Supporting Information For Catalytic Enantioselective Indium-Mediated Allylation of Hydrazones

Gregory R. Cook,* Robert Kargbo, and Bikash Maity

Department of Chemistry and Molecular Biology,
North Dakota State University, Fargo, ND 58105-5516
Gregory.cook@ndsu.edu

Experimental Section

Thin layer chromatography (TLC) was performed on silica gel Whatman-60F glass plates, and components were visualized by illumination with UV light or by staining with potassium permanganate solution. Chromatography was performed using silica E. Merck silica gel 60 (230-400 mesh). NMR spectra were recorded in DMSO or CDCl₃ on a Varian Inova 500 MHz, 400 MHz, or Varian Mercury 300 MHz spectrometer. ¹³C NMR was recorded using broad band proton decoupling. Chemical shifts are reported in δ relative to TMS and coupling constants in Hz. Optical rotations were recorded on a JASCO-CIP-370 instrument. Elemental analyses were performed on a Perkin Elmer Series II CHNS/O Analyzer 2400. High-resolution mass spectra (HRMS) [Positive Ion FAB (FAB⁺) or Electrospray (ES)] were obtained at the Mass Spectrometry Laboratory, the Ohio State University, or in the Department of Chemistry and Molecular Biology at North Dakota State University. Melting points were determined without correction. Reactions were carried out under an inert atmosphere of nitrogen or argon. Solvents were dried using a nitrogen pressurized alumina column system from Solvtek.

Preparation of *o*-(2,4-diphenylphosphinyl)hydroxylamine:¹ To a cooled ice/salt bath aqueous solution of hydroxylamine hydrochloride (8.0 g in 17.4 mL of H₂O, 6.6 M, 115 mmol) was added aqueous sodium hydroxide (3.9 g in 14 mL of H₂O, 7.1 M, 97 mmol), followed by 1,4-dioxane (55.2 mL). The solution was allowed to partially solidify and fresh diphenylphosphinyl chloride from Acros chemicals (10 g, 42 mmol) in dioxane (42 mL) was added in one portion with vigorous stirring. The mixture was stirred in the ice/salt cooled bath until copious precipitation ensued. Water (167 mL) was added and, after 30 minutes, the slurry was filtered using a Büchner funnel with a No. 3 Whatman filter paper. The precipitate was air dried by pressing with filter paper on the funnel under vacuum aspirator for 15 min. The solid was purified by stirring with aqueous sodium hydroxide (840 mg, 0.21 M, 100 mL) at 0 °C for 20 min, followed by filtration as above and drying in vacuo (P₂O₅, 2 days of drying with intermittent replacement of wet P₂O₅). The dried solid was crushed with a spatula to obtained 6.9 g (70%) of *o*-(2,4-diphenylphosphinyl)hydroxylamine as a fine powder. This could be stored in the freezer for a considerable period of time without noticeable change.

¹ Colvin, E. W.; Kirby, G. W.; Wilson, A. C. *Tetrahedron Lett.* **1982**, 23, 3835.

General procedure for preparation of hydrazones: Hydrazones were prepared by a modified literature procedure.² To a solution of the appropriate 2-oxazolidinone in THF (0.05 M) was added *n*-BuLi (2.2 M in hexane, 1.1 eq) at -78 °C. After 50 min, *o*-(2,4-diphenylphosphinyl)-hydroxylamine (1.2 eq) was added, the reaction was allowed to warm to room temperature and further stirred for 14 hours. The mixture was filtered and concentrated to afford the corresponding *N*-amino-2-oxazolidinone. Without purification, the *N*-amino-2-oxazolidinone was dissolved in toluene (0.5 M), and aldehyde (2 eq), magnesium sulfate (4 eq) and TsOH•H₂O (0.02 eq) were added. The mixture was stirred under reflux for 2 hours then concentrated and purified by flash chromatography (CombiFlash by Isco, gradient from 2% to 20% Ethyl Acetate in hexanes) to afford the corresponding hydrazone.

3-(Benzylidene)amino-2-oxazolidinone (**1a**)³

Colorless solid (1.4 g, 75 % yield); m.p. 132-135 °C; IR(film): 3500, 2984, 2960, 2919, 1756, 1468, 1450, 1421, 1249, 1102, 1042, 757, 697 cm⁻¹; ¹H NMR (500 MHz): δ 7.72-7.70 (m, 2H), 7.64 (s, 1H), 7.37-7.35 (m, 3H), 4.51-4.48 (m, 2H), 3.90 (t, 8.0 Hz, 2H), ; ¹³C NMR (125.5 MHz): δ 133.7, 123.6, 113.1, 109.6, 108.1, 106.8, 40.8, 21.8; HRMS Calcd for C₁₀H₁₀N₂O₂ (M+Na)⁺: 213.0640; Found: 213.0632.

3-(4-Methyl-benzylidene)amino-2-oxazolidinone (**1b**)

Colorless solid (470 mg, 78% yield); m.p. 182-183 °C; IR(film): 3496, 3123, 3030, 2977, 2959, 2923, 1752, 1481, 1419, 1255, 1215, 1095, 1037 cm⁻¹; ¹H NMR (400 MHz): δ 7.69 (s, 1H), 7.62 (d, *J* = 8.4 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 4.52-4.48 (m, 2H), 3.92-3.88 (m, 2H), 2.34 (s, 3H); ¹³C NMR (125.5 MHz): δ 154.6, 144.7, 140.8, 131.2, 129.6, 127.7, 61.5, 42.8, 21.7; HRMS Calcd for C₁₁H₁₂N₂O₂ (M+Na)⁺: 227.0796; Found: 227.0788.

² (a) Friestad, G. K.; Qin, J. *J. Am. Chem. Soc.* **2000**, *122*, 8329. (b) Shen, Y.; Friestad, G. K. *J. Org. Chem.* **2002**, *67*, 6236.

³ Friestad, G. K.; Shen, Y.; Ruggles, E. L. *Angew. Chem. Int. Ed.* **2003**, *42*, 5061.

3-(4-Methoxy-benzylidene)amino-2-oxazolidinone (1c)

Colorless solid (450 mg, 70% yield); m.p. 198-201 °C; IR(film): 3030, 2906, 2843, 1753, 1604, 1463, 1416, 1257, 1026 cm^{-1} ; ^1H NMR (400 MHz): δ 7.74 (s, 1H), 7.63 (d, J = 8.8 Hz, 2H), 6.97 (d, J = 8.8 Hz, 2H), 4.46-4.42 (m, 2H), 3.89 (t, J = 8.0 Hz, 2H), 3.76 (s, 3H); ^{13}C NMR (125.5 MHz): δ 161.2, 154.6, 144.1, 129.2, 127.6, 114.9, 62.2, 55.9, 42.8; HRMS Calcd for $\text{C}_{11}\text{H}_{12}\text{N}_2\text{O}_3$ ($\text{M}+\text{Na}$) $^+$: 243.0746; Found: 243.0760.

3-(4-Chloro-benzylidene)amino-2-oxazolidinone (1d)⁴

Colorless solid (450 mg, 75% yield); m.p. 169-170 °C; IR(film): 2981, 2918, 2839, 1759, 1414 cm^{-1} ; ^1H NMR (500 MHz): δ 7.70 (d, J = 5.5 Hz, 2H), 7.68 (s, 1H), 7.37 (d, J = 8.5 Hz, 2H), 4.58-4.55 (m, 2H), 3.96 (t, J = 8.0 Hz, 2H); ^{13}C NMR (125.5 MHz): δ 154.4, 143.3, 136.4, 132.5, 129.2, 128.8, 61.5, 42.9; HRMS Calcd for $\text{C}_{10}\text{H}_9\text{ClN}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 247.0250; Found: 247.0228.

3-(2-Bromo-benzylidene)amino-2-oxazolidinone (1e)

Colorless solid (430 mg, 70% yield); m.p. 120-123 °C; IR(film): 3059, 2921, 2850, 1769, 1412, 1245, 1209, 1101, 1037, 758 cm^{-1} ; ^1H NMR (400 MHz): δ 8.11 (dd, J = 8.0, 2.0 Hz, 1H), 7.97 (s, 1H), 7.53 (dd, J = 8.0, 1.2 Hz, 1H), 7.33-7.29 (m, 1H), 7.24-7.19 (m, 1H), 4.58-4.54 (m, 2H), 3.97 (t, J = 8.0 Hz, 2H); ^{13}C NMR (125.5 MHz): δ 154.3, 143.0, 133.1, 132.8, 131.6, 128.4, 128.0, 124.4, 61.6, 42.6; HRMS Calcd for $\text{C}_{10}\text{H}_9\text{BrN}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 290.9745; Found: 290.9752.

3-(2-Chlorobenzylidene)amino-2-oxazolidinone (1f)

Colorless solid (400 mg, 72% yield); m.p. 115-117 °C; IR(film): 3063, 2920, 2847, 1774, 1477, 1403, 1245, 1205, 1091, 1033, 750 cm^{-1} ; ^1H NMR (400 MHz): δ 8.15-8.13 (m, 1H), 8.02 (s, 1H), 7.37-7.35 (m,

⁴ Kaminsky, D.; Dubnick, B.; Anderson, F. E. *J. Med. Chem.* **1964**, 7, 367.

1H), 7.33-7.27 (m, 2H), 4.60-4.57 (m, 2H), 3.99 (t, $J = 8.0$ Hz, 2H); ^{13}C NMR (125.5 MHz): δ 154.4, 140.5, 134.3, 131.4, 131.3, 129.9, 127.9, 127.4, 61.6, 42.6; HRMS Calcd for $\text{C}_{10}\text{H}_9\text{ClN}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 247.0250; Found: 247.0240.

3-(2-Methyl-benzylidene)amino-2-oxazolidinone (1g)

Colorless solid (450 mg, 70% yield); m.p. 162-164 °C; IR(film): 3022, 2992, 2917, 1768, 1406, 1247, 1221, 1117, 1093, 1038, 783 cm^{-1} ; ^1H NMR (400 MHz): δ 7.96 (s, 1H), 7.92 (dd, $J = 7.6, 1.6$ Hz, 1H), 7.28-7.14 (m, 3H), 4.54-4.50 (m, 2H), 3.96-3.91 (m, 2H), 2.44 (s, 3H); ^{13}C NMR (125.5 MHz): δ 154.5, 143.4, 137.0, 132.0, 131.0, 130.2, 127.2, 126.5, 61.5, 43.0, 19.7; HRMS Calcd for $\text{C}_{11}\text{H}_{12}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 227.0796; Found: 227.0783.

3-(Naphthalen-1-ylmethylene)amino-2-oxazolidinone (1h)

Colorless solid (455 mg, 72% yield); m.p. 148-150 °C; IR(film): 3048, 2910, 2839, 1765, 1412, 1392, 1246, 1231 cm^{-1} ; ^1H NMR (400 MHz): δ 8.62 (d, $J = 8.8$ Hz, 1H), 8.40 (s, 1H), 7.97 (d, $J = 7.2$ Hz, 1H), 7.89 (dd, $J = 8.4, 4.0$ Hz, 2H), 7.61-7.47 (m, 3), 4.59-4.55 (m, 2H), 4.04 (t, 8.0 Hz, 2H); ^{13}C NMR (125.5 MHz): δ 154.5, 144.1, 134.0, 131.1, 130.9, 129.4, 129.1, 127.9, 127.5, 126.3, 125.5, 123.9, 61.6, 43.0; HRMS Calcd for $\text{C}_{14}\text{H}_{12}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 263.0796; Found: 263.0811.

3-(Furan-2-ylmethylene)amino-2-oxazolidinone (1i)⁵

Colorless solid (350 mg, 55% yield); m.p. 160-162 °C; IR(film): 2921, 2847, 1772, 1743, 1485, 1410, 1250, 1093 cm^{-1} ; ^1H NMR (500 MHz): δ 7.82 (s, 1H), 7.50 (d, $J = 1.5$ Hz, 1H), 6.79 (d, $J = 3.5$ Hz, 1H), 6.48 (dd, $J = 3.5, 1.5$ Hz, 1H), 4.53 (t, 8.5 Hz, 2H), 3.95 (t, 8.0 Hz, 2H); ^{13}C NMR (125.5 MHz): δ 154.3, 149.6, 144.7, 135.5, 113.2, 112.2, 61.6, 43.6; HRMS Calcd for $\text{C}_8\text{H}_8\text{N}_2\text{O}_3$ ($\text{M}+\text{Na}$) $^+$: 203.0433; Found: 203.0443.

⁵ Guo, Z. R.; Yang, G. Z.; Chu, F. M.; Xu, F. M.; Xu, G. S.; Zhang, J. J.; Zhang, S. R.; Yu, Y. W. *Yaoxue Xuebao* **1989**, 24, 737

3-(3-Phenyl-allylidene)amino-2-oxazolidinone (1j)

Colorless solid (420 mg, 55% yield); m.p. 187-189 °C; IR(film): 3033, 2970, 2910, 1754, 1411, 1250, 1227, 969 cm^{-1} ; ^1H NMR (400 MHz): δ 7.51 (d, J = 8.8 Hz, 1H), 7.43-7.41 (m, 2H), 7.36-7.28 (m, 3H), 7.06 (dd, J = 16.0, 16.0 Hz, 1H), 6.87 (d, J = 16.4 Hz, 1H), 4.53-4.49 (m, 2H), 3.89-3.84 (m, 2H); ^{13}C NMR (125.5 MHz): δ 154.5, 146.2, 139.8, 136.0, 129.3, 129.1, 127.2, 125.4, 61.6, 42.6; HRMS Calcd for $\text{C}_{12}\text{H}_{12}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 239.0796; Found: 239.0791.

3-(3-Phenyl-propylidene)amino-2-oxazolidinone (1k)

Colorless solid (400 mg, 60% yield); m.p. 71-73 °C; IR(film): 3021, 2920, 1758, 1409, 1260, 1223, 1057, 754, 707 cm^{-1} ; ^1H NMR (500 MHz): δ 7.31 (dd, J = 8.0, 7.0 Hz, 2H), 7.22 (dd, J = 8.0, 5.5 Hz, 3H), 7.05 (t, J = 5.5 Hz 1H), 4.48 (t, J = 8.0 Hz, 2H), 3.74 (t, J = 8.0 Hz, 2H), 2.90 (t, J = 8.0 Hz, 2H), 2.76-2.72 (m, 2H); ^{13}C NMR (125.5 MHz): δ 154.7, 147.7, 140.6, 128.8, 128.6, 126.5, 61.5, 42.5, 34.4, 33.3; HRMS Calcd for $\text{C}_{12}\text{H}_{14}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 241.0953; Found: 241.0957.

3-[4-(Benzyloxy)butylidene]amino-2-oxazolidinone (1l)

Colorless liquid (350 mg, 64% yield); IR(film): 2923, 2858, 1767, 1479, 1407, 1227, 1096, 1039, 752, 699 cm^{-1} ; ^1H NMR (500 MHz): δ 7.36-7.26 (m, 5H), 7.02 (t, J = 5.5 Hz, 1H), 4.47 (s, 2H), 4.41-4.38 (m, 2H), 3.60 (t, J = 8.0 Hz, 2H), 3.56 (t, 6.5 Hz, 2H), 2.54-2.50 (m, 2H), 1.91-1.85 (m, 2H); ^{13}C NMR (125.5 MHz): δ 154.8, 148.7, 138.6, 128.6, 128.0, 127.8, 73.2, 69.9, 61.5, 42.3, 30.4, 27.3; HRMS Calcd for $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_3$ ($\text{M}+\text{Na}$) $^+$: 285.1215; Found: 285.1217.

General Procedure for asymmetric allylation of hydrazones: To an oven-dried Schlenk flask under nitrogen was added activated 4Å molecular sieves (100 mg/1.5mL of THF), indium powder (1.1 eq), allyl iodide (1.65 eq.), BINOL ligand⁶ (0.11 eq or 1.1 eq) and dry THF (0.18 M in indium) and the mixture was stirred for four hours at room temperature. The reaction mixture was cooled to 0 °C and the hydrazone (1 eq) was added. The mixture was allowed to warm to room temperature and then stirred for 24 hours. The mixture was filtered through a small plug of silica gel (230-400 mesh) using 10-30% ethyl acetate/hexane

⁶ Chong, J. M.; Shen, L.; Wu, T. R. *Org. Lett.* **2004**, 6, 2701.

as eluent afforded the allylated products. If necessary, the products were further purified by flash chromatography using 10-30% ethyl acetate/hexane.

(S)-3-(1-Phenylbut-3-enylamino)-2-oxazolidinone (2a)

Colorless solid; m.p. 55-56 °C; $[\alpha]_D^{25} = -144.0$ ($c = 2.22$ in CHCl_3); IR (film): 3492, 3280, 3064, 3030, 2978, 2910, 1751, 1640, 1491, 1454, 1402, 1249, 1221, 1089, 1029, 919, 760, 703 cm^{-1} ; ^1H NMR 500 MHz): $\delta = 7.38$ (d, $J = 3.8$ Hz, 2H), 7.33 (dd, $J = 7.5, 7.5$ Hz, 2H), 7.27 (dd, $J = 7.0, 4.5$ Hz, 1H), 5.76 (dddd, $J = 17.0, 10.0, 7.0, 3.0$ Hz, 1H), 5.11 (ddt, $J = 17.0, 10.5, 1.0$ Hz, 2H), 4.56-4.32 (br s, 1H), 4.26 (t, $J = 7.0$ Hz, 1H), 4.12 (dt, $J = 8.5, 3.5$ Hz, 1H), 3.99 (dt, $J = 8.5, 8.5$ Hz, 1H), 3.43 (dt, $J = 8.5, 8.5$ Hz, 1H), 3.06 (dt, $J = 8.0, 3.0$ Hz, 1H), 2.44 (dd, $J = 6.5, 6.5$ Hz, 2H); ^{13}C NMR (125.5 MHz): δ 158.9, 141.7, 134.5, 128.6, 128.1, 128.0, 118.4, 63.0, 61.6, 48.0, 40.3; HRMS Calcd for $\text{C}_{13}\text{H}_{16}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 255.1109; Found: 255.1094. HPLC (Chiralcel OD, 97:3 hexane/2-propanol, 0.5 mL/min, 254 nm) 40.1 min, 46.1 min.

(S)-3-(1-p-Tolylbut-3-enylamino)-2-oxazolidinone (2b)

Colorless solid; m.p. 95-97 °C; IR (film): 3490, 3277, 2980, 2919, 1759, 1641, 1513, 1479, 1408, 1253, 1221, 1092, 1032, 920, 818, 762 cm^{-1} ; ^1H NMR 500 MHz): $\delta = 7.27$ (d, $J = 8.0$ Hz, 2H), 7.14 (d, $J = 8.0$ Hz, 2H), 5.76 (dddd, $J = 17.0, 10.0, 7.0, 3.0$ Hz, 1H), 5.11 (ddt, $J = 17.0, 10.0, 1.5$ Hz, 2H), 4.52-4.26 (br s, 1H), 4.22 (t, $J = 7.0$ Hz, 1H), 4.13 (dt, $J = 9.0, 3.5$ Hz, 1H), 4.01 (dt, $J = 8.5, 8.5$ Hz, 1H), 3.43 (dt, $J = 8.5, 8.5$ Hz, 1H), 3.08 (dt, $J = 8.5, 3.0$ Hz, 1H), 2.43 (dd, $J = 7.0, 7.0$ Hz, 2H), 2.34 (s, 3H); ^{13}C NMR (125.5 MHz): δ 159.0, 138.6, 137.6, 134.6, 129.3, 128.0, 118.2, 62.7, 61.6, 48.0, 40.3, 21.4; HRMS Calcd for $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 269.1266; Found: 269.1268. HPLC (Chiralcel OD-H, 97:3 hexane/2-propanol, 0.8 mL/min, 210 nm) 24.6 min, 28.5 min.

(S)-3-[1-(4-Methoxyphenyl)but-3-enylamino]-2-oxazolidinone (2c)

Colorless solid; m.p. 101-103 °C; $[\alpha]_D^{25} = -130.9$ ($c = 0.41$ in CHCl_3); IR (film): 3254, 3001, 2932, 2831, 1742, 1611, 1510, 1241, 1172, 1029, 927, 764 cm^{-1} ; ^1H NMR 500 MHz): $\delta = 7.30$ (d, $J = 8.5$ Hz, 2H), 6.87 (d, $J = 8.5$ Hz, 2H), 5.75 (dddd, $J = 17.0, 10.0, 7.0, 3.0$ Hz, 1H), 5.10 (ddt, $J = 17.5, 10.0, 1.0$ Hz,

2H), 4.64-4.30 (br s, 1H), 4.21 (t, $J = 7.5$ Hz, 1H), 4.14 (dt, $J = 8.5, 3.5$ Hz, 1H), 4.02 (dt, $J = 8.5, 8.5$ Hz, 1H), 3.80 (s, 3H), 3.43 (dt, $J = 8.5, 8.5$ Hz, 1H), 3.06 (dt, $J = 8.5, 3.0$ Hz, 1H), 2.44-2.41 (m, 2H); ^{13}C NMR (125.5 MHz): δ 159.4, 158.8, 134.6, 133.5, 129.2, 118.3, 114.0, 62.4, 61.6, 55.4, 48.0, 40.3; HRMS Calcd for $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_3$ ($\text{M}+\text{Na}$) $^+$: 285.1215; Found: 285.1214. HPLC (Chiralcel AS, 70:30 hexane/2-propanol, 1.0 mL/min, 254 nm) 14.8 min, 23.4 min.

(S)-3-[1-(4-Chlorophenyl)but-3-enylamino]-2-oxazolidinone (2d)

Colorless solid; m.p. 109-110 °C; $[\alpha]_{\text{D}}^{25} = -143.0$ ($c = 0.41$ in CHCl_3); IR (film): 3495, 3279, 3076, 2979, 2912, 1755, 1489, 1403, 1250, 1220, 1090, 1030, 1015, 921, 827, 770 cm^{-1} ; ^1H NMR (500 MHz): δ = 7.34-7.30 (m, 4H), 5.74 (dddd, $J = 17.0, 10.5, 7.0, 3.0$ Hz, 1H), 5.15-5.10 (m, 2H), 4.72-4.30 (br s, 1H), 4.26 (t, $J = 7.0$ Hz, 1H), 4.13 (dt, $J = 8.5, 3.5$ Hz, 1H), 4.04 (dt, $J = 8.5, 8.5$ Hz, 1H), 3.46 (dt, $J = 9.0, 8.0$ Hz, 1H), 3.11 (dt, $J = 8.0, 3.0$ Hz, 1H), 2.45-2.34 (m, 2H); ^{13}C NMR (125.5 MHz): δ 159.0, 140.3, 134.0, 133.7, 129.4, 128.8, 118.8, 62.5, 61.6, 48.1, 40.4; HRMS Calcd for $\text{C}_{13}\text{H}_{15}\text{ClN}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 289.0720; Found 289.0711. HPLC (Chiralcel OD, 95:5 hexane/2-propanol, 0.5 mL/min, 254 nm) 33.9 min, 40.3 min.

(S)-3-[1-(2-Bromophenyl)but-3-enylamino]-2-oxazolidinone (2e)

Colorless liquid; IR (film): 3278, 3072, 2978, 2915, 1755, 1469, 1401, 1248, 1220, 1091, 1025, 758 cm^{-1} ; ^1H NMR 500 MHz): δ = 7.59 (dd, $J = 8.0, 1.5$ Hz, 1H), 7.47 (dd, $J = 8.0, 1.0$ Hz, 1H), 7.26 (dd, $J = 7.5, 7.5$ Hz, 1H), 7.06 (ddd, $J = 8.0, 8.0, 1.5$ Hz, 1H), 5.79 (dddd, $J = 17.0, 11.5, 8.5, 4.5$ Hz, 1H), 5.12-5.06 (m, 2H), 4.70 (dd, $J = 8.0, 5.0$ Hz, 1H), 4.60-4.21 (br s, 1H), 4.12-4.01 (m, 2H), 3.45 (dt, $J = 9.0, 9.0$ Hz, 1H), 3.17 (dt, $J = 8.5, 3.0$ Hz, 1H), 2.47-2.25 (m, 1H), 2.31-2.25 (m, 1H); ^{13}C NMR (125.5 MHz): δ 158.9, 140.7, 134.1, 133.1, 129.2, 128.9, 127.8, 124.6, 118.9, 61.5, 61.2, 47.7, 39.4; HRMS Calcd for $\text{C}_{13}\text{H}_{15}\text{BrN}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 333.0215; Found: 333.0216. HPLC (Chiralcel OJ-H, 95:5 hexane/2-propanol, 1.0 mL/min, 254 nm) 39.0 min, 44.7 min.

(S)-3-[1-(2-Chlorophenyl)but-3-enylamino]-2-oxazolidinone (2f)

Colorless oil; IR (film): 3278, 2914, 2360, 1751, 1506, 1473, 1437, 1399, 1223, 1091, 1033, 758 cm^{-1} ; ^1H NMR 500 MHz): δ = 7.66 (dd, J = 7.5, 1.0 Hz, 1H), 7.34 (dd, J = 8.0, 1.0 Hz, 1H), 7.30-7.27 (m, 1H), 7.22-7.18 (m, 1H), 5.84 (dddd, J = 16.5, 11.0, 8.5, 2.5 Hz, 1H), 5.13 (ddt, J = 17.0, 10.5, 1.5 Hz, 2H), 4.81 (dd, J = 8.5, 3.0 Hz, 1H), 4.52-4.26 (br s, 1H), 4.16 (dt, J = 8.5, 3.5 Hz, 1H), 4.09 (dt, J = 8.5, 8.5 Hz, 1H), 3.52 (dt, J = 8.5, 8.5 Hz, 1H), 3.25 (dt, J = 8.0, 3.0 Hz, 1H), 2.53-2.48 (m, 1H), 2.40-2.33 (m, 1H); ^{13}C NMR (125.5 MHz): δ 158.9, 139.1, 134.2, 134.1, 129.8, 128.8, 128.7, 127.1, 118.8, 61.5, 58.7, 47.7, 39.2; HRMS Calcd for $\text{C}_{13}\text{H}_{15}\text{ClN}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 289.0720; Found: 289.0721. HPLC (Chiralcel OD, 98.5:1.5 hexane/2-propanol, 0.5 mL/min, 254 nm) 104.7 min, 107.9 min.

(S)-3-(1-*o*-Tolylbut-3-enylamino)-2-oxazolidinone (2g)

Colorless oil; IR (film): 3278, 3074, 2976, 2914, 1752, 1488, 1401, 1248, 1221, 1087, 1029, 919, 761 cm^{-1} ; ^1H NMR 500 MHz): δ = 7.55 (d, J = 7.5 Hz, 1H), 7.23-7.14 (m, 3H), 5.59 (dddd, J = 16.5, 10.0, 6.5, 2.5 Hz, 1H), 5.13 (dd, J = 17.0, 10.0 Hz, 2H), 4.62 (t, J = 7.0 Hz, 1H), 4.58-4.26 (br s, 1H), 4.16 (dt, J = 8.5, 3.5 Hz, 1H), 4.03 (dt, J = 8.5, 3.0 Hz, 1H), 3.48-3.43 (m, 1H), 3.18 (dt, J = 8.5, 3.5 Hz, 1H), 2.46-2.38 (m, 2H), 2.36 (s, 3H); ^{13}C NMR (125.5 MHz): δ 159.1, 139.6, 136.7, 134.6, 130.7, 127.4, 127.0, 126.3, 118.4, 61.6, 58.4, 48.2, 39.8, 19.7; HRMS Calcd for $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 269.1266; Found: 269.1250. HPLC (Chiralcel OD, 97:3 hexane/2-propanol, 0.5 mL/min, 254 nm) 42.4 min, 46.3 min.

(S)-3-[1-(Naphthalen-1-yl)but-3-enylamino]-2-oxazolidinone (2h)

Colorless oil; IR (film): 3493, 3278, 3066, 2978, 2912, 1751, 1478, 1398, 1248, 1221, 1089, 1029, 802, 780 cm^{-1} ; ^1H NMR 500 MHz): δ = 8.30 (d, J = 5.0 Hz, 1H), 7.88 (d, J = 8.0 Hz, 1H), 7.79 (dd, J = 9.5, 8.0 Hz, 2H), 7.55-7.47 (m, 3H), 5.89 (dddd, J = 17.0, 11.5, 8.5, 3.0 Hz, 1H), 5.22-5.11 (m, 3H), 4.70 (br s, 1H), 4.09 (dt, J = 9.0, 4.0 Hz, 1H), 3.89 (dt, J = 8.5, 8.5 Hz, 1H), 3.46 (dt, J = 8.5, 8.5 Hz, 1H), 3.13 (d, J = 5.0 Hz, 1H), 2.71-2.56 (m, 2H); ^{13}C NMR (125.5 MHz): δ 159.2, 137.3, 134.7, 134.2, 132.0, 129.1, 128.3, 126.4, 125.8, 125.5, 125.2, 123.4, 118.5, 61.6, 48.1, 39.9; HRMS Calcd for $\text{C}_{17}\text{H}_{18}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 305.1266; Found: 305.1248. HPLC (Chiralcel OD, 95:5 hexane/2-propanol, 1.0 mL/min, 254 nm) 20.3 min, 32.4 min.

(S)-3-[1-(Furan-2-yl)but-3-enylamino]-2-oxazolidinone (2i)

Colorless oil; IR (film): 3278, 3074, 2976, 2914, 1752, 1488, 1401, 1248, 1221, 1087, 1029, 919, 761 cm^{-1} ; ^1H NMR 500 MHz): δ = 7.33 (s, 1H), 6.27-6.26 (m, 1H), 6.21 (d, J = 3.0 Hz, 1H), 5.59 (dddd, J = 17.0, 10.5, 9.0, 3.5 Hz, 1H), 5.11 (ddt, J = 17.0, 10.5, 1.5 Hz, 2H), 4.60-4.26 (br s, 1H), 4.27 (t, J = 7.0 Hz, 1H), 4.17-4.05 (m, 2H), 3.43-3.38 (m, 1H), 3.09-3.04 (m, 1H), 2.56-2.43 (m, 2H); ^{13}C NMR (125.5 MHz): δ 158.7, 153.9, 142.4, 133.9, 118.6, 110.5, 108.5, 61.6, 56.4, 47.7, 36.9; HRMS Calcd for $\text{C}_{11}\text{H}_{14}\text{N}_2\text{O}_3$ ($\text{M}+\text{Na}$) $^+$: 245.0902; Found: 245.0884. HPLC (Chiralcel OD-H, 97:3 hexane/2-propanol, 0.8 mL/min, 254 nm) 34.9 min, 38.7 min.

(S)-3-(1-Phenylhexa-1,5-dien-3-ylamino)-2-oxazolidinone (2j)

Colorless solid; m.p. 91-93 $^{\circ}\text{C}$; $[\alpha]_{\text{D}}^{25}$ = -185.0 (c = 0.14 in CHCl_3); IR (film): 3490, 3280, 3077, 3025, 2978, 2910, 1751, 1641, 1493, 1403, 1250, 1222, 1087, 1029, 969, 751, 694 cm^{-1} ; ^1H NMR 500 MHz): δ = 7.31 (d, J = 7.5 Hz, 2H), 7.25 (dd, J = 7.5, 7.5 Hz, 2H), 7.19-7.16 (m, 1H), 6.50 (d, J = 16.0 Hz, 1H), 6.00 (dd, J = 16.0, 8.5 Hz, 1H), 5.77 (dddd, J = 17.0, 14.0, 10.0, 6.5 Hz, 1H), 5.12-5.04 (m, 2H), 4.4-4.2 (br s, 1H), 4.19-4.10 (m, 2H), 3.79 (dt, J = 8.5, 8.5 Hz, 1H), 3.57-3.53 (m, 2H), 2.72 (t, J = 7.0 Hz, 2H); ^{13}C NMR (125.5 MHz): δ 158.9, 136.8, 134.2, 133.4, 129.9, 128.9, 128.0, 126.7, 118.4, 61.6, 61.6, 48.4, 38.4; HRMS Calcd for $\text{C}_{15}\text{H}_{18}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 281.1266; Found: 281.1264. HPLC (Chiralcel OD, 95:5 hexane/2-propanol, 1.0 mL/min, 254 nm) 22.9 min, 26.5 min.

(R)-3-(1-Phenylhex-5-en-3-ylamino)-2-oxazolidinone (2k)

Colorless oil; IR (film): 3278, 3074, 2976, 2914, 1752, 1488, 1401, 1248, 1221, 1087, 1029, 919, 761 cm^{-1} ; ^1H NMR 500 MHz): δ = 7.30-7.27 (m, 2H), 7.21-7.18 (m, 3H), 5.85 (dddd, J = 16.5, 10.0, 6.5, 3.0 Hz, 1H), 5.18-5.11 (m, 2H), 4.27 (t, J = 8.0 Hz, 2H), 4.20-3.9 (br s, 1H), 3.60 (t, J = 8.0 Hz, 2H), 3.16 (dt, J = 12.0, 6.0 Hz, 1H), 2.78-2.65 (m, 2H), 2.36-2.21 (m, 2H), 1.79-1.74 (m, 2H); ^{13}C NMR (125.5 MHz): δ 159.4, 142.2, 134.9, 128.7, 128.6, 126.2, 118.0, 61.5, 58.0, 48.7, 37.2, 34.2, 31.8; HRMS Calcd for $\text{C}_{15}\text{H}_{20}\text{N}_2\text{O}_2$ ($\text{M}+\text{Na}$) $^+$: 283.1422; Found: 283.1427. HPLC (Chiralcel OJ-H, 75:25 hexane/2-propanol, 0.5 mL/min, 254 nm) 24.3 min, 28.1 min.

(S)-3-[7-(Benzyloxy)hept-1-en-4-ylamino]-2-oxazolidinone (2l)

Colorless oil; IR (film): 3498, 3284, 3065, 3030, 2918, 2859, 1759, 1640, 1495, 1453, 1400, 1248, 1219, 1089, 1029, 915, 737, 699 cm^{-1} ; ^1H NMR 500 MHz): δ = 7.36-7.26 (m, 5H), 5.84 (dddd, J = 17.0, 10.0, 7.0, 2.5 Hz, 1H), 5.15-5.09 (m, 2H), 4.50, (s, 2H), 4.27-4.10 (m, 3H), 3.59 (dt, J = 16.5, 8.0 Hz, 2H), 3.49 (t, J = 7.5 Hz, 2H) 3.13 (dt, J = 12.0, 6.0 Hz, 1H), 2.28-2.14 (m, 2H), 1.77-1.62 (m, 2H), 1.57-1.49 (m, 2H); ^{13}C NMR (125.5 MHz): δ 159.3, 138.8, 135.1, 128.6, 127.9, 127.8, 117.8, 73.1, 70.5, 61.5, 58.2, 48.7, 37.2, 29.0, 25.7 ; HRMS Calcd for $\text{C}_{17}\text{H}_{24}\text{N}_2\text{O}_3$ ($\text{M}+\text{Na}$) $^+$: 327.1685; Found: 327.1680. HPLC (Chiralcel OD-H, 90:10 hexane/2-propanol, 1.0 mL/min, 254 nm) 15.9 min, 22.9 min.

Determination of Absolute Configuration of 2a⁷

Aromatic NMR Spectra for 3,3'-bistrifluoromethylBINOL and the BINOL-allylindium mixture in $\text{D}_8\text{-THF}$.

Figure 1: Proton NMR A) 3,3'-bistrifluoromethylBINOL, B) Allylindium prepared from $\text{In}(0)$ and allyliodide + 3,3'-bistrifluoromethylBINOL

⁷ (a) Cook, G. R.; Maity, B.; Kargbo, R. *Org. Lett.* **2004**, 6, 1741. (b) Friestad, G. K.; Ding, H. *Angew. Chem. Int. Ed.* **2001**, 40, 4491.

kr-3-32A
 Sample directory: proton-test_02Mar2000
 File: PROTON
 Pulse Sequence: s2pu1
 Solvent: CDCl3
 Temp: 25.0 C / 288.1 K
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.908 sec
 Width 6500.9 Hz
 8 repetitions
 OBSERVE H1 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 25 sec

kr-3-32A
 Sample directory: eb-chloroform_01Mar2000
 File: CARBON
 Pulse Sequence: s2pu1

kr-3-19A
Pulse Sequence: s2pu1
Solvent: CDCl3
Temp: 25.0 C / 298.1 K
File: kr-3-toluene
INOVA-500 "delta5"
PULSE SEQUENCE
Relax: delay 8.300 sec
Pulse 45.0 degrees
Acq. time 3.334 sec
Width 4662.9 Hz
8 repetitions
OBSERVE H1: 399.9356384 MHz
DATA PROCESSING
FT size 262144
Total time 0 min, 29 sec

kr-3-toluene
Pulse Sequence: s2pu1

kr-3-18A
Pulse Sequence: s2pul
Solvent: dmso
Temp. 25.0 C / 298.1 K
File: kr-3-meo
INOVA-500 "delta5"
PULSE SEQUENCE
Relax. delay 0.300 sec
Pulse 45.0 degrees
Acq. time 3.334 sec
Width 4662.0 Hz
8 repetitions
OBSERVE H1, 309.9375610 MHz
DATA PROCESSING
FT size 635144
Total time 0 min, 29 sec

kr-meo
Pulse Sequence: s2pul

Kr-3-15
 Sample directory: proton-test_02Mar2000
 File: PROTON
 Pulse Sequence: s2pu1
 Solvent: CDCl3
 Temp.: 25.0 C / 298.1 K
 INOVA-500 "vnmr500"

Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acs. time 2.308 sec
 Width 6500.9 Hz
 8 repetitions
 OBSERVE: H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 25 sec

Kr-3-15
 Sample directory: sb-chloroform_01Mar2000
 File: CARBON
 Pulse Sequence: s2pu1

k-bromo
Pulse Sequence: s2pu1
Solvent: cdc13
Temp: 25.0 C / 298.1 K
INOVA-400 1Hnmr400
Relax. delay 0.300 sec
Pulse 45.0 degrees
Acq. time 3.334 sec
Width 4662.0 Hz
8 repetitions
OBSERVE H1, 399.9356500 MHz
DATA PROCESSING
FT size 262144
Total time 0 min, 29 sec

k-bromo
Pulse Sequence: s2pu1

Kr-3-38A
 Sample directory: proton-test_02Mar2000
 File: PROTON

Pulse Sequence: s2pu1
 Solvent: CDCl3
 Temp. 25.0 C / 298.1 K
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.908 sec
 Width 6500.9 Hz
 16 repetitions
 QASERVE H1, 401.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

Kr-3-38A
 Sample directory: eb-chloroform_01Mar2000
 File: CARBON
 Pulse Sequence: s2pu1

kr-3-Otolune
Pulse Sequence: s2pu1
Solvent: CDCl3
Temp.: 25.0 C / 298.1 K
INNOVA-400 "vnmr400"
Relax. delay 0.300 sec
Pulse 45.0 degrees
Acq. time 3.334 sec
Width 4662.0 Hz
S repetitions
OBSERVE H1, 399.8356500 MHz
DATA PROCESSING
FT size 262144
Total time 0 min, 29 sec

kr-3-Otolune
Pulse Sequence: s2pu1

kr-3-inaphthyl
Pulse Sequence: s2pu1
Solvent: CDCl3
Temp: 25.0 C / 298.1 K
INOVA-400 "vnmr400"

Relax. delay 0.300 sec
Pulse 45.0 degrees
Acq. time 3.334 sec
Width 4662.0 Hz
8 repetitions
OBSERVE H1, 399.9356500 MHz
DATA PROCESSING
FT size 262144
Total time 0 min, 29 sec

kr-3-inaphthyl
Pulse Sequence: s2pu1
Solvent: CDCl3
Temp: 25.0 C / 298.1 K
INOVA-400 "vnmr400"

Relax. delay 0.300 sec
Pulse 45.0 degrees
Acq. time 0.720 sec
Width 22222.2 Hz
2624 repetitions
OBSERVE C13, 100.5638752 MHz
DECOUPLE H1, 399.9376499 MHz
Power 35 dB
on during acquisition
off during delay
VALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 32768
Total time 51 min, 28 sec

KR-3-25A
 Sample directory: proton-test_02Mar2000
 File: PROTON

Pulse Sequence: s2pu1
 Solvent: cdc13
 Temp. 25.0 C / 298.1 K
 INOVA-500 ¹Hnmr500
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.600 sec
 Width 6500.9 Hz
 8 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 25 sec

KR-3-25A
 Sample directory: eb-chloroform_01Mar2000
 File: CARBON
 Pulse Sequence: s2pu1

kr-3-cinaamy1
Pulse Sequence: s2pul
Solvent: CDCl3
Temp. 25.0 C / 298.1 K
INOVA-400 "vnmr400"
Relax. delay 0.300 sec
Pulse 45.0 degrees
Acq. time 3.334 sec
Width 4062.0 Hz
0 repetitions
OBSERVE H1, 399.9356500 MHz
DATA PROCESSING
FT size 262144
Total time 0 min, 29 sec

kr-3-cinaamy1
Pulse Sequence: s2pul
Solvent: CDCl3
Temp. 25.0 C / 298.1 K
INOVA-400 "vnmr400"
Relax. delay 0.300 sec
Pulse 45.0 degrees
Acq. time 9.720 sec
Width 22222.2 Hz
258 repetitions
OBSERVE C13, 100.5636752 MHz
DECOUPLE H1, 399.9376499 MHz
Power 35 dB
on during acquisition
off during delay
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 32768
Total time 13 min, 45 sec

kr-3-38A
Pulse Sequence: s2pu1
Solvent: cdc13
Temp: 25.0 C / 298.1 K
INQVA-490 "vnmr400"

Relax. delay 0.300 sec
Pulse 45.0 degrees
ACS. time 3.334 sec
Width 4662.0 Hz
16 repetitions
OBSERVE H1, 399.9356500 MHz
DATA PROCESSING
F1 size 262144
Total time 0 min, 58 sec

kr-3-38A
Pulse Sequence: s2pu1

kr-oxy
Pulse Sequence: s2pu1
Solvent: CDCl3
Temp: 25.0 C / 298.1 K
INOVA-400 "vnmr400"

Relax. delay 0.300 sec
Pulse 45.0 degrees
Acq. time 3.338 sec
Width 4662.0 Hz
8 repetitions
OBSERVE H1, 399.8356500 MHz
DATA PROCESSING
FT Size 262144
Total time 8 min, 29 sec

kr-oxy
Pulse Sequence: s2pu1

bcm-111-47Ap
 Sample directory: proton-test_02Mar2000
 Pulse Sequence: s2pul
 Solvent: cdcl3
 Temp: 25.0 C / 298.1 K
 File: bcm-111-47A
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.908 sec
 Width 6500.3 Hz
 16 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

bcm-111-47c
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pul

8SA
 bcm-111-88A
 Sample directory: proton=test_02Mar2000
 Pulse Sequence: s2pu1
 Solvent: cdcl3
 Temp: 25.0 C / 298.1 K
 File: bcm-111-776
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.998 sec
 Width 6500.9 Hz
 15 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

bcm-111-85Ac
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pu1

bcm-111-888proton
 Sample directory: proton-test_02Mar2000
 Pulse Sequence: s2pu1
 Solvent: cdcl3
 Temp: 25.0 C / 298.1 K
 File: bcm-111-888proton
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.308 sec
 Width 6500.9 Hz
 16 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

bcm-111-888c
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pu1

bcm-111-62Aproton
 Sample directory: proton-test_02Mar2000
 Pulse Sequence: s2pul
 Solvent: CDCl3
 Temp. 25.0 C / 298.1 K
 File: bcm-111-62Aproton
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.908 sec
 Width 8500.8 Hz
 16 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 9 min, 51 sec

bcm-111-62Acarbon
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pul

bcm-111-90Ap
 Sample directory: proton-test_02Mar2000
 Pulse Sequence: s2pul
 Solvent: CDCl3
 Temp: 25.0 C / 298.1 K
 File: bcm-111-90Ap
 INOVA-500 1Hnmr500
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.938 sec
 Width 6500.9 Hz
 16 repetitions
 OBSERVE H1, 499.6717278 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

bcm-111-90Ac
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pul

bcm-111-110A
 Sample directory: proton-test_02Mar2000
 Pulse Sequence: s2pul
 Solvent: cdcl3
 Temp. 25.0 C / 298.1 K
 File: bcm-111-109p
 INOVA-500 "vnmr500"
 Relax, delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.908 sec
 Width 6500.9 Hz
 16 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FI size 65536
 Total time 0 min, 51 sec

bcm-111-116Ac
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pul

bcm-iii-118A
 Sample directory: proton+test_02Mar2000
 Pulse Sequence: s2pu1
 Solvent: CDCl3
 Temp: 25.0 C / 298.1 K
 File: bcm-iii-118A
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.908 sec
 Width 6500.9 Hz
 16 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

bcm-iii-118A
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pu1

C=CC[C@H](N1C(=O)OCC1)c2ccc3ccccc3c2

¹³C NMR spectrum (CDCl₃) of compound 10b. The x-axis represents chemical shift in ppm, ranging from 160 to 40. The spectrum shows several sharp peaks. Key peaks are labeled with their chemical shifts: 159.173, 137.310, 134.691, 133.874, 131.851, 129.145, 128.312, 126.378, 125.661, 125.158, 124.414, 118.482, 77.548, 77.293, 77.038, 61.581, 48.111, and 39.332. The peaks at 77.548, 77.293, and 77.038 correspond to the CDCl₃ solvent triplet.

bcm-III-95A
 Sample directory: proton-test_02Mar2000
 Pulse Sequence: s2pul
 Solvent: cdcl3
 Temp: 25.0 C / 298.1 K
 File: bcm-III-75c
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.908 sec
 Width 6500.3 Hz
 16 repetitions
 OBSERVE H1, 499.6717274 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

bcm-III-95Ac
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pul

bcm-iii-55A
 Sample directory: proton=est_02Mar2000
 Pulse Sequence: s2pul
 Solvent: cdcl3
 Temp: 25.0 C / 298.1 K
 File: bcm-iii-55Ap
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.908 sec
 Width 6500.9 Hz
 15 repetitions
 OBSERVE H1, 499.6717304 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 9 min, 51 sec

bcm-iii-55Ac
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pul

bcm-iii-1208p
 Sample directory: proton=test_02Mar2000
 File: PROTON
 Pulse Sequence: s2pu1
 Solvent: cdc13
 Temp. 25.0 C / 298.1 K
 INOVA-500 ¹Hnmr500
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.598 sec
 Width 8500.9 Hz
 16 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

bcm-iii-1208c
 Sample directory: eb-chloroform_01Mar2000
 File: CARBON
 Pulse Sequence: s2pu1

bcm-111-1018p
 Sample directory: proton-test_02Mar2000
 Pulse Sequence: s2pu1
 Solvent: cdc13
 Temp: 25.0 C / 298.1 K
 File: bcm-111-1018p
 INOVA-500 "vnmr500"
 Relax. delay 0.300 sec
 Pulse 45.0 degrees
 Acq. time 2.806 sec
 Width 6500.8 Hz
 16 repetitions
 OBSERVE H1, 499.6716913 MHz
 DATA PROCESSING
 Line broadening 0.3 Hz
 FT size 65536
 Total time 0 min, 51 sec

bcm-111-1018
 Sample directory: eb-chloroform_01Mar2000
 Pulse Sequence: s2pu1