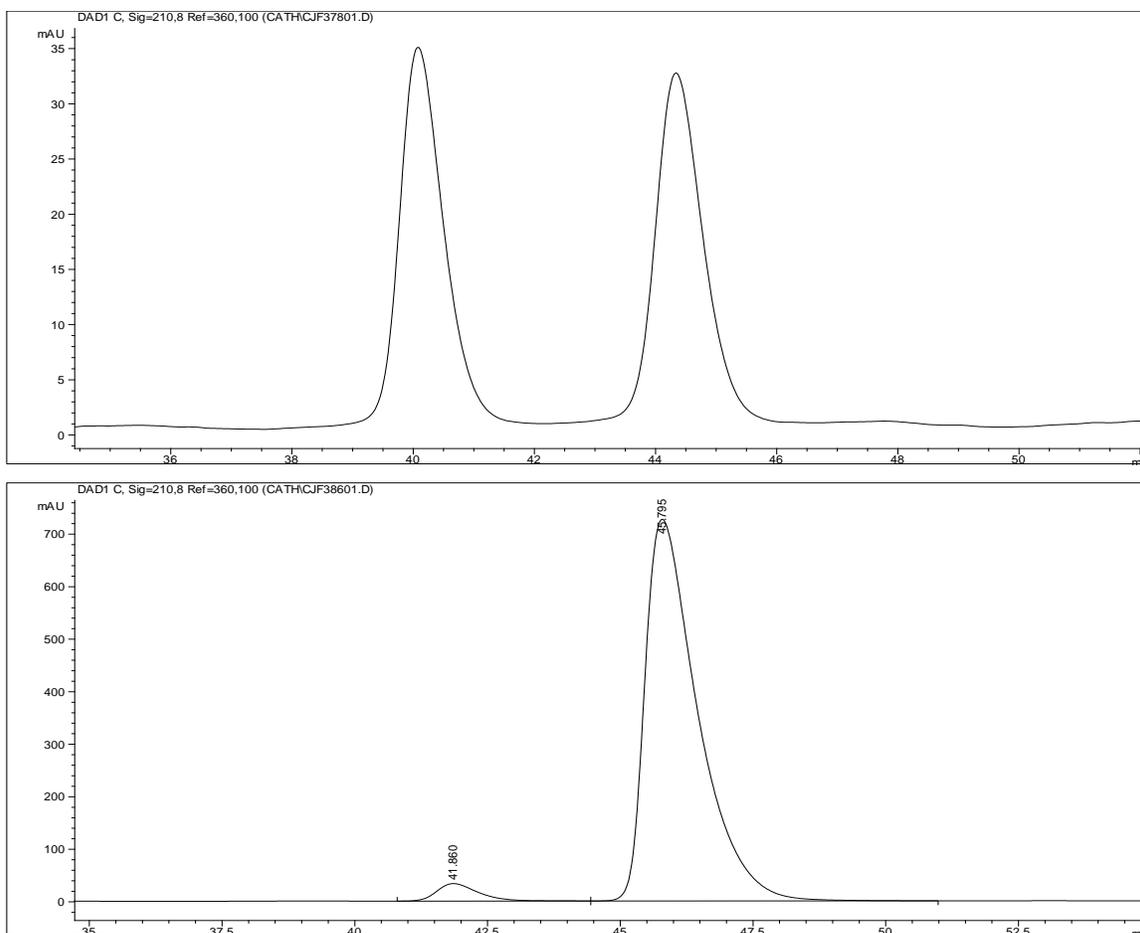
HRMS (CI) calcd. for  $\text{C}_{12}\text{H}_{16}\text{NO}$   $[\text{M}]^+$  190.1232, found 190.1226.

$[\alpha]_{\text{D}}^{20}$   $-4$  ( $c$  1.00,  $\text{CHCl}_3$ ).

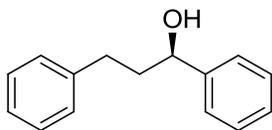
HPLC separation conditions: Chiralpak IB column with guard, 5.0% *i*PrOH in hexane, flow rate: 0.7 mL/min,  $20\text{ }^{\circ}\text{C}$ ;  $t_{\text{R}}$  41.9 min for (*S*)-enantiomer (minor) and  $t_{\text{R}}$  45.8 min for (*R*)-enantiomer (major).

e.r. = 97:3.

<sup>9</sup> Y. Takagi and T. Itoh, *Bull. Chem. Soc. Jpn.*, 1993, **66**, 2949.



### **(R)-1,3-Diphenylpropan-1-ol (10g)**



According to GP1, 3-phenylpropyl 2,4,6-triisopropylbenzoate (**7a**) (293 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (–)-sparteine (0.22 mL, 0.96 mmol) and a solution of phenylboronic acid pinacol ester in Et<sub>2</sub>O (196 mg in 1 mL, 0.96 mmol) in Et<sub>2</sub>O (4 mL), and refluxed for 2 h, followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10g** (149 mg, 88%) as a white solid.

According to GP2, 3-phenylpropyl diisopropylcarbamate (**1a**) (210 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (–)-sparteine (0.22 mL, 0.96 mmol) and a solution of phenylboronic acid pinacol ester in Et<sub>2</sub>O (196 mg in 1 mL, 0.96 mmol) in Et<sub>2</sub>O (4 mL) and refluxed for 16 h, followed by

oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10g** (21 mg, 8%) as a white solid.

According to GP3, 3-phenylpropyl diisopropylcarbamate (**1a**) (210 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) and a solution of phenylboronic acid pinacol ester in Et<sub>2</sub>O (196 mg in 1 mL, 0.96 mmol) in Et<sub>2</sub>O (4 mL), followed by MgBr<sub>2</sub>·OEt<sub>2</sub> (4 mL), refluxed for 16 h, and subsequent oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 20:80 EtOAc/petroleum ether), the desired alcohol **10g** (134 mg, 79%) as a white solid.

Data recorded for this compound were in accordance with literature values.<sup>6</sup>

Mp 46 – 47 °C. Lit. 45 – 47 °C.

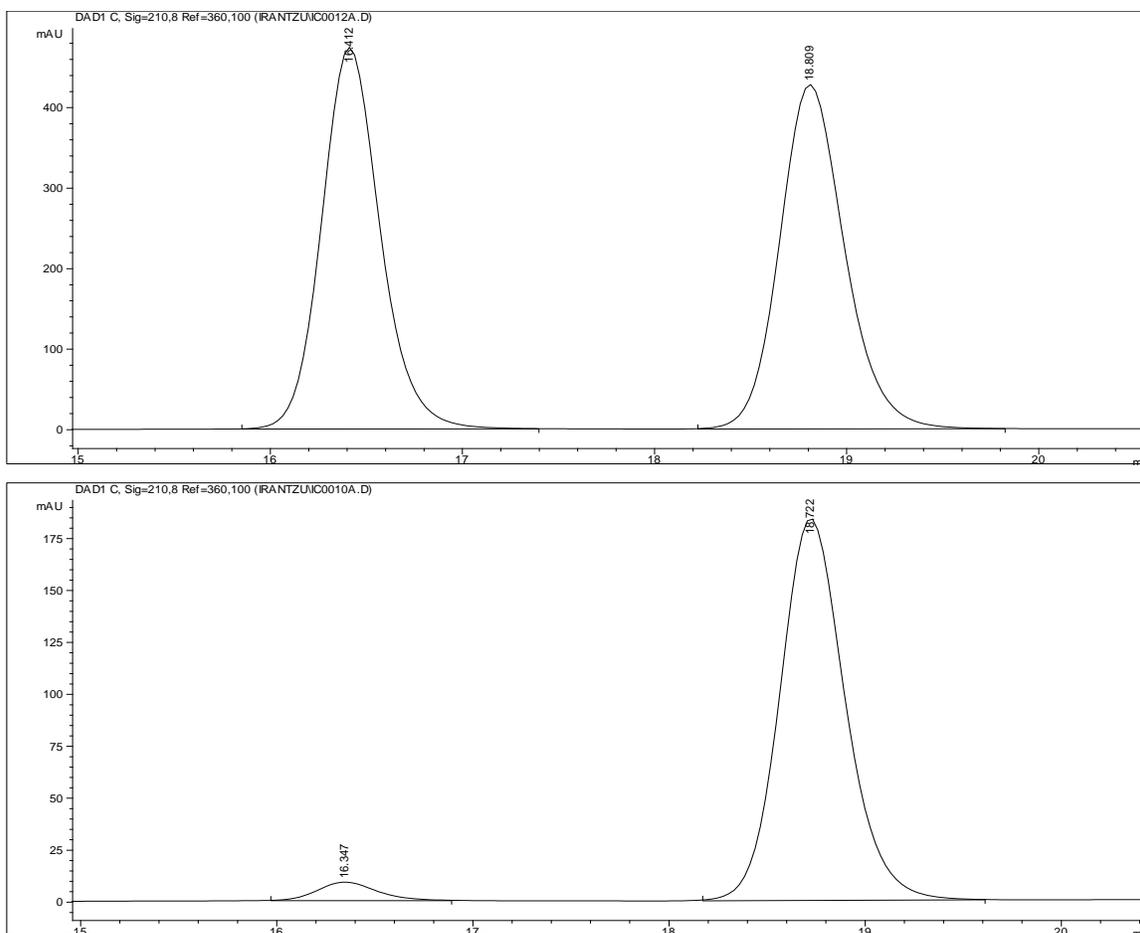
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 1.82 (1 H, d, *J*=3.5 Hz), 1.99-2.21 (2 H, m), 2.63-2.82 (2 H, m), 4.71 (1 H, ddd, *J*=8.1, 5.1, 3.5 Hz), 7.21 (3 H, d, *J*=7.5 Hz), 7.28-7.39 (7 H, m).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 32.0 (1 CH<sub>2</sub>), 40.5 (1 CH<sub>2</sub>), 73.9 (1 CH), 125.85 (1 CH), 125.91 (2 CH), 127.7 (1 CH), 128.4 (2 CH), 128.4 (2 CH), 128.5 (2 CH), 141.8 (1 C), 144.5 (1 C).

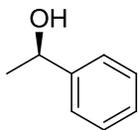
[α]<sub>D</sub><sup>25</sup> +26 (*c* 1.00, CH<sub>2</sub>Cl<sub>2</sub>). Lit. [α]<sub>D</sub><sup>21</sup> +16.0 (*c* = 0.7, CH<sub>2</sub>Cl<sub>2</sub> for 97:3 e.r.).

HPLC separation conditions: Chiralpak IB column with guard, 3.0% *i*PrOH in hexane, flow rate: 0.7 mL/min, 20 °C; *t*<sub>R</sub> 16.3 min for (*S*)-enantiomer (minor) and *t*<sub>R</sub> 18.7 min for (*R*)-enantiomer (major).

e.r. = 96:4



### **(R)-1-Phenylethanol (15)**



According to GP2, ethyl 2,4,6-triisopropylbenzoate (**7b**) (221 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (-)-sparteine (0.22 mL, 0.96 mmol) a solution of phenylboronic acid pinacol ester in Et<sub>2</sub>O (196 mg in 1 mL, 0.96 mmol) in Et<sub>2</sub>O (4 mL) and refluxed for 2 h, followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 10:90 EtOAc/petroleum ether), the desired alcohol **15** (71 mg, 72%) as a colorless oil.

Data recorded for this compound were in accordance with literature values.<sup>6</sup>

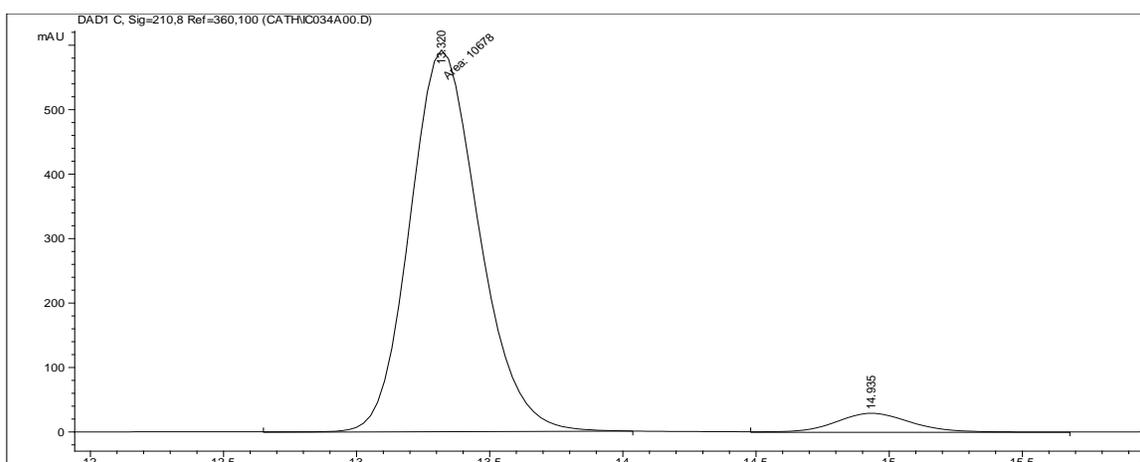
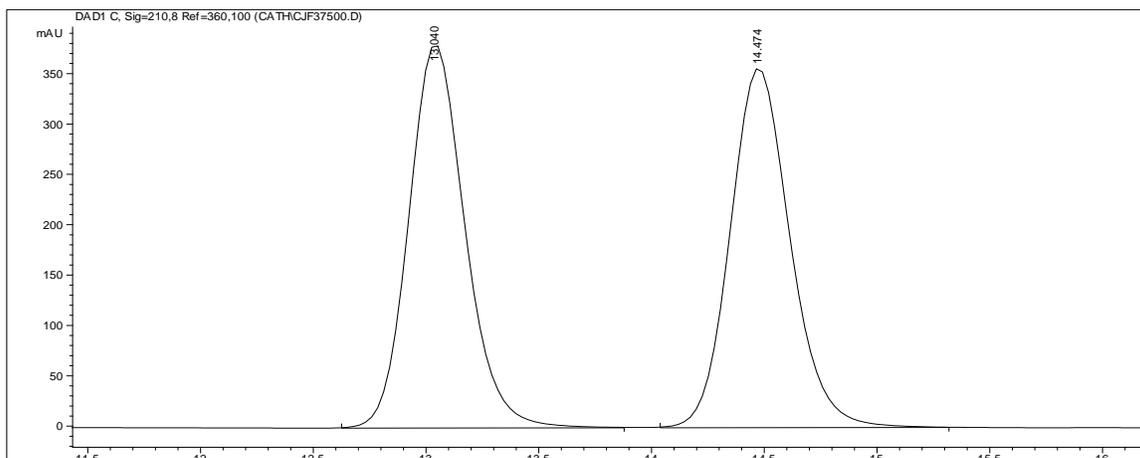
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 1.51 (3 H, d, *J*=6.4 Hz), 1.85 (1 H, d, *J*=3.4 Hz), 4.91 (1 H, qd, *J*=6.4, 3.4 Hz), 7.26-7.41 (5 H, m).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 25.1 (1 CH<sub>3</sub>), 70.4 (1 CH), 125.4 (2 CH), 127.5 (1 CH), 128.5 (2 CH), 145.8 (1 C).

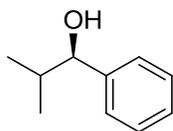
$[\alpha]_D^{21} +42$  ( $c$  1.00, MeOH). Lit.  $[\alpha]_D^{23} +40.0$  ( $c$  = 2.30, MeOH for 97:3 e.r.).

HPLC separation conditions: Chiralpak IB column with guard, 3.0% *i*PrOH in hexane, flow rate: 0.7 mL/min, 20 °C;  $t_R$  13.0 min for (*R*)-enantiomer (major) and  $t_R$  14.5 min for (*S*)-enantiomer (minor).

e.r. = 95:5.



### (*R*)-2-Methyl-1-phenylpropan-1-ol (**16**)



According to GP2, isobutyl 2,4,6-triisopropylbenzoate (**7c**) (221 mg, 0.80 mmol) was treated with *s*-BuLi (1.3 M in 92:8 cyclohexane/hexane, 0.68 mL, 0.88 mmol), (–)-sparteine (0.22 mL, 0.96 mmol) a solution of phenylboronic acid pinacol ester in Et<sub>2</sub>O (196 mg in 1 mL, 0.96 mmol) in Et<sub>2</sub>O (4 mL) and refluxed for 2 h, followed by oxidation with a solution of NaOH (2 M)/H<sub>2</sub>O<sub>2</sub> (30%) (2:1 v/v, 4.0 mL) to give, after purification by column chromatography (SiO<sub>2</sub>, 10:90 EtOAc/petroleum ether), the desired alcohol **16** (94 mg, 78%) as a colorless oil.

Data recorded for this compound were in accordance with literature values.<sup>6</sup>

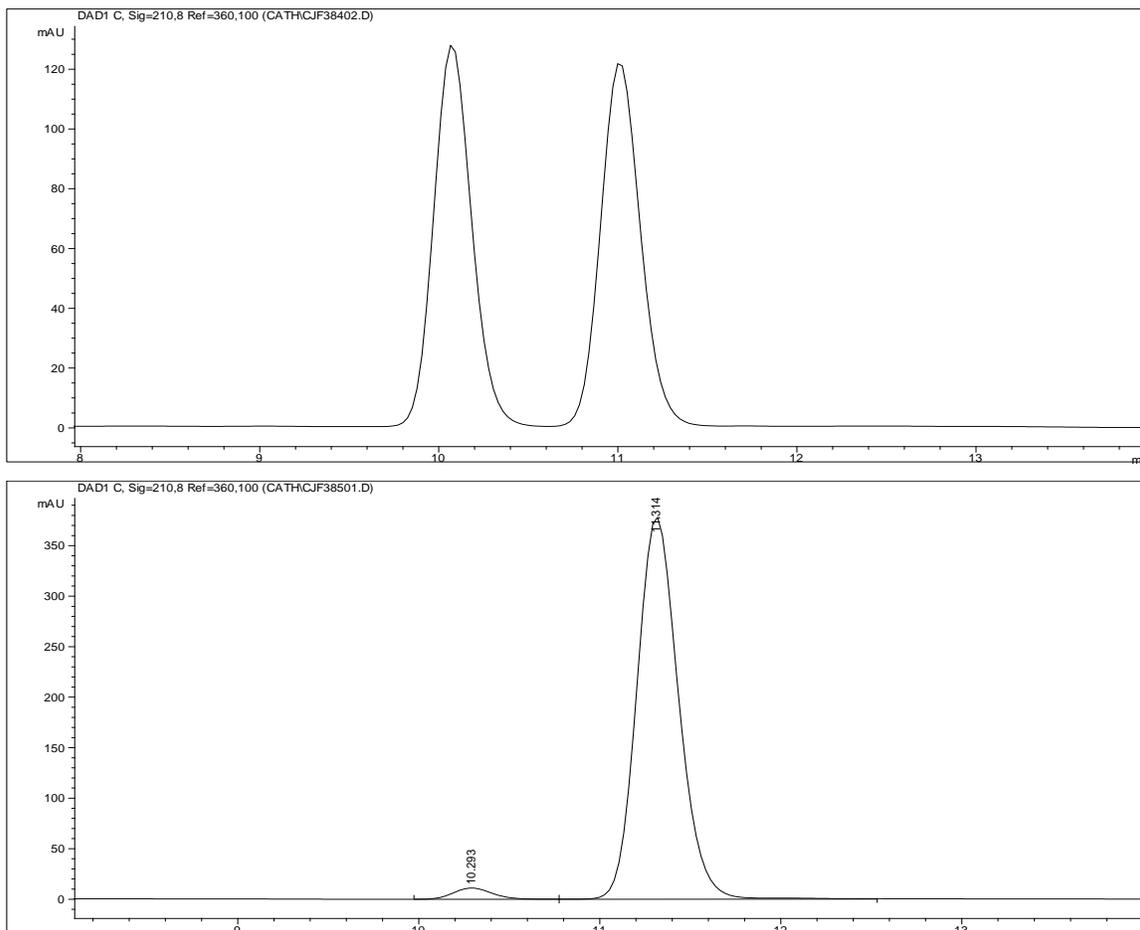
<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm 0.72 (3 H, d, *J*=6.6 Hz), 0.92 (3 H, d, *J*=6.8 Hz), 1.80-1.95 (1 H, dsp, *J*=7.1, 6.8 Hz), 1.85 (1 H, s), 4.27 (1 H, d, *J*=7.1 Hz), 7.13-7.30 (5 H, m).

<sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ ppm 18.2 (1 CH<sub>3</sub>), 18.9 (1 CH<sub>3</sub>), 35.2 (1 CH), 80.0 (1 CH), 126.5 (2 CH), 127.4 (1 CH), 128.1 (2 CH), 143.6 (1 C).

[α]<sub>D</sub><sup>20</sup> +34 (*c* 1.00, Et<sub>2</sub>O). Lit. [α]<sub>D</sub><sup>23</sup> +46.0 (*c* = 3.90, Et<sub>2</sub>O for 98:2 e.r.).

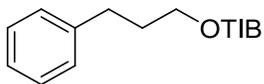
HPLC separation conditions: Chiralpak IB column with guard, 3.0% *i*PrOH in hexane, flow rate: 0.7 mL/min, 20 °C; *t*<sub>R</sub> 10.3 min for (*S*)-enantiomer (minor) and *t*<sub>R</sub> 11.3 min for (*R*)-enantiomer (major).

e.r. = 97:3.

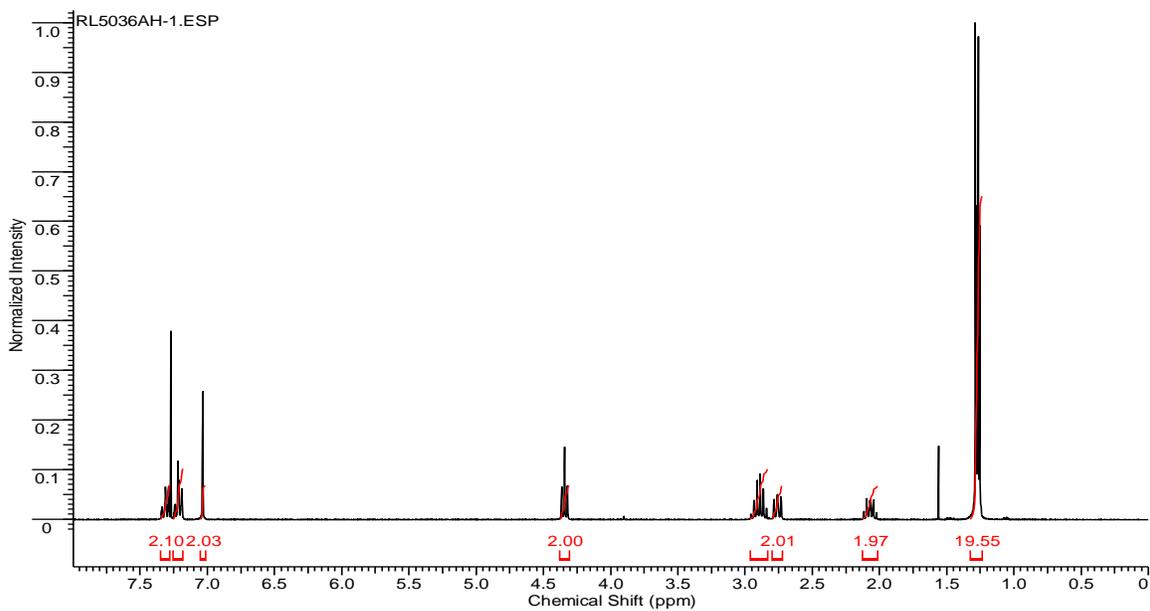


5.  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR and  $^{11}\text{B}$  NMR spectra

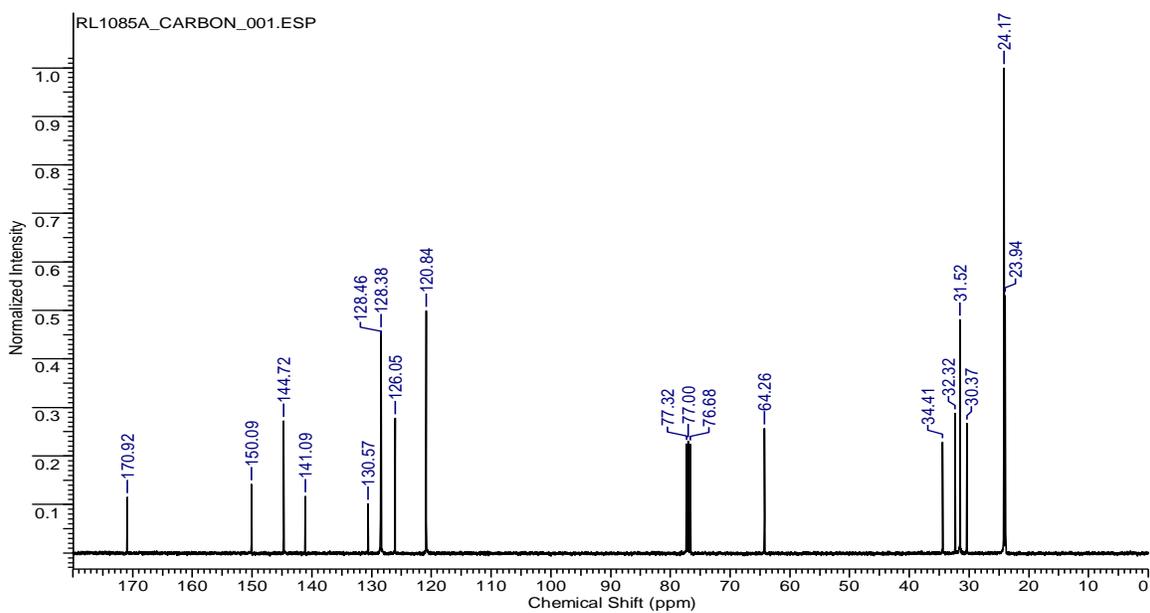
**3-Phenylpropyl 2,4,6-triisopropylbenzoate (7a)**



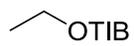
$^1\text{H}$  NMR



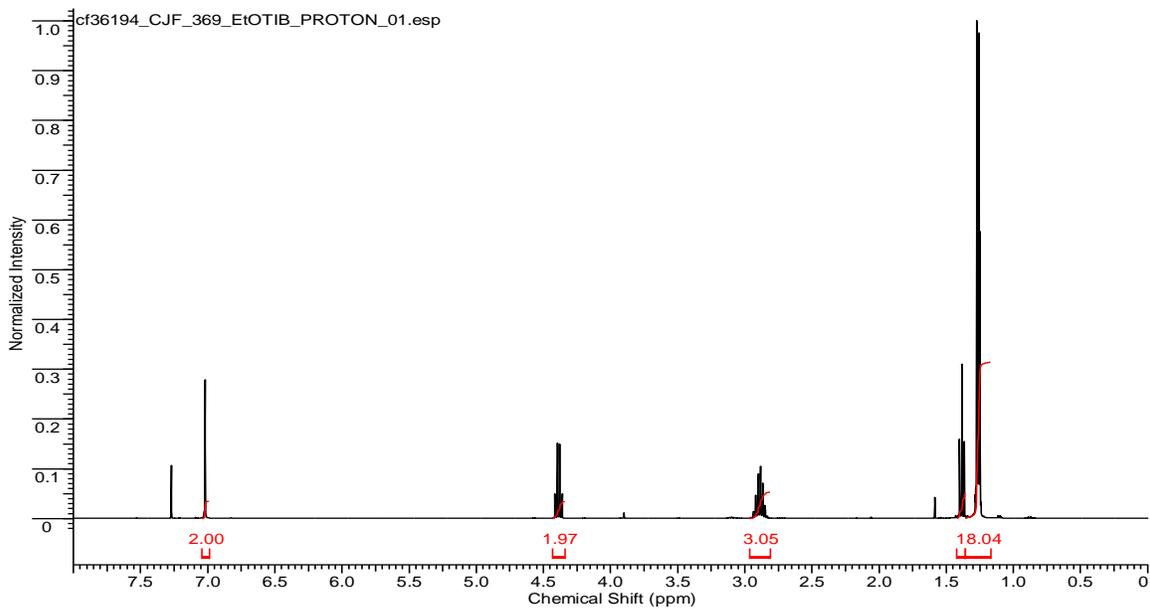
$^{13}\text{C}$  NMR



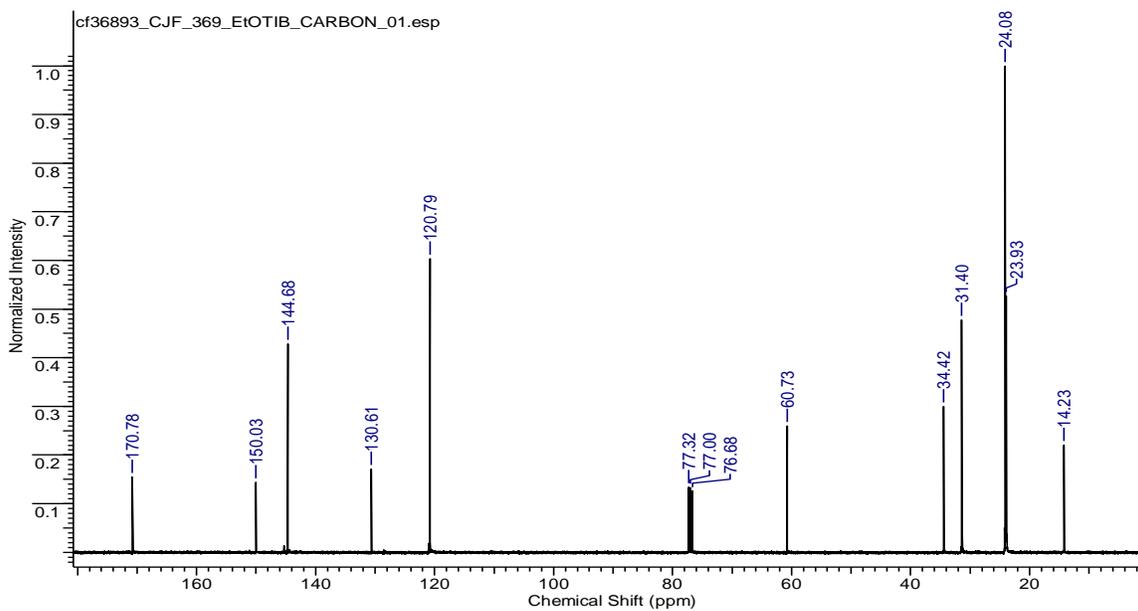
### Ethyl 2,4,6-triisopropylbenzoate (7b)



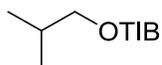
#### <sup>1</sup>H NMR



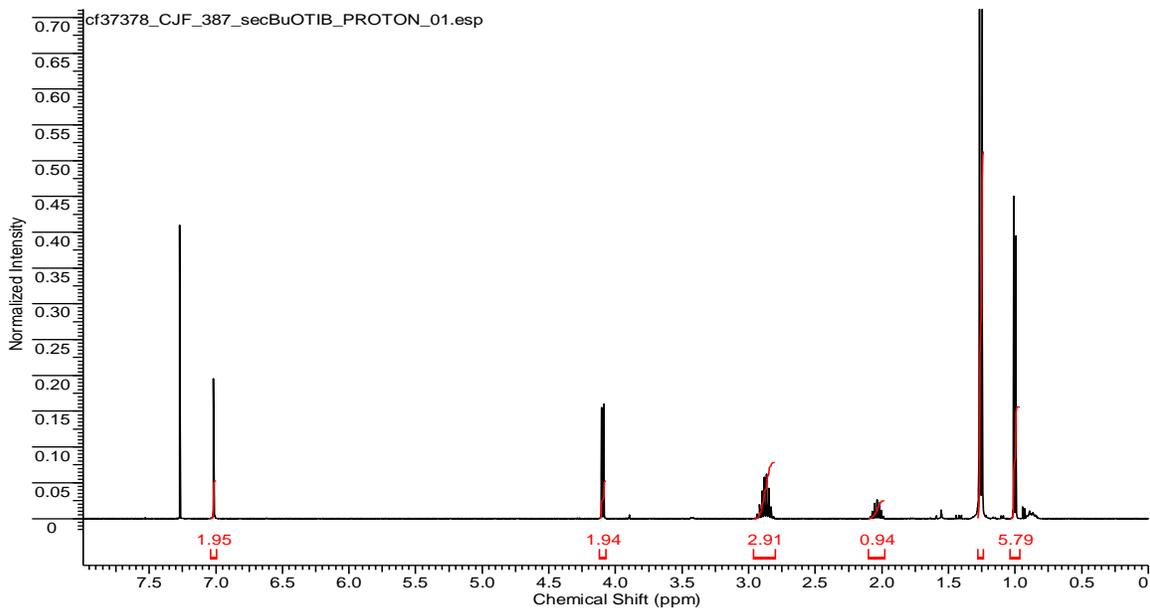
#### <sup>13</sup>C NMR



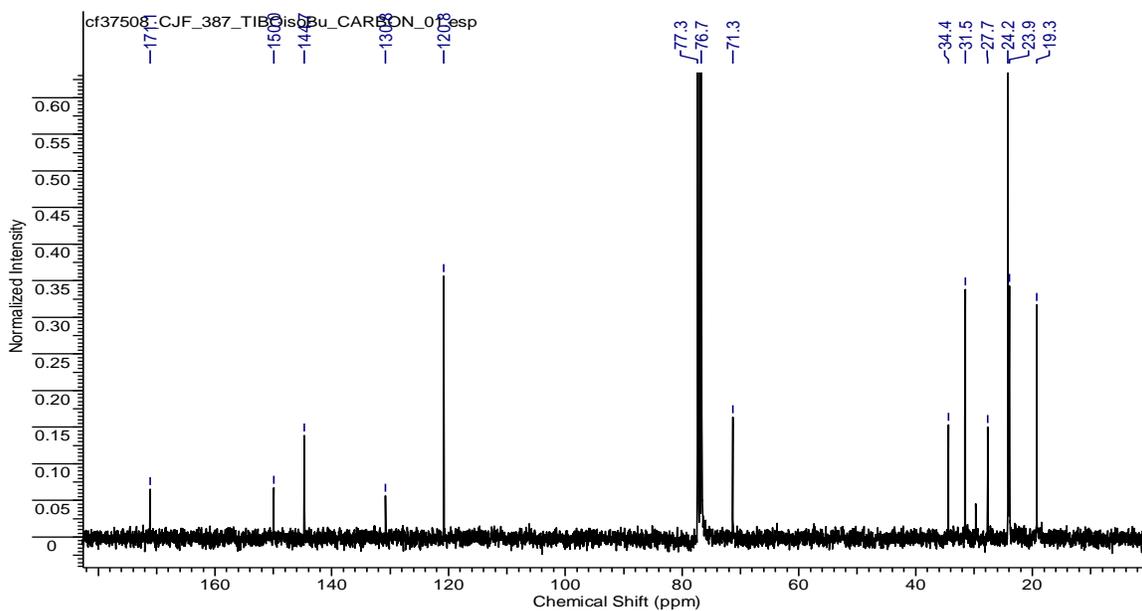
### Isobutyl 2,4,6-triisopropylbenzoate (7c)



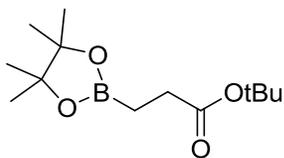
#### <sup>1</sup>H NMR



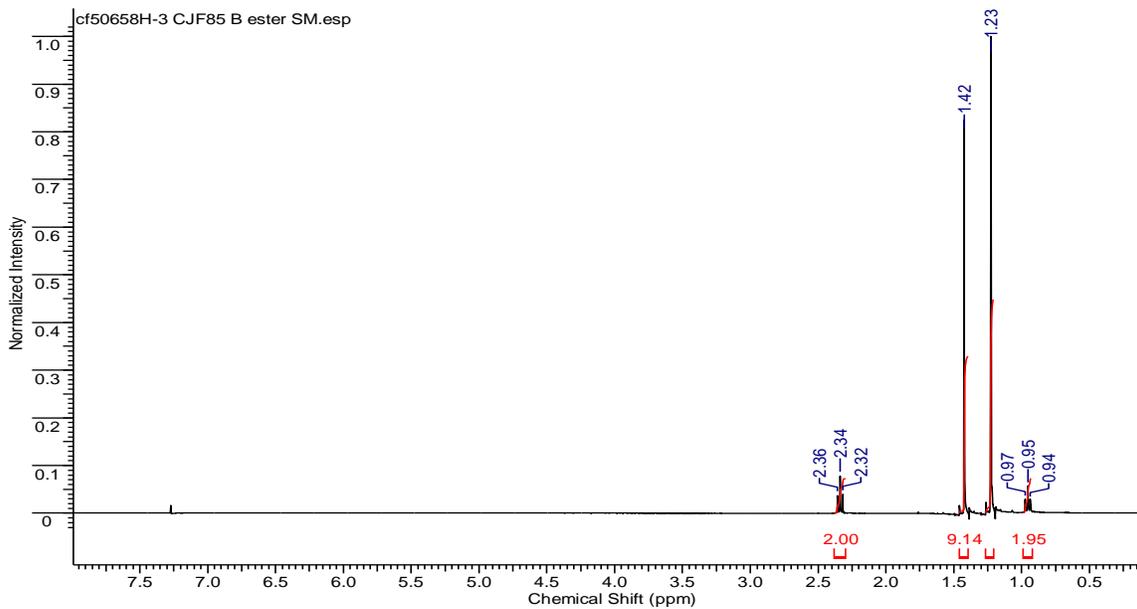
#### <sup>13</sup>C NMR



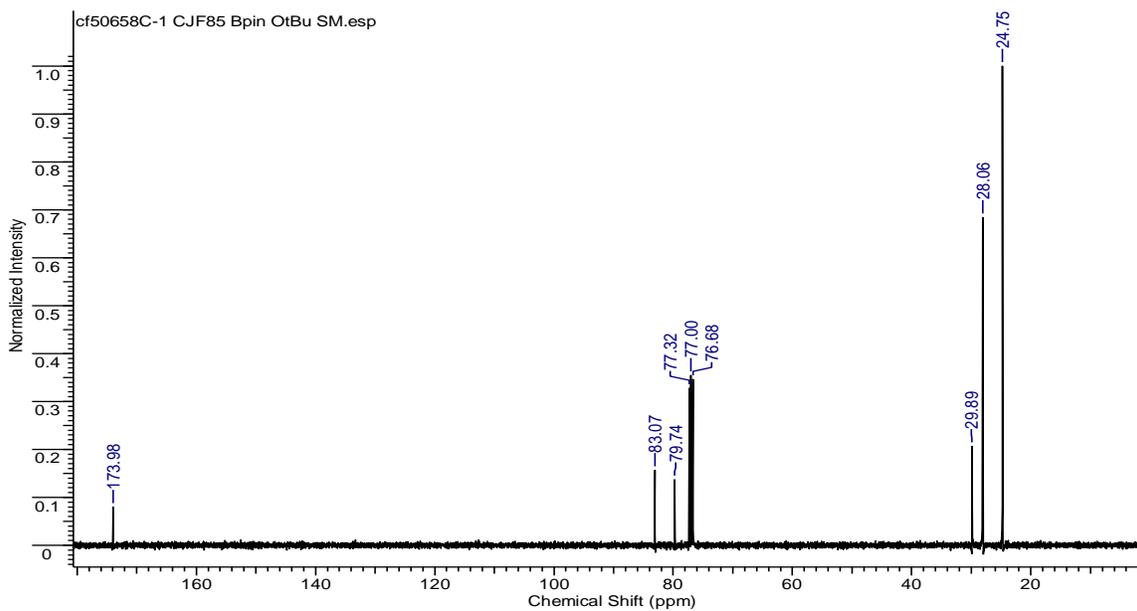
***tert*-Butyl 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propanoate (9e)**



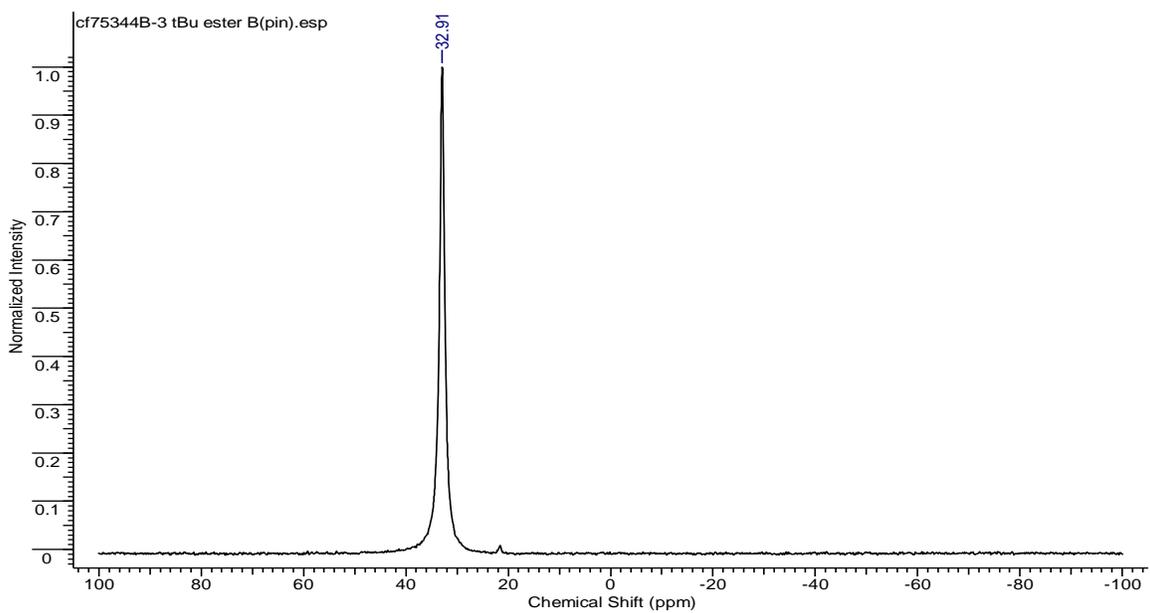
**<sup>1</sup>H NMR**



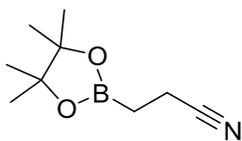
**<sup>13</sup>C NMR**



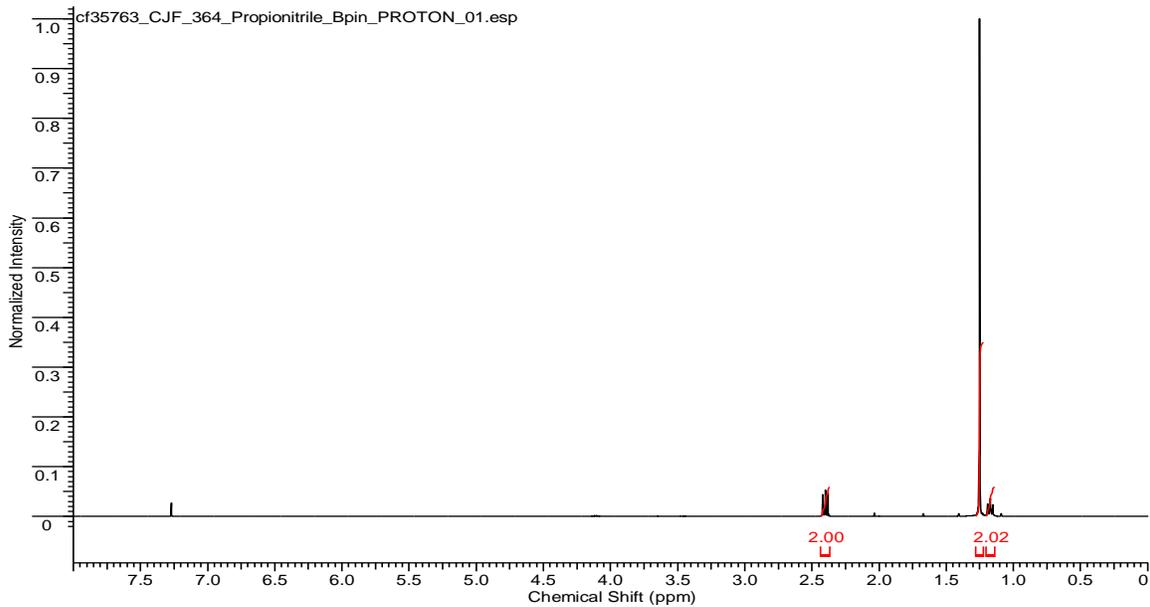
$^{11}\text{B}$  NMR



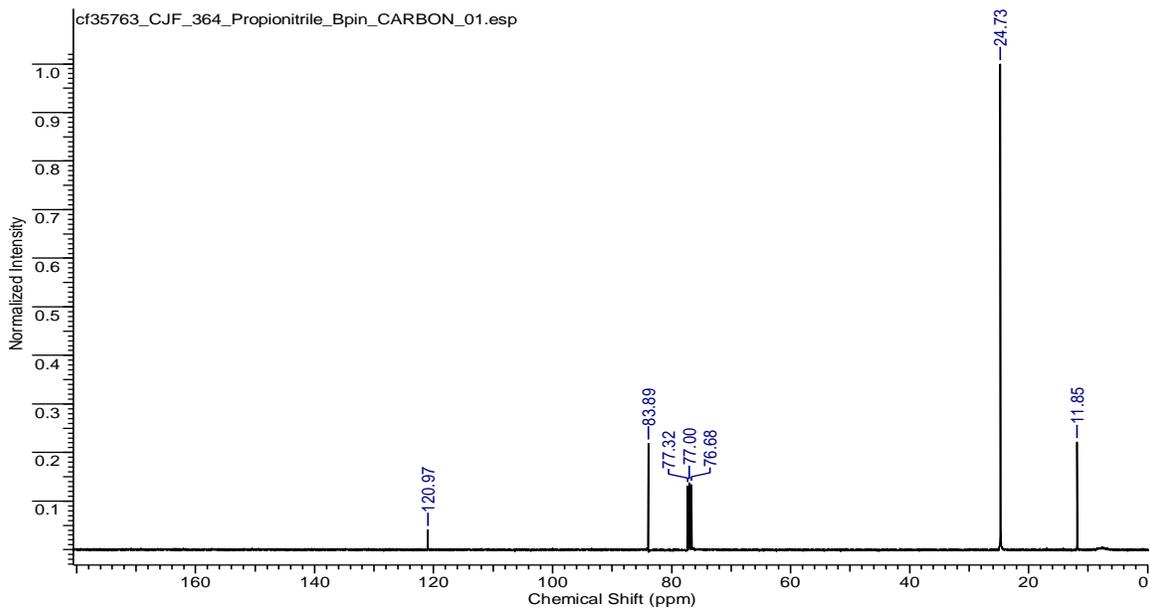
### 3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)propanenitrile (9f)



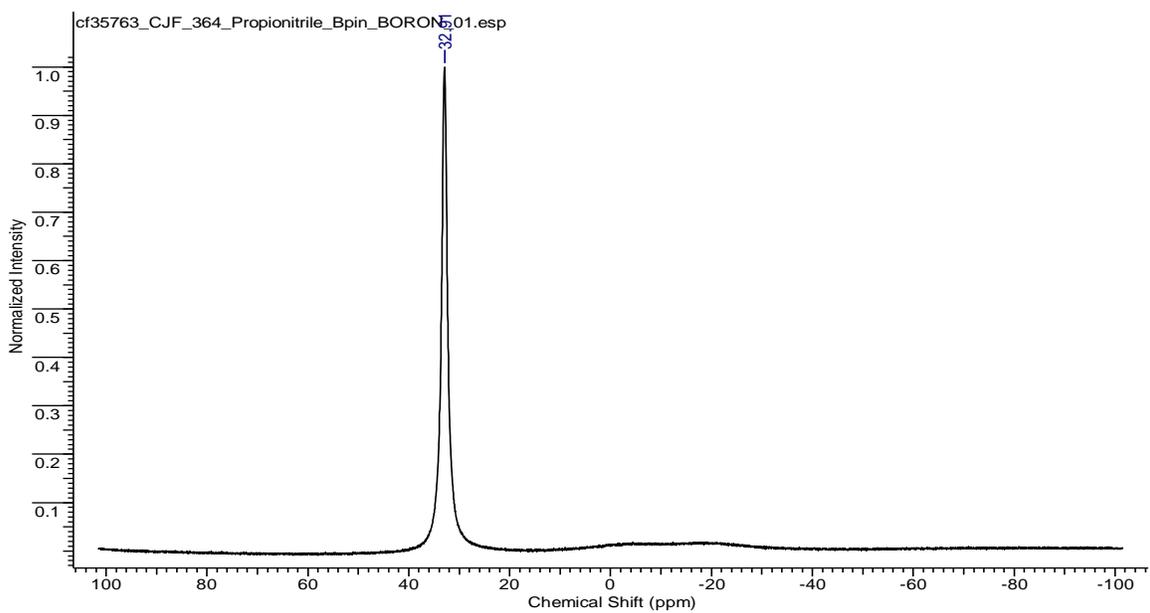
#### <sup>1</sup>H NMR



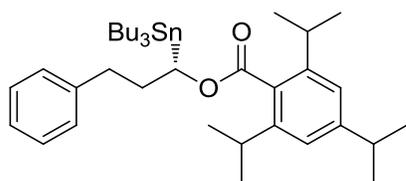
#### <sup>13</sup>C NMR



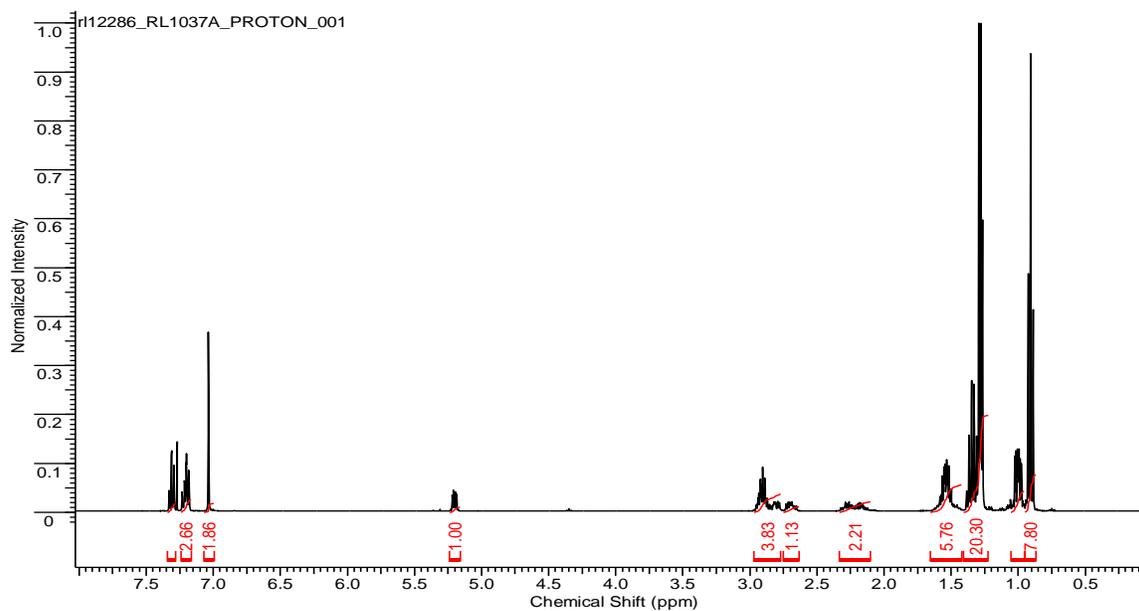
# $^{11}\text{B}$ NMR



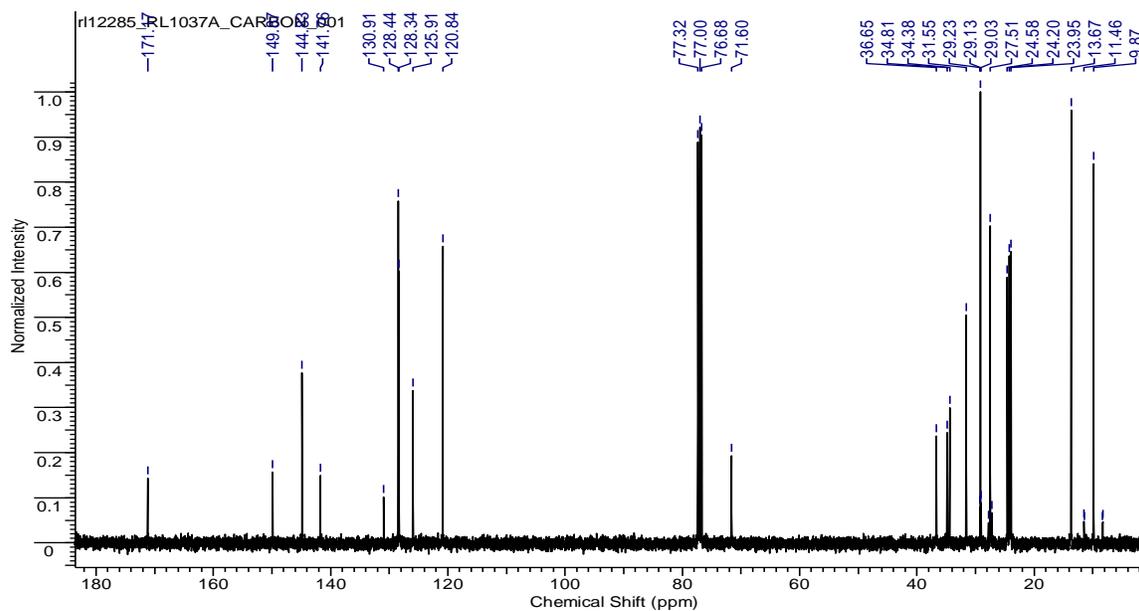
**(S)-3-Phenyl-1-(tributylstannyl)propyl 2,4,6-triisopropylbenzoate (8)**



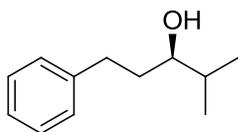
**<sup>1</sup>H NMR**



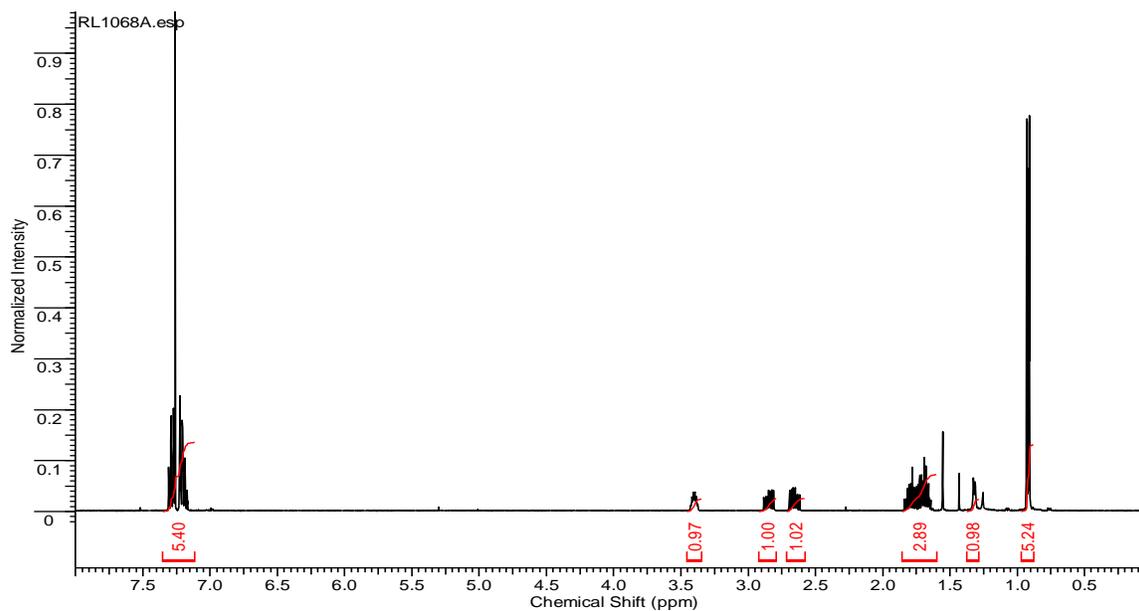
**<sup>13</sup>C NMR**



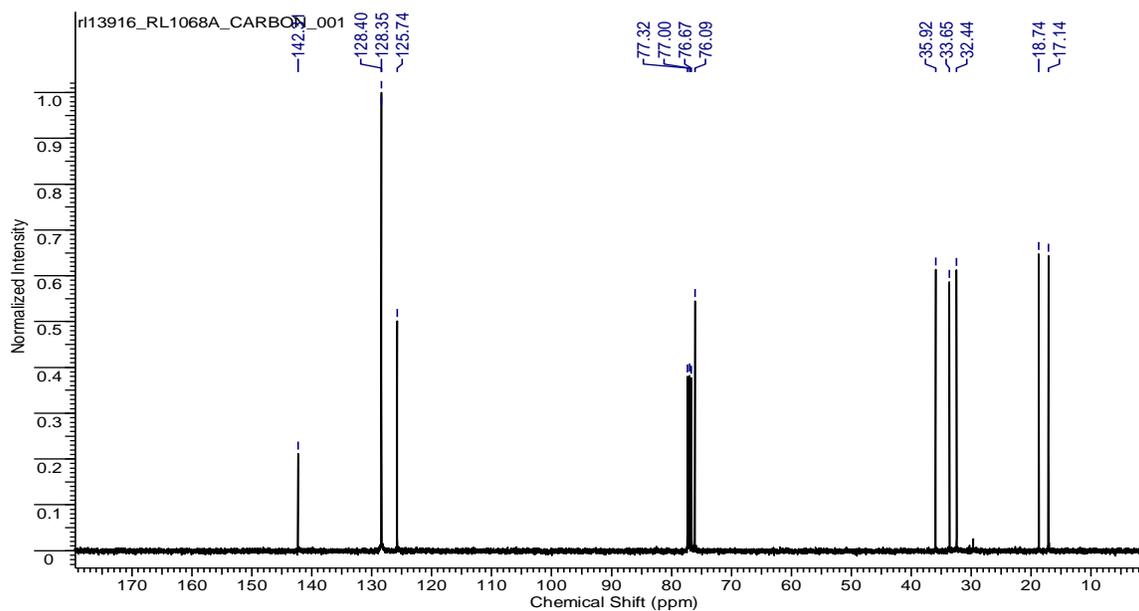
**(R)-4-Methyl-1-phenylpentan-3-ol (9a)**



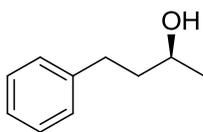
**<sup>1</sup>H NMR**



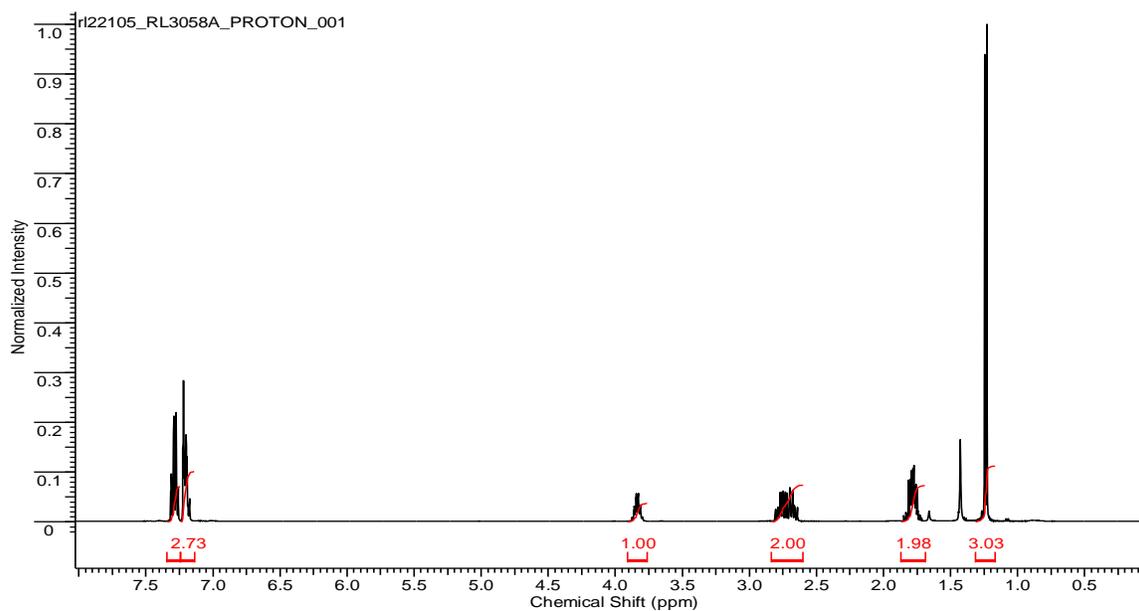
**<sup>13</sup>C NMR**



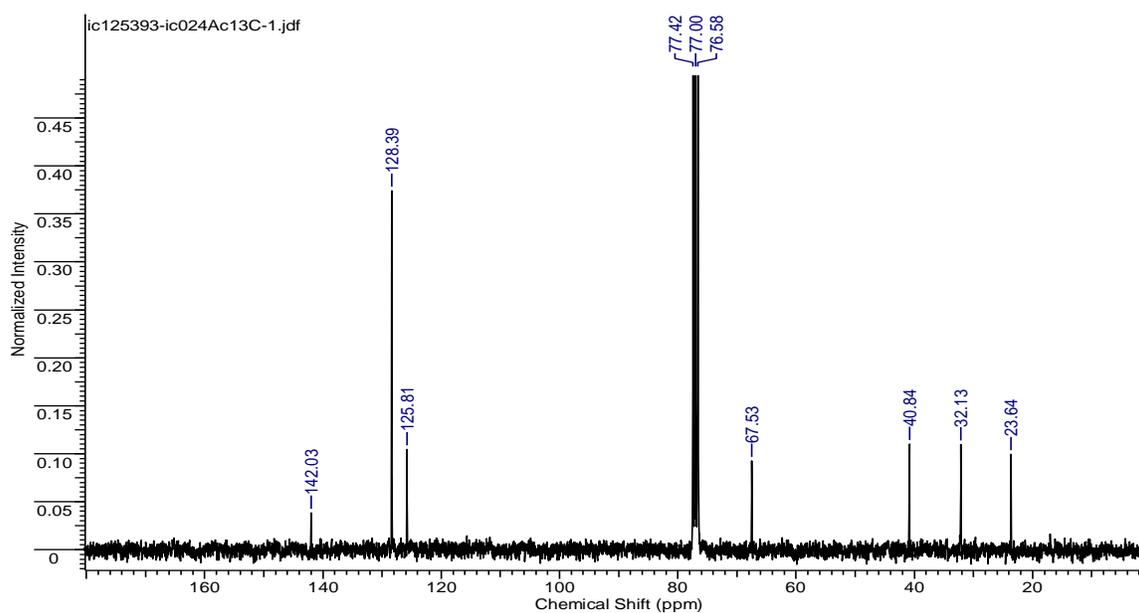
### (S)-4-Phenylbutan-2-ol (9b)



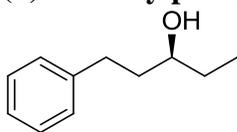
### <sup>1</sup>H NMR



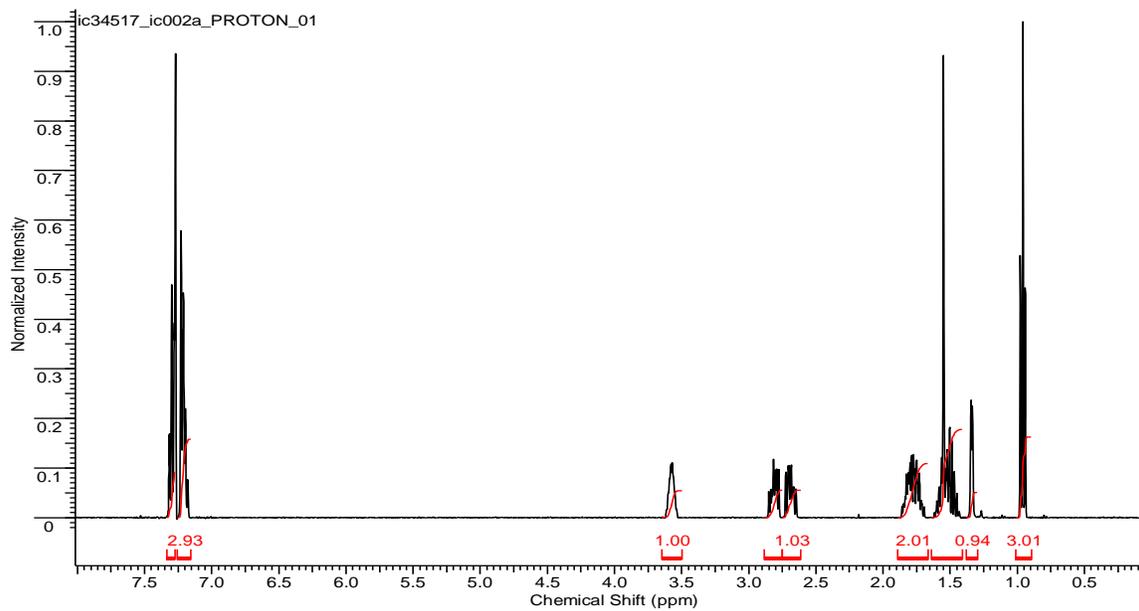
### <sup>13</sup>C NMR



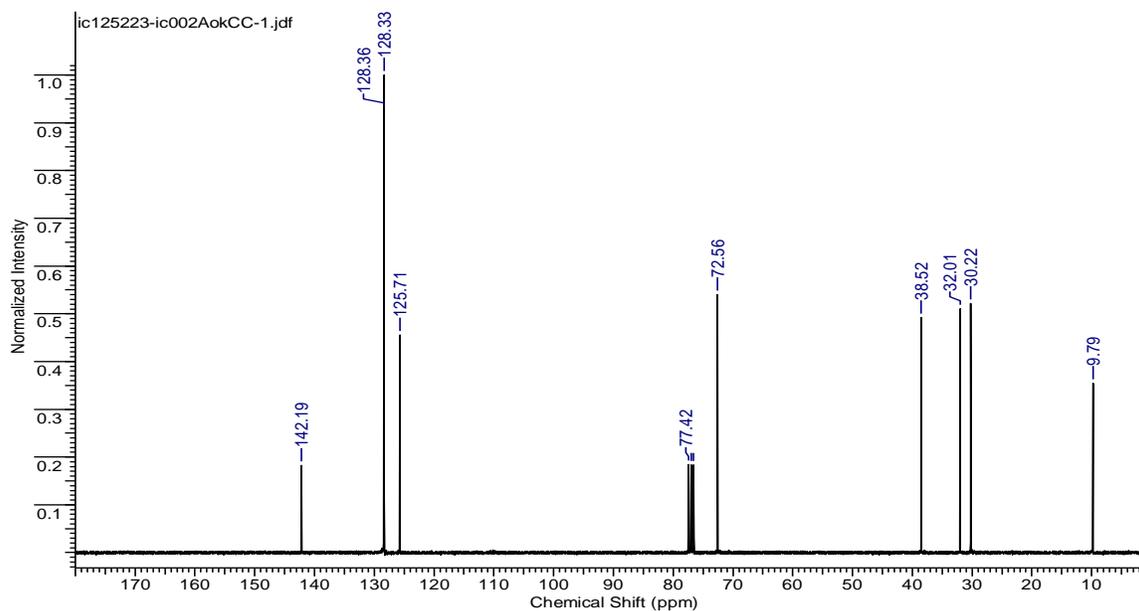
**(S)-1-Phenylpentan-3-ol (9c)**



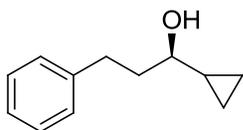
**<sup>1</sup>H NMR**



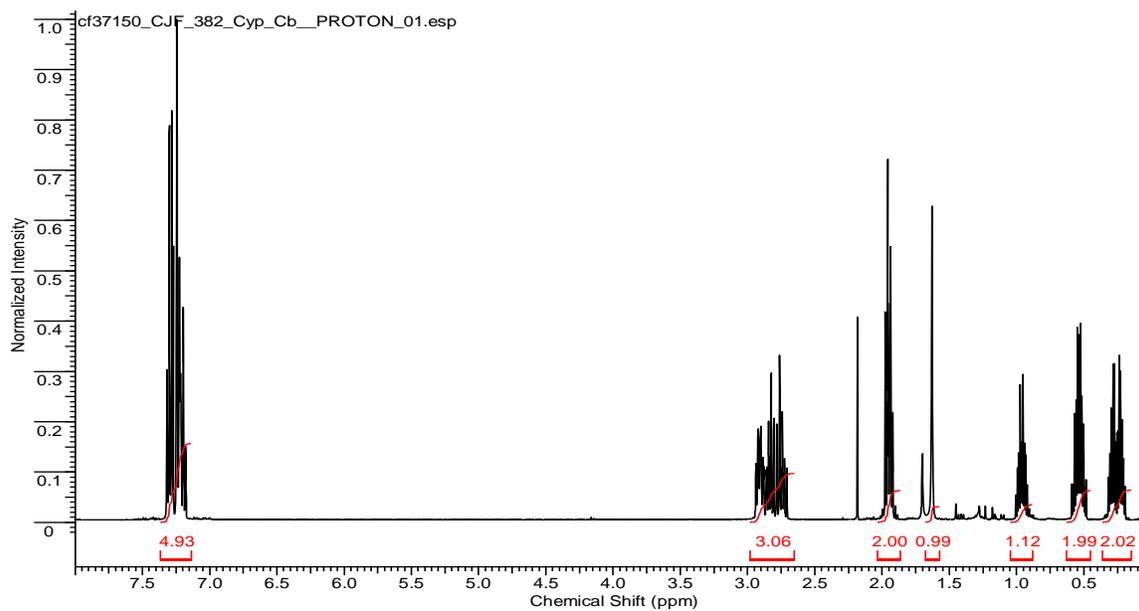
**<sup>13</sup>C NMR**



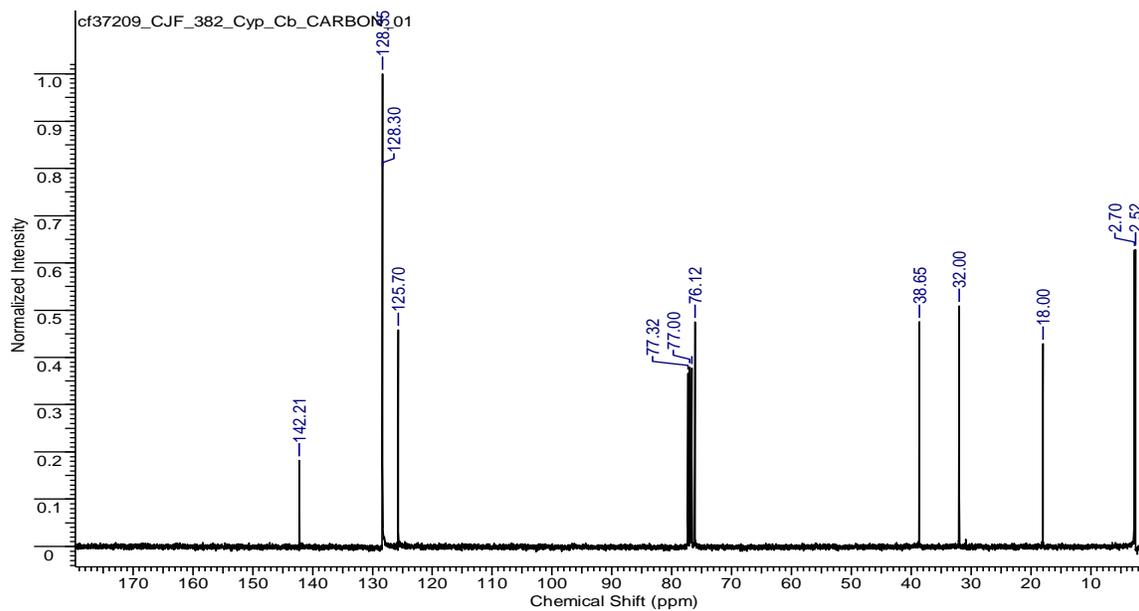
**(R)-1-Cyclopropyl-3-phenylpropan-1-ol (9d)**



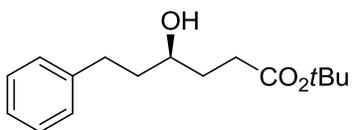
**<sup>1</sup>H NMR**



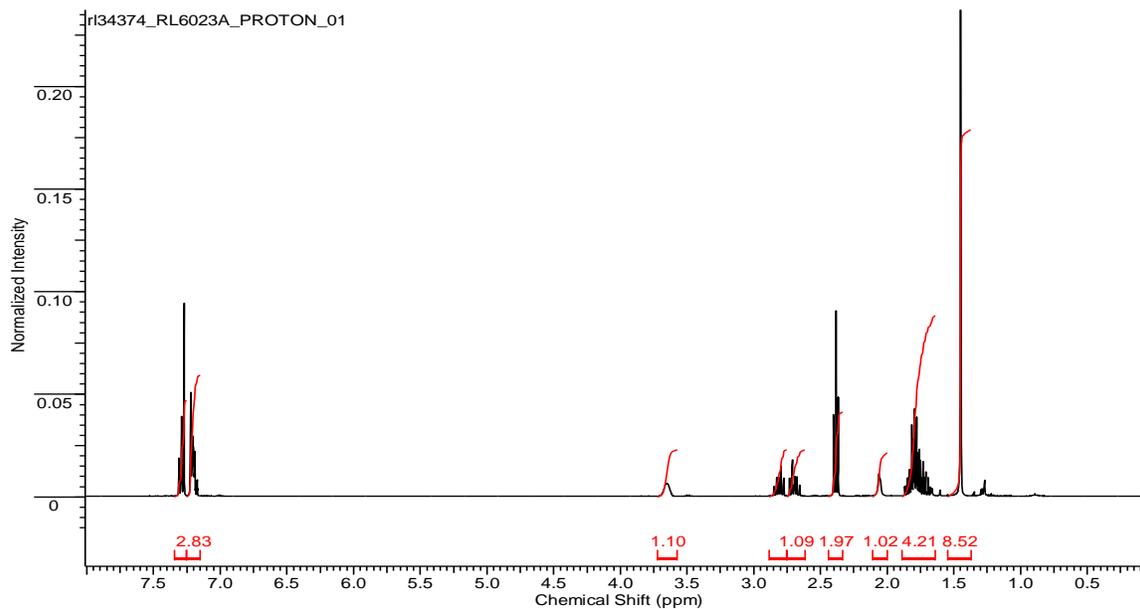
**<sup>13</sup>C NMR**



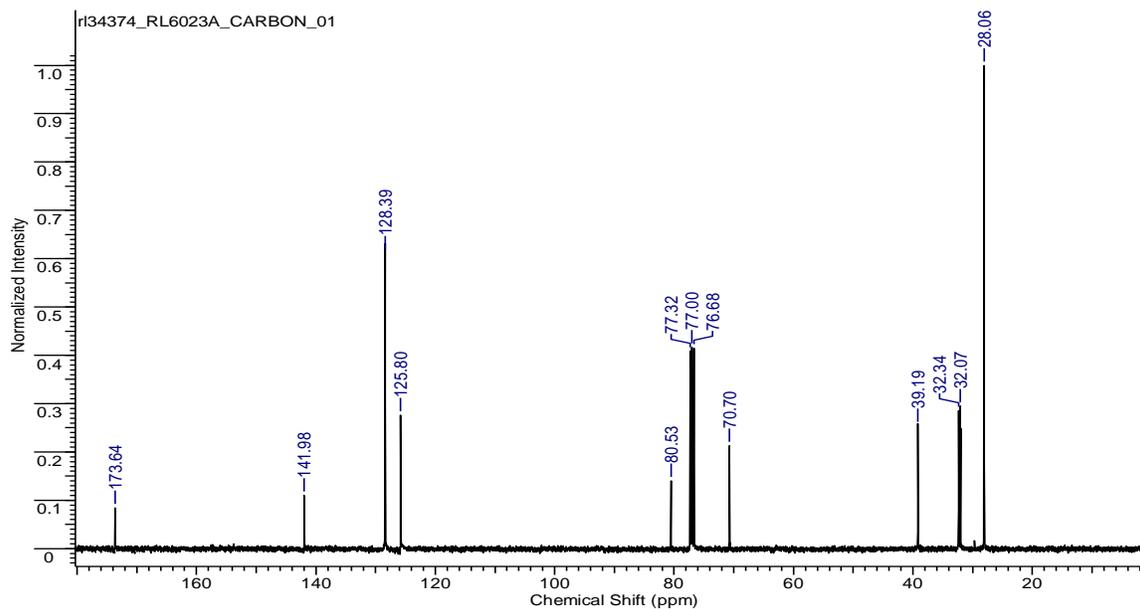
**(R)-tert-Butyl 4-hydroxy-6-phenylhexanoate (9e)**



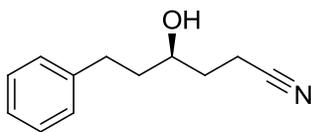
**<sup>1</sup>H NMR**



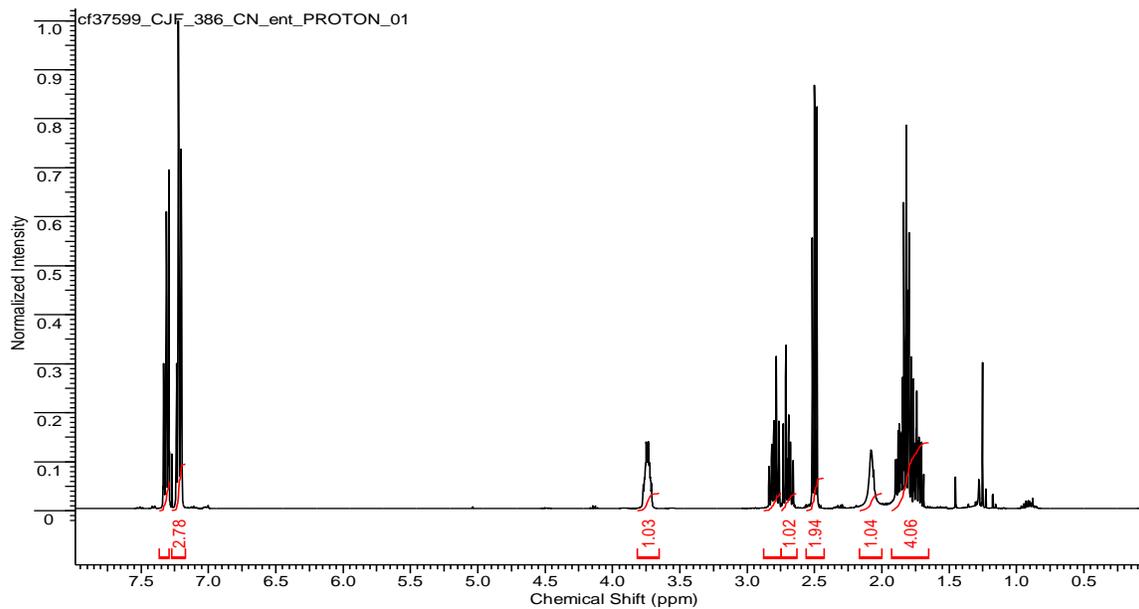
**<sup>13</sup>C NMR**



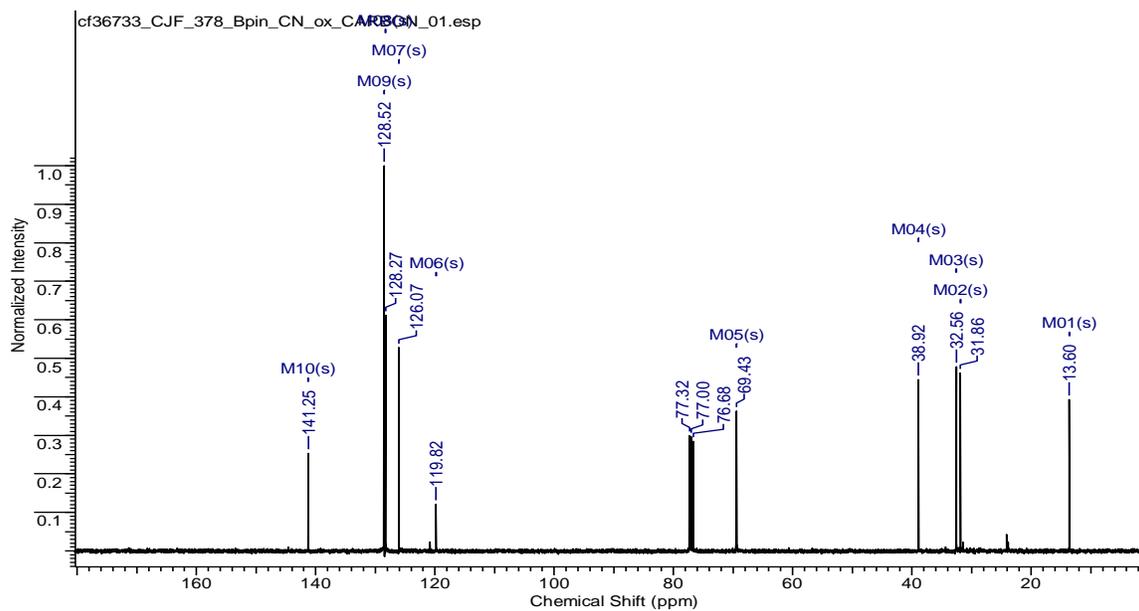
### (R)-4-Hydroxy-6-phenylhexanenitrile (9f)



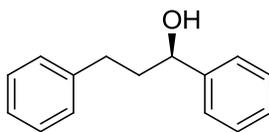
#### <sup>1</sup>H NMR



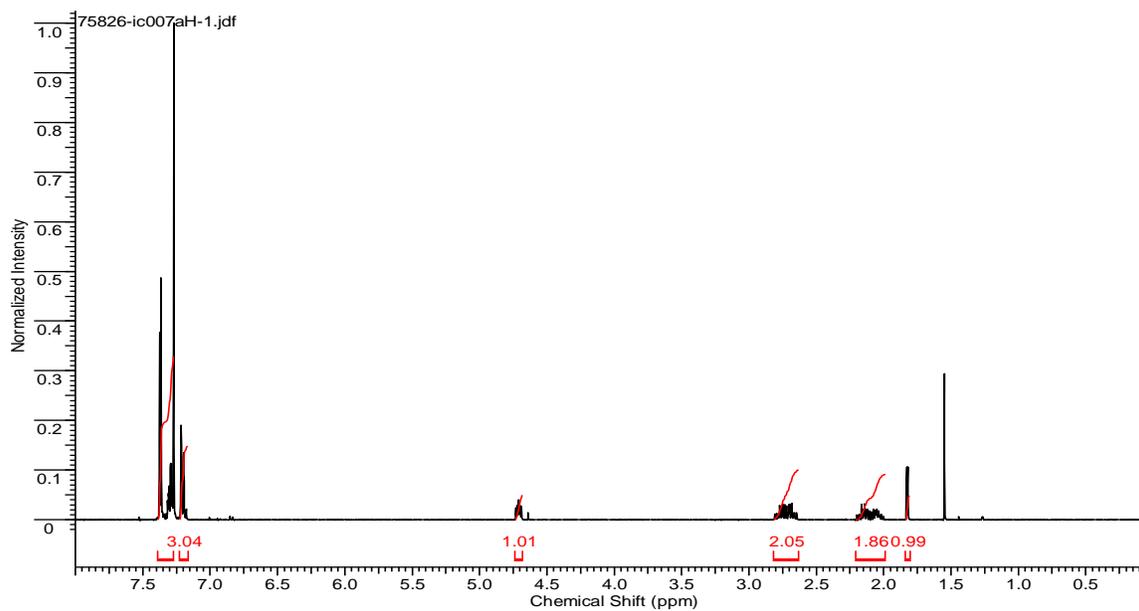
#### <sup>13</sup>C NMR



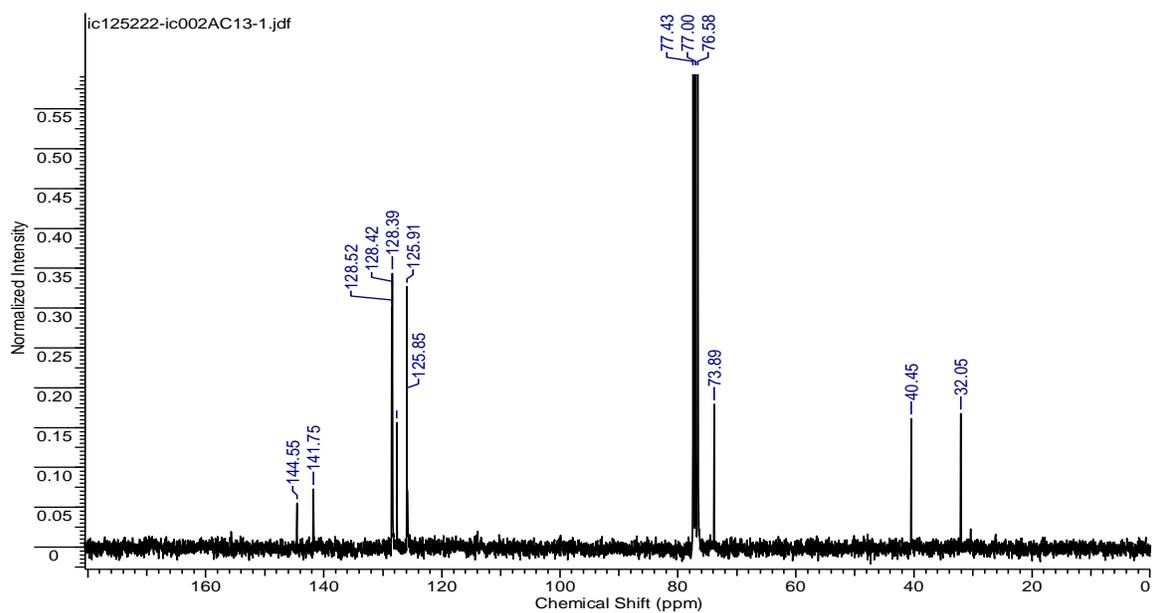
**(R)-1,3-Diphenylpropan-1-ol (9g)**



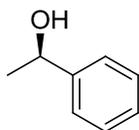
**<sup>1</sup>H NMR**



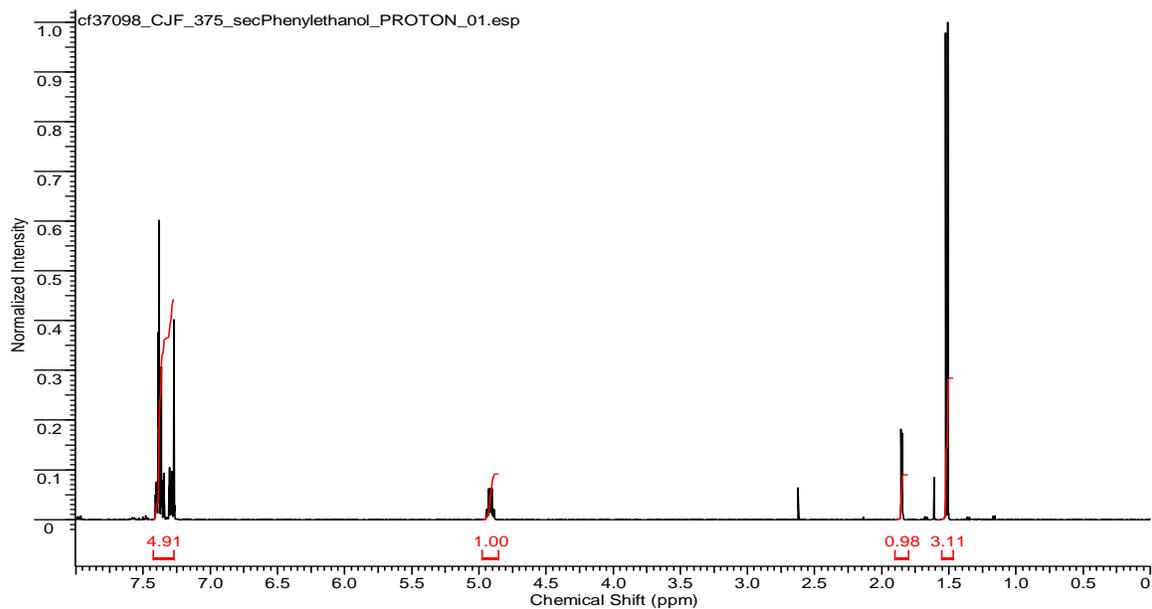
**<sup>13</sup>C NMR**



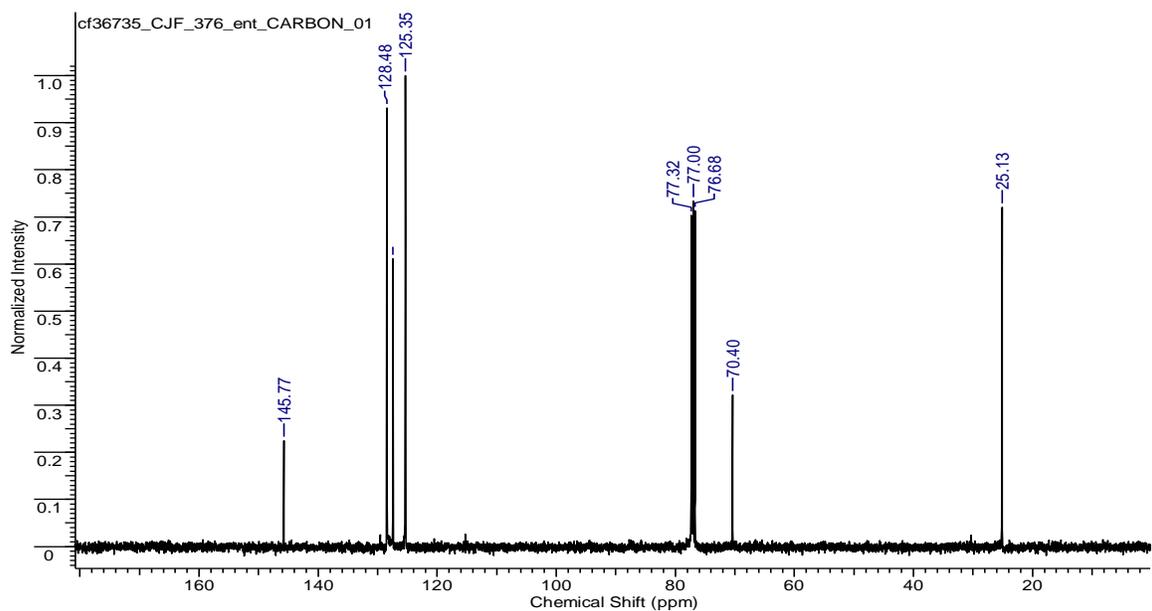
### (*R*)-1-Phenylethanol (15)



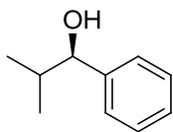
### <sup>1</sup>H NMR



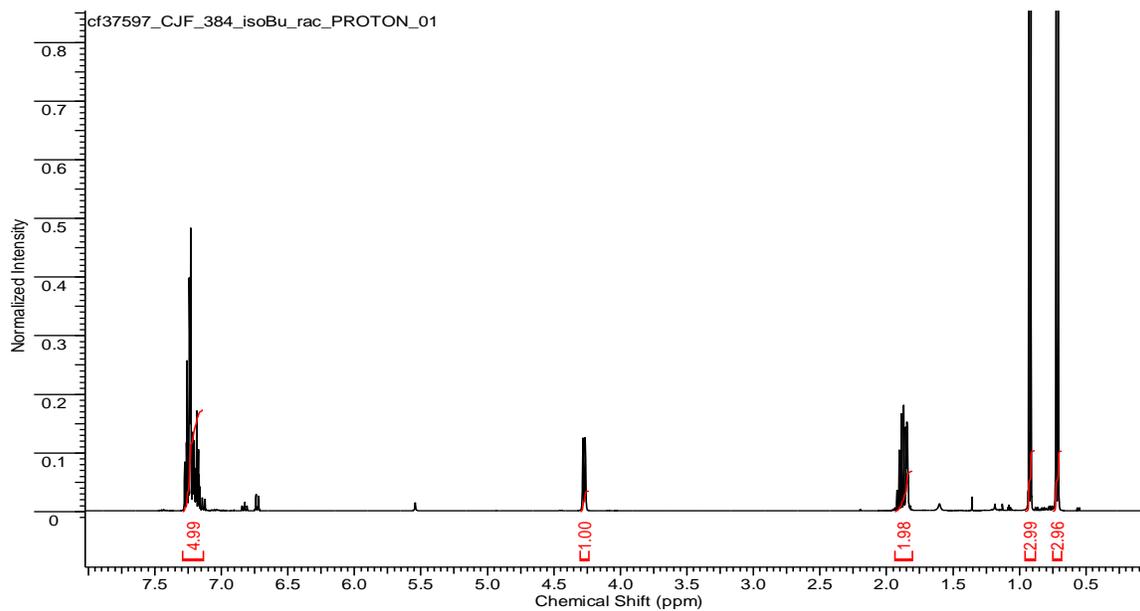
### <sup>13</sup>C NMR



### (R)-2-Methyl-1-phenylpropan-1-ol (16)



#### <sup>1</sup>H NMR



#### <sup>13</sup>C NMR

