Supporting Information

Palladium-Catalyzed Suzuki–Miyaura Cross-Coupling Reactions of Enantiomerically enriched Potassium β-Trifluoroboratoamides with Various Aryl- and Hetaryl Chlorides

Gary A. Molander*, Inji Shin and Ludivine Jean-Gérard

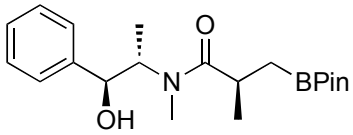
Roy and Diana A. Vagelos Laboratories, Department of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6323

Contents:

General.

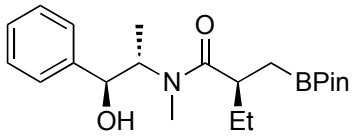
$Pd(OAc)_2$, RuPhos, SPhos and K_2CO_3 were used as received. All halides were used as received. Lithium chloride was dried under vacuum at 150 ºC for 24 h prior to use. Toluene was distilled from sodium/benzophenone prior to use. H_2O was degassed prior to use. Melting points (ºC) are uncorrected. ^1H, ^{13}C and ^{19}F NMR spectra were recorded at 500.39, 125.75, and 470.55 MHz, respectively. ^{19}F NMR chemical shifts were referenced to external $CFCl_3$ (0.0 ppm). ^{11}B NMR spectra at 128.4 MHz were obtained on a spectrometer equipped with the appropriate decoupling accessories. All ^{11}B NMR chemical shifts were referenced to external $BF_3 \bullet OEt_2$ (0.0 ppm) with a negative sign indicating an upfield shift. Analytical thin layer chromatography (TLC) was performed on TLC silica gel plates (0.25 nm) precoated with a fluorescent indicator. Standard flash chromatography procedures were followed using 32–63 μm silica gel. Visualization was effected with ultraviolet light, cerium ammonium molybdate (CAM), and $KMnO_4$.

General Procedure for the Alkylation Reaction.

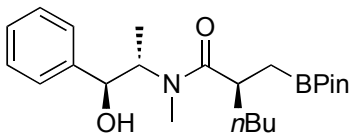


(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethyl-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)propanamide (5a). A flame-dried round bottom flask was charged with LiCl (1.1 g, 27.1 mmol, 6.0 equiv), *i*-Pr_2NH (1.5 mL, 10.6 mmol, 2.4 equiv), and THF (13 mL). The solution was cooled to –78 ºC, and added to a solution of *n*-BuLi in hexanes (2.5 M, 4.4 mL, 9.5 mmol, 2.1 equiv). The resulting mixture was briefly warmed to 0 ºC and cooled to –78 ºC again. A cooled solution of amide **4a** (1.0 g, 4.5 mmol, 1.0 equiv) in THF (15 mL) was added to the reaction flask. The mixture was stirred at –78 ºC for 1 h, at 0 ºC for 15 min, and at rt for 5 min and then cooled to 0 ºC. Iodomethylpinacolboronate (1.8 g, 6.75 mmol, 1.5 equiv) was added to reaction mixture and stirred at 0 ºC for 30 min, and then the reaction was quenched by the addition of saturated aq. NH_4Cl solution (10 mL). The mixture was extracted with EtOAc (2 ×30 mL) and brine (10 mL). The organic layer was dried ($MgSO_4$), concentrated in vacuo, and purified by column chromatography (hexane:EtOAc = 1:1) to afford the product **5a** (1.4 g, 3.9 mmol) as a colorless oil in 86% yield. $[\alpha]^{20}_D$ +60.8 (c 1.20, $CHCl_3$); ^{1}H NMR (1.2:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.39–7.06 (m, 5H), 4.72 (br, 1H), 4.42 (d, *J* = 9.0 Hz, 1H), 4.14* (d, *J* = 1.5 Hz, 1H), 4.12–4.02* (m, 1H), 4.02–3.94 (m, 1H), 3.34–3.27 (m, 1H), 2.77 (s, 3H), 2.69–2.63* (m, 1H), 2.37* (s, 3H), 1.71 (dd, *J* = 16.0, 10.0 Hz, 1H), 1.25 (dd, 1H, *J* = 15.5, 7.0 Hz, 1H), 1.14* (s, 12H), 1.12–1.11 (m, 15H), 1.03 (d, 3H, *J* = 7.0 Hz, 3H), 0.60* (d, 3H, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) 179.7*, 178.8 128.8, 142.5*, 141.1, 128.6, 128.3*, 128.1*, 127.5*, 127.1, 126.6, 83.2*, 82.9, 76.2*, 75.5, 58.8, 33.1*, 32.3, 26.9, 25.9,

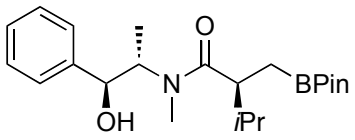
24.7*, 24.5, 20.3, 19.4*, 15.8, 14.2*; ^{11}B NMR (128.4 MHz, C_6D_6) δ 31.8; IR (neat) 3369, 2976, 1617 cm^{-1}; HRMS (ES+) calcd. for $C_{20}H_{32}BNO_4Na$ $[M+Na]^+$ 383.2322, found 383.2314.



(*S*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*-methyl-2-((4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)methyl)butanamide (5b). The reaction was carried out with amide **4b** (4.1 g, 17.4 mmol, 1.0 equiv) according to the general alkylation procedure to obtain **5b** (6.5 g, 17.2 mmol) as a colorless oil in 99% yield. $[\alpha]^{20}_D$ +72.0 (c 1.54, $CHCl_3$); ^{1}H NMR (1:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.39 (t, *J* = 8.0 Hz, 2H), 7.22–7.06 (m, 3H), 4.80–4.74 (m, 1H), 4.71* (br, 1H), 4.42 (d, *J* = 9.0 Hz, 1H), 4.11–4.02 (m, 1H), 3.27–3.18* (m, 1H), 2.80 (s, 3H), 2.62–2.53 (m, 1H), 2.45* (s, 3H), 1.84–1.73 (m, 1H), 1.70–1.62* (dd, *J* = 16.0, 10.0 Hz, 1H), 1.61–1.40 (m, 2H), 1.32–1.25 (m, 1H), 1.13* (d, *J* = 10.5 Hz, 12H), 1.10 (s, 12H), 1.08 (d, *J* = 7.0 Hz, 3H), 0.86* (t, *J* = 7.5 Hz, 3H), 0.81 (t, *J* = 7.5 Hz, 3H), 0.64* (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 179.2*, 178.2, 142.6*, 141.2, 128.7, 128.4, 128.2*, 127.7*, 127.2, 126.8*, 83.5, 83.1*, 78.4*, 75.7, 59.0, 39.7*, 38.8, 28.0, 27.7*, 26.9, 25.0, 24.8*, 24.6, 16.1, 14.5*, 11.9*, 11.9; ^{11}B NMR (128.4 MHz, C_6D_6) δ 31.9; IR (neat) 3435, 1638 cm^{-1}; HRMS (ES+) calcd. for $C_{21}H_{35}NO_4$ $[M+H]^+$ 376.2659, found 376.2653.



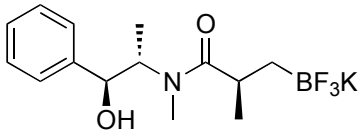
(*S*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*-methyl-2-((4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)methyl)hexanamide (5c). The reaction was carried out with amide **4c** (1.1 g, 4.18 mmol, 1.0 equiv) according to the general alkylation procedure to obtain **5c** (1.4 g, 3.47 mmol) as a colorless oil in 83% yield. $[\alpha]^{20}_{D}$ +61.8 (c 1.23, $CHCl_3$); ^{1}H NMR (1:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.39 (dd, *J* = 7.0, 5.0 Hz, 2H), 7.22–7.07 (m, 3H), 4.77* (s, 1H), 4.46 (d, *J* = 9.0 Hz, 1H), 4.36 (s, 1H), 4.18–4.08 (m, 1H), 3.36–3.28* (m, 1H), 2.82 (s, 3H), 2.72–2.63 (m, 1H), 2.51* (s, 3H), 1.82–1.73* (m, 1H), 1.65 (dd, *J* = 16.0, 10.0 Hz, 1H), 1.60–1.43 (m, 2H), 1.32–1.17 (m, 5H), 1.14* (d, *J* = 10.0 Hz, 12H), 1.11 (s, 12H), 0.87* (t, *J* = 7.0 Hz, 3H), 0.76 (t, *J* = 7.0 Hz, 3H), 1.37 (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 179.4*, 178.4, 142.7*, 141.3, 128.7, 128.4, 128.3*, 127.7*, 127.3, 126.8*, 83.5, 83.2*, 76.5*, 75.8, 59.0, 38.2*, 37.1, 34.7, 34.5*, 29.7*, 29.4, 26.9, 25.0, 24.8*, 24.6, 22.9*, 22.7, 16.1, 14.5*, 14.1*, 14.0; ^{11}B NMR (128.4 MHz, C_6D_6) δ 31.7; IR (neat) 3436, 1634 cm^{-1}; HRMS (ES+) calcd. for $C_{23}H_{39}NO_4B$ $[M+H]^+$ 404.2972, found 404.2984.



(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*,3-dimethyl-2-((4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)methyl)butanamide (5d). The reaction was carried out with amide **4d** (1.4 g, 5.62 mmol, 1 equiv) according to the general alkylation procedure to obtain **5d** (1.5 g, 3.85 mmol) as a colorless oil in 69% yield. $[\alpha]^{20}_{D}$ +73.5 (c 2.04, $CHCl_3$); ^{1}H NMR (1:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.40 (dd, *J* = 15.0, 7.5 Hz, 2H), 7.23–7.07 (m, 3H), 4.83–4.78* (m, 1H),

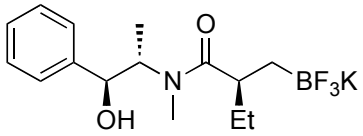
4.76* (s, 1H), 4.47 (d, J = 8.0 Hz, 2H), 4.18–4.08 (m, 1H), 3.25–3.19* (m, 1H), 2.80 (s, 3H), 2.56* (s, 3H), 2.55–2.47 (m, 1H), 2.08–1.99* (m, 1H), 1.89–1.78 (m, 1H), 1.70–1.61* (m, 1H), 1.35* (dd, J = 16.0, 9.0 Hz, 1H), 1.12* (d, J = 14.0 Hz, 12H), 1.10 (s, 12H), 1.00 (ddd, J = 21.0, 16.5, 5.0 Hz, 2H), 0.89 (dd, J = 11.5, 6.5 Hz, 6H), 0.83 (d, J = 7.0 Hz, 3H), 0.66* (d, J = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 178.8*, 177.6, 142.6*, 141.2, 128.7, 128.3, 128.1*, 127.6*, 127.2, 126.8*, 83.5, 83.1*, 76.4*, 75.7, 59.1, 44.4*, 43.0, 31.7, 31.5*, 26.8*, 24.9, 24.7*, 24.5, 21.5, 21.1*, 19.0*, 18.5, 16.2, 14.3*; ^{11}B NMR (128.4 MHz, C_6D_6) δ 32.3; IR (neat) 3435, 1620 cm^{-1}; HRMS (ES+) calcd. for $C_{22}H_{37}NO_4B$ $[M+H]^+$ 390.2816, found 390.2797.

General Procedure for the Preparation of Chiral Potassium Trifluoroboratoamidohomoenolates.



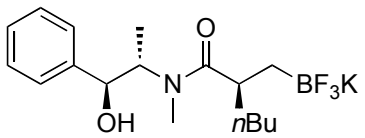
Potassium (*R*)-3-(Trifluoroborato)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (6a). Boronate ester **5a** (4.4 g, 12.2 mmol, 1.0 equiv) was dissolved in MeCN (24 mL) and cooled to 0 ºC. KHF_2 (2.9 g, 36.5 mmol, 3.0 equiv) in H_2O (8 mL) was added. The reaction mixture was stirred for 20 min at 0 ºC. The solution was concentrated in vacuo and then dried in vacuo overnight. The crude mixture was extracted with acetone (2 × 20 mL), and the extracts were combined and concentrated. Et_2O (30 mL) was added to precipitate the product. The product **6a** (3.7 g, 11.0 mmol) was filtered and dried in vacuo and obtained as a white solid in 90% yield. $[\alpha]^{20}_D$ +48.2 (c 1.42, MeOH); mp: 124–129 ºC; ^{1}H NMR (2:1 rotamer ratio, asterisk denotes minor

rotamer peaks, presence of less than 5% of pinacol, 500 MHz, DMSO-d_6) δ 7.47–7.19 (m, 5H), 5.31–5.18 (m, 1H), 5.07–4.99* (m, 1H), 4.68–4.54 (m, 1H), 4.54–4.45 (m, 1H), 4.25–4.15* (m, 1H), 2.82 (s, 3H), 2.70* (s, 3H), 2.59–2.51 (m, 1H), 0.94* (d, J = 6.0 Hz, 3H), 0.88 (d, J = 6.5 Hz, 3H), 0.79 (d, J = 6.5 Hz, 3H), 0.68–0.65* (m, 1H), 0.23–0.12 (m, 1H), 0.07– –0.11 (m, 1H); ^{13}C NMR (125.6 MHz, DMSO-d_6) δ 179.5, 179.4*, 143.9, 143.8*, 128.0*, 127.8, 127.5*, 127.3*, 127.0, 126.9, 74.2, 74.0, 73.5*, 56.2, 32.3, 32.0*, 29.5*, 26.0*, 25.0, 20.0*, 18.9, 15.4*, 13.9; ^{19}F NMR (470.8 MHz, DMSO-d_6) δ –135.2*, –136.1; ^{11}B NMR (128.4 MHz, DMSO-d_6) δ 3.92; IR (KBr) 3505, 2970, 1615 cm^{-1}; HRMS (ES-) calcd. for $C_{15}H_{22}BNO_2F_3$ $[M–K]^-$ 302.1539, found 302.1547.

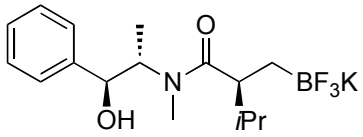


Potassium (*S*)-2-((Trifluoroborato)methyl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*-methylbutanamide (6b). The reaction was carried out with boronate ester **5b** (6.1 g, 16.3 mmol, 1.0 equiv) according to the general procedure for the preparation of chiral potassium trifluoroboratohomoenolates to obtain **6b** (4.2 g, 11.8 mmol) as a white solid in 72% yield. $[\alpha]^{20}_D$ +52.3 (c 1.21, MeOH); mp: 185–186 ºC; ^{1}H NMR (2:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, DMSO-d_6) δ 7.63–7.29 (m, 5H), 5.36 (s, 1H), 5.03* (s, 1H), 4.76 (br, 1H), 4.70–4.68 (m, 1H), 4.62–4.58* (m, 1H), 4.39–4.38* (m, 1H), 2.95 (s, 3H), 2.86* (s, 3H), 2.65–2.57 (m, 1H), 1.67–1.55* (m, 2H), 1.55–1.44 (m, 2H), 0.99 (d, J = 6.5 Hz, 3H), 0.92* (d, J = 6.0 Hz, 3H), 0.77* (t, J = 7.0 Hz, 3H), 0.70 (t, J = 7.0 Hz, 3H), 0.65–0.58* (m, 1H), 0.30–0.18 (m, 1H), 0.18–0,07 (m, 1H); ^{13}C NMR (125.6 MHz, DMSO-d_6) δ 178.7, 178.5*, 143.9, 143.8*, 128.0, 127.8, 127.5*, 127.3*,

126.8*, 126.7, 74.4*, 74.1, 56.2, 53.5*, 40.1, 30.2, 27.9, 26.8, 25.9*, 15.5*, 13.9, 12.9*, 12.7; ^{19}F NMR (470.8 MHz, DMSO-d_6) δ –134.9*, –136.0; ^{11}B NMR (128.4 MHz, DMSO-d_6) δ 4.5; IR (KBr) 3504, 2968, 1611 cm^{-1}; HRMS (ES-) calcd. for $C_{15}H_{22}BNO_2F_3$ [M–K]$^-$ 316.1696, found 316.1707.

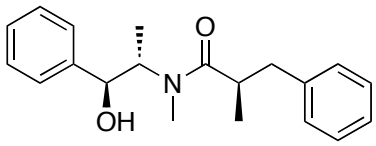


Potassium (*S*)-2-((Trifluoroboryl)methyl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*-methylhexanamide (6c). The reaction was carried out with boronate ester **5c** (1.2 g, 3.00 mmol, 1 equiv) according to the general procedure for the preparation of chiral potassium trifluoroboratohomoenolate to obtain **6c** (590 mg, 1.54 mmol) as a white solid in 61% yield. $[\alpha]^{20}_D$ +44.9 (c 1.02, MeOH); mp: 64–68 ºC; ^{1}H NMR (2:1 rotamer ratio, asterisk denotes minor rotamer peaks, presence of less than 5% of pinacol, 500 MHz, DMSO-d_6) δ 7.56–7.24 (m, 5H), 5.32 (s, 1H), 5.01–4.94* (m, 1H), 4.76–4.66 (m, 1H), 4.66–4.59 (m, 1H), 4.57–4.49* (m, 1H), 4.37–4.28* (m, 1H), 2.88 (s, 3H), 2.80* (s, 3H), 2.67–2.59* (m, 1H), 2.57 (s, 1H), 1.62–1.37 (m, 2H), 1.36–1.17 (m, 2H), 1.11–0.97 (m, 2H), 0.95 (d, J = 6.5 Hz, 3H), 0.87 (dd, J = 14.0, 7.5 Hz, 3H), 0.65–0.53* (m, 1H), 0.23–0.11 (m, 1H), 0.11–0.00 (m, 1H); ^{13}C NMR (125.6 MHz, DMSO-d_6) δ 178.9, 178.7*, 143.9, 128.0, 127.7, 127.5*, 127.3*, 126.8*, 126.7, 74.5, 74.2, 73.6*, 56.3, 38.0, 34.8*, 33.8, 30.4*, 29.9, 26.0*, 25.0, 22.6, 15.5*, 14.1, 14.0*, 13.9; ^{19}F NMR (470.8 MHz, DMSO-d_6) δ –134.9*, –136.0; ^{11}B NMR (128.4 MHz, DMSO-d_6) δ 4.19; IR (KBr) 3400, 2931, 1611 cm^{-1}; HRMS (ES-) calcd. for $C_{17}H_{26}BNO_2F_3$ [M–K]$^-$ 344.2009, found 344.2017.

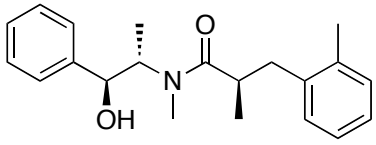


Potassium (*S*)-2-((Trifluoroboryl)methyl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,3-dimethylbutanamide (6d). The reaction was carried out with boronate ester **5d** (1.3 g, 3.44 mmol, 1.0 equiv) according to the general procedure for the preparation of chiral potassium trifluoroboratohomoenolate to obtain **6d** (1.1 g, 2.98 mmol) as a white solid in 83% yield. $[\alpha]^{20}_{D}$ +49.6 (c 1.21, MeOH); mp: 70–75 ºC; ^{1}H NMR (3:2 rotamer ratio, asterisk denotes minor rotamer peaks, presence of less than 5% of pinacol, 500 MHz, DMSO-d_6) δ 7.51–7.18 (m, 5H), 5.01 (s, 1H), 4.74–4.64* (m, 1H), 4.61–4.48 (m, 2H), 4.45–4.38* (m, 1H), 4.32–4.24* (m, 1H), 2.85 (s, 3H), 2.71* (s, 3H), 2.28–2.24* (m, 1H), 2.24–2.17 (m, 1H), 1.64–1.54* (m, 1H), 1.54–1.45 (m, 1H), 0.82 (ddd, J = 29.0, 14.0, 7.5 Hz, 6H), 0.70* (d, J = 6.5 Hz, 3H), 0.64 (d, J = 7.0 Hz, 3H), 0.34–0.26 (m, 1H), 0.22–0.06 (m, 1H); ^{13}C NMR (125.6 MHz, DMSO-d_6) δ 178.5, 178.3*, 144.0*, 143.9, 127.9, 127.7, 127.5*, 127.2*, 126.8, 74.9*, 74.2, 56.5, 44.7, 44.4*, 33.2*, 32.4, 26.0, 24.9*, 21.5*, 21.0, 20.6*, 20.5, 15.4*, 13.7; ^{19}F NMR (470.8 MHz, DMSO-d_6) δ –134.3*, –135.9; ^{11}B NMR (128.4 MHz, DMSO-d_6) δ 3.58; IR (KBr) 3512, 2964, 1611 cm^{-1}; HRMS (ES-) calcd. for $C_{16}H_{24}BNO_2F_3$ $[M–K]^-$ 330.1852, found 330.1855.

General Procedure for the Suzuki–Miyaura Cross-coupling Reaction.

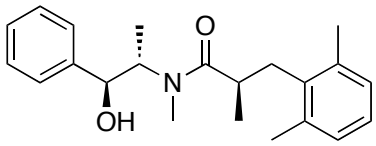


(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethyl-3-phenylpropanamide (7a). The flask was charged with **6a** (90 mg, 0.263 mmol, 1.05 equiv), $Pd(OAc)_2$ (3 mg, 0.013 mmol, 0.05 equiv), RuPhos (12 mg, 0.03 mmol, 0.1 equiv) and K_2CO_3 (104 mg, 0.75 mmol, 3.0 equiv) and then N_2 was purged 3 times. Chlorobenzene (32 mg, 0.25 mmol, 1.0 equiv) and toluene/H_2O (4:1, 0.8 mL/0.2 mL) were added to the reaction flask. The reaction mixture was stirred for 22 h at 85 ºC and then cooled to room temperature. A solution of pH 7 buffer (1 mL) was added, and the resulting mixture was extracted with EtOAc (2 × 3 mL). The organic layer was combined, dried ($MgSO_4$) and filtered. The solvent was removed in vacuo and purified by column chromatography (hexane:EtOAc = 2:1) to afford the product **7a** (54 mg, 0.18 mmol) as a white solid in 70% yield. ^{1}H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.33–6.98 (m, 10H), 4.70 (br, 1H), 4.57–4.36 (m, 2H), 4.22* (dd, *J* = 8.0, 3.0 Hz, 1H), 3.96–3.87* (m, 1H), 3.39* (dd, *J* = 13.5, 6.0 Hz, 1H), 3.01 (dd, *J* = 13.0, 8.0 Hz), 2.80* (s, 3H), 2.65–2.55 (m, 1H), 2.39 (dd, *J* = 13.5, 6.5 Hz, 1H), 2.15 (s, 3H), 1.06* (d, *J* = 6.5 Hz, 3H), 1.03 (d, *J* = 6.5 Hz, 3H), 0.83 (d, *J* = 6.0 Hz, 3H), 0.68* (d, *J* = 7.0 Hz, 3H). Data is consistant with that reported in the literature.[a]



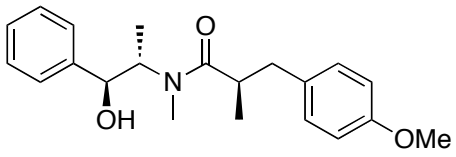
(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethyl-3-(*o*-tolyl)propanamide (7b). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and *o*-chlorotoluene (32 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **7c** (33 mg, 0.1

mmol) as a colorless oil in 40% yield. $[\alpha]^{20}_{D}$ +10.6 (c 1.60, $CHCl_3$); ^{1}H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.38–6.91 (m, 9H), 4.85 (br, 1H), 4.60 (br, 1H), 4.53 (d, *J* = 6.5 Hz, 1H), 4.33* (d, *J* = 8.5 Hz, 1H), 4.00–3.92* (m, 1H), 3.80* (br, 1H), 3.39* (dd, *J* = 13.5, 5.5 Hz, 1H), 3.32–3.24* (m, 1H), 3.00 (dd, *J* = 13.5, 8.0 Hz, 1H), 2.94* (dd, *J* = 13.5, 8.5 Hz, 1H), 2.82* (s, 3H), 2.74–2.70 (m, 1H), 2.59 (dd, *J* = 14.0, 6.0 Hz, 1H), 2.38* (s, 3H), 2.20 (s, 3H), 2.14 (s, 3H), 1.08 (d, *J* = 6.5 Hz, 3H), 0.86 (d, *J* = 6.5 Hz, 3H), 0.72* (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 178.5, 177.4*, 142.5, 141.3*, 138.6*, 138.1, 136.5*, 136.1, 130.4*, 130.3, 130.1*, 129.7, 128.7*, 128.4, 127.6, 126.9*, 126.5, 126.4, 126.4*, 125.9 76.5, 75.1*, 58.3, 37.5, 37.2, 37.1*, 36.6*, 32.2, 27.1*, 19.6*, 19.5, 17.9*, 17.7, 15.6*, 14.3 ; IR (neat) 3370, 2972, 2933, 1618 cm^{-1}; HRMS (ES+) calcd. for $C_{21}H_{28}NO_2$ $[M+H]^+$ 326.2120, found 326.2115.



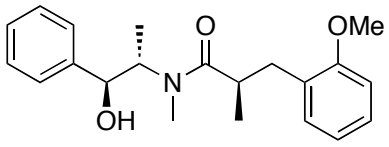
(*R*)-3-(2,6-Dimethylphenyl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (7c). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 2,6-dimethyl-1-chlorobenzene (35 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **7c** (32 mg, 0.09 mmol) as a colorless oil in 38% yield. $[\alpha]^{20}_{D}$ –10.1 (c 1.05, $CHCl_3$); ^{1}H NMR (5:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.32–6.84 (m, 8H), 4.59 (br, 1H), 4.43 (d, *J* = 7.5 Hz, 1H), 4.16* (d, *J* = 9.0 Hz, 1H), 3.87–3.78* (m, 1H), 3.39–3.25* (m, 2H), 3.19–3.10* (m, 1H), 3.03 (dd, *J* = 14.0,

8.5 Hz, 1H), 2.82–2.72 (m, 1H), 2.78* (s, 3H), 2.68 (dd, *J* = 14.0, 6.0 Hz, 1H), 2.42* (s, 6H), 2.18 (s, 6H), 2.06 (s, 3H), 1.08 (d, *J* = 6.5 Hz, 3H), 1.07* (d, *J* = 6.5 Hz, 3H), 0.79 (d, *J* = 7.0 Hz, 3H), 0.60* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 179.2, 142.5, 137.4*, 137.0, 136.8, 128.8*, 128.5*, 128.5, 128.4, 127.8, 127.0*, 126.6, 126.3, 76.7, 58.5, 36.2, 35.8*, 34.0, 33.4*, 29.8, 27.0*, 20.6*, 20.5, 17.8, 15.8*, 14.4; IR (neat) 3369, 2929, 1617 cm^{-1}; HRMS (ES+) calcd. for $C_{22}H_{30}NO_2$ $[M+H]^+$ 340.2277, found 340.2275.

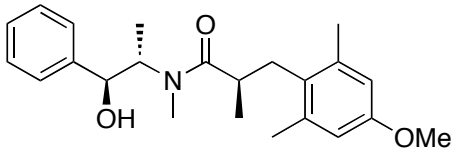


(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-3-(4-methoxyphenyl)-*N*,2-dimethylpropanamide (7d). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 4-chloroanisole (36 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure using SPhos to obtain **7d** (44 mg, 0.13 mmol) as a colorless oil in 51% yield. $[\alpha]^{20}_D$ +18.1 (c 1.38, $CHCl_3$); ^{1}H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.37–6.71 (m, 9H), 4.96 (br, 1H), 4.60 (br, 1H), 4.53 (d, *J* = 7.5 Hz, 1H), 4.41* (d, *J* = 8.0 Hz, 1H), 4.04–3.97* (m, 1H), 3.35* (s, 3H), 3.33 (s, 3H), 3.16–3.09* (m, 1H), 2.97 (dd, *J* = 13.5, 8.5 Hz, 1H), 2.84* (s, 3H), 2.97* (dd, *J* = 13.5, 9.0 Hz, 1H), 2.68–2.60 (m, 1H), 2.47 (dd, *J* = 13.5, 6.0 Hz, 1H), 2.26 (s, 3H), 1.07* (d, *J* = 6.5 Hz, 3H), 1.04 (d, *J* = 6.5 Hz, 3H), 0.86 (d, *J* = 6.5 Hz, 3H), 0.76* (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 178.3, 177.3*, 158.1, 158.0*, 142.4, 141.5*, 132.6*, 132.1, 130.2*, 129.9, 128.6*, 128.3, 128.2*, 127.6, 127.0*, 126.5, 113.8*, 113.7, 76.4, 75.3*, 58.0, 55.2,

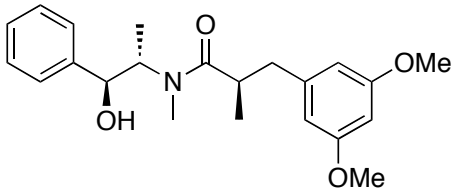
39.5, 39.1, 38.2*, 32.2, 27.3*, 24.8*, 17.5*, 17.4, 15.5*, 14.3; IR (neat) 3377, 2971, 1614 cm^{-1}; HRMS (ES+) calcd. for $C_{21}H_{28}NO_3$ $[M+H]^+$ 342.2069, found 342.2065.



(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-3-(2-methoxyphenyl)-*N*,2-dimethylpropanamide (7e). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 2-chloroanisole (36 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **7e** (47 mg, 0.14 mmol) as a colorless oil in 55% yield. $[\alpha]^{20}_D$ 2.6 (c 1.50, $CHCl_3$); ^{1}H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.36–7.00 (m, 7H), 6.86* (d, *J* = 7.5 Hz, 1H), 6.78 (d, *J* = 7.0 Hz, 1H), 6.60* (d, *J* = 8.0 Hz, 1H), 6.50 (d, *J* = 8.0 Hz, 1H), 5.00 (br, 1H), 4.58–4.52 (m, 1H), 4.46–4.37 (m, 1H), 4.31* (d, *J* = 7.5 Hz, 1H), 4.20–4.12* (m, 1H), 3.56* (dd, *J* = 13.0, 6.0 Hz, 1H), 3.42* (s, 3H), 3.28 (s, 3H), 3.05–2.95 (m, 2H) (m, 1H), 2.84–2.75 (m, 1H), 2.78* (s, 3H), 2.34 (s, 3H), 1.12 (d, *J* = 6.0 Hz, 3H), 0.91 (d, *J* = 6.5 Hz, 3H), 0.69* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 179.0, 177.7*, 157.6*, 157.5, 142.6, 141.3*, 131.6*, 131.3, 128.6, 128.0*, 127.7, 127.5, 127.2*, 126.5, 120.4, 110.3*, 110.1, 76.5, 75.2*, 58.9*, 58.1, 55.3*, 55.2, 36.1, 35.5, 35.4*, 32.7, 26.8*, 17.7*, 17.1, 15.4*, 14.4; IR (neat) 3370, 2970, 1616 cm^{-1}; HRMS (ES+) calcd. for $C_{21}H_{28}NO_3$ $[M+H]^+$ 342.2069, found 342.2075.

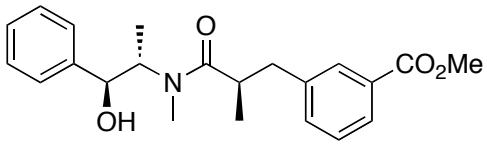


(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-3-(4-methoxy-2,6-dimethylphenyl)-*N*,2-dimethylpropanamide (7f). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 2-chloro-5-methoxy-1,3-dimethylbenzene (43 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **7f** (38 mg, 0.10 mmol) as a colorless oil in 41% yield. $[\alpha]^{20}_{D}$ +0.6 (c 0.69, $CHCl_3$); ^{1}H NMR (3.5:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.33 (d, *J* = 7.5 Hz, 2H), 7.22–7.04 (m, 3H), 6.70* (s, 2H), 6.57 (s, 2H), 4.66 (br, 2H), 4.48 (br, 1H), 4.28* (d, *J* = 9.0 Hz, 1H), 3.93–3.85* (m, 1H), 3.49–3.42* (m, 1H), 3.40* (s, 3H), 3.37 (s, 3H), 3.34–3.27* (m, 2H), 3.00 (dd, *J* = 14.0, 8.5 Hz, 1H), 2.85* (s, 3H), 2.81–2.74 (m, 1H), 2.65 (dd, *J* = 14.0, 6.0 Hz, 1H), 2.42* (s, 6H), 2.18 (s, 6H), 2.13 (s, 3H), 1.13 (d, *J* = 6.5 Hz, 3H), 1.10* (d, *J* = 6.5 Hz, 1H), 0.83 (d, *J* = 6.5 Hz, 3H), 0.65* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 179.1, 177.9*, 157.5, 142.5, 141.4*, 138.7*, 138.2, 129.5, 129.0*, 128.7*, 128.4, 127.7, 126.9*, 126.6, 113.7*, 113.6, 76.6, 75.1*, 58.4, 57.6*, 55.1, 36.4, 36.0*, 33.4, 32.5*, 31.7, 27.0*, 20.9*, 20.7, 17.8*, 17.7, 15.7*, 14.4; IR (neat) 3381, 2966, 1616 cm^{-1}; HRMS (ES+) calcd. for $C_{23}H_{31}NO_3Na$ $[M+Na]^+$ 392.2202, found 392.2199.



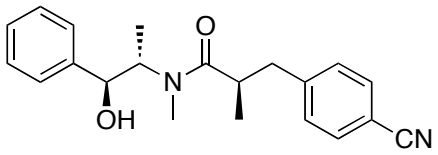
(*R*)-3-(3,5-Dimethoxyphenyl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (7g). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 1-chloro-3,5-dimethoxybenzene (43 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to

obtain **7g** (57 mg, 0.15 mmol) as a colorless oil in 62% yield. $[\alpha]^{20}_{D}$ +26.4 (c 2.25, $CHCl_3$); ^{1}H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.40–6.34 (m, 8H), 4.60–4.48 (m, 1H), 4.50 (d, *J* = 7.0 Hz, 1H), 4.28* (d, *J* = 8.5 Hz, 1H), 4.01–3.90* (m, 1H), 3.43* (s, 6H), 3.36 (s, 6H), 3.21–3.12* (m, 1H), 3.04 (dd, *J* = 13.0, 8.5 Hz, 1H), 2.82* (s, 3H), 2.75–2.64 (m, 1H), 2.51 (dd, *J* = 13.5, 6.0 Hz, 1H), 2.24 (s, 3H), 1.14* (d, *J* = 7.0 Hz, 3H), 1.05 (d, *J* = 6.5 Hz, 3H), 0.79 (d, *J* = 6.0 Hz, 3H), 0.71* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 178.4, 177.2*, 160.9*, 160.8, 142.5, 142.5, 141.5*, 128.7*, 128.4, 127.7, 127.3*, 127.0*, 126.6, 107.3*, 107.2, 98.4*, 98.2, 77.4, 76.6, 75.5*, 58.2*, 55.4, 40.7, 40.5*, 38.8, 38.0*, 27.3*, 25.0, 17.9*, 17.6, 15.6*, 14.5; IR (neat) 3370, 2971, 2930, 1607 cm^{-1}; HRMS (ES+) calcd. for $C_{22}H_{29}NO_4Na$ $[M+Na]^+$ 394.1994, found 394.1993.



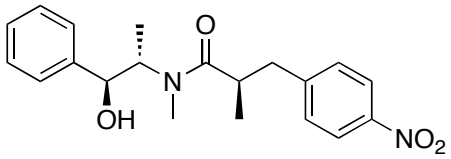
Methyl 3-((*R*)-3-(((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)(methyl)amino)-2-methyl-3-oxopropyl)benzoate (7h) The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and methyl-3-chlorobenzoate (43 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **7h** (53 mg, 0.14 mmol) as a colorless oil in 57% yield. $[\alpha]^{20}_{D}$ +13.6 (c 2.06, $CHCl_3$); ^{1}H NMR (2.5:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 8.24–6.97 (m, 9H), 4.69 (br, 1H), 4.61 (br, 1H), 4.50 (d, *J* = 7.0 Hz, 1H), 4.36* (d, *J* = 7.5 Hz, 1H), 3.98* (br, 1H), 3.96–3.89* (m, 1H), 3.53* (s, 3H), 3.50 (s, 3H), 3.28* (dd, *J* = 13.5 Hz, 5.5 Hz, 1H), 3.11–3.02* (m, 1H), 2.99 (dd, *J* = 13.0 Hz, 8.5 Hz,

1H), 2.84* (s, 3H), 2.79–2.71* (m, 1H), 2.64-2.55 (m, 1H), 2.44 (dd, *J* = 13.5 Hz, 5.5 Hz, 1H), 2.22 (s, 3H) 0.96 (d, *J* = 6.5 Hz, 3H), 0.82 (d, *J* = 6.5 Hz, 3H), 0.75* (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 177.5, 176.8*, 167.3*, 167.1, 142.3, 141.7*, 140.9*, 140.4, 130.3*, 133.8, 130.1, 129.8, 128.6*, 128.4, 128.2, 128.2*, 128.0*, 127.8*, 127.5, 127,5, 127.3*, 126.8*, 126.4, 76.2, 75.3, 57.9, 57.4*, 52.0, 39.9, 39.4*, 38.6, 37.5*, 31.9, 27.4*, 17.4, 15.6*, 14.2; IR (neat) 3401, 2974, 1720, 1618 cm^{-1}; HRMS (ES+) calcd. for $C_{22}H_{27}NO_4Na$ $[M+Na]^+$ 392.1838, found 392.1838.

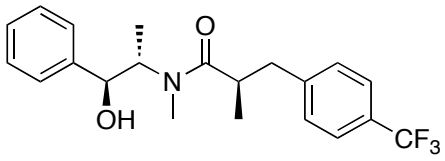


(*R*)-3-(4-Cyanophenyl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (7i). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 4-chlorobenzonitrile (34 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure using SPhos to obtain **7i** (63 mg, 0.19 mmol) as a white solid in 75% yield. $[\alpha]^{20}_D$ +27.8 (c 1.29, $CHCl_3$); mp: 140–142 ºC; ^{1}H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.35–6.76 (m, 9H), 4.53 (d, *J* = 6.5 Hz, 1H), 4.48 (br, 1H), 4.23* (d, *J* = 8.0 Hz, 1H), 3.93–3.85* (m, 1H), 3.29* (dd, *J* = 13.5, 7.0 Hz, 1H), 3.14–3.05* (m, 1H), 2.93 (dd, *J* = 13.5, 8.5 Hz, 1H), 2.84* (s, 3H), 2.64* (dd, *J* = 13.5, 6.5 Hz, 1H), 2.52–2.43 (m, 1H), 2.33 (dd, *J* = 13.5, 6.0 Hz, 1H), 2.22 (s, 3H), 1.02* (d, *J* = 7.0 Hz, 3H), 0.98 (d, *J* = 7.0 Hz, 3H), 0.90 (d, *J* = 6.5 Hz, 3H), 0.77* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 177.0, 176.2*, 146.5*, 145.9, 142.2, 141.5*, 132.1, 132.0*, 130.1*, 129.9, 128.7*, 128.3, 127.7, 126.8*, 126.4, 119.2*, 119.0, 110.1, 109.7*, 76.2,

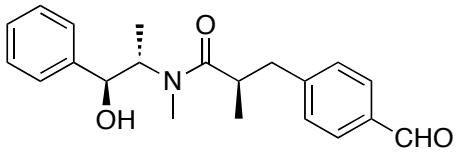
75.2*, 57.9, 40.1, 39.8*, 38.5, 37.4*, 32.2, 27.4*, 17.7*, 17.6, 15.6*, 14.3; IR (neat) 3430, 1622 cm^{-1}; HRMS (ES+) calcd. for $C_{21}H_{25}N_2O_2$ $[M+H]^+$ 337.1916, found 337.1931.



(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethyl-3-(4-nitrophenyl)propanamide (7j). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 4-chloronitrobenzene (39 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **7j** (67 mg, 0.19 mmol) as a yellow solid in 75% yield. $[\alpha]^{20}_D$ +40.0 (c 1.01, $CHCl_3$); mp: 161–164 ºC; ^{1}H NMR (2:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.93* (d, *J* = 8.5 Hz, 2H), 7.83 (d, *J* = 8.5 Hz, 2H), 7.30–7.03 (m, 5H), 6.73 (d, *J* = 8.0 Hz, 2H), 4.43 (br, 2H), 4.14* (d, 8.0 Hz, 1H), 3.87–3.68* (m, 1H), 3.22* (dd, *J* = 13.5, 7.5 Hz, 1H), 3.09–3.00* (m, 1H), 2.96 (br, 1H), 2.86 (dd, *J* = 13.5, 8.5 Hz, 1H), 2.74* (s, 3H), 2.56* (dd, *J* = 13.5, 6.5 Hz, 1H), 2.47–2.35 (m, 1H), 2.26 (dd, *J* = 13.5, 5.5 Hz, 1H), 2.15 (s, 3H), 0.93* (d, *J* = 7.0 Hz, 3H), 0.89 (d, *J* = 7.0 Hz, 3H), 0.80 (d, *J* = 5.0 Hz, 3H), 0.68* (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 177.1, 176.2*, 148.7*, 148.2, 146.7, 146.5*, 142.3, 130.1*, 129.9, 128.9*, 128.6*, 128.5, 127.8, 126.9*, 126.4, 123.7, 123.5*, 76.4, 75.4*, 58.0, 39.9, 39.7*, 38.7, 37.6*, 32.4, 27.4*, 18.0*, 17.8, 15.7*, 14.5; IR (neat) 3370, 2976, 2932, 1619, 1517, 1346 cm^{-1}; HRMS (ES+) calcd. for $C_{20}H_{25}N_2O_4$ $[M+H]^+$ 357.1814, found 357.1823.

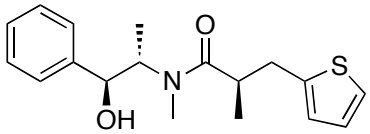


(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethyl-3-(4-(trifluoromethyl)phenyl)propanamide (7k). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 4-chlorobenzotrifluoride (45 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **7k** (41 mg, 0.11 mmol) as a white solid in 43% yield. $[\alpha]^{20}_{D}$ +11.0 (c 1.10, $CHCl_3$); mp: 118–120 ºC; ^{1}H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.42–6.85 (m, 9H), 4.63 (br, 1H), 4.55–4.40 (m, 1H), 4.45 (s, 1H), 4.27* (d, 8.0 Hz, 1H), 3.94–3.84* (m, 1H), 3.67* (s, 1H), 3.09–3.00* (m, 1H), 2.90 (dd, *J* = 13.5, 8.5 Hz, 1H), 2.79* (s, 3H), 2.67* (dd, *J* = 13.5, 7.5 Hz, 1H), 2.52–2.41 (m, 1H), 2.34 (dd, *J* = 13.0, 6.0 Hz, 1H), 2.16 (s, 3H), 0.93 (d, *J* = 7.0 Hz, 3H), 0.79 (d, *J* = 5.5 Hz, 3H), 0.73* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 177.4, 176.6*, 144.9*, 144.3, 142.3, 141.7*, 129.6, 129.4*, 129.3, 128.7, 128.4*, 128.3, 127.6, 126.9*, 126.4, 125.2 (q, *J* = 3.8 Hz), 123.3*, 76.2, 75.4*, 57.9, 39.9, 39.5*, 38.6, 37.5*, 32.1, 27.5*, 17.5, 17.5*, 15.5*, 14.2; IR (neat) 3380, 2976, 1619, 1326 cm^{-1}; HRMS (ES+) calcd. for $C_{21}H_{24}NO_2Na$ $[M+Na]^+$ 402.1657, found 402.1649.



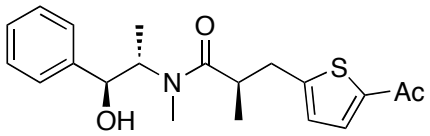
(*R*)-3-(4-Formylphenyl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (7l). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 4-chlorobenzaldehyde (35 mg, 0.25 mmol, 1.0 equiv)

according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **7l** (70 mg, 0.21 mmol) as a colorless oil in 82% yield. $[\alpha]^{20}_{D}$ +35.7 (c 1.71, $CHCl_3$); ^1H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 9.71* (s, 1H), 9.70 (s, 1H), 7.64–7.06 (m, 9H), 4.55–4.34 (br, 3H), 4.22* (d, *J* = 8.0 Hz, 1H), 3.93–3.84* (m, 1H), 3.31* (dd, *J* = 13.5, 6.5 Hz, 1H), 3.16–3.07* (m, 1H), 2.95 (dd, *J* = 13.0, 8.5 Hz, 1H), 2.78* (s, 3H), 2.70* (dd, *J* = 13.5, 7.5 Hz, 1H), 2.56–2.45 (m, 1H), 2.38 (dd, *J* = 13.5, 6.0 Hz, 1H), 2.16 (s, 3H), 0.98* (d, *J* = 7.0 Hz, 3H), 0.95 (d, *J* = 6.5 Hz, 3H), 0.82 (d, *J* = 5.5 Hz, 3H), 0.70* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 192.2, 192.0*, 177.5, 176.6*, 148.3*, 147.6, 142.3, 141.4*, 134.89*, 134.9, 130.0*, 130.0*, 129.9, 129.8, 128.8*, 128.4, 128.3*, 127.8, 126.9*, 126.5, 76.4, 75.4*, 58.1, 40.4, 40.0*, 38.7, 37.7*, 27.4, 17.8*, 17.7, 15.7*, 14.4; IR (neat) 3401, 1607 cm^{-1}; HRMS (ES+) calcd. for $C_{21}H_{25}NO_3Na$ $[M+Na]^+$ 362.1732, found 362.1740.



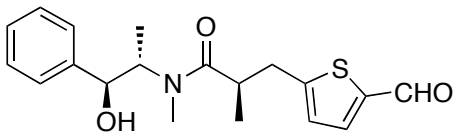
(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethyl-3-(thiophen-2-yl)propanamide (8a). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 2-chlorothiophene (30 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **8a** (42 mg, 0.13 mmol) as a white solid in 53% yield. $[\alpha]^{20}_{D}$ +25.6 (c 0.80, $CHCl_3$); mp: 100–103 ºC; ^1H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.34–6.64 (m, 8H), 4.48 (s, 2H), 4.22* (d, *J* = 8.0 Hz, 1H), 3.95–3.86* (m, 1H), 4.00* (dd, *J* = 14.5, 6.0 Hz, 1H), 3.26 (dd, *J* = 13.5, 7.5 Hz, 1H), 3.17–3.07* (m, 1H), 3.04–2.95* (m,

1H), 2.79* (s, 3H), 2.71–2.57 (m, 2H), 2.24 (s, 3H), 1.33* (d, *J* = 6.5 Hz, 3H), 0.97 (d, *J* = 6.5 Hz, 3H), 0.86 (d, *J* = 6.0 Hz, 3H), 0.68* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 177.8, 176.8*, 143.1*, 142.6, 142.4, 141.2*, 128.8*, 128.4, 127.7, 127.0*, 127.0*, 126.9, 126.6, 125.8*, 125.6, 123.7*, 123.6, 76.7, 75.5*, 58.2, 39.6, 38.8*, 34.2, 34.1*, 32.5, 27.4*, 17.7*, 17.5, 15.6*, 14.4 ; IR (neat) 3429, 1634 cm^{-1}; HRMS (ES+) calcd. for $C_{18}H_{23}NO_2SNa$ $[M+Na]^+$ 340.1347, found 340.1333.

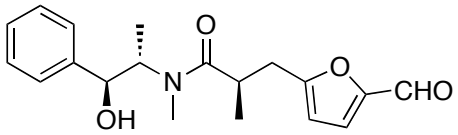


(*R*)-3-(5-Acetylthiophen-2-yl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (8b). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 2-acetyl-5-chlorothiophene (40 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **8b** (66 mg, 0.18 mmol) as a yellow oil in 73% yield. $[\alpha]^{20}_D$ +47.3 (c 1.04, $CHCl_3$); ^{1}H NMR (2.5:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.39–6.97 (m, 6 H), 6.69* (d, *J* = 3.5 Hz, 1H), 6.56 (d, *J* = 3.5 Hz, 1H), 4.46 (s, 2H), 4.30 (br, 1H), 4.22* (d, *J* = 8.5 Hz, 1H), 3.91–3.82* (m, 1H), 3.37* (dd, *J* = 14.5, 6.5 Hz, 1H), 3.19 (dd, *J* = 13.5, 8.0 Hz, 1H), 3.12–3.03* (m, 1H), 2.88* (dd, *J* = 14.5, 8.0 Hz, 1H), 2.80* (s, 3H), 2.61–2.51 (m, 1H), 2.50 (dd, *J* = 14.0, 5.5 Hz, 1H), 2.25 (s, 3H), 2.07* (s, 3H), 2.05 (s, 3H), 1.00* (d, *J* = 7.0 Hz, 3H), 0.89 (d, *J* = 6.5 Hz, 3H), 0.87 (d, *J* = 6.5 Hz, 3H), 0.71* (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 190.7*, 190.6, 177.1, 176.2*, 153.4*, 152.8, 142.8, 142.7*, 142.3, 141.3*, 133.0*, 132.9, 128.9*, 128.5*, 128.5, 127.8, 127.3*, 127.2, 126.9*, 126.5, 76.5, 75.6*, 58.1, 39.3, 38.4*, 34.8, 34.7*, 43.4, 27.6*, 26.6, 25.0*, 17.7*, 17.6, 15.7*, 14.5 ;IR (neat) 3401, 2974, 2935,

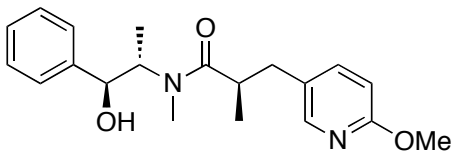
1656, 1620 cm^{-1}; HRMS (ES+) calcd. for $C_{20}H_{25}NO_3SNa$ $[M+Na]^+$ 382.1453, found 382.1436.



(*R*)-3-(5-Formylthiophen-2-yl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (8c). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 5-chlorothiophene-2-carboxaldehyde (37 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **8c** (52 mg, 0.15 mmol) as a light yellow oil in 60% yield. $[\alpha]^{20}_D$ +8.6 (c 1.74, $CHCl_3$); ^{1}H NMR (2:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 9.53* (s, 1H), 9.50 (s, 1H), 7.40–7.04 (m, 5H), 7.01* (d, *J* = 3.0 Hz, 1H), 6.92 (d, *J* = 3.5 Hz, 1H), 6.69* (d, *J* = 3.0 Hz, 1H), 6.92 (d, *J* = 3.0 Hz, 1H), 4.51 (br, 1H), 4.48–4.42 (m, 1H), 4.30 (br, 1H), 4.25* (d, *J* = 7.5 Hz, 1H), 3.88–3.79* (m, 1H), 3.45* (br, 1H), 3.32* (dd, *J* = 145, 6.5 Hz, 1H), 3.15 (dd, *J* = 14.0, 8.5 Hz, 1H), 3.08–2.99* (m, 1H), 2.89–2.78* (m, 1H), 2.81* (s, 3H), 2.55–2.47 (m, 1H), 2.44 (dd, *J* = 14.5, 5.5 Hz, 1H), 2.25 (s, 3H), 0.94* (d, *J* = 6.5 Hz, 3H), 0.84 (d, *J* = 6.0 Hz, 6H), 0.73* (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 182.8*, 182.8, 176.7, 175.9*, 155.2*, 154.6, 142.3, 141.5, 137.1*, 137.0, 128.8*, 128.4, 127.8, 127.5*, 127.4, 126.8*, 126.5, 76.4, 75.5*, 58.0, 39.2, 38.2*, 34.9, 34.8*, 27.6*, 25.0, 17.7*, 17.6, 15.7*, 14.4 ; IR (neat) 3411, 1661, 1620 cm^{-1}; HRMS (ES+) calcd. for $C_{19}H_{24}NO_3S$ $[M+H]^+$ 346.1477, found 346.1486.

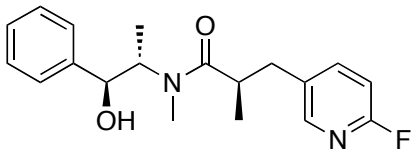


(*R*)-3-(5-Formylfuran-2-yl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (8d). The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 5-chloro-2-furaldehyde (33 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **8d** (57 mg, 0.17 mmol) as a yellow oil in 69% yield. $[\alpha]^{20}_{D}$ +21.5 (c 1.43, $CHCl_3$); ^{1}H NMR (2:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 9.82* (s, 1H), 9.25 (s, 1H), 7.39–7.02 (m, 5H), 6.60* (s, 1H), 6.53 (d, *J* = 3.0 Hz, 1H), 6.01* (d, *J* = 3.5 Hz, 1H), 5.81 (d, *J* = 3.0 Hz, 1H), 4.49 (br, 3H), 4.32* (d, *J* = 8.5 Hz, 1H), 3.99–3.89* (m, 1H), 3.32–3.21 (m, 1H), 2.92 (dd, *J* = 14.5, 8.5 Hz, 1H), 2.80* (s, 3H), 2.77–2.70* (m, 1H), 2.64* (dd, *J* = 14.0, 6.5 Hz, 1H), 2.41 (dd, *J* = 15.0, 6.0 Hz, 1H), 2.31 (s, 3H), 0.94* (d, *J* = 7.0 Hz, 3H), 0.87 (d, *J* = 7.0 Hz, 3H), 0.85 (d, *J* = 7.0 Hz, 3H), 0.70* (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 176.9*, 176.8, 176.7, 175.9*, 162.2*, 161.5, 152.0, 151.8*, 142.3, 141.5*, 128.8, 128.4, 128.3*, 127.7*, 127.6*, 126.9, 126.4, 126.3*, 110.3, 110.0*, 76.2, 75.3*, 58.2, 35.6, 34.8*, 32.5, 27.3, 18.0*, 17.4, 15.7*, 14.3; IR (neat) 3412, 1636 cm^{-1}; HRMS (ES+) calcd. for $C_{19}H_{23}NO_4Na$ $[M+Na]^+$ 352.1525, found 352.1510.



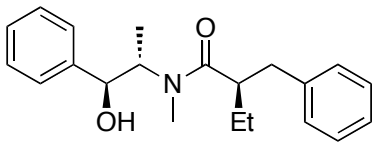
(*R*)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-3-(6-methoxypyridin-3-yl)-*N*,2-dimethylpropanamide (8e). The reaction was carried out with trifluoroborate **6a** (90 mg,

0.263 mmol, 1.05 equiv) and 2-chloro-5-methoxypyridine (36 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **8e** (47 mg, 0.14 mmol) as a light yellow oil in 55% yield. $[\alpha]^{20}_{D}$ +26.3 (c 1.70, $CHCl_3$); ^1H NMR (3:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 8.23* (d, *J* = 2.0 Hz, 1H), 8.03 (d, *J* = 2.5 Hz, 1H), 7.40–7.03 (m, 6H), 6.67* (d, *J* = 8.5 Hz, 1H), 6.58 (d, *J* = 8.5 Hz, 1H), 4.69 (br, 1H), 4.75–4.50 (m, 1H), 4.48 (d, *J* = 7.0 Hz, 1H), 4.27* (d, 1H, *J* = 8.0 Hz, 1H), 3.93–3.86* (m, 1H), 3.82 (s, 3H), 3.14* (dd, *J* = 13.5, 6.5 Hz, 1H), 3.05–2.96* (m, 1H), 2.83 (dd, *J* = 13.5, 8.5 Hz, 1H), 2.78* (s, 3H), 2.60* (dd, *J* = 13.5, 8.0 Hz, 1H), 2.51–2.42 (m, 1H), 2.28 (dd, *J* =13.5, 6.0 Hz, 1H), 2.19 (s, 3H), 0.98* (d, *J* = 6.9 Hz, 3H), 0.93 (d, *J* = 6.7 Hz, 3H), 0.83 (d, *J* = 6.6 Hz, 3H), 0.72* (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 177.6, 176.8*, 162.9, 162.8*, 146.9, 146.7, 142.4, 141.7*, 139.9*, 139.6, 128.7, 128.5*, 128.3, 128.2*, 128.1*, 127.6, 126.9*, 126.4, 110.3, 110.2*, 76.3, 75.3*, 57.9, 53.4, 38.9, 37.7*, 36.3, 35.9*, 32.4, 27.4*, 17.4, 15.6*, 14.3; IR (neat) 3422, 1618 cm^{-1}; HRMS (ES+) calcd. for $C_{20}H_{26}N_2O_3Na$ $[M+Na]^+$ 365.1841, found 365.1827.



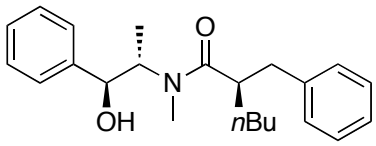
(*R*)-3-(6-fluoropyridin-3-yl)-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (8f) The reaction was carried out with trifluoroborate **6a** (90 mg, 0.263 mmol, 1.05 equiv) and 2-chloro-5-fluoropyridine (33 mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **8f** (66 mg, 0.20 mmol) as a light yellow oil in 80% yield. $[\alpha]^{20}_{D}$ +32.2 (c 0.75, $CHCl_3$); ^1H

NMR (2:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 8.10* (s, 1H), 7.86 (s, 1H), 7.39–7.02 (m, 6H), 6.47–6.42* (m, 1H), 6.40–6.33 (m, 1H), 4.66 (br, 1H), 4.52 (s, 1H), 4.48 (s, 1H), 4.29* (d, *J* = 7.5 Hz, 1H), 4.16* (s, 1H), 3.90–3.80* (m, 1H), 3.12–2.98 (m, 1H), 2.74* (s, 3H), 2.52–2.44* (m, 1H), 2.44–2.33 (m, 1H), 2.01 (s, 3H), 2.22–2.14 (m, 1H), 0.92* (d, *J* = 6.5 Hz, 3H), 0.86 (d, *J* = 6.5 Hz, 3H), 0.81 (d, *J* = 6.5 Hz, 3H), 0.72* (d, *J* = 6.5 Hz, 3H), ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 177.0, 176.2*, 162.5 (d, *J* = 236.3 Hz), 162.3* (d, *J* = 236.3 Hz), 147.7* (d, *J* = 13.8 Hz), 147.5* (d, *J* = 15.0 Hz), 142.3, 142.0 (d, *J* = 30.0 Hz), 142.0* (d, *J* = 60.0 Hz), 133.6* (d, *J* = 3.8 Hz), 133.3 (d, *J* = 3.8 Hz), 128.7*, 128.4, 128.3*, 127.7, 126.8*, 126.4, 109.0 (d, *J* = 37.5 Hz), 108.8* (d, *J* = 37.5 Hz), 76.2, 75.1*, 57.9, 38.8, 37.6*, 36.1, 35.8*, 27.4, 17.7*, 17.6, 15.6*, 14.3; IR (neat) cm^{-1}; HRMS (ES+) calcd. for $C_{19}H_{23}N_2O_2FNa$ $[M+Na]^+$ 353.1641, found 353.1642.

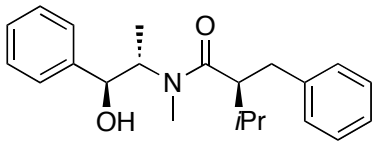


(*R*)-2-benzyl-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*-methylbutanamide (9a). The reaction was carried out with trifluoroborate **6b** (93 mg, 0.263 mmol, 1.05 equiv) and chlorobenzene (28mg, 0.25 mmol, 1.0 equiv) according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **8f** (57 mg, 0.18 mmol) as a white solid in 70% yield. $[\alpha]^{20}_D$ +7.4 (c 1.37, $CHCl_3$); mp: 85–88 ºC; ^{1}H NMR (4:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.40–6.84 (m, 10H), 4.62 (br, 1H), 4.57–4.38 (m, 2H), 4.26* (d, *J* = 8.0 Hz, 1H), 4.12–4.01* (m, 1H), 3.42–3.31* (m, 2H), 3.12–3.02* (m, 1H), 2.95 (dd, *J* = 11.5, 8.5 Hz, 1H), 2.88–2.78* (m, 1H), 2.81* (s,

3H), 2.66–2.49 (m, 2H), 2.16 (s, 3H), 1.90–1.77 (m, 1H), 1.51–1.42* (m, 1H), 1.42–1.31 (m, 1H), 0.81 (t, J = 7.5 Hz, 3H), 0.76 (d, J = 6.5 Hz, 3H), 0.71* (d, 3H, J = 6.5 Hz, 3H); ^{13}C NMR (125.6 MHz, $CDCl_3$) δ 177.7, 176.5*, 142.4, 141.4*, 140.7*, 140.1, 129.3*, 129.0, 128.7*, 128.5*, 128.4, 128.3, 128.3*, 127.7, 127.0*, 126.6, 126.4*, 126.3, 76.4, 75.2*, 58.3, 46.5, 45.5*, 39.4, 39.1*, 32.3, 27.2*, 26.2, 26.0*, 15.6*, 14.4, 12.1*, 12.0; IR (neat) 3370, 2965, 1615 cm^{-1}; HRMS (ES+) calcd. for $C_{21}H_{27}NO_2Na$ $[M+Na]^+$ 348.1939, found 348.1927.



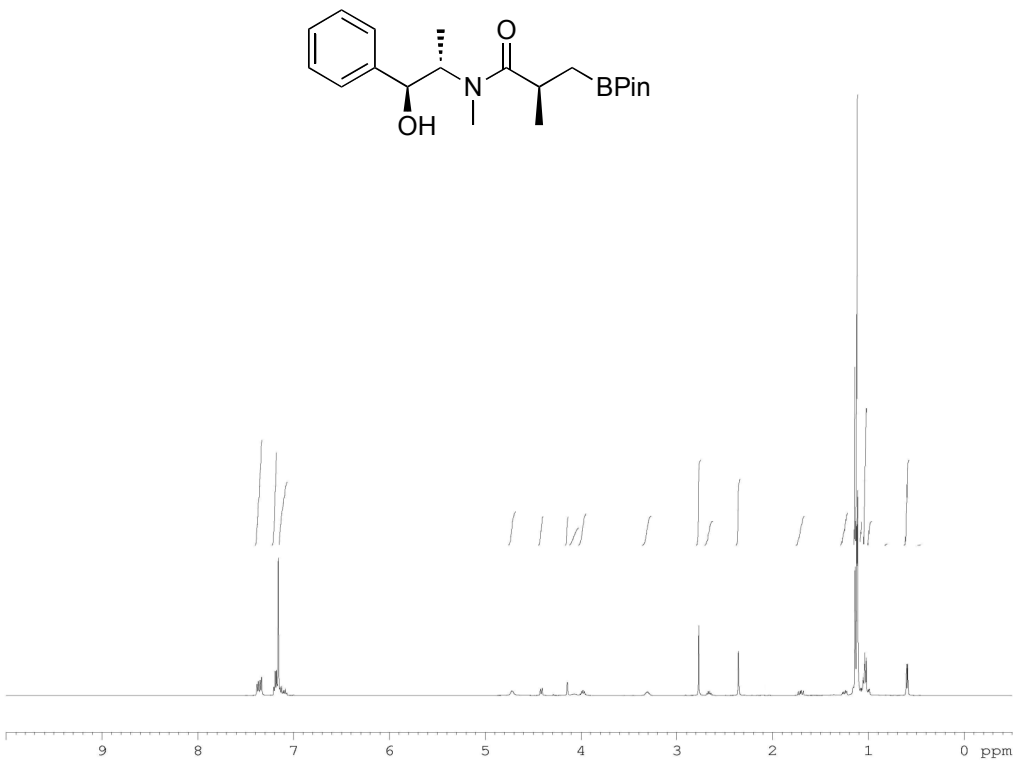
(*R*)-2-Benzyl-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*-methylhexanamide (9b). The reaction was carried out with trifluoroborate **6c** (101 mg, 0.263 mmol, 1.05 equiv) and chlorobenzene (28 mg, 0.25 mmol, 1.0 equiv) for 48 h according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **9b** (42 mg, 0.12 mmol) as a white solid in 47% yield. ^{1}H NMR (4:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.40–6.99 (m, 10H), 4.58 (br, 1H), 4.50 (d, J = 7.5 Hz, 1H), 4.20* (d, J = 8.5 Hz, 1H), 4.11–4.03* (m, 1H), 3.40* (dd, J = 13.5, 6.5 Hz, 1H), 3.18–3.07* (m, 1H), 2.98 (dd, J = 12.5, 9.0 Hz, 1H), 2.85* (dd, J = 13.0, 7.5 Hz, 1H), 2.79* (s, 3H), 2.72–2.63 (m, 1H), 2.58 (dd, J = 13.0, 5.0 Hz, 1H), 2.17 (s, 3H), 1.92–1.82 (m, 1H), 1.51–1.06 (m, 6H), 2.92* (t, J = 7.5 Hz, 3H), 0.89 (t, J = 7.5 Hz, 3H), 0.76 (d, J = 7.5 Hz, 3H), 0.72* (d, J = 6.5 Hz, 3H). Data is consistant with that reported in the literature.[a]



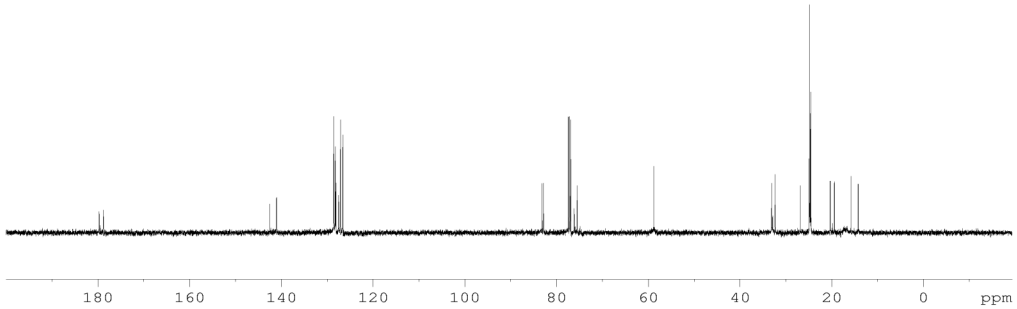
(*S*)-2-Benzyl-*N*-((1*S*,2*S*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,3-dimethylbutanamide (9c). The reaction was carried out with trifluoroborate **6d** (97 mg, 0.263 mmol, 1.05 equiv) and chlorobenzene (28 mg, 0.25 mmol, 1.0 equiv) for 48 h according to the general Suzuki–Miyaura cross-coupling reaction procedure to obtain **9c** (25 mg, 0.08 mmol) as a white solid in 30% yield. ^{1}H NMR (10:1 rotamer ratio, asterisk denotes minor rotamer peaks, 500 MHz, C_6D_6) δ 7.42–6.96 (m, 10H), 4.63 (br, 1H), 4.37 (d, *J* = 7.5 Hz, 1H), 4.02–3.81 (m, 1H), 3.34* (dd, *J* = 12.5, 10.0 Hz, 1H), 2.99 (dd, *J* = 11.5, 11.5 Hz, 1H), 2.85* (dd, *J* = 13.0, 4.5 Hz, 1H), 2.72 (dd, *J* = 12.5, 3.5 Hz, 1H), 2.63* (s, 3H), 2.51–2.41 (m, 1H), 2.09 (s, 3H), 2.07–2.01 (m, 1H), 0.95 (dd, *J* = 13.5, 6.5 Hz, 6H), 0.64* (d, *J* = 6.5 Hz, 3H), 0.60 (d, *J* = 7.0 Hz, 3H). Data is consistant with that reported in the literature.[a]

Reference:

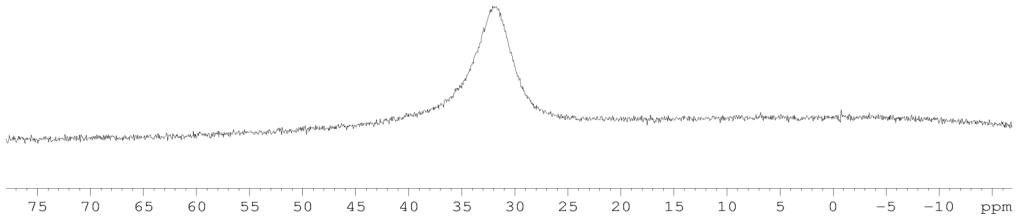
(a) Myers, A. G.; Yang, B. H.; Chen, H.; McKinstry, L.; Kopecky, D. J.; Gleason, J. L. *J. Am. Chem. Soc.* **1997**, *119*, 649



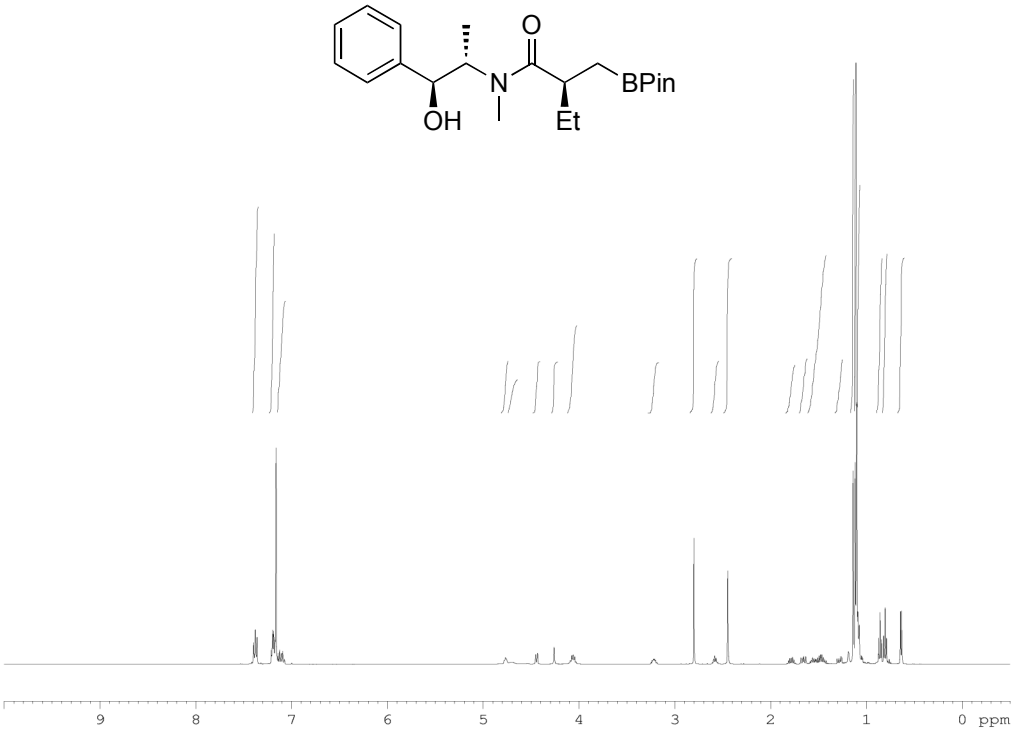
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **5a**



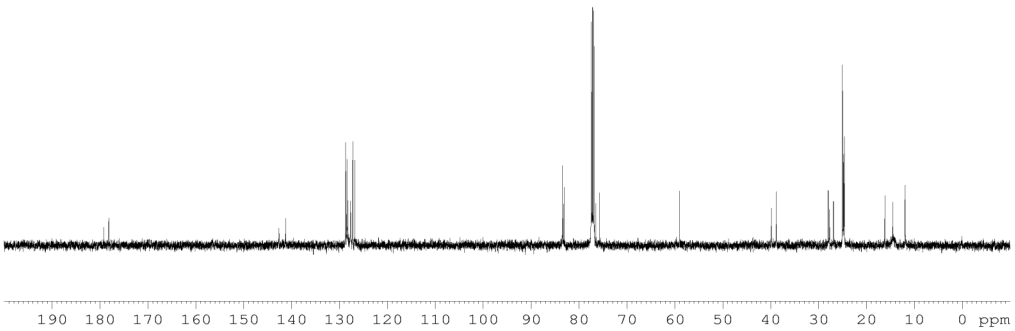
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **5a**



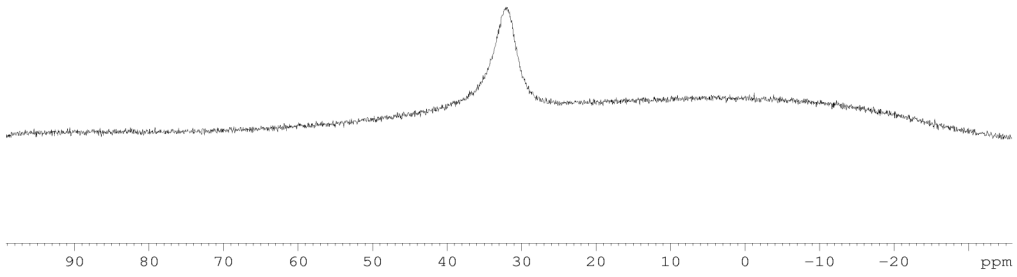
^{11}B NMR (128.4 MHz, C_6D_6) Spectrum of **5a**



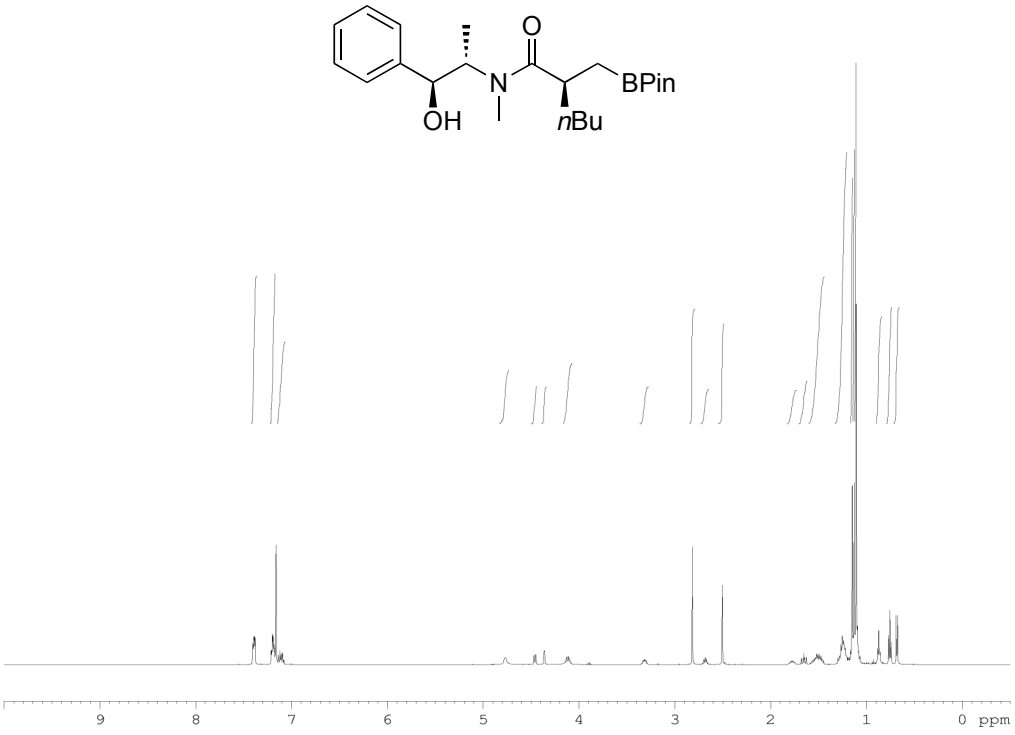
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **5b**



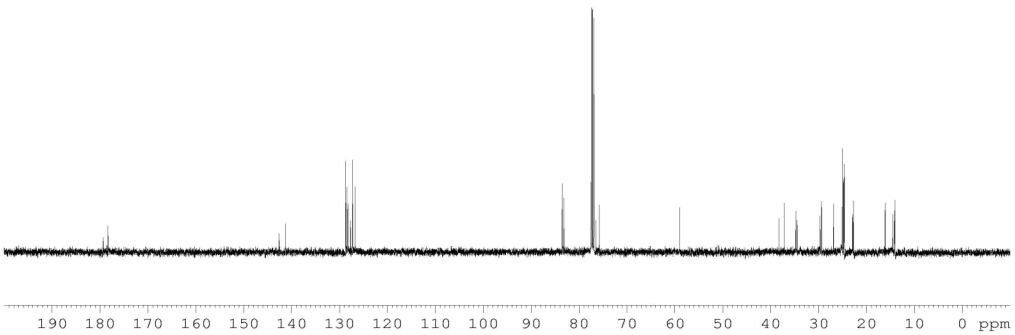
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **5b**



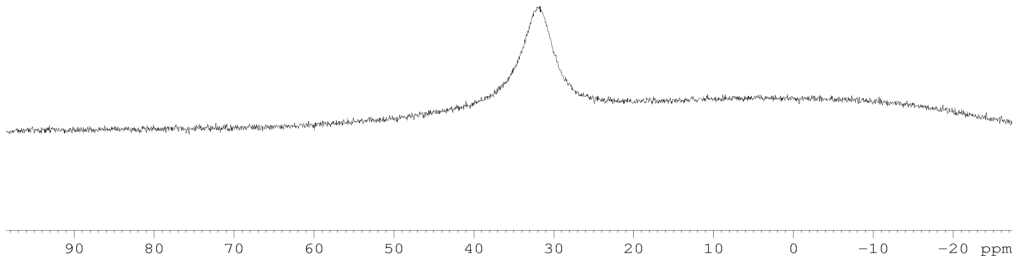
^{11}B NMR (128.4 MHz, C_6D_6) Spectrum of **5b**



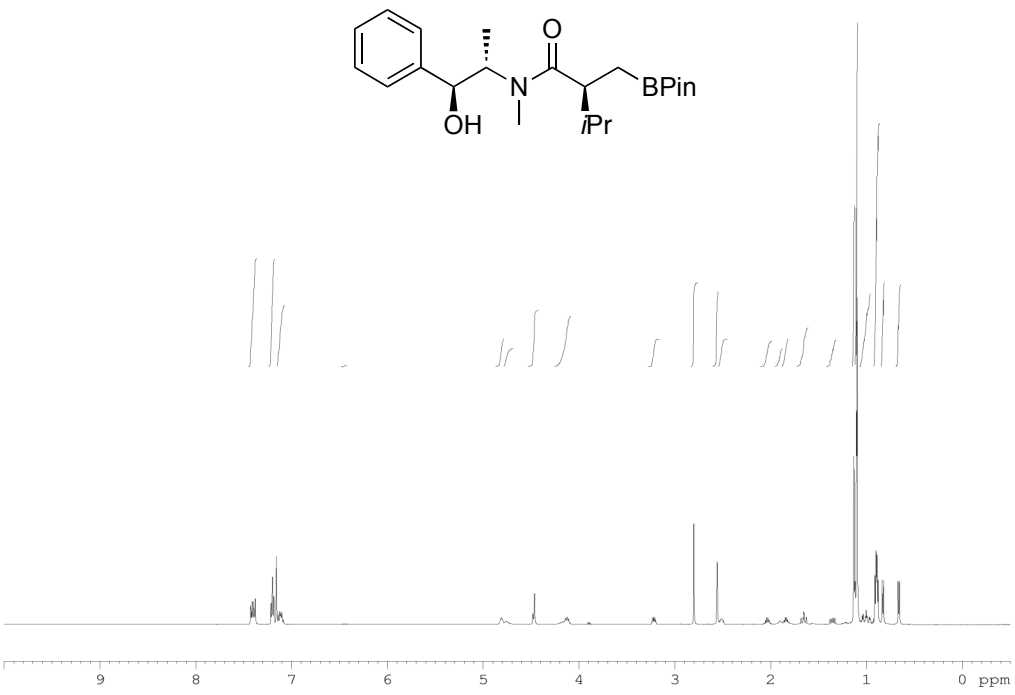
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **5c**



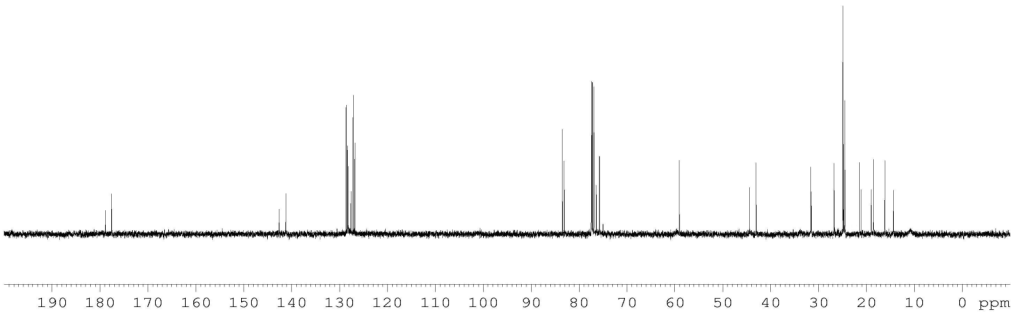
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **5c**



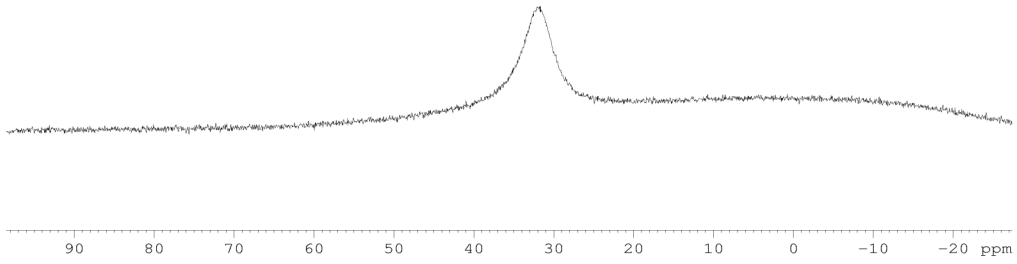
^{11}B NMR (128.4 MHz, C_6D_6) Spectrum of **5c**



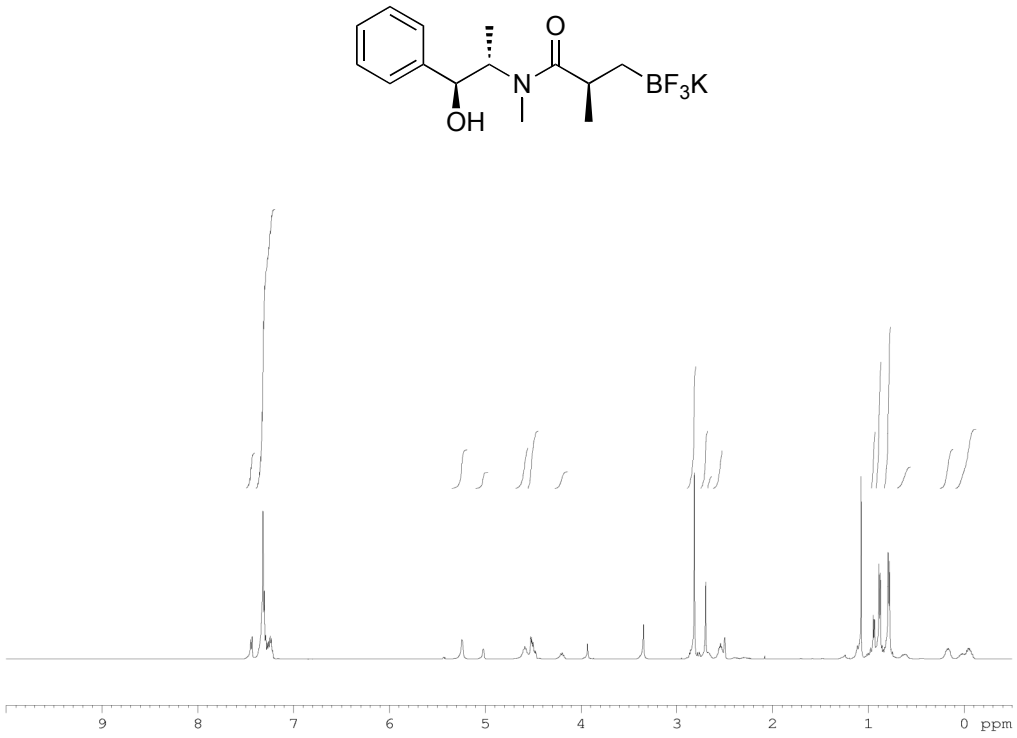
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **5d**



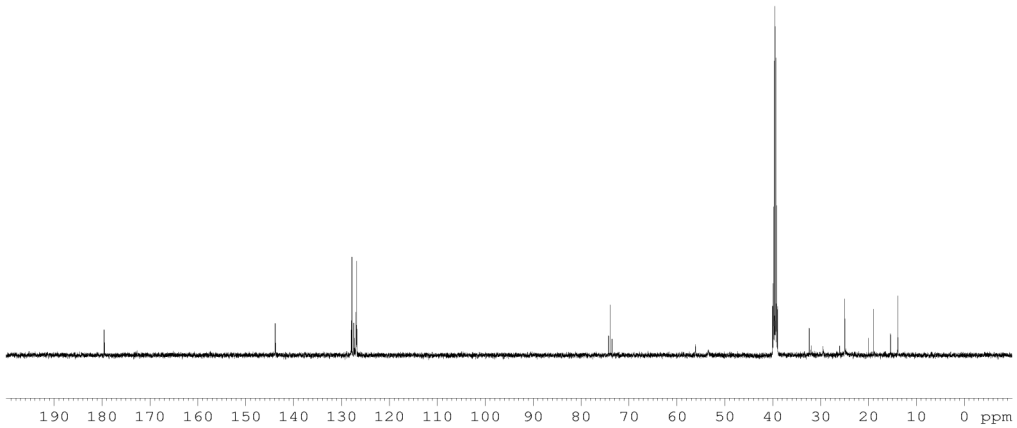
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **5d**



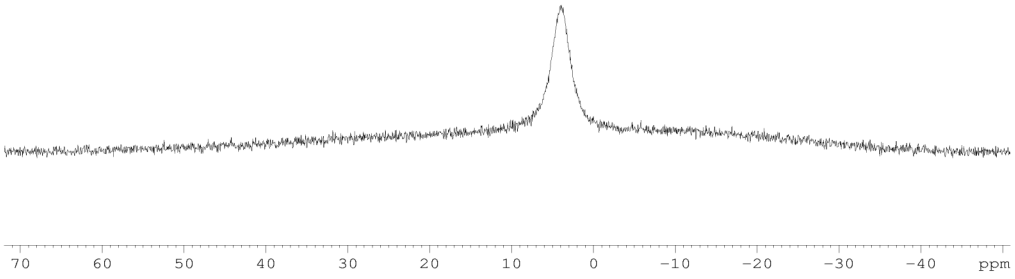
^{11}B NMR (128.4 MHz, C_6D_6) Spectrum of **5d**



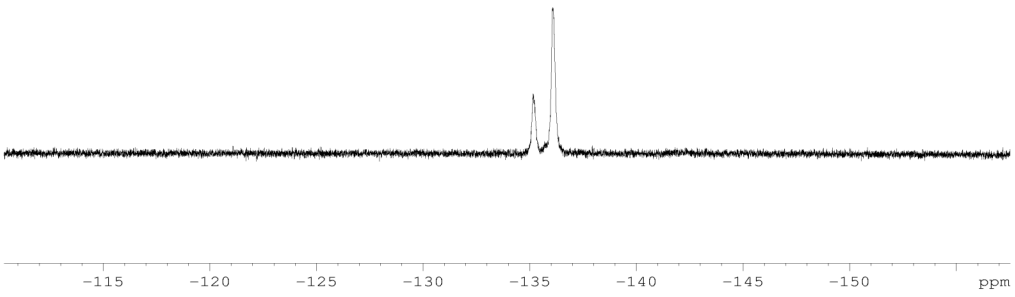
^{1}H NMR (500 MHz, DMSO-d_6) Spectrum of **6a**



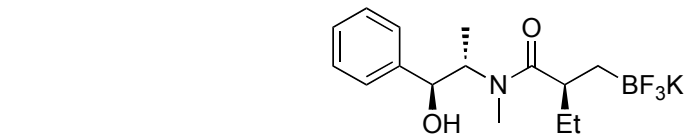
^{13}C NMR (125 MHz, DMSO-d_6) Spectrum of **6a**

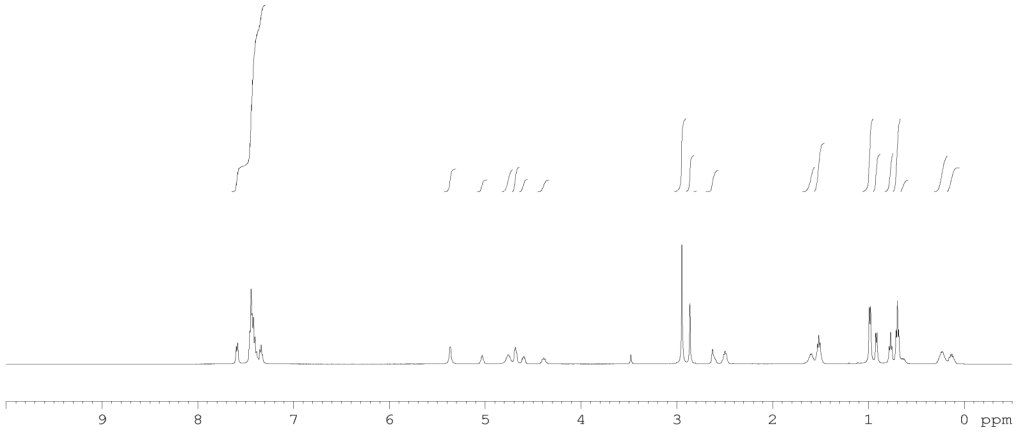


^{11}B NMR (128.4 MHz, DMSO-d_6) Spectrum of **6a**

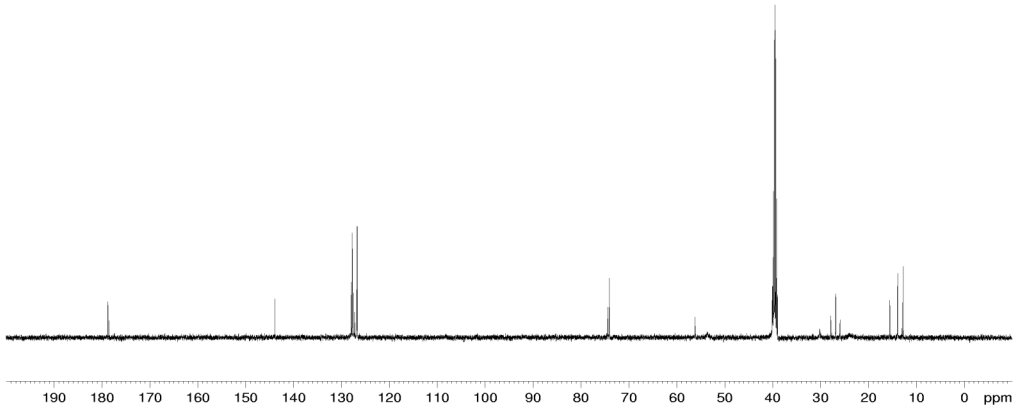


^{19}F NMR (470.8 MHz, DMSO-d_6) Spectrum of **6a**

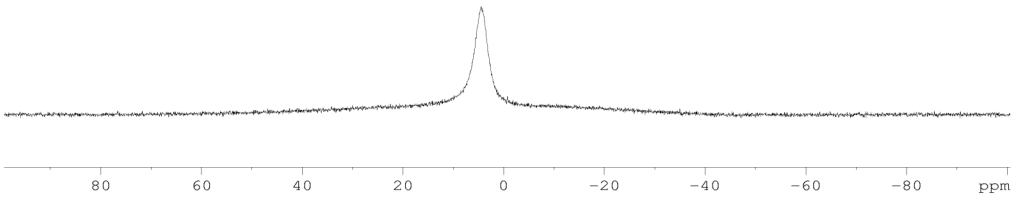




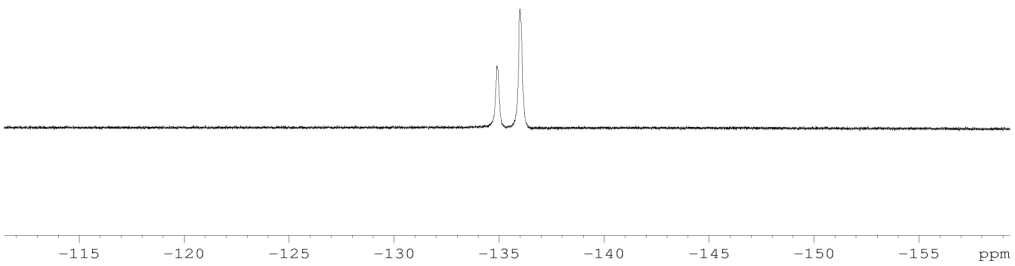
^{1}H NMR (500 MHz, DMSO-d_6) Spectrum of **6b**



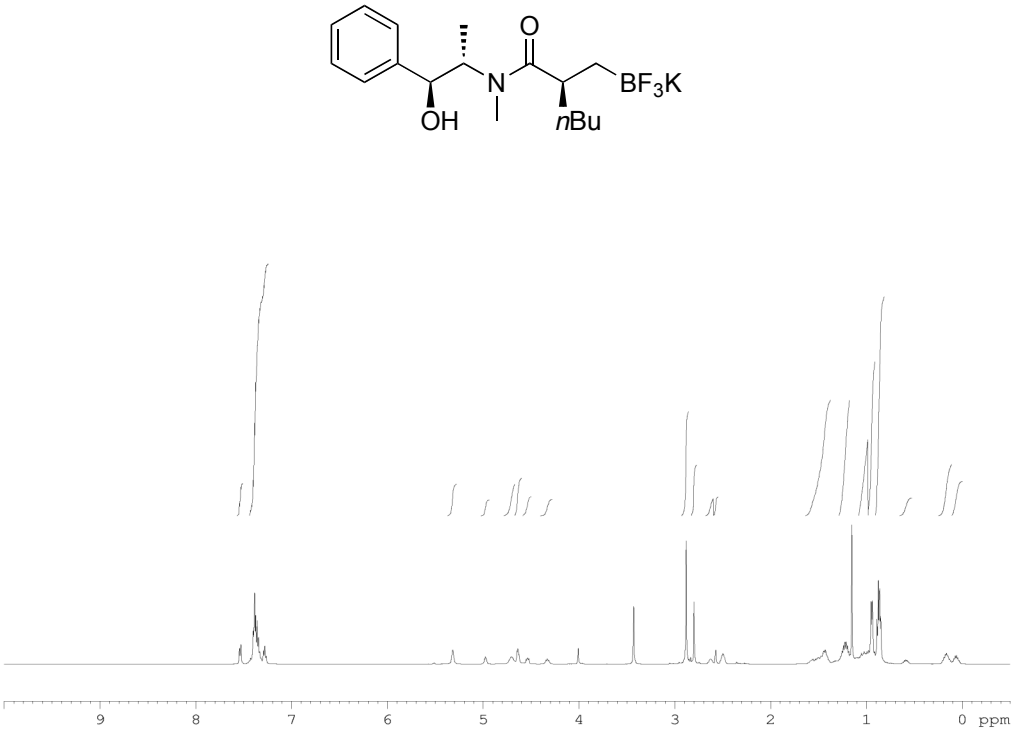
^{13}C NMR (125 MHz, DMSO-d_6) Spectrum of **6b**



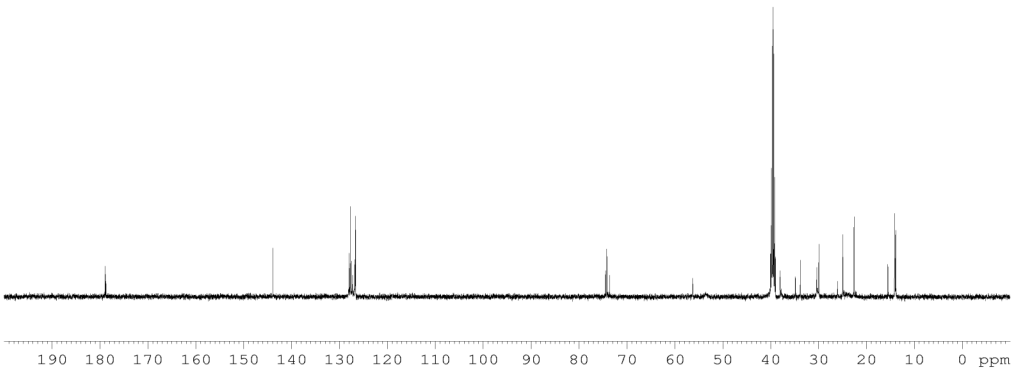
^{11}B NMR (128.4 MHz, DMSO-d_6) Spectrum of **6b**



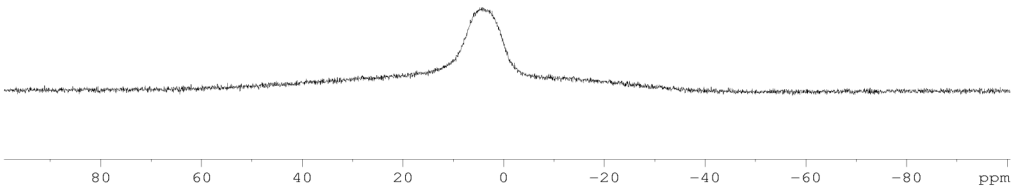
^{19}F NMR (470.8 MHz, DMSO-d_6) Spectrum of **6b**



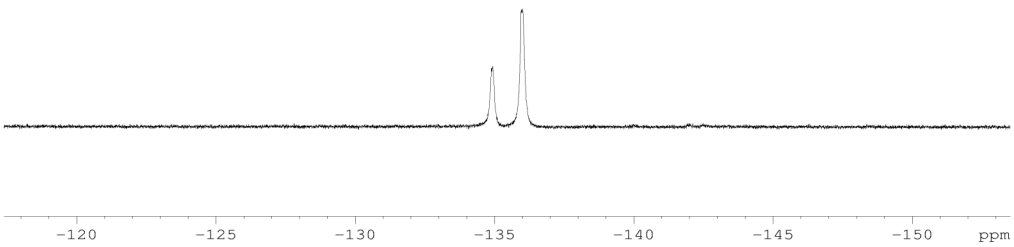
^{1}H NMR (500 MHz, DMSO-d_6) Spectrum of **6c**



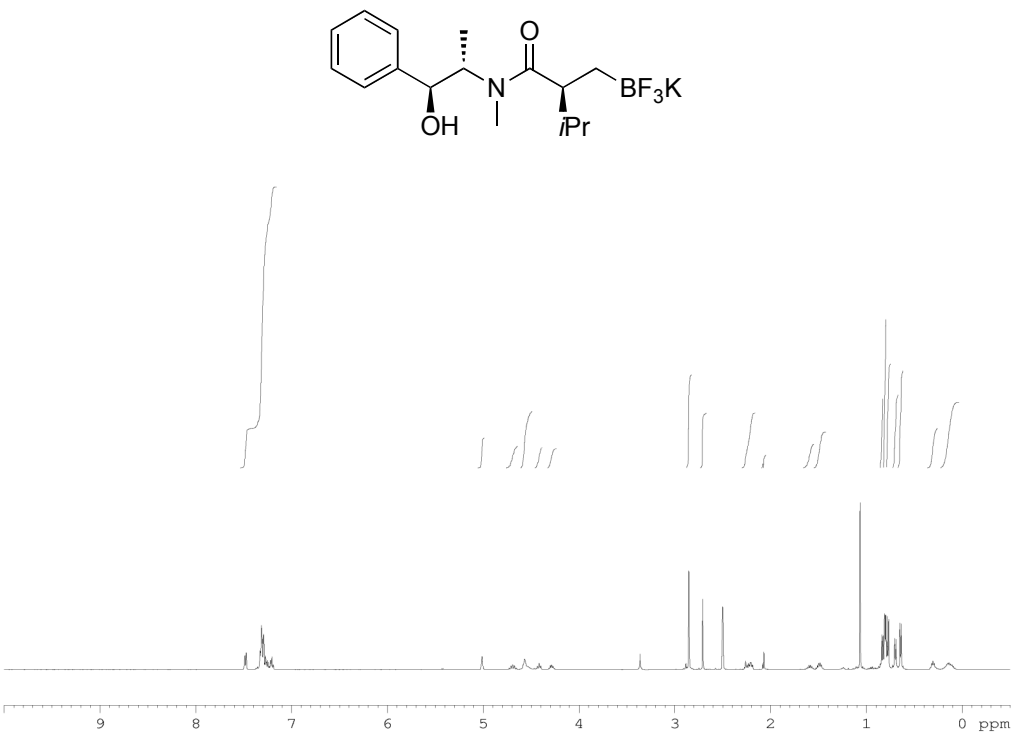
^{13}C NMR (125 MHz, DMSO-d_6) Spectrum of **6c**



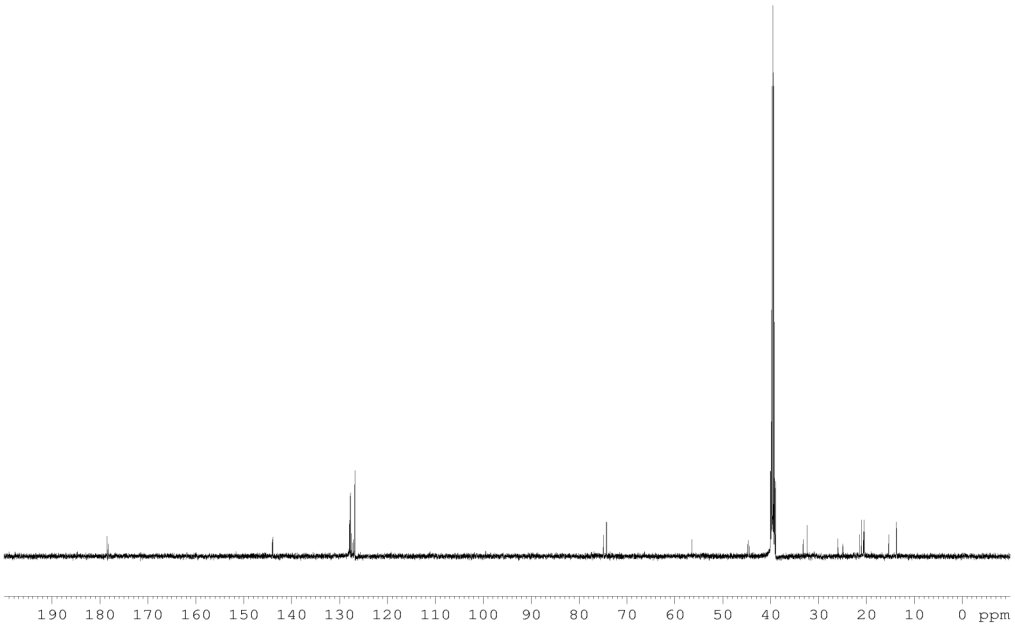
^{11}B NMR (128.4 MHz, DMSO-d_6) Spectrum of **6c**



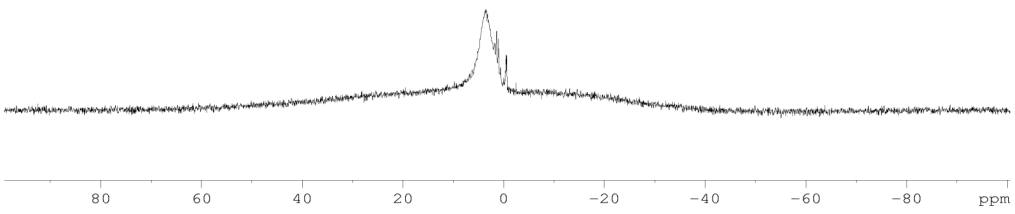
^{19}F NMR (470.8 MHz, DMSO-d_6) Spectrum of **6c**



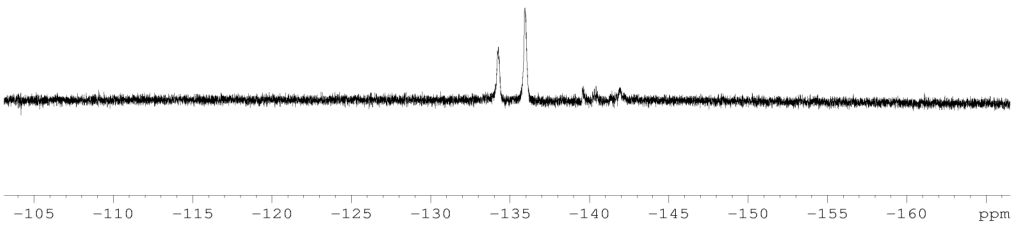
^{1}H NMR (500 MHz, DMSO-d_6) Spectrum of **6d**



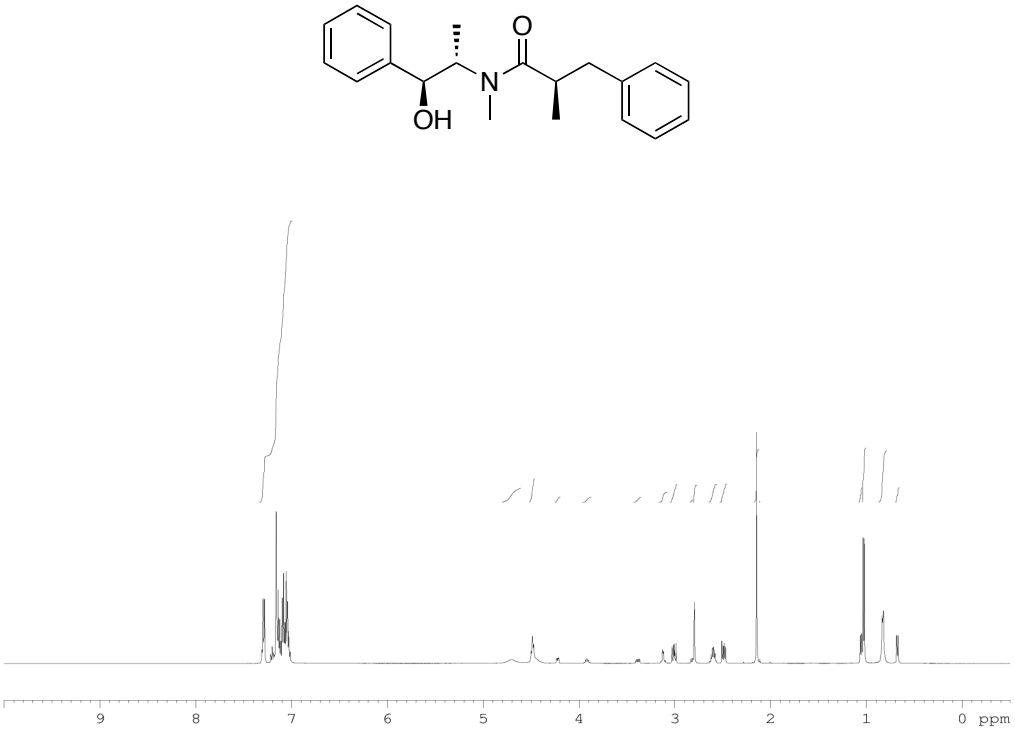
^{13}C NMR (125 MHz, DMSO-d_6) Spectrum of **6d**



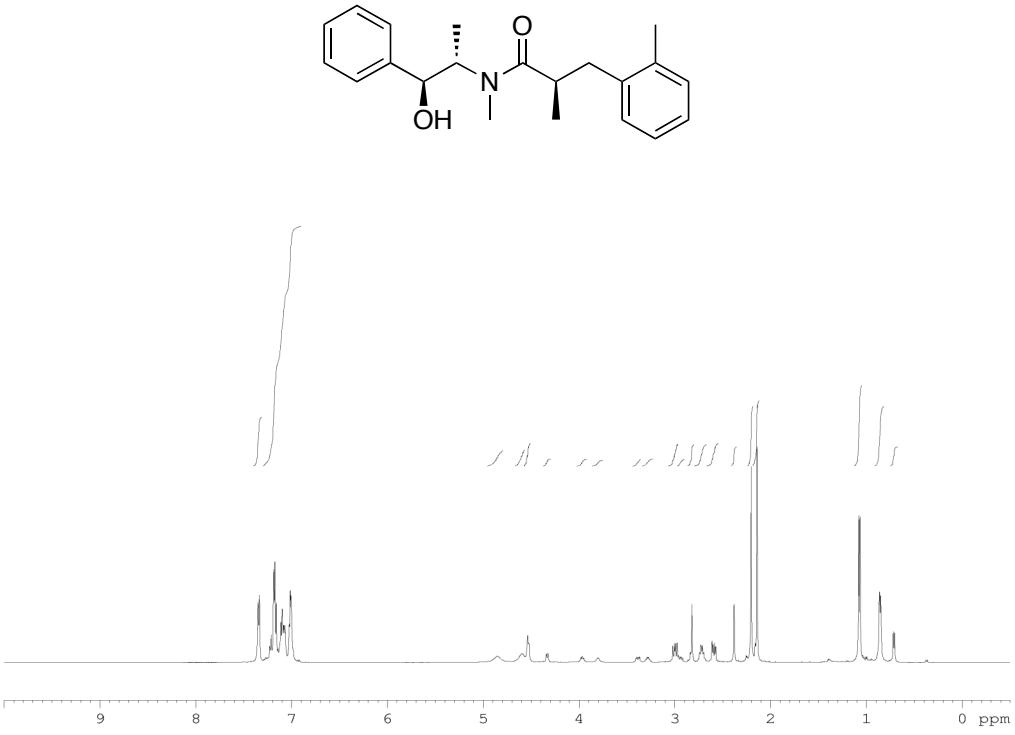
^{11}B NMR (128.4 MHz, DMSO-d_6) Spectrum of **6d**



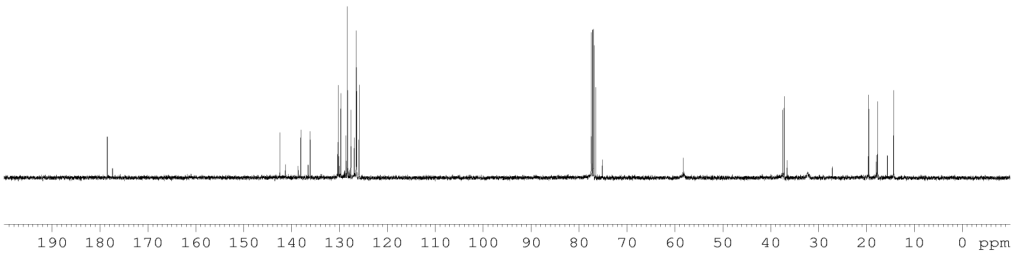
^{19}F NMR (470.8 MHz, DMSO-d_6) Spectrum of **6d**



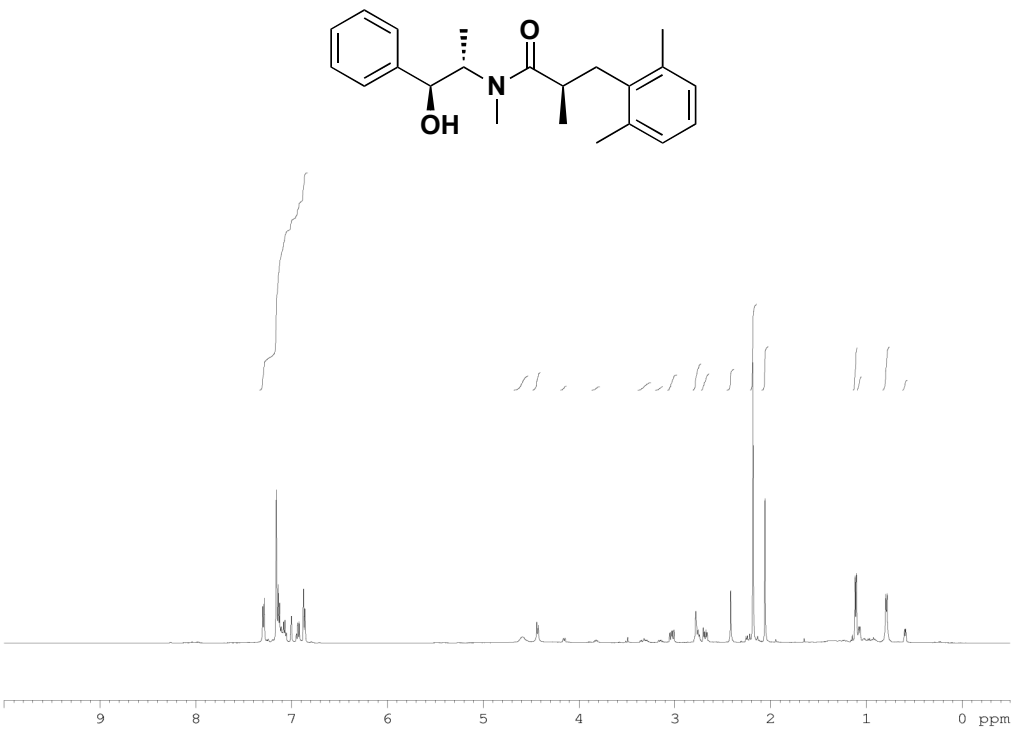
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7a**



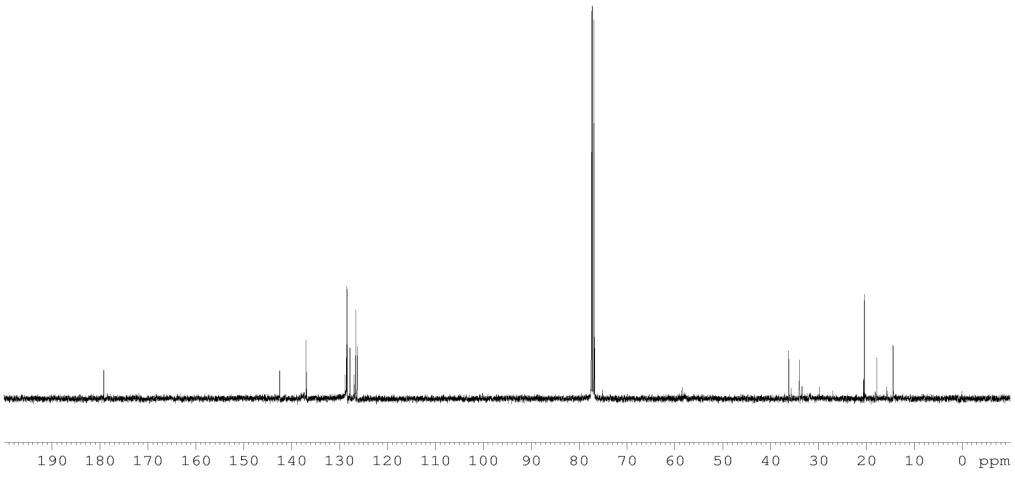
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7b**



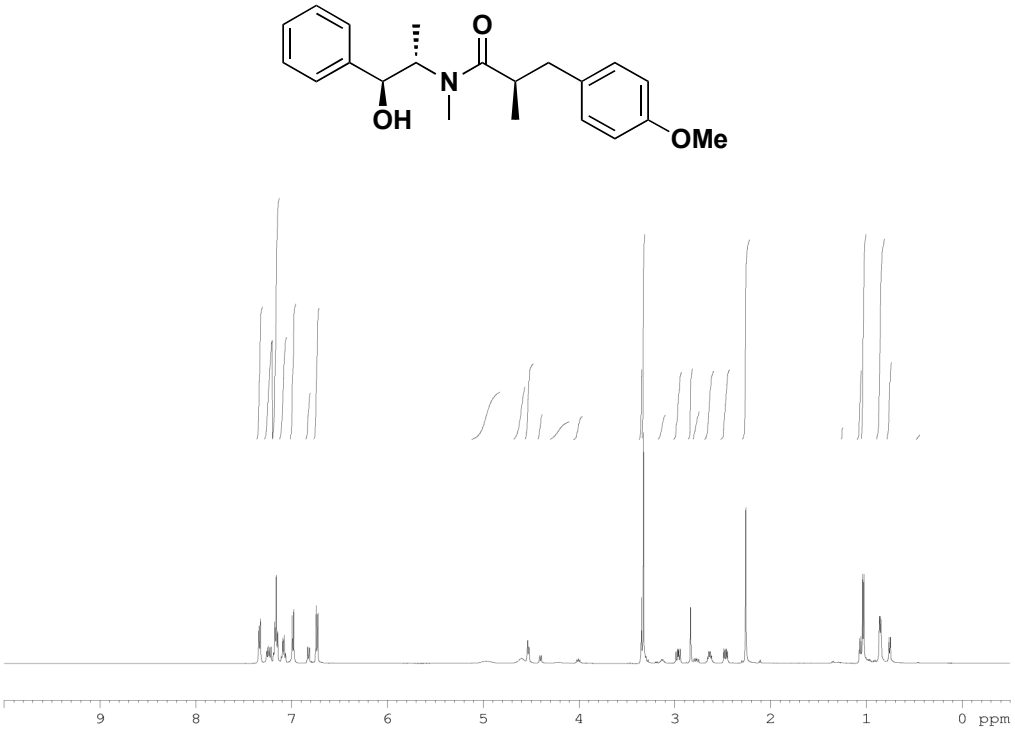
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7b**



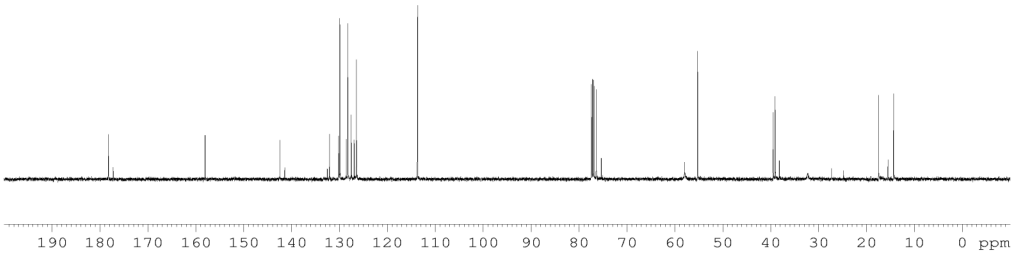
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7c**



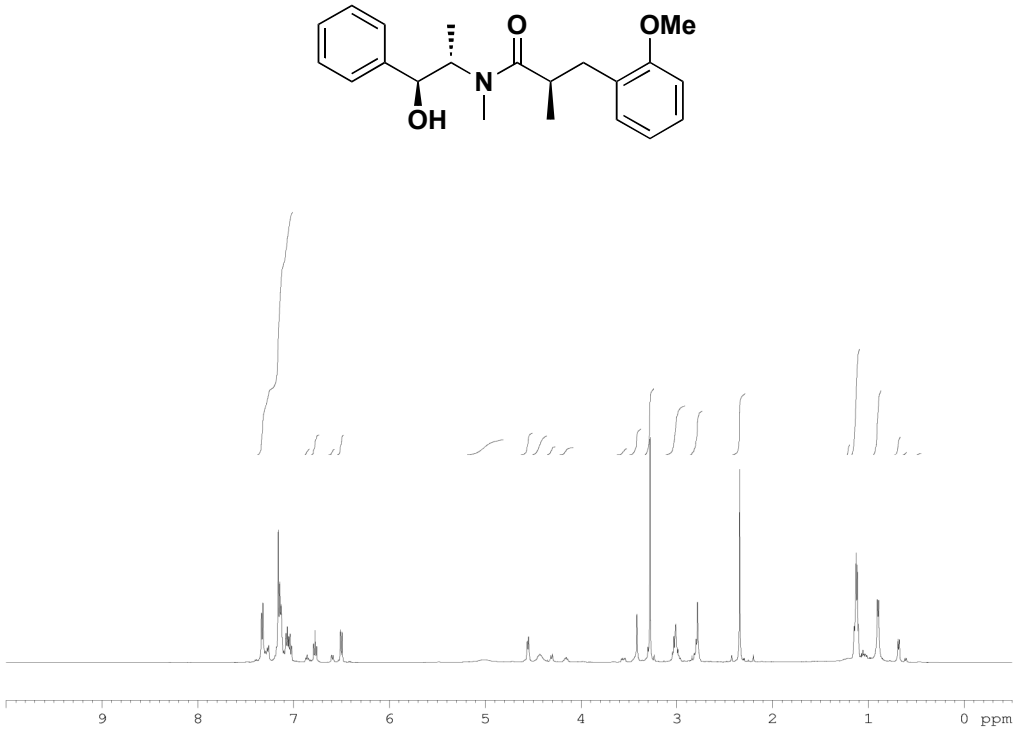
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7c**



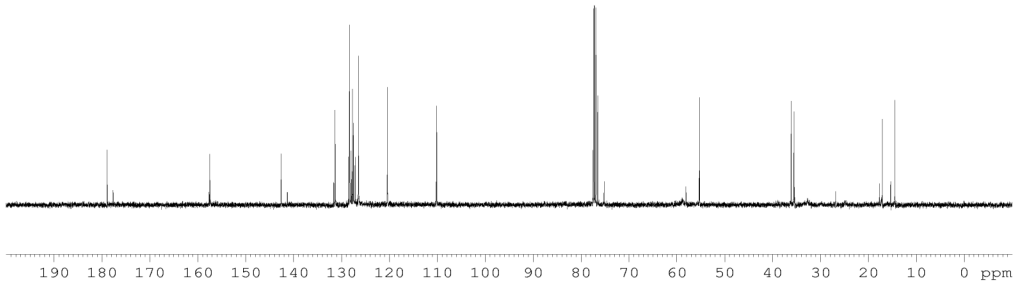
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7d**



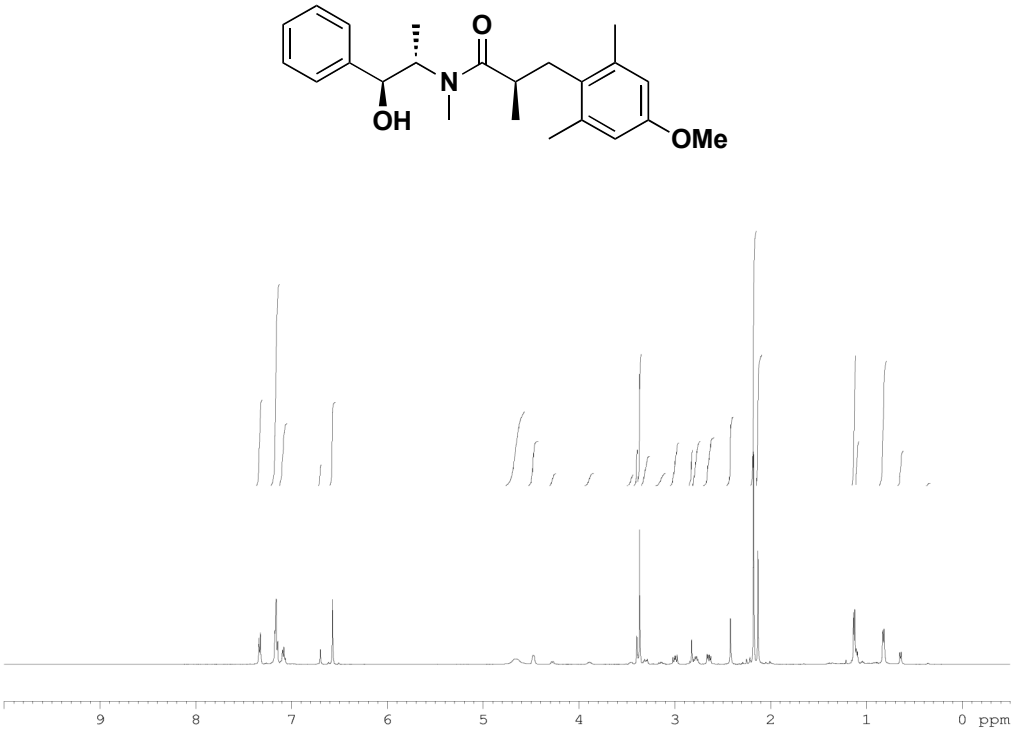
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7d**



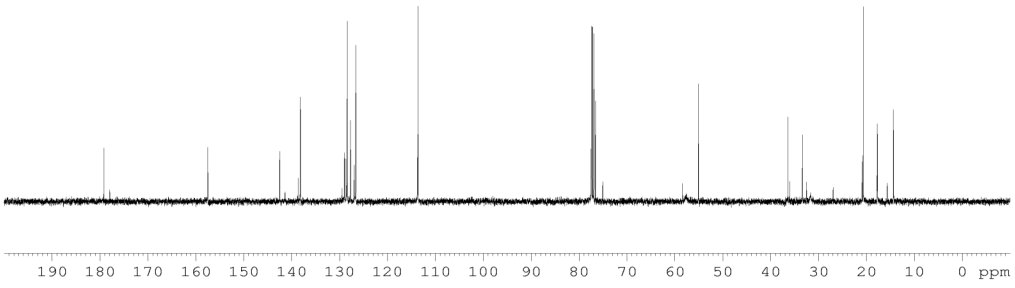
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7e**



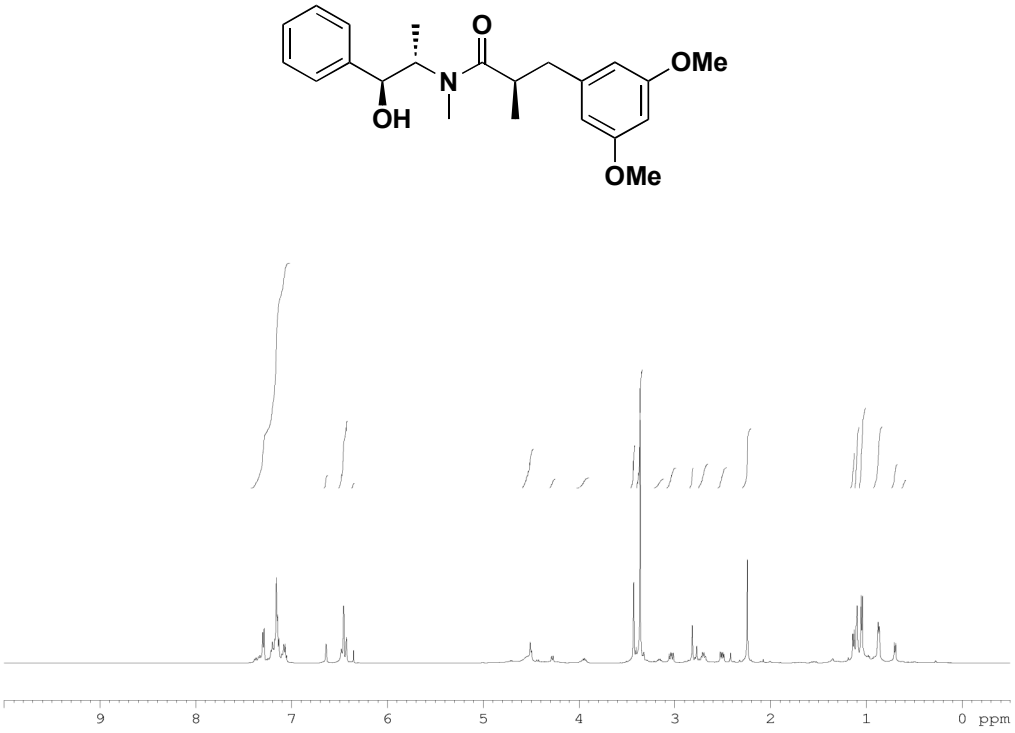
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7e**



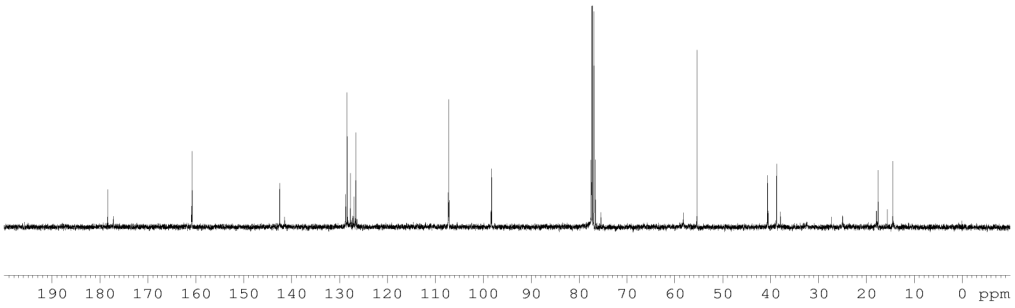
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7f**



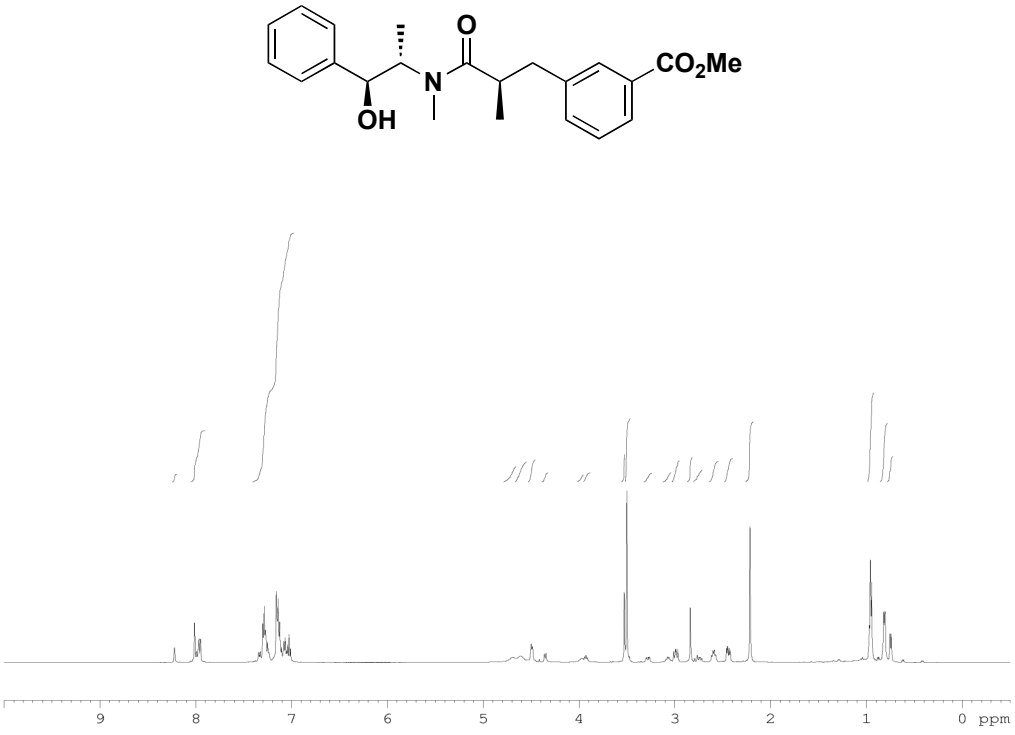
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7f**



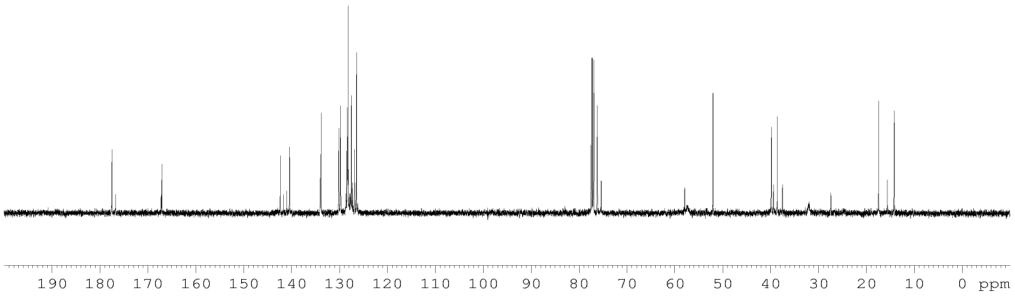
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7g**



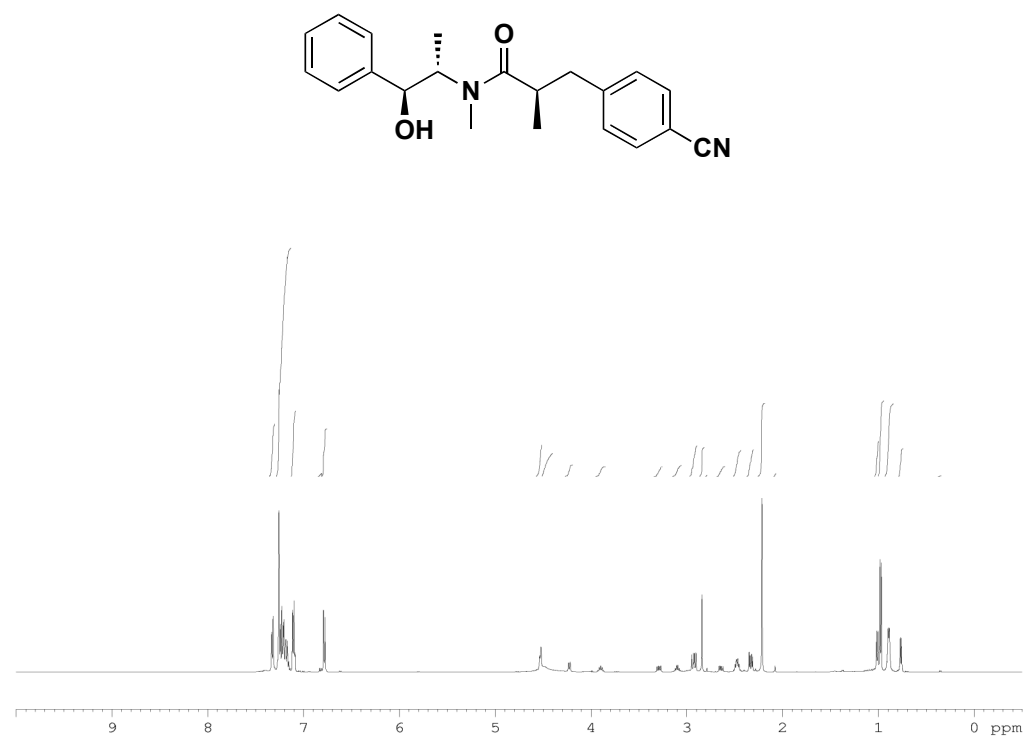
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7g**



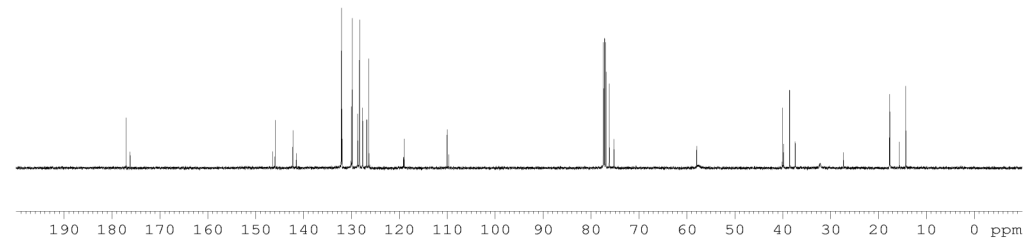
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7h**



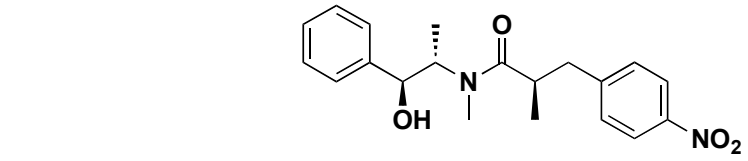
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7h**

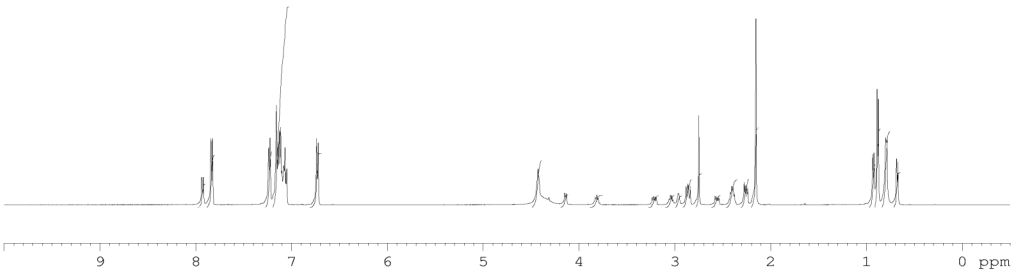


^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7i**

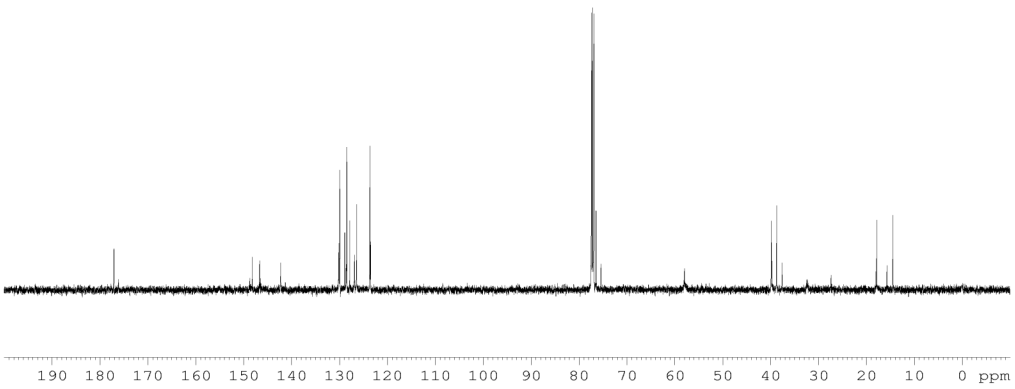


^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7i**

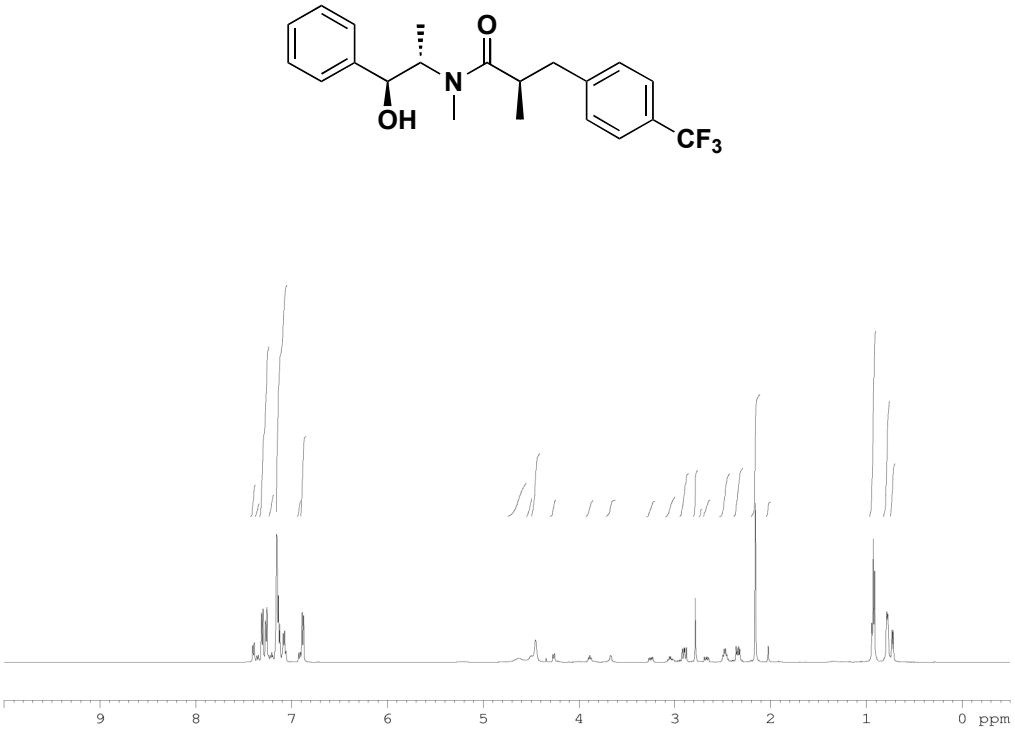




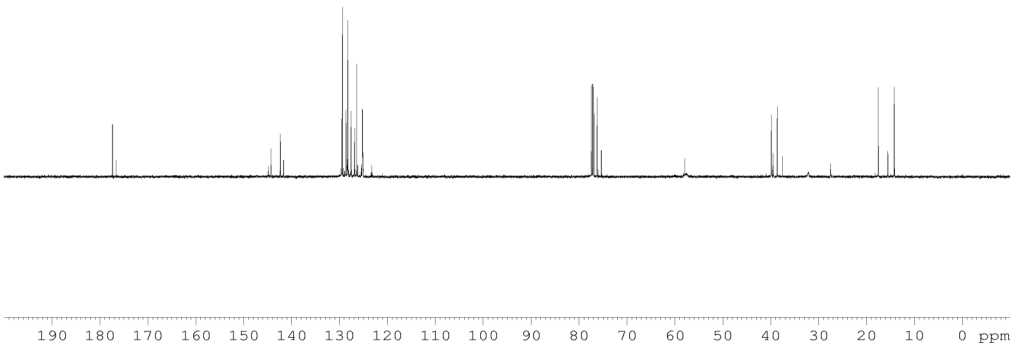
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7j**



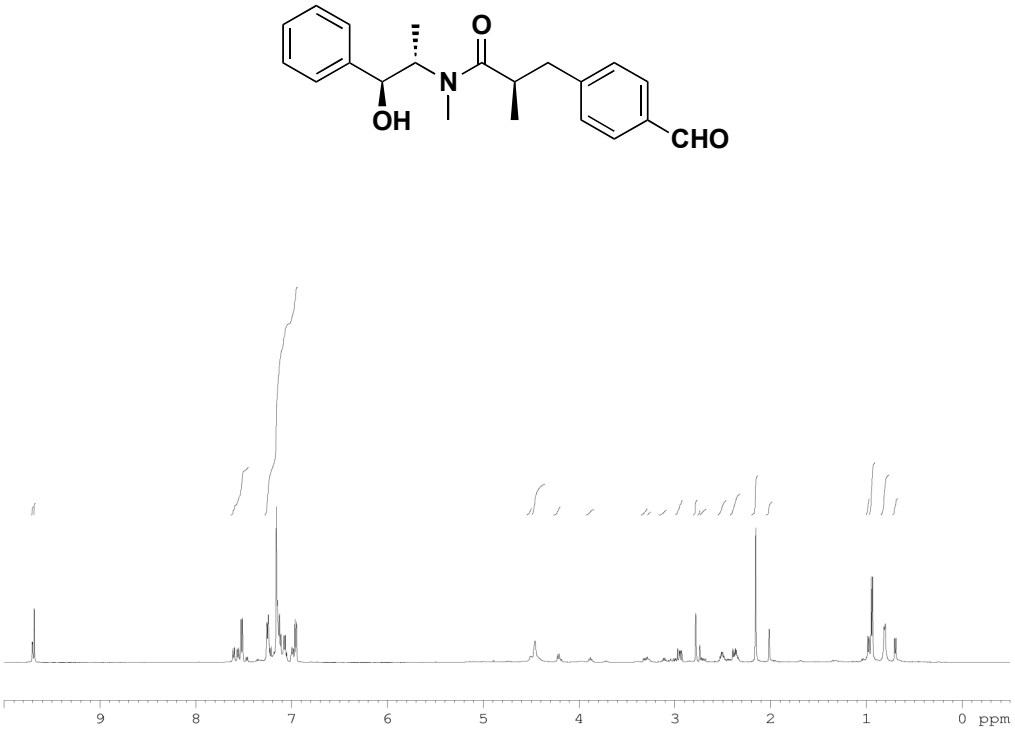
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7j**



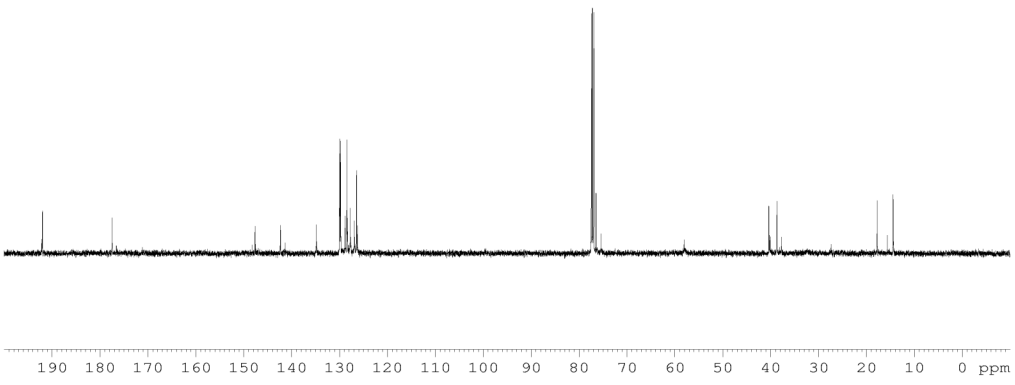
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7k**



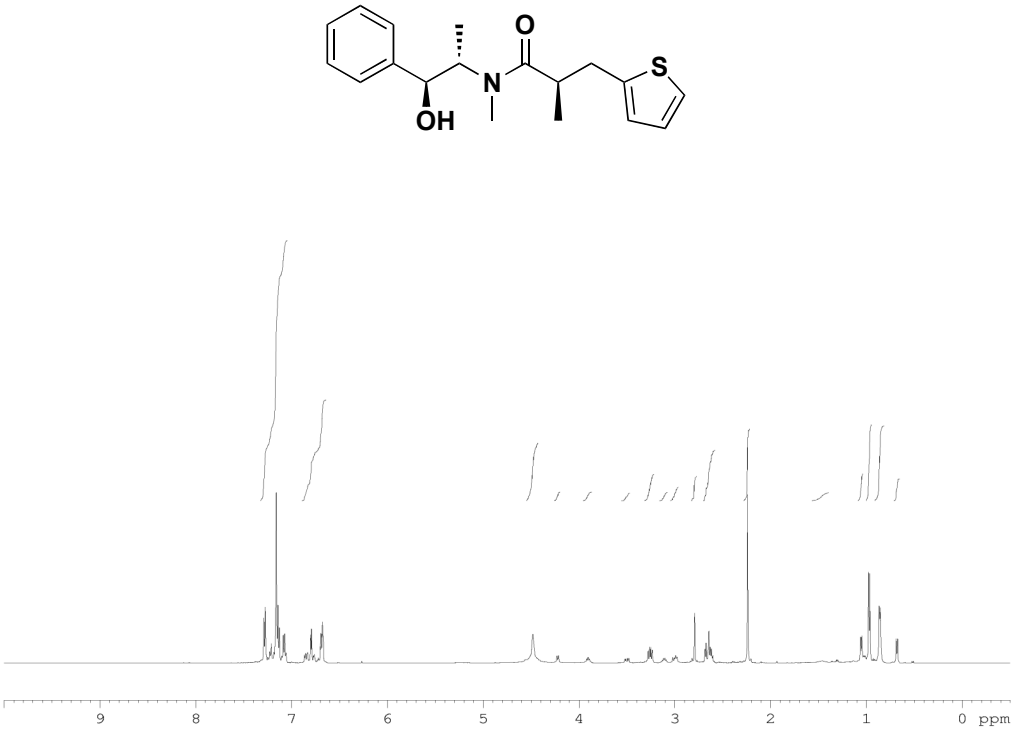
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7k**



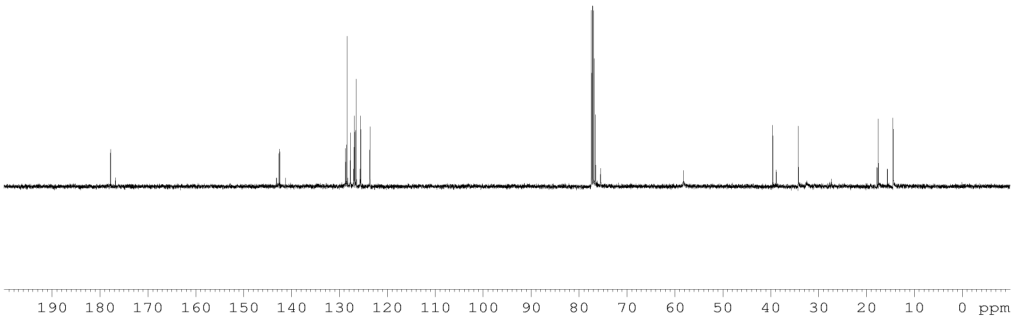
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **7l**



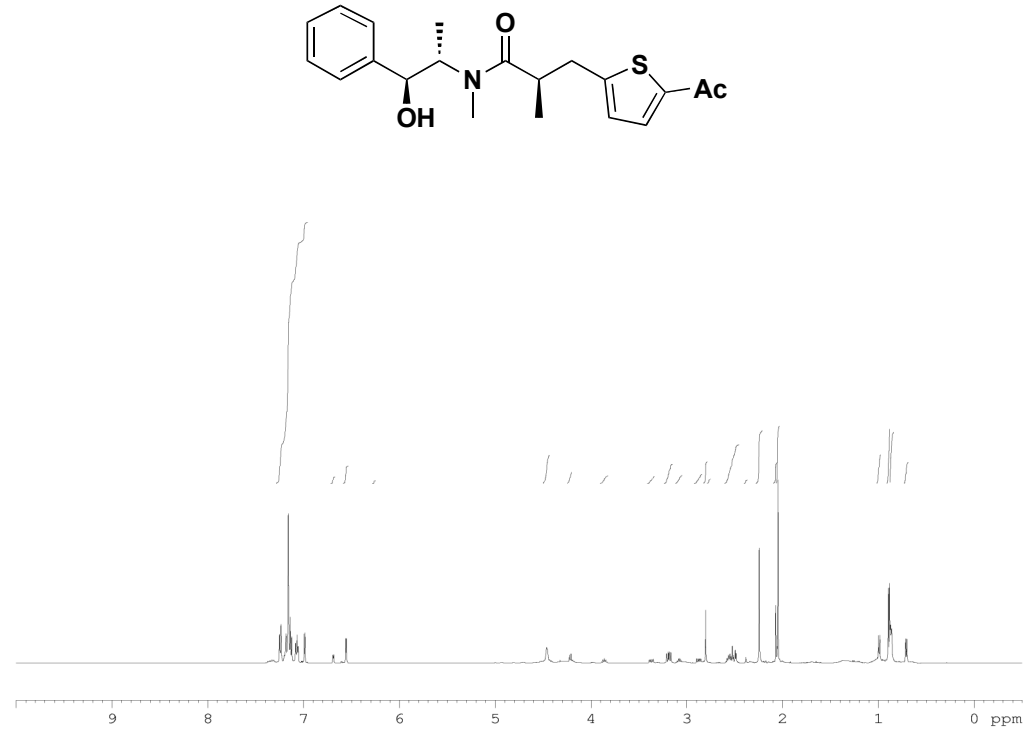
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **7l**



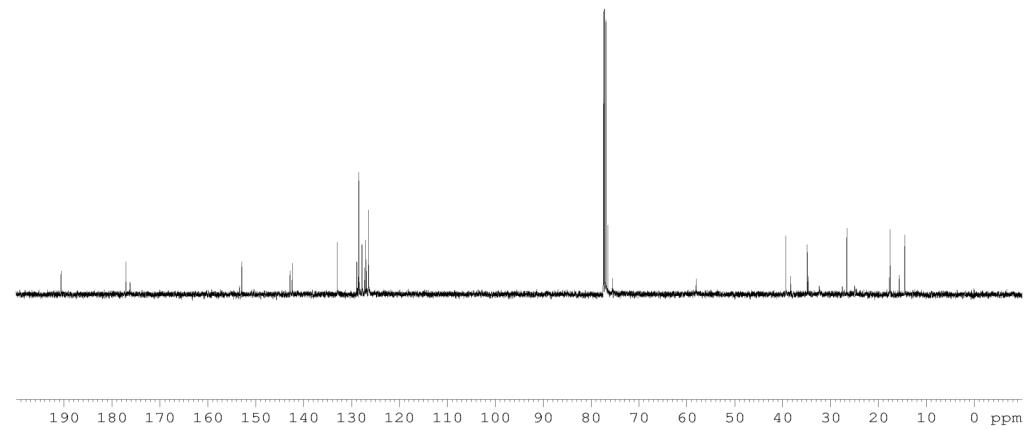
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **8a**



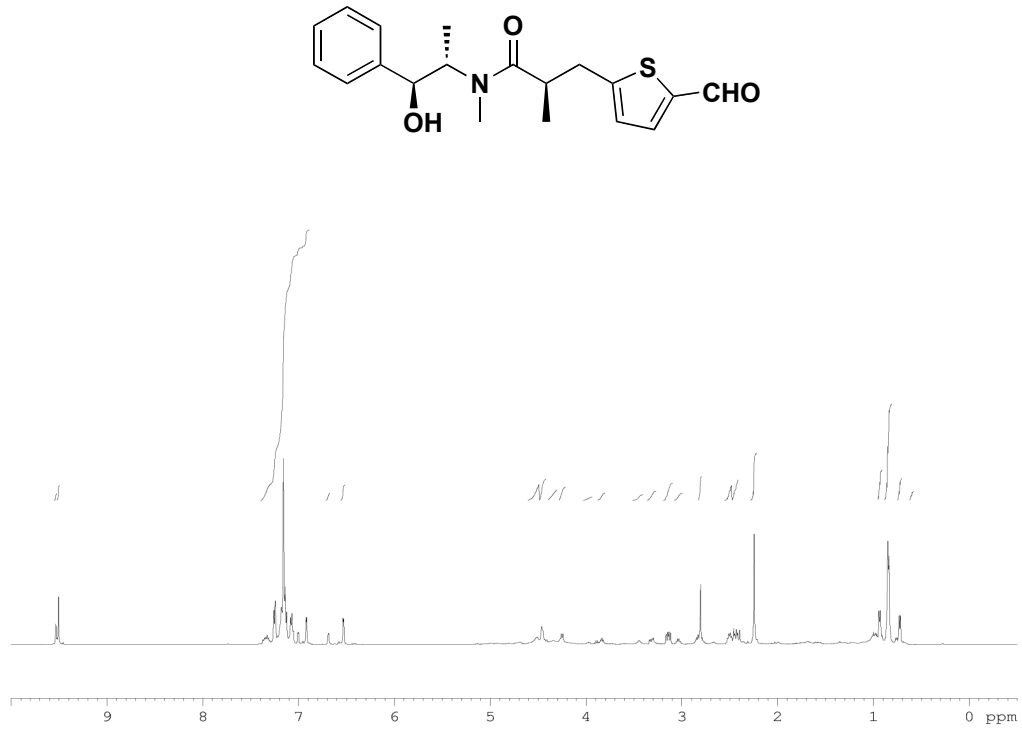
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **8a**



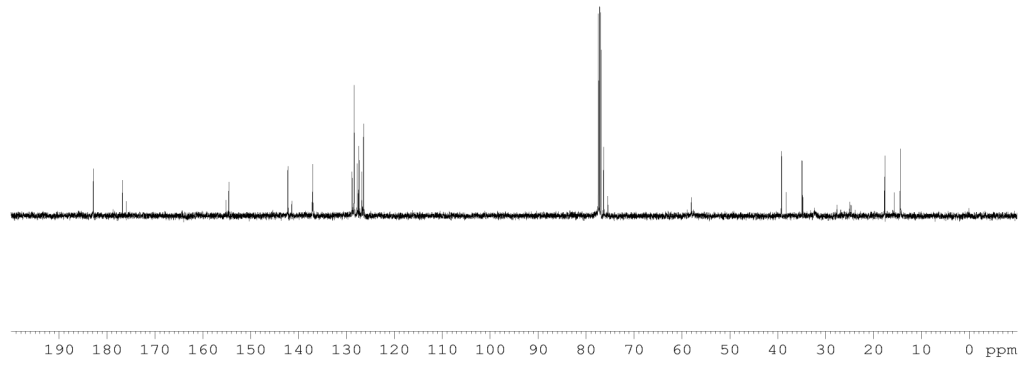
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **8b**



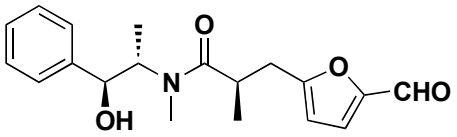
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **8b**

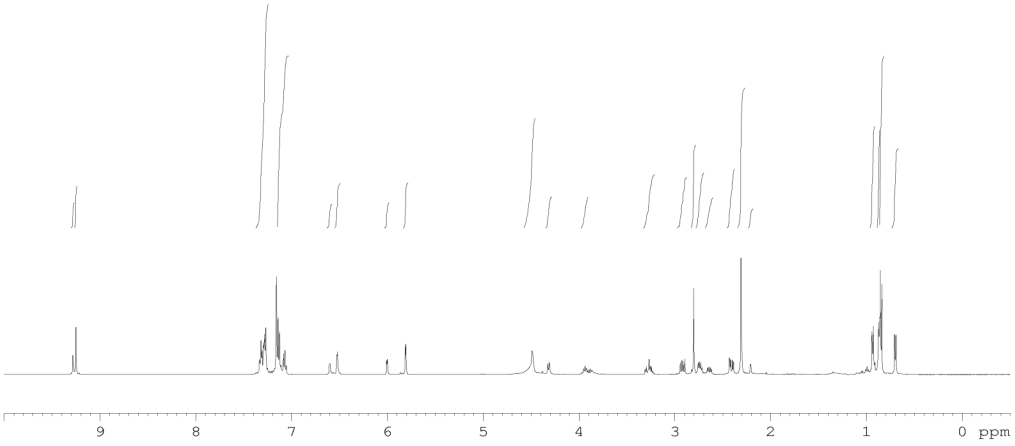


^{1}H NMR (500 MHz, C_6D_6) Spectrum of **8c**

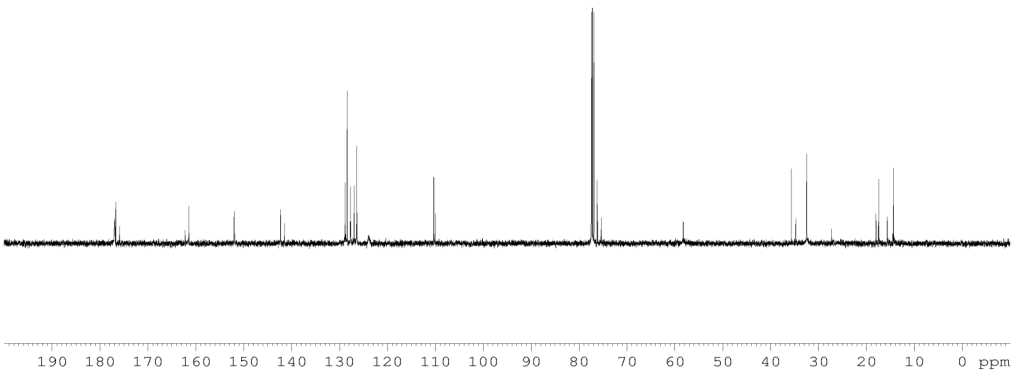


^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **8c**

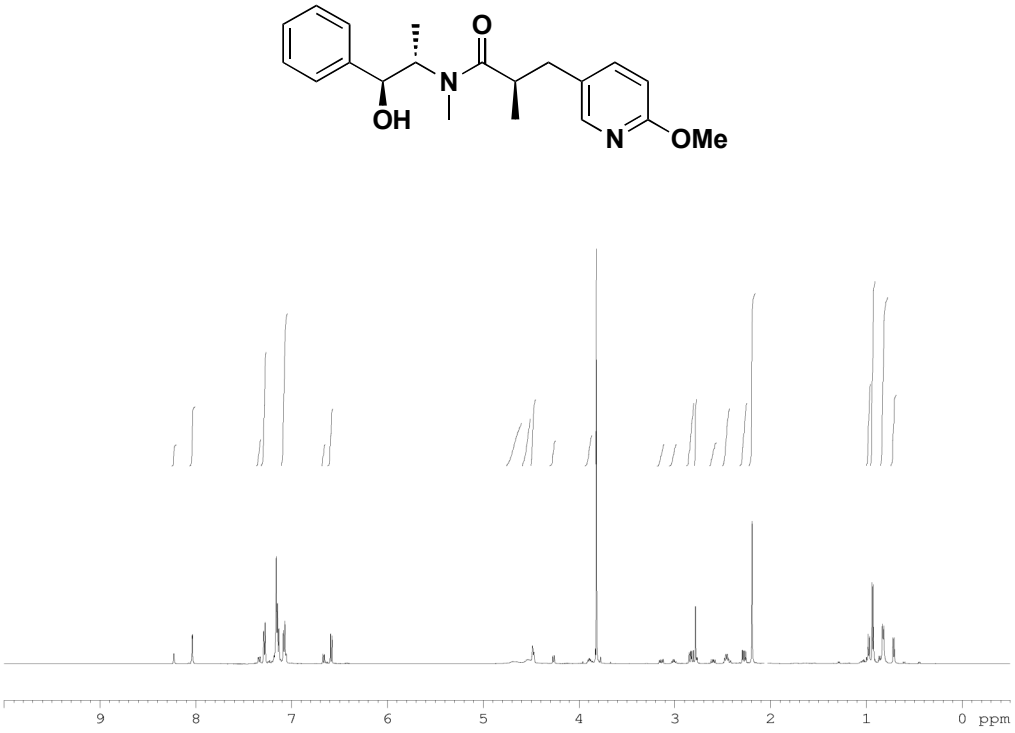




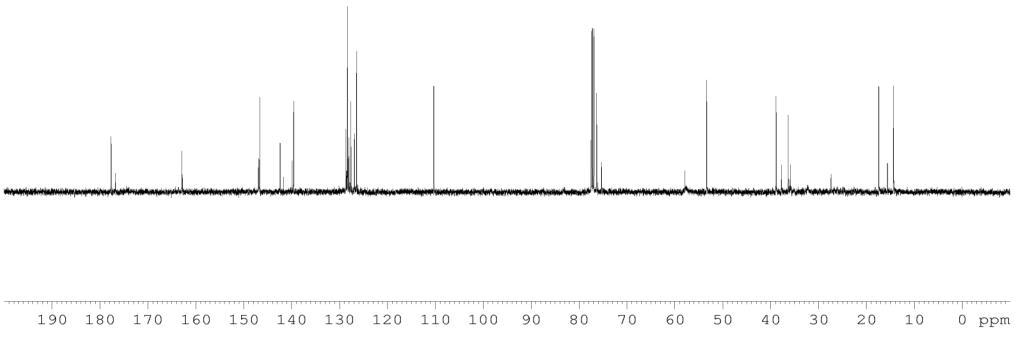
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **8d**



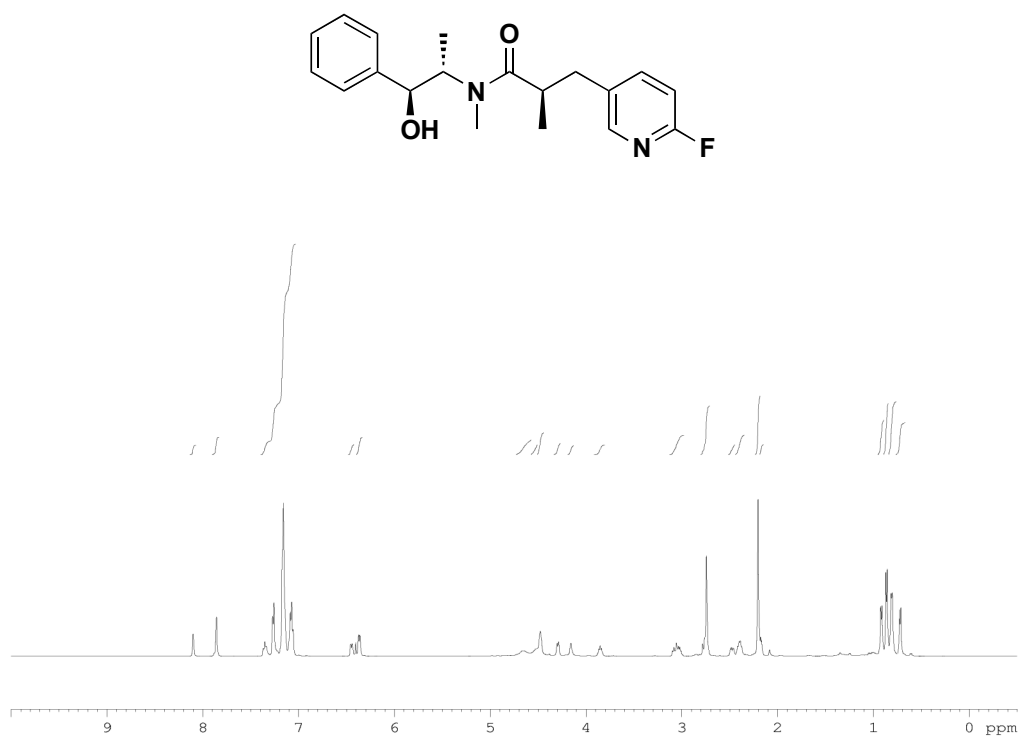
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **8d**



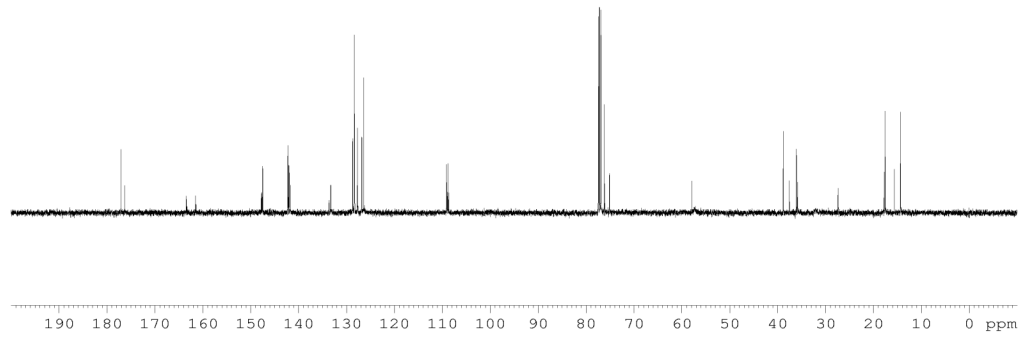
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **8e**



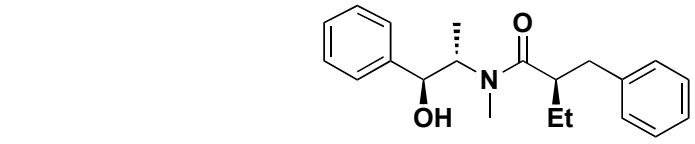
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **8e**

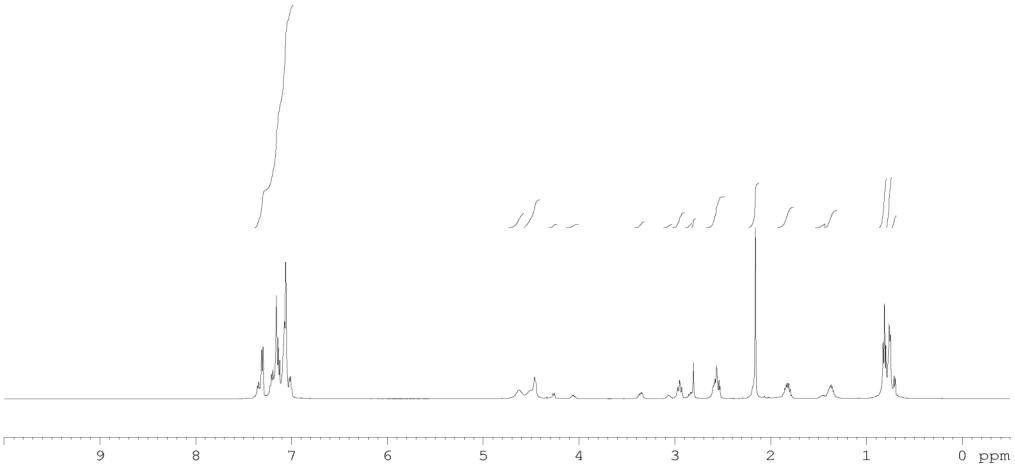


^{1}H NMR (500 MHz, C_6D_6) Spectrum of **8f**

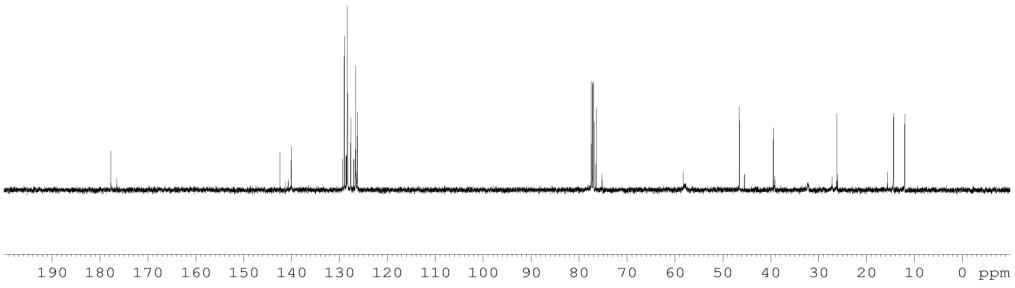


^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **8f**

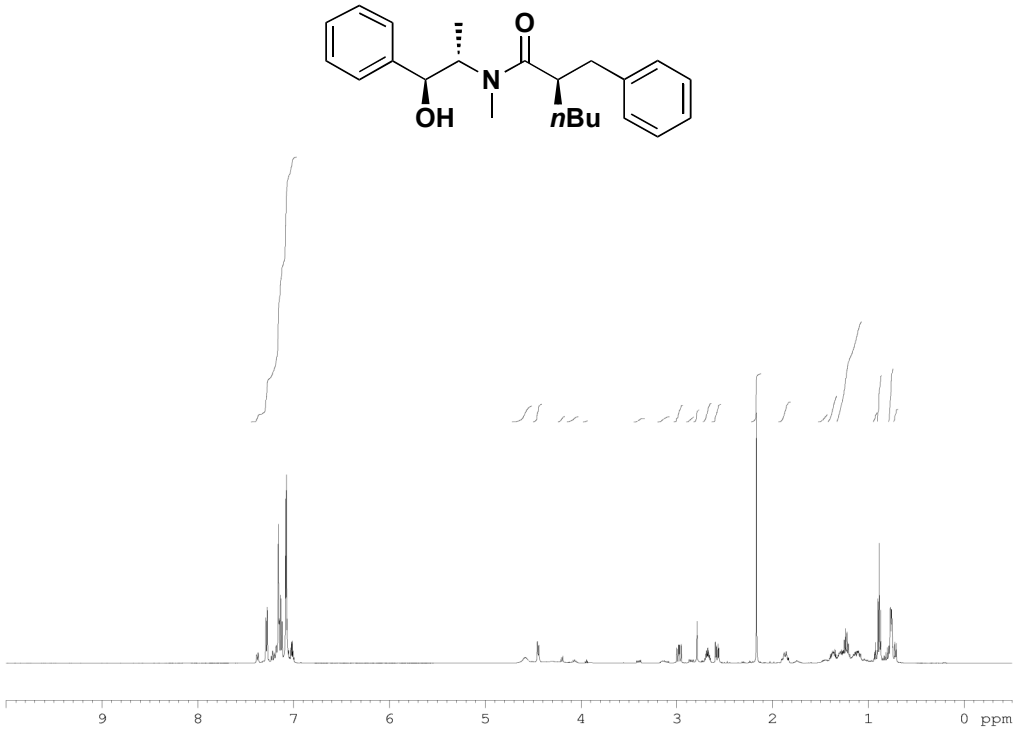




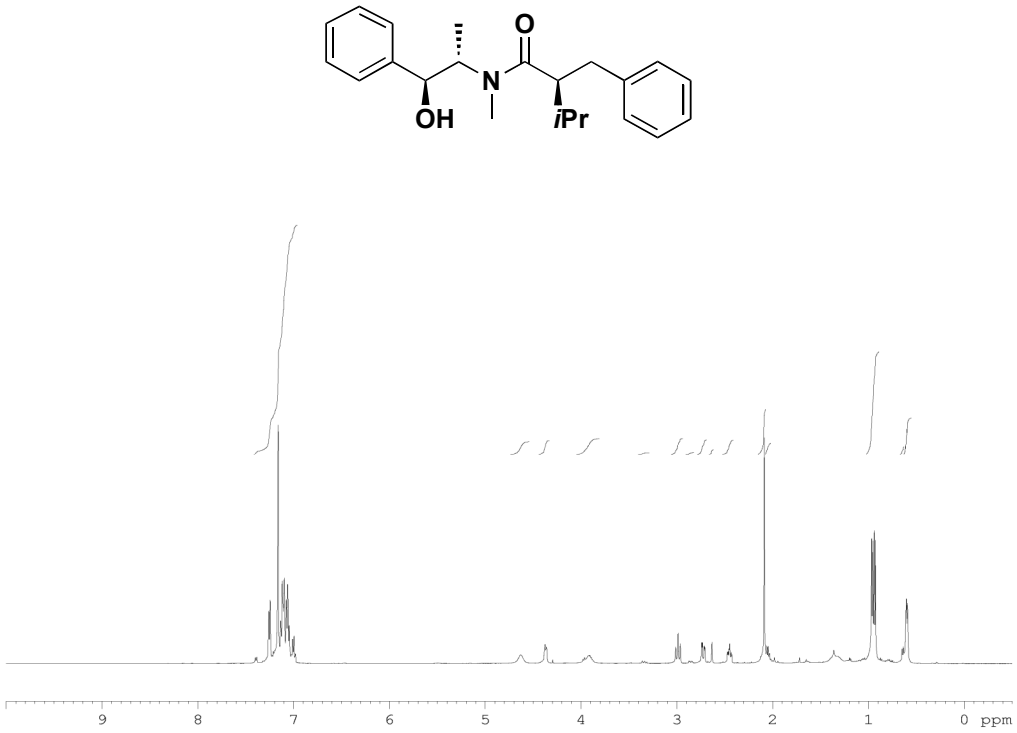
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **9a**



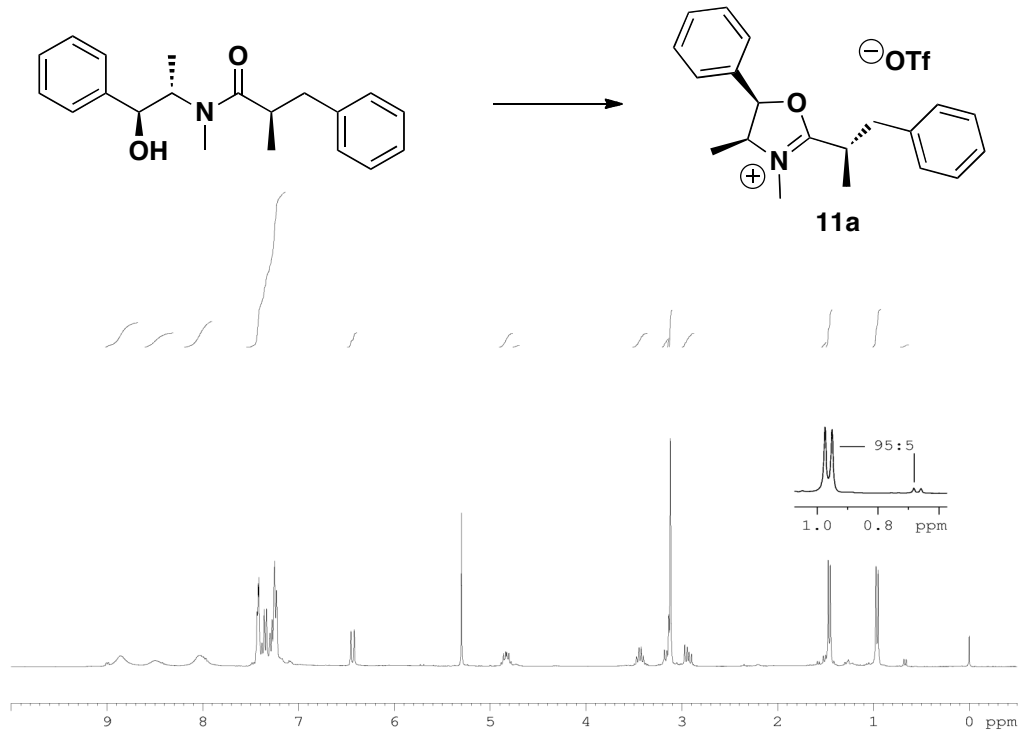
^{13}C NMR (125 MHz, $CDCl_3$) Spectrum of **9a**



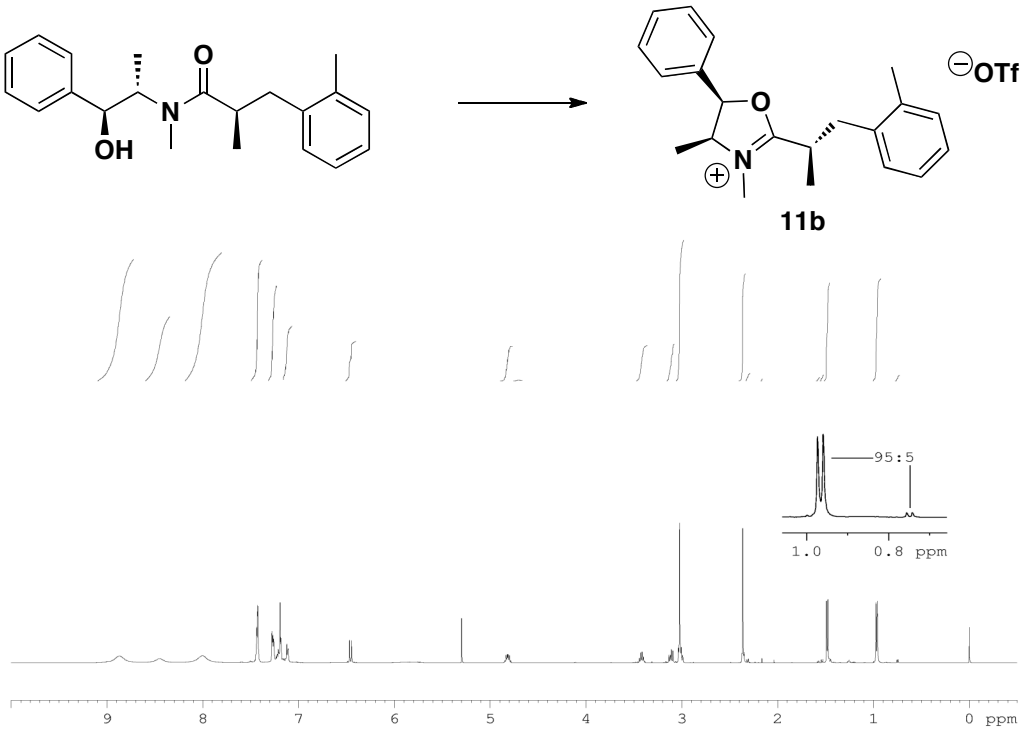
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **9b**



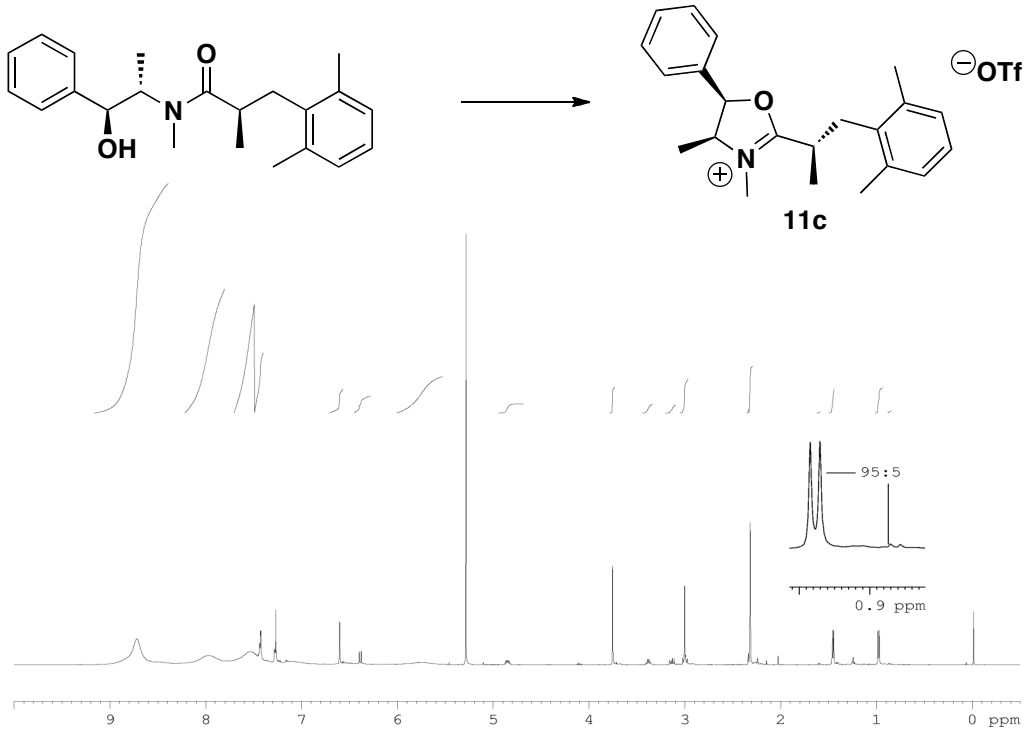
^{1}H NMR (500 MHz, C_6D_6) Spectrum of **9c**



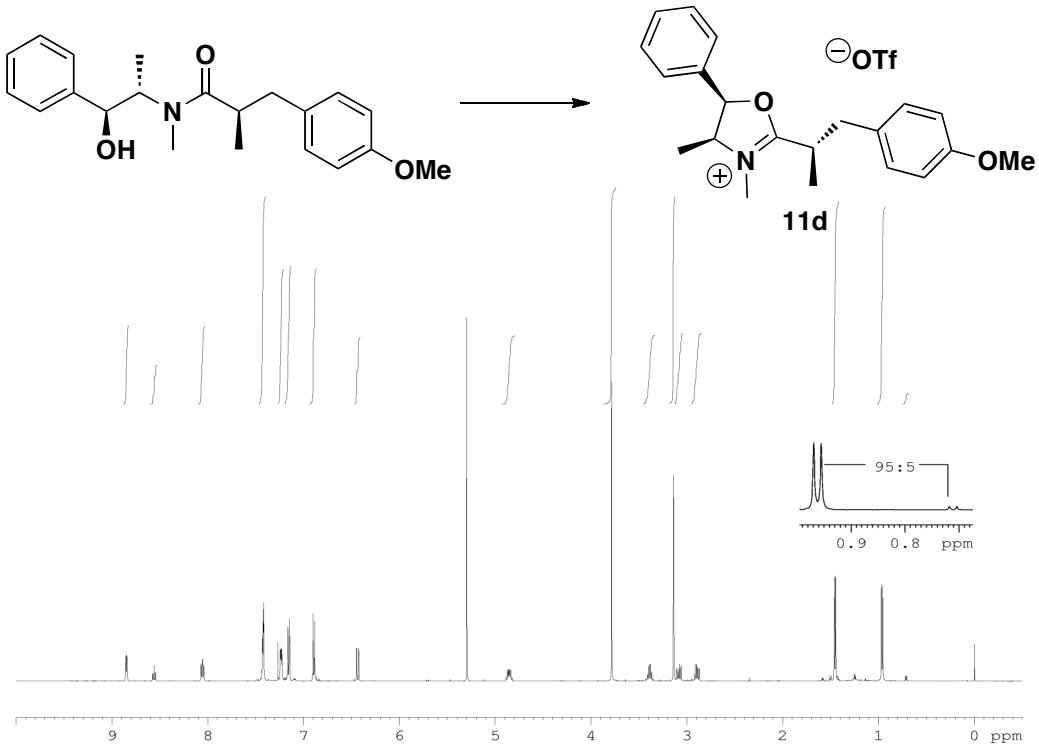
^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11a**



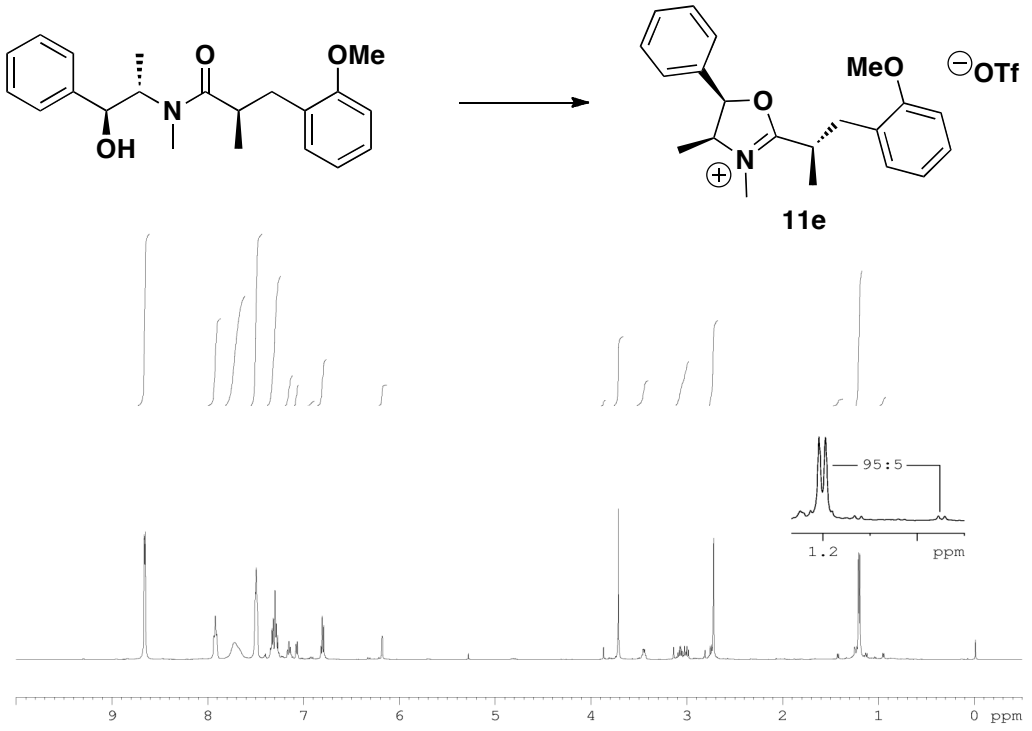
^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11b**



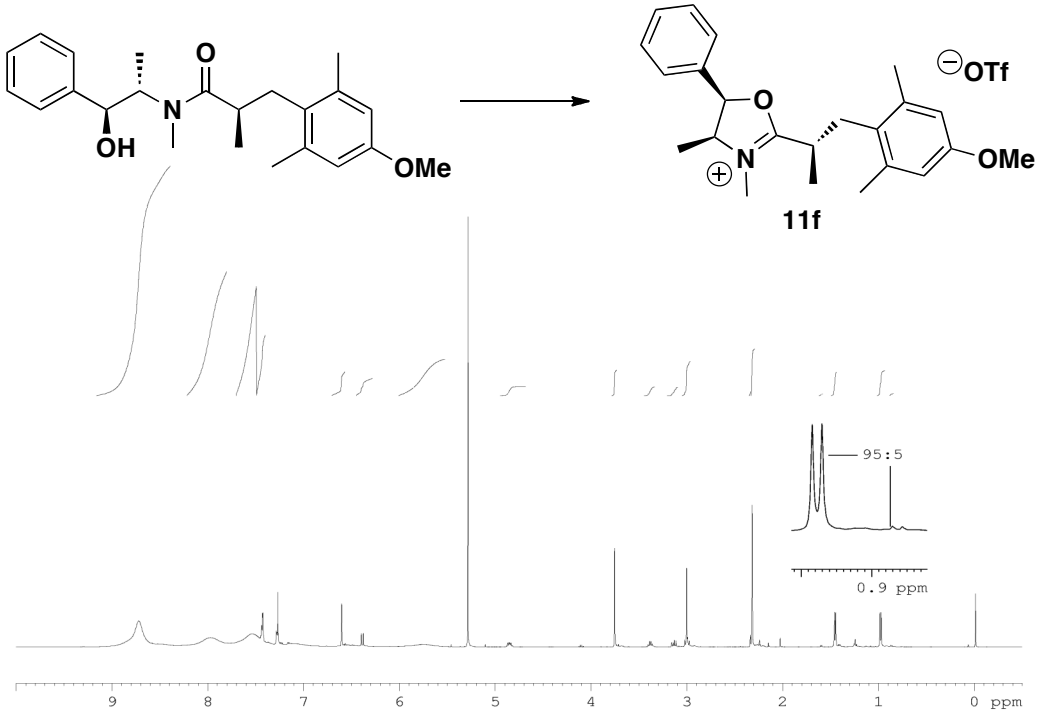
^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11c**



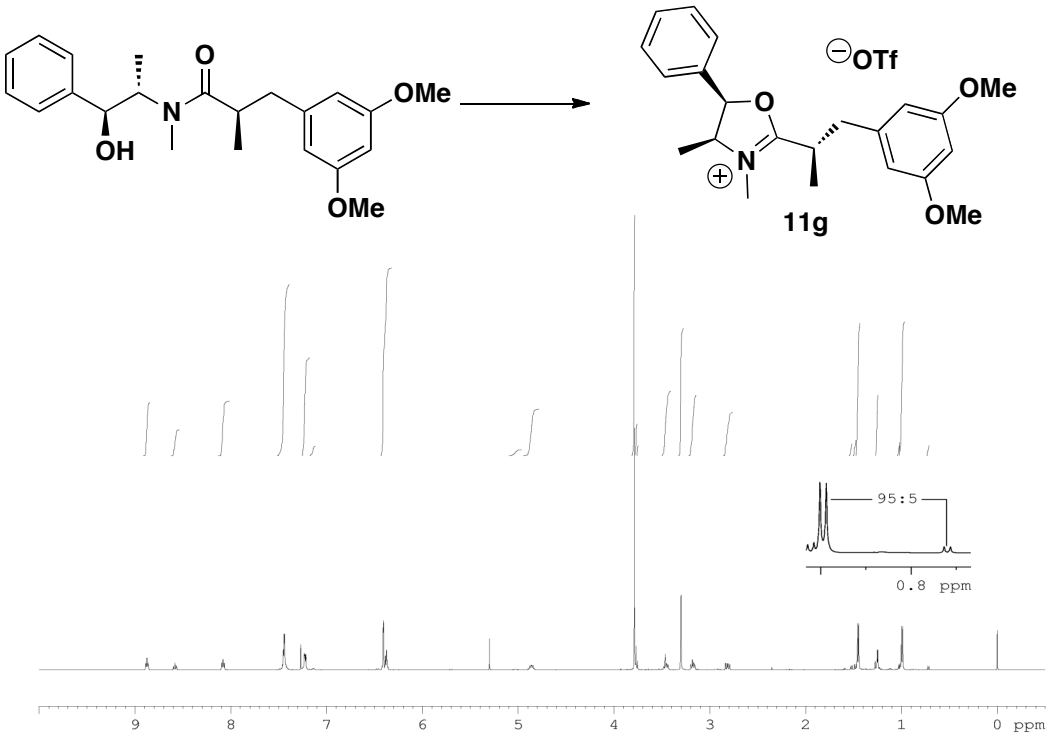
^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11d**



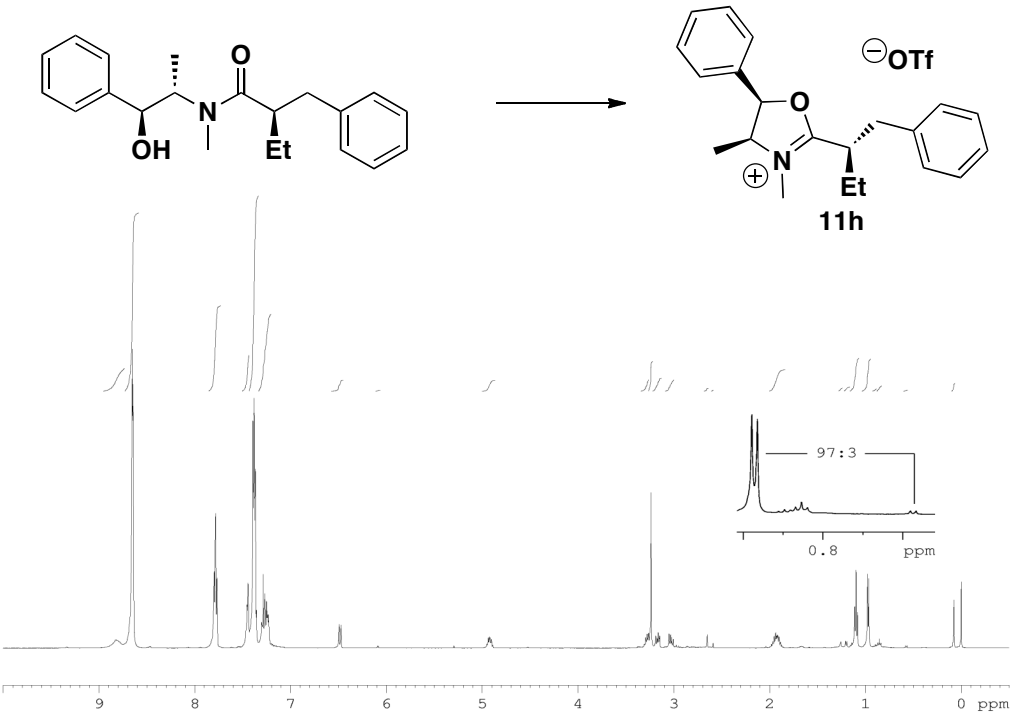
^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11e**



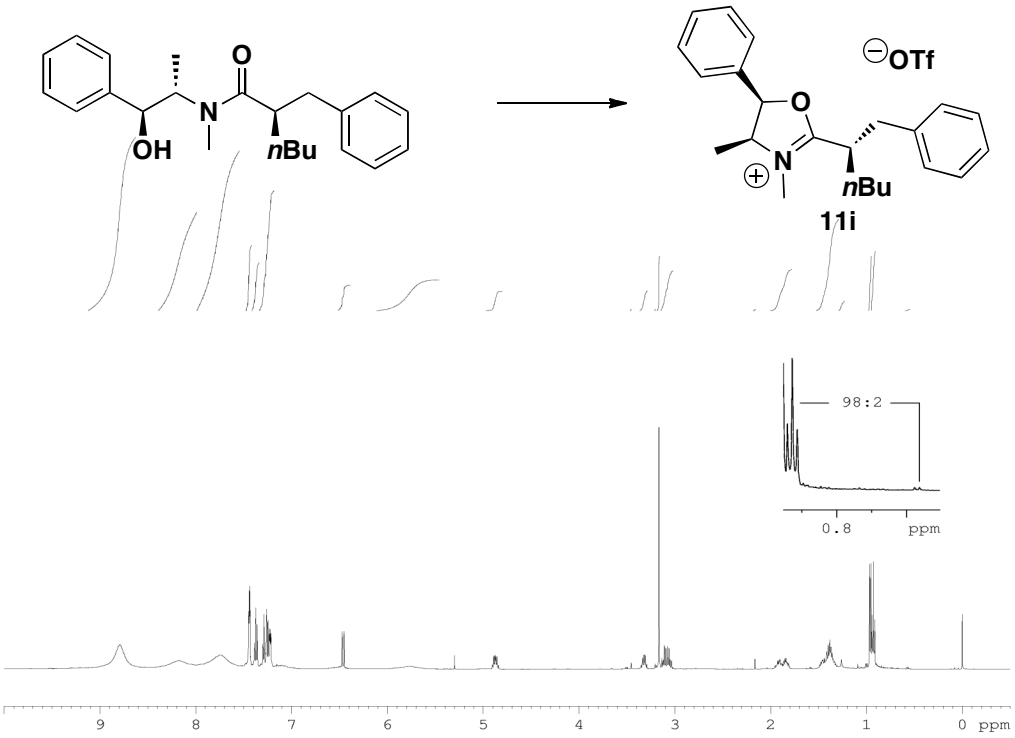
^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11f**



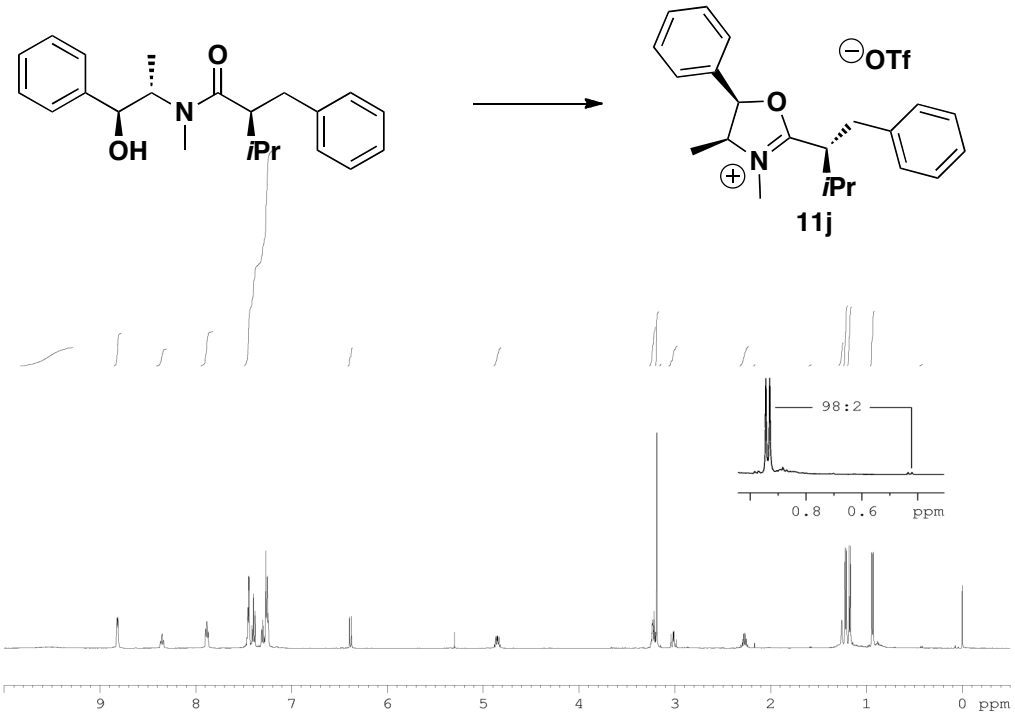
^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11g**



^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11h**



^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11i**



^{1}H NMR (500 MHz, $CDCl_3$) Spectrum of **11j**