# Synthesis of *Aza*-Quaternary Centers via Pictet–Spengler Reactions of Ketonitrones

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## Supporting Information

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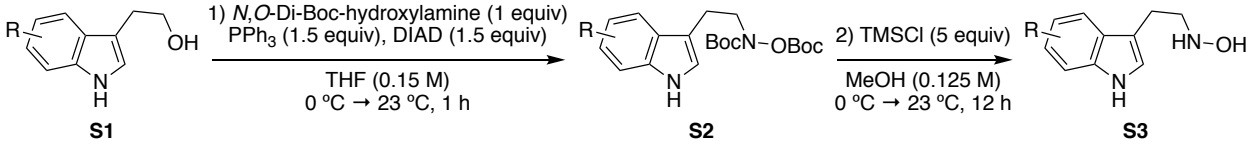
**Experimental Data for Compounds**

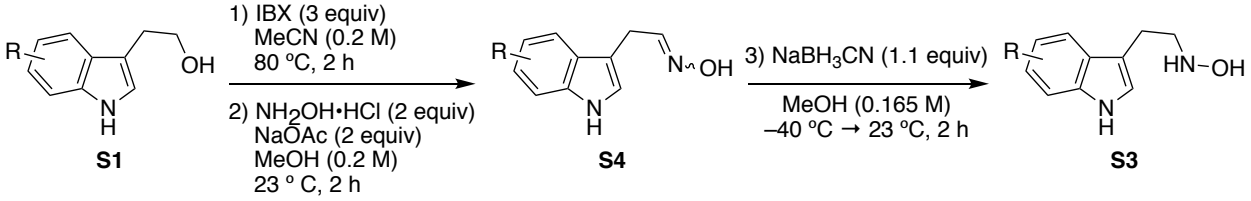
**A. General Procedures.** All reactions were carried out under an argon atmosphere with dry solvents under anhydrous conditions, unless otherwise noted. Dry tetrahydrofuran (THF), toluene, acetonitrile (MeCN), and dichloromethane ($CH_2Cl_2$) were obtained by passing commercially available pre-dried, oxygen-free formulations through activated alumina columns. Yields refer to chromatographically and spectroscopically ($^1H$ and $^{13}C$ NMR) homogeneous materials, unless otherwise stated. Reagents were purchased at the highest commercial quality and used without further purification, unless otherwise stated. Reactions were magnetically stirred and monitored by thin-layer chromatography (TLC) carried out on 0.25 mm E. Merck silica gel plates (60F-254) using UV light as visualizing agent, and an aqueous solution of ceric ammonium sulfate, ammonium molybdate, and sulfuric acid or aqueous solution of potassium permanganate and sodium bicarbonate and heat as a developing agent. SiliCycle silica gel (60, academic grade, particle size 0.040–0.063 mm) was used for flash column chromatography. Preparative thin-layer chromatography separations were carried out on 0.50 mm E. Merck silica gel plates (60F-254). NMR spectra were recorded on Bruker 400 and 500 MHz instruments and calibrated using residual undeuterated solvent as an internal reference. The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, br = broad, m = multiplet. IR spectra were recorded on a Nicolet iS5 FT-IR spectrometer using neat thin film technique. High-resolution mass spectra (HRMS) were recorded on Agilent 6244 TOF-MS using ESI (Electrospray Ionization) or CI (Chemical Ionization) at the University of Chicago Mass Spectroscopy Core Facility. Chiral high-performance liquid chromatography (HPLC) analysis was performed using a Shimadzu Prominence analytical chromatograph with commercial ChiralPak columns (OD-H). The X-ray diffraction data were measured on a Bruker D8 VENTURE diffractometer at the University of Chicago X-ray Laboratory.

**B. Abbreviations.** EtOAc = ethyl acetate, AcOH = acetic acid, MeOH = methanol, DIAD = diisopropyl azodicarboxylate, TMSCl = trimethylsilyl chloride, IBX = 2-iodoxybenzoic acid, 4Å MS = 4Å molecular sieves, DMSO = dimethyl sulfoxide, BzCl = benzoyl chloride, AcCl = acetyl chloride, PivCl = pivaloyl chloride, MTBE = methyl *tert*-butyl ether, Nap = naphthalene, 4-DMAP = 4-dimethylaminopyridine, TMPDA = *N*,*N*,*N*′,*N*′-tetramethyl-1,3-propanediamine.

## C. Preparation of Hydroxylamines.

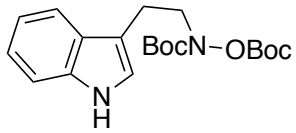



**Method A.**[1,2] *Step 1:* To a solution of tryptophol **S1** (1.0 equiv), $Ph_3P$ (1.5 equiv), *N*,*O*-Di-Boc-hydroxylamine (1.0 equiv) in THF (0.15 M) at 0 ºC was added DIAD (1.5 equiv) dropwise under an argon atmosphere. The resultant mixture was warmed to 23 ºC and stirred for 1 h. Upon completion, MeOH (10.0 equiv) was added and the reaction was stirred for 15 min. The reaction contents were then concentrated directly and the resultant crude material was purified by flash column chromatography (silica gel, hexanes/EtOAc = 1/0→3/1) to yield **S2**. *Step 2:* Next, to a solution of the newly-formed **S2** (1.0 equiv) in MeOH (0.125 M) at 0 ºC was added TMSCl (5.0 equiv) dropwise under an argon atmosphere. The resultant mixture was slowly warmed to 23 ºC and stirred for 12 h. Upon completion, the reaction contents were concentrated directly and then diluted with $CH_2Cl_2$:MeOH (9:1). Saturated aqueous $Na_2CO_3$ was added, the contents were poured into a separatory funnel, and then the product was extracted with $CH_2Cl_2$ (3 ×). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified either by flash column chromatography (silica gel, $CH_2Cl_2$/MeOH = 1/0→9/1) or recrystallization ($CH_2Cl_2$) to afford **S3**.



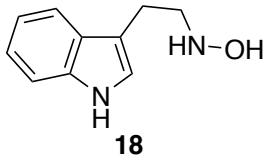

**Method B.**[3,4] *Step 1:* To a solution of tryptophol **S1** (1.0 equiv) in MeCN (0.2 M) at 23 ºC was added IBX (3.0 equiv) under an argon atmosphere. The resultant mixture was then heated at 80 ºC with stirring for 2 h. Upon completion, the reaction contents were cooled to 23 ºC, filtered through a pad of Celite, and rinsed with MeCN. The reaction contents were then concentrated directly to yield an aldehyde (not shown). This material was carried forward without any further purification. *Step 2:* Next, to a solution of the newly-prepared aldehyde (1.0 equiv) and NaOAc (2.0 equiv) in MeOH (0.2 M) at 23 ° C was added $NH_2OH$•HCl (2.0 equiv) under an argon atmosphere. The resultant mixture was stirred for 2 h at 23 ºC. Upon completion, the reaction contents were concentrated directly and then diluted with EtOAc. Saturated aqueous $NaHCO_3$ was added, the contents were poured into a separatory funnel, and then the product was extracted with EtOAc (3 ×). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, $CH_2Cl_2$/MeOH = 1/0→9/1) to yield **S4**. *Step 3:* Finally, to a solution of **S4** (1.0 equiv) and methyl orange (~5 mg) in MeOH (0.2 M) at –40 ºC was concurrently added a solution of $NaBH_3CN$ (1.1 equiv) in MeOH (1.0 M) and 6 M aqueous HCl/MeOH (1/1) dropwise open to air. The resultant mixture was slowly warmed to 23 ºC over 2 h, adding HCl as needed to maintain the color of the reaction solution red (pH < 3.1). Upon completion, the reaction contents were concentrated directly and then diluted with $Et_2O$. Saturated aqueous NaCl was added and

the solution was basified with 6 M aqueous KOH. The contents were then poured into a separatory funnel and then the product was extracted with EtOAc (3 ×). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, $CH_2Cl_2$/MeOH = 1/0→9/1) to yield **S3**.



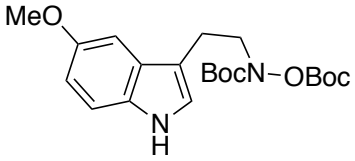
**S5**

***tert*-butyl (2-(1*H*-indol-3-yl)ethyl)((*tert*-butoxycarbonyl)oxy)carbamate (S5).** Prepared using Method A, Step 1 described above, starting from tryptophol **17** (2.00 g, 12.41 mmol), ultimately yielding **S5** (2.81 g, 60% yield) as a pale yellow solid. **S5**: $R_f$ = 0.44 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3373, 2980, 1786, 1710, 1597, 1458, 1395, 1370, 1244, 1145, 1099, 743 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.06 (br s, 1 H, exchangeable), 7.62 (d, *J* = 7.8 Hz, 1 H), 7.36 (d, *J* = 8.1 Hz, 1 H), 7.22–7.15 (m, 1 H), 7.15–7.09 (m, 1 H), 7.06 (d, *J* = 2.1 Hz, 1 H), 3.91 (m, 2 H), 3.09 (t, *J* = 7.6 Hz, 2 H), 1.54 (s, 9 H), 1.38 (s, 9 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 154.9, 152.5, 136.4, 127.5, 122.5, 122.0, 119.3, 118.7, 112.3, 111.3, 85.0, 82.4, 50.9, 28.1, 27.7, 23.1; HRMS (ESI) calcd for $C_{20}H_{29}N_2O_5^+$ $[M + H]^+$ 377.2071, found 377.2071.



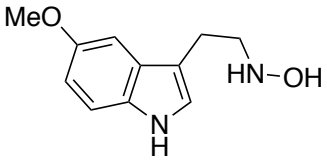
**18**

***N*-(2-(1*H*-indol-3-yl)ethyl)hydroxylamine (18).** Prepared using Method A, Step 2 described above with **S5** (2.50 g, 6.64 mmol), ultimately yielding **18** (0.950 g, 81% yield) as a white solid. **18**: $R_f$ = 0.36 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3395, 2926, 1597, 1564, 1455, 1228, 1093, 1024, 857, 808, 742 $cm^{-1}$; $^1H$ NMR (500 MHz, DMSO-$d_6$) δ 10.77 (br s, 1 H, exchangeable), 7.50 (d, *J* = 7.8 Hz, 1 H), 7.32 (d, *J* = 8.1 Hz, 1 H), 7.23 (br s, 1 H, exchangeable), 7.13 (d, *J* = 2.3 Hz, 1 H), 7.08–7.02 (m, 1 H), 7.00–6.92 (m, 1 H), 5.59 (br s, 1 H, exchangeable), 3.01 (t, *J* = 7.5 Hz, 2 H), 2.84 (t, *J* = 7.4 Hz, 2 H); $^{13}C$ NMR (101 MHz, DMSO-$d_6$) δ 136.3, 127.4, 122.6, 120.9, 118.3, 118.2, 112.5, 111.4, 54.5, 23.0; HRMS (CI) calcd for $C_{10}H_{13}N_2O^+$ $[M + H]^+$ 177.1022, found 177.1026.



**S6**

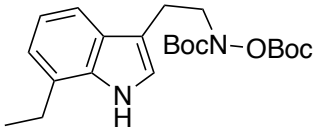
***tert*-butyl ((*tert*-butoxycarbonyl)oxy)(2-(5-methoxy-1*H*-indol-3-yl)ethyl)carbamate (S6).** Prepared using Method A, Step 1 described above, starting from 5-methoxytryptophol (0.900 g, 4.71 mmol), ultimately yielding **S6** (0.950 g, 50% yield) as a yellow solid. **S6**: $R_f$ = 0.30 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3373, 1785, 1597, 1564, 1482, 1448, 1394, 1219, 1145, 1097 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.09 (br s, 1 H, exchangeable), 7.24 (d, *J* = 8.8 Hz, 1 H), 7.06 (d, *J* = 2.5 Hz, 1 H), 7.01 (d, *J* = 2.5 Hz, 1 H), 6.85 (dd, *J* = 8.8, 2.5 Hz, 1 H), 3.96–3.88 (m, 2 H), 3.87 (s, 3 H), 3.06 (t, *J* = 7.1 Hz, 2 H), 1.54 (s, 9 H), 1.37 (s, 9 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 154.9, 154.0, 152.5, 131.5, 127.9, 123.2, 112.3, 112.2, 112.0, 100.6, 84.9, 82.3, 56.0, 50.8, 28.1, 27.8, 23.1; HRMS (ESI) calcd for $C_{21}H_{31}N_2O_6^+$ $[M + H]^+$ 407.2177, found 407.2175.



**S7**

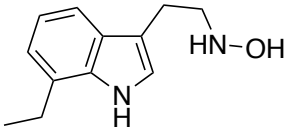
***N*-(2-(5-methoxy-1*H*-indol-3-yl)ethyl)hydroxylamine (S7).** Prepared using Method A, Step 2 described above with **S6** (0.870 g, 2.14 mmol), ultimately yielding **S7** (0.355 g, 80% yield) as a white solid. **S7**: $R_f$ = 0.35 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3409, 2936, 1597, 1485, 1450, 1295, 1217, 1173, 1069, 1029, 798 $cm^{-1}$; $^1H$ NMR (400 MHz, DMSO-$d_6$) δ 10.62 (br s, 1 H

exchangeable), 7.30–7.18 (m, 2 H), 7.09 (d, $J$ = 2.4 Hz, 1 H), 6.99 (d, $J$ = 2.4 Hz, 1 H), 6.71 (dd, $J$ = 8.7, 2.4 Hz, 1 H), 5.60 (br s, 1 H, exchangeable), 3.76 (s, 3 H), 3.02 (t, $J$ = 7.4 Hz, 2 H), 2.82 (t, $J$ = 7.4 Hz, 2 H); $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 152.9, 131.4, 127.6, 123.3, 112.2, 112.0, 111.0, 100.1, 55.3, 54.4, 22.9; HRMS (CI) calcd for $C_{11}H_{15}N_2O_2^+$ $[M + H]^+$ 207.1128, found 207.1130.



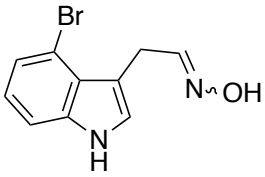
**S8**

***tert*-butyl ((*tert*-butoxycarbonyl)oxy)(2-(7-ethyl-1*H*-indol-3-yl)ethyl)carbamate (S8).** Prepared using Method A, Step 1 described above, starting from 7-ethyltryptophol (1.00 g, 5.28 mmol), ultimately yielding **S8** (1.30 g, 61% yield) as a yellow solid. **S8**: $R_f$ = 0.50 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3373, 2978, 1786, 1712, 1597, 1564, 1448, 1395, 1370, 1246, 1151, 1131 cm$^{-1}$; $^1$H NMR (400 MHz, $CDCl_3$) δ 8.14 (br s, 1 H, exchangeable), 7.49 (d, $J$ = 7.4 Hz, 1 H), 7.12–7.01 (m, 3 H), 4.00–3.84 (m, 2 H), 3.10 (t, $J$ = 7.7 Hz, 2 H), 2.85 (q, $J$ = 7.6 Hz, 2 H), 1.55 (s, 9 H), 1.38 (s, 9 H), 1.34 (t, $J$ = 7.6 Hz, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 154.9, 152.5, 135.2, 127.2, 126.7, 122.1, 120.6, 119.7, 116.5, 112.9, 84.9, 82.3, 50.9, 28.1, 27.7, 24.1, 23.2, 14.0; HRMS (CI) calcd for $C_{22}H_{33}N_2O_5^+$ $[M + H]^+$ 405.2384, found 405.2376.



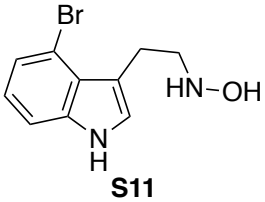
**S9**

***N*-(2-(7-ethyl-1*H*-indol-3-yl)ethyl)hydroxylamine (S9).** Prepared using Method A, Step 2 described above with **S8** (1.20 g, 2.97 mmol), ultimately yielding **S9** (0.400 g, 66% yield) as a white solid. **S9**: $R_f$ = 0.45 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3402, 2925, 1597, 1566, 1436, 1411, 1222, 1095, 794, 742 cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-$d_6$) δ 10.75 (br s, 1 H, exchangeable), 7.35 (dd, $J$ = 7.4, 1.6 Hz, 1 H), 7.27 (br s, 1 H, exchangeable), 7.12 (d, $J$ = 2.5 Hz, 1 H), 6.95–6.86 (m, 2 H), 5.60 (br s, 1 H, exchangeable), 3.08–2.98 (m, 2 H), 2.89–2.78 (m, 4 H), 1.26 (t, $J$ = 7.5 Hz, 3 H); $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 135.0, 127.2, 126.8, 122.2, 119.6, 118.5, 116.0, 112.8, 54.5, 23.7, 23.1, 14.5; HRMS (CI) calcd for $C_{12}H_{17}N_2O^+$ $[M + H]^+$ 205.1335, found 205.1337.



**S10**

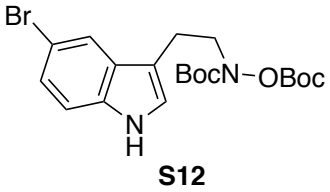
**2-(4-bromo-1*H*-indol-3-yl)acetaldehyde oxime (S10).** Prepared using Method B, Steps 1 and 2 described above, starting from 4-bromotryptophol (2.10 g, 8.75 mmol), ultimately yielding **S10** (1.26 g, 57% yield over 2 steps, single undetermined stereoisomer) as a pale yellow solid. **S10**: $R_f$ = 0.38 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3419, 2924, 1620, 1424, 1334, 1186, 1043, 912, 773, 736 cm$^{-1}$; $^1$H NMR (500 MHz, DMSO-$d_6$) δ 11.29 (br s, 1 H, exchangeable), 10.93 (br s, 1 H, exchangeable), 7.38 (d, $J$ = 8.0 Hz, 1 H), 7.33 (d, $J$ = 2.5 Hz, 1 H), 7.17 (d, $J$ = 7.5 Hz, 1 H), 6.98 (t, $J$ = 7.8 Hz, 1 H), 6.87 (t, $J$ = 4.8 Hz, 1 H), 3.91 (d, $J$ = 4.8 Hz, 2 H); $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 150.0, 137.8, 125.7, 124.8, 122.7, 122.3, 112.8, 111.4, 110.3, 22.5; HRMS (ESI) calcd for $C_{10}H_{10}BrN_2O^+$ $[M + H]^+$ 252.9971, found 252.9971.



**S11**

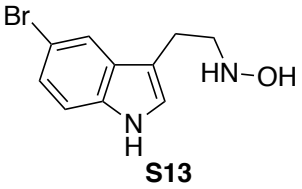
***N*-(2-(4-bromo-1*H*-indol-3-yl)ethyl)hydroxylamine (S11).** Prepared using Method A, Step 3 described above with **S10** (0.360 g, 1.42 mmol), ultimately yielding **S11** (0.314 g, 87% yield) as a white solid. **S11**: $R_f$ = 0.29 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3272, 1477, 1333, 1183, 1119, 1032, 913, 856, 769, 736 cm$^{-1}$; $^1$H NMR (500 MHz, DMSO-

$d_6$) δ 11.18 (br s, 1 H, exchangeable), 7.36 (d, $J$ = 8.1 Hz, 1 H), 7.25 (d, $J$ = 2.4 Hz, 1 H), 7.15 (d, $J$ = 7.6 Hz, 1 H), 6.95 (t, $J$ = 7.8 Hz, 1 H), 5.75 (br s, 1 H, exchangeable), 3.13–3.01 (m, 4 H); $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 137.8, 125.2, 124.9, 122.5, 121.9, 113.0, 112.9, 111.2, 55.4, 23.8; HRMS (ESI) calcd for $C_{10}H_{12}BrN_2O^+$ $[M + H]^+$ 255.0128, found 255.0124.



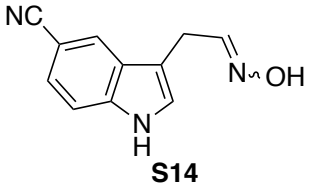
**S12**

***tert*-butyl (2-(5-bromo-1*H*-indol-3-yl)ethyl)((*tert*-butoxycarbonyl)oxy)carbamate (S12).** Prepared using Method A, Step 1 described above, starting from 5-bromotryptophol (1.10 g, 4.58 mmol), ultimately yielding **S12** (0.506 g, 24% yield) as a pale yellow solid. **S12**: $R_f$ = 0.53 (silica gel, hexanes/EtOAc = 2/1); IR (film) $\nu_{max}$ 3354, 2981, 1785, 1715, 1597, 1456, 1370, 1242, 1147, 1102 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 8.20 (br s, 1 H, exchangeable), 7.72 (d, $J$ = 1.8 Hz, 1 H), 7.27–7.19 (m, 2 H), 7.05 (d, $J$ = 2.4 Hz, 1 H), 3.94–3.82 (m, 2 H), 3.03 (t, $J$ = 7.3 Hz, 2 H), 1.54 (s, 9 H), 1.36 (s, 9 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 154.9, 152.4, 135.0, 129.3, 124.9, 123.8, 121.4, 112.8 (2 C), 112.3, 85.1, 82.5, 50.7, 28.1, 27.8, 23.0; HRMS (ESI) calcd for $C_{20}H_{28}BrN_2O_5^+$ $[M + H]^+$ 455.1176, found 455.1177.



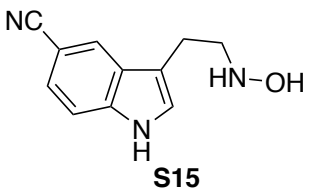
**S13**

***N*-(2-(5-bromo-1*H*-indol-3-yl)ethyl)hydroxylamine (S13).** Prepared using Method A, Step 2 described above with **S12** (0.410 g, 0.89 mmol), ultimately yielding **S13** (0.172 g, 75% yield) as a white solid. **S13**: $R_f$ = 0.42 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3425, 2921, 1597, 1564, 1449, 1394, 1220, 1096, 1049, 859, 797, 735 cm$^{-1}$; $^1$H NMR (500 MHz, DMSO-$d_6$) δ 11.01 (br s, 1 H, exchangeable), 7.67 (d, $J$ = 2.0 Hz, 1 H), 7.30 (d, $J$ = 8.6 Hz, 1 H), 7.24 (br s, 1 H, exchangeable), 7.20 (d, $J$ = 2.4 Hz, 1 H), 7.16 (dd, $J$ = 8.6, 1.9 Hz, 1 H), 5.63 (br s, 1 H, exchangeable), 2.97 (t, $J$ = 7.4 Hz, 2 H), 2.81 (t, $J$ = 7.4 Hz, 2 H); $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 134.9, 129.2, 124.4, 123.2, 120.6, 113.3, 112.4, 110.8, 54.4, 22.6; HRMS (ESI) calcd for $C_{10}H_{12}BrN_2O^+$ $[M + H]^+$ 255.0128, found 255.0132.



**S14**

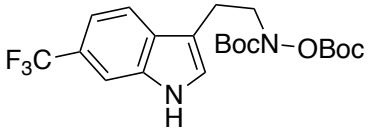
**(*E/Z*)-3-(2-(hydroxyimino)ethyl)-1*H*-indole-5-carbonitrile (S14).** Prepared using Method B, Steps 1 and 2 described above, starting from 5-carbonitriletryptophol[5] (0.600 g, 3.22 mmol), ultimately yielding **S14** (0.415 g, 64% yield over 2 steps, 1:1 *E:Z*) as a yellow solid. **S14**: $R_f$ = 0.42 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3363, 2227, 1597, 1564, 1485, 1395, 1219 1100, 858, 799 cm$^{-1}$; $^1$H NMR (500 MHz, DMSO-$d_6$) δ 11.51 (br s, 2 H, exchangeable), 11.09 (br s, 1 H, exchangeable), 10.53 (br s, 1 H, exchangeable), 8.08–8.01 (m, 2 H), 7.56–7.49 (m, 2 H), 7.49–7.38 (m, 5 H), 6.85 (t, $J$ = 5.4 Hz, 1 H), 3.72 (d, $J$ = 6.3 Hz, 2 H), 3.59 (d, $J$ = 5.5 Hz, 2 H); $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 148.5, 148.1, 138.1, 138.0, 126.9, 126.9, 126.0, 125.9, 124.3 124.2, 123.9 (2 C), 120.9 (2 C), 112.8 (2 C), 111.0, 111.0, 100.5, 100.5, 25.3, 20.8; HRMS (ESI) calcd for $C_{11}H_{10}N_3O^+$ $[M + H]^+$ 200.0818, found 200.0818.



**S15**

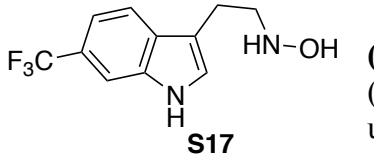
**3-(2-(hydroxyamino)ethyl)-1*H*-indole-5-carbonitrile (S15).** Prepared using Method A, Step 3 described above with **S14** (0.150 g, 0.74 mmol), ultimately yielding **S15** (0.140 g, 94% yield) as a white solid. **S15**: $R_f$ = 0.27 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$

3362, 2924, 2370, 1597, 1563, 1448, 1394, 1219, 1091, 861 $cm^{-1}$; $^1H$ NMR (500 MHz, DMSO-$d_6$) δ 11.40 (br s, 1 H, exchangeable), 8.21–7.92 (m, 1 H), 7.49 (d, $J$ = 8.4 Hz, 1 H), 7.40 (dd, $J$ = 8.4, 1.6 Hz, 1 H), 7.36 (d, $J$ = 2.3 Hz, 1 H), 7.25 (br s, 1 H, exchangeable), 5.65 (br s, 1 H, exchangeable), 3.00 (t, $J$ = 7.2 Hz, 2 H), 2.86 (t, $J$ = 7.2 Hz, 2 H); $^{13}C$ NMR (101 MHz, DMSO-$d_6$) δ 137.9, 127.3, 125.4, 124.3, 123.5, 121.0, 114.1, 112.6, 100.2, 54.3, 22.5; HRMS (ESI) calcd for $C_{11}H_{12}N_3O^+$ $[M + H]^+$ 202.0975, found 202.0975.



**S16**

***tert*-butyl ((*tert*-butoxycarbonyl)oxy)(2-(6-(trifluoromethyl)-1*H*-indol-3-yl)ethyl)carbamate (S16).** Prepared using Method A, Step 1 described above, starting from 6-trifluoromethyltryptophol[6] (1.00 g, 4.36 mmol), ultimately yielding **S16** (0.556 g, 29% yield) as a pale yellow solid. **S16**: $R_f$ = 0.44 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3357, 2982, 1786, 1709, 1597, 1459, 1395, 1337, 1242, 1149, 1107, 1070 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.37 (br s, 1 H, exchangeable), 7.69 (dd, $J$ = 8.4, 0.8 Hz, 1 H), 7.65 (s, 1 H), 7.35 (dd, $J$ = 8.6, 1.6 Hz, 1 H), 7.20 (d, $J$ = 2.4 Hz, 1 H), 3.99–3.83 (m, 2 H), 3.09 (t, $J$ = 7.3 Hz, 2 H), 1.53 (s, 9 H), 1.34 (s, 9 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 154.9, 152.4, 135.2, 129.8, 125.4 (q, $J$ = 271.6 Hz) 125.3, 124.2 (q, $J$ = 31.6 Hz), 119.2, 116.1, 112.9, 108.9, 85.2, 82.5, 50.7, 28.1, 27.7, 23.0; HRMS (ESI) calcd for $C_{21}H_{27}F_3N_2NaO_5^+$ $[M + Na]^+$ 467.1764, found 467.1769.

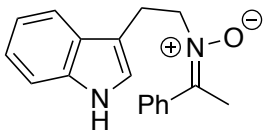


**S17**

***N*-(2-(6-(trifluoromethyl)-1*H*-indol-3-yl)ethyl)hydroxylamine (S17).** To a solution of **S16** (0.500 g, 1.13 mmol, 1 equiv) in $CH_2Cl_2$ (2.25 mL) at 23 ºC was added TFA (4.5 mL) and stirred for 2 h under an argon atmosphere. Then followed Method A, Step 2 work-up and purification procedure described above, ultimately yielding **S17** (0.212 g, 77% yield) as a white solid. **S17**: $R_f$ = 0.41 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3269, 1597, 1563, 1457, 1337, 1243, 1219, 1162, 1109, 1052, 815 $cm^{-1}$; $^1H$ NMR (400 MHz, DMSO-$d_6$) δ 11.27 (br s, 1 H, exchangeable), 7.74–7.66 (m, 2 H), 7.41 (d, $J$ = 2.4 Hz, 1 H), 7.31–7.22 (m, 2 H), 5.64 (br s, 1 H, exchangeable), 3.02 (t, $J$ = 7.4 Hz, 2 H), 2.89 (t, $J$ = 7.3 Hz, 2 H); $^{13}C$ NMR (101 MHz, DMSO-$d_6$) δ 135.0, 129.8, 126.3, 125.6 (q, $J$ = 271.2 Hz), 121.3 (q, $J$ = 31.0 Hz), 119.2, 114.4, 113.2, 108.7, 54.3, 22.7; HRMS (ESI) calcd for $C_{11}H_{12}F_3N_2O^+$ $[M + H]^+$ 245.0896, found 245.0899.

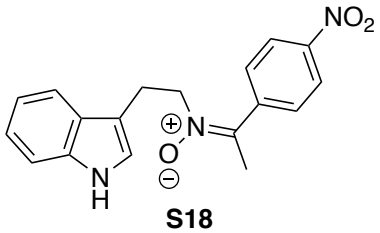
## D. General Procedure for Preparation of Nitrones.[7]

To a solution of hydroxylamine **18** (0.100 g, 0.57 mmol, 1.0 equiv) in $CH_2Cl_2$/MeOH (1/1, 3.8 mL) or MeOH (3.8 mL) at 23 ºC was added the requisite ketone (0.85–2.84 mmol, 1.5–5.0 equiv), AcOH (10 drops, from a syringe fitted with 3" needle), and $MgSO_4$ (0.205 g, 1.70 mmol, 3.0 equiv) under an argon atmosphere. The resultant mixture was stirred for 12 h either at 23 ºC or 50 ºC. Upon completion, the contents were quenched at 23 ºC with saturated aqueous $NaHCO_3$ (5 mL), poured into a separatory funnel, and extracted with $CH_2Cl_2$ (3 × 5 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, $CH_2Cl_2$/MeOH = 1/0→9/1) to yield nitrone **19**, **S18**–**S45**. *Note:* The ratio of mixed *E*-/*Z*- isomers can vary depending on conditions (time, temperature, and equivalents). In addition, the *E*-/*Z*- ratio for each nitrone was determined by NOESY experiments.



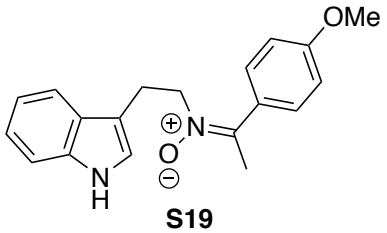
**19**

**(*E*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-phenylethan-1-imine oxide (19).** Prepared using the general procedure described above with **18** and acetophenone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **19** (0.152 g, 96% yield) as a white solid. When executed on gram scale with **18** (1.41 g, 8.00 mmol, 1.0 equiv), acetophenone (3.0 equiv), and AcOH (1 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **19** (2.13 g, 96% yield) as a white solid. **19**: $R_f$ = 0.62 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3213, 2922, 1597, 1564, 1446, 1220, 1165, 1071, 763, 744, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.23 (br s, 1 H, exchangeable), 7.36 (d, *J* = 8.2 Hz, 1 H), 7.29–7.22 (m, 2 H), 7.21–7.13 (m, 3 H), 7.02–6.95 (m, 2 H), 6.74 (m, 2 H), 4.07 (t, *J* = 7.0 Hz, 2 H), 3.37 (t, *J* = 7.1 Hz, 2 H), 2.36 (s, 3 H); 13C NMR (101 MHz, $CDCl_3$) δ 148.5, 136.3, 136.1, 128.9, 128.7, 127.4, 127.2, 122.7, 122.0, 119.3, 118.5, 111.7, 111.3, 60.3, 23.9, 20.8; HRMS (ESI) calcd for $C_{18}H_{19}N_2O^+$ $[M + H]^+$ 279.1492, found 279.1497.



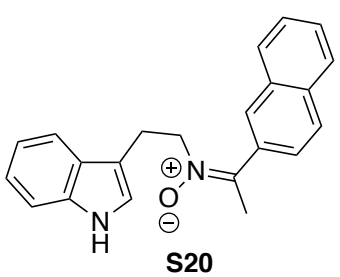
**S18**

**(*E*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-(4-nitrophenyl)ethan-1-imine oxide (S18).** Prepared using the general procedure described above with **18** and 4′-nitroacetophenone (2.5 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S18** (0.162 g, 88% yield) as a bright yellow solid. **S18**: $R_f$ = 0.43 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3245, 1598, 1561, 1518, 1400, 1349, 1219, 1069, 857, 744 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.50 (br s, 1 H, exchangeable), 7.83–7.75 (m, 2 H), 7.42–7.36 (m, 1 H), 7.22–7.14 (m, 2 H), 6.99 (d, *J* = 2.3 Hz, 1 H), 6.95–6.88 (m, 1 H), 6.60–6.53 (m, 2 H), 4.10 (t, *J* = 6.0 Hz, 2 H), 3.33 (t, *J* = 6.1 Hz, 2 H), 2.28 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 147.3, 146.2, 142.0, 136.3, 128.3, 127.4, 123.6, 122.9, 122.5, 119.7, 118.3, 111.6, 111.4, 60.8, 23.7, 20.5; HRMS (CI) calcd for $C_{18}H_{18}N_3O_3^+$ $[M + H]^+$ 324.1343, found 324.1342.



**S19**

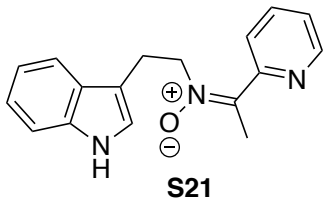
**(*E*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-(4-methoxyphenyl)ethan-1-imine oxide (S19).** Prepared using the general procedure described above with **18** and 4′-methoxyacetophenone (3.5 equiv) in MeOH at 50 ºC, ultimately yielding **S19** (0.155 g, 89% yield) as a gray solid. **S19**: $R_f$ = 0.46 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3181, 2922, 1607, 1513, 1457, 1289, 1250, 1165, 1071, 1028, 833, 743 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.19 (br s, 1 H, exchangeable), 7.39–7.33 (m, 1 H), 7.28 (d, *J* = 7.9 Hz, 1 H), 7.21–7.13 (m, 1 H), 7.04–6.97 (m, 2 H), 6.66 (d, *J* = 0.9 Hz, 4 H), 4.08 (t, *J* = 7.0 Hz, 2 H), 3.76 (s, 3 H), 3.36 (t, *J* = 7.0 Hz, 2 H), 2.34 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 159.8, 148.6, 136.4, 128.6, 128.3, 127.5, 122.8, 121.9, 119.3, 118.6, 114.0, 111.7, 111.3, 60.1, 55.4, 23.9, 20.9; HRMS (ESI) calcd for $C_{19}H_{21}N_2O_2^+$ $[M + H]^+$ 309.1598, found 309.1604.



**S20**

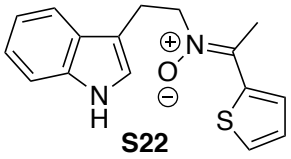
**(*E*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-(naphthalen-2-yl)ethan-1-imine oxide (S20).** Prepared using the general procedure described above with **18** and 2-acetonaphthone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S20** (0.160 g, 86% yield) as a pale yellow solid. **S20**: $R_f$ = 0.51 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3210, 1597, 1563, 1448, 1389, 1219, 1164, 1065, 858, 744 $cm^{-}$

[1]; $^1$H NMR (500 MHz, $CDCl_3$) δ 8.14 (br s, 1 H, exchangeable), 7.77 (d, *J* = 8.1 Hz, 1 H), 7.66 (d, *J* = 8.5 Hz, 1 H), 7.53–7.47 (m, 1 H), 7.47–7.42 (m, 1 H), 7.42–7.36 (m, 2 H), 7.24 (d, *J* = 7.9 Hz, 1 H), 7.18–7.12 (m, 1 H), 7.01–6.97 (m, 1 H), 6.97–6.94 (m, 1 H), 6.91–6.83 (m, 2 H), 4.13 (t, *J* = 6.7 Hz, 2 H), 3.41 (t, *J* = 6.8 Hz, 2 H), 2.43 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 148.7, 136.3, 133.3, 132.8, 132.7, 128.6, 128.3, 127.7, 127.5, 127.1, 127.0, 126.8, 124.4, 122.9, 122.1, 119.4, 118.6, 111.7, 111.3, 60.3, 23.7, 21.0; HRMS (CI) calcd for $C_{22}H_{21}N_2O^+$ $[M + H]^+$ 329.1648, found 329.1657.



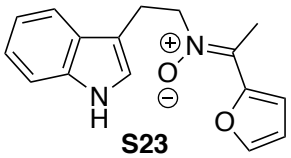
**S21**

**(*E*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-(pyridin-2-yl)ethan-1-imine oxide (S21).** Prepared using the general procedure described above with **18** and 2-acetylpyridine (3.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S21** (0.120 g, 76% yield) as a yellow solid. **S21**: $R_f$ = 0.37 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3220, 2922, 1586, 1561, 1430, 1264, 1223, 1169, 1102, 1085, 784, 743 $cm^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 8.60–8.44 (m, 1 H), 8.24 (br s, 1 H, exchangeable), 7.43–7.30 (m, 3 H), 7.17–7.11 (m, 1 H), 7.09 (ddd, *J* = 7.6, 4.8, 1.0 Hz, 1 H), 7.02–6.95 (m, 2 H), 6.67–6.61 (m, 1 H), 4.32 (t, *J* = 7.1 Hz, 2 H), 3.41 (t, *J* = 7.1 Hz, 2 H), 2.40 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 153.8, 149.2, 146.4, 136.5, 136.3, 127.4, 123.2, 123.1, 122.7, 122.0, 119.3, 118.5, 112.0, 111.3, 61.0, 24.1, 19.4; HRMS (ESI) calcd for $C_{17}H_{18}N_3O^+$ $[M + H]^+$ 280.1444, found 280.1451.



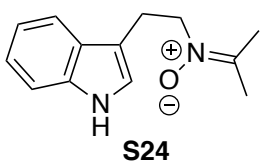
**S22**

**(*Z*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-(thiophen-2-yl)ethan-1-imine oxide (S22).** Prepared using the general procedure described above with **18** and 2-acetylthiophene (5.0 equiv) in MeOH at 50 ºC, ultimately yielding **S22** (0.136 g, 84% yield) as a yellow solid. **S22**: $R_f$ = 0.55 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3180, 2921, 1597, 1563, 1456, 1419, 1365, 1337, 1212, 1160, 1101, 744 $cm^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 8.10 (br s, 1 H, exchangeable), 7.63 (d, *J* = 7.8 Hz, 1 H), 7.48 (d, *J* = 5.1 Hz, 1 H), 7.41–7.33 (m, 2 H), 7.23–7.17 (m, 1 H), 7.16–7.08 (m, 2 H), 6.99 (d, *J* = 2.2 Hz, 1 H), 4.36 (t, *J* = 7.0 Hz, 2 H), 3.48 (t, *J* = 7.0 Hz, 2 H), 2.15 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 137.6, 136.3, 134.6, 130.2, 129.1, 127.2, 126.0, 122.9, 122.2, 119.7, 118.4, 111.5 (2 C), 59.9, 23.8, 16.4; HRMS (ESI) calcd for $C_{16}H_{17}N_2OS^+$ $[M + H]^+$ 285.1056, found 285.1058.



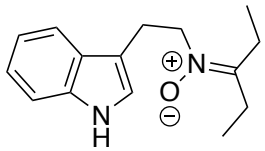
**S23**

**(*Z*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-(furan-2-yl)ethan-1-imine oxide (S23).** Prepared using the general procedure described above with **18** and 2-acetylfuran (5.0 equiv) in MeOH at 50 ºC, ultimately yielding **S23** (0.126 g, 83% yield) as a yellow solid. **S23**: $R_f$ = 0.47 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3178, 1597, 1563, 1482, 1449, 1389, 1219, 1153, 1073, 744 $cm^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 8.16–8.05 (m, 2 H, 1 exchangeable), 7.64 (d, *J* = 7.7 Hz, 1 H), 7.50–7.45 (m, 1 H), 7.40–7.33 (m, 1 H), 7.24–7.17 (m, 1 H), 7.16–7.08 (m, 1 H), 7.04 (d, *J* = 2.3 Hz, 1 H), 6.58 (dd, *J* = 3.5, 1.7 Hz, 1 H), 4.27 (t, *J* = 7.2 Hz, 2 H), 3.45 (t, *J* = 7.2 Hz, 2 H), 2.12 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 148.0, 143.6, 136.4, 134.4, 127.2, 122.9, 122.1, 119.5, 118.3, 117.0, 112.7, 111.5, 111.4, 60.7, 23.7, 14.7; HRMS (CI) calcd for $C_{16}H_{17}N_2O_2^+$ $[M + H]^+$ 269.1285, found 269.1287.



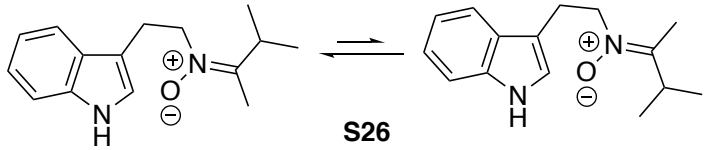
**S24**

***N*-(2-(1*H*-indol-3-yl)ethyl)propan-2-imine oxide (S24).** Prepared using the general procedure described above with **18** and acetone (50.0 equiv) at 23 ºC, ultimately yielding **S24** (0.112 g, 91% yield) as a white solid. **S24**: $R_f$ = 0.38 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3182, 2922, 1597, 1564, 1448, 1392, 1218, 1141, 1071, 858, 798, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.72 (br s, 1 H, exchangeable), 7.61 (d, *J* = 7.9 Hz, 1 H), 7.38 (d, *J* = 8.1 Hz, 1 H), 7.22–7.16 (m, 1 H), 7.14–7.08 (m, 1 H), 7.04 (d, *J* = 2.4 Hz, 1 H), 4.13 (t, *J* = 6.9 Hz, 2 H), 3.39 (t, *J* = 6.9 Hz, 2 H), 2.08 (s, 3 H), 1.66 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 144.9, 136.3, 127.3, 122.7, 122.1, 119.5, 118.4, 111.8, 111.4, 59.4, 23.4, 20.3, 20.1; HRMS (ESI) calcd for $C_{13}H_{17}N_2O^+$ $[M + H]^+$ 217.1335, found 217.1336.



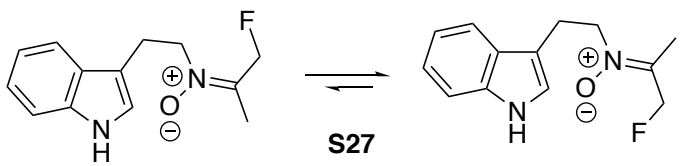
**S25**

***N*-(2-(1*H*-indol-3-yl)ethyl)pentan-3-imine oxide (S25).** Prepared using the general procedure described above with **18** and 3-pentanone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S25** (0.133 g, 96% yield) as a yellow solid. **S25**: $R_f$ = 0.49 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3173, 2974, 1597, 1458, 1342, 1234, 1141, 1108, 1072, 743 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.42 (br s, 1 H, exchangeable), 7.63 (d, *J* = 7.8 Hz, 1 H), 7.41–7.34 (m, 1 H), 7.23–7.16 (m, 1 H), 7.15–7.09 (m, 1 H), 7.06 (d, *J* = 2.2 Hz, 1 H), 4.11 (t, *J* = 7.0 Hz, 2 H), 3.41 (t, *J* = 7.0 Hz, 2 H), 2.54 (q, *J* = 7.5 Hz, 2 H), 2.02 (q, *J* = 7.6 Hz, 2 H), 1.07 (t, *J* = 7.5 Hz, 3 H), 0.81 (t, *J* = 7.6 Hz, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 154.8, 136.5, 127.2, 123.2, 121.8, 119.2, 118.2, 111.6, 111.1, 59.0, 24.9, 24.2, 23.7, 11.0, 9.3; HRMS (CI) calcd for $C_{15}H_{21}N_2O^+$ $[M + H]^+$ 245.1648, found 245.1660.



**S26**

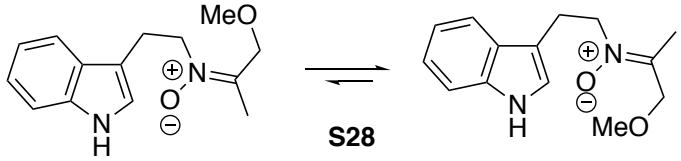
**(*E/Z*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-3-methylbutan-2-imine oxide (S26).** Prepared using the general procedure described above with **18** and methyl isopropyl ketone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S26** (0.130 g, 94% yield, 1.4:1 *E*:*Z*) as a yellow solid. **S26**: $R_f$ = 0.43 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3178, 1597, 1561, 1449, 1389, 1207, 1095,1074, 858, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$, 1.4:1 *E*:*Z*) δ 8.53 (br s, 1 H, exchangeable), 7.63 (t, *J* = 7.6 Hz, 1 H), 7.40–7.32 (m, 1 H), 7.22–7.15 (m, 1 H), 7.15–7.09 (m, 1 H), 7.08–7.03 (m, 1 H), 4.19 (t, *J* = 6.8 Hz, 1.1 H), 4.11 (t, *J* = 6.9 Hz, 0.8 H), 3.84–3.74 (m, 0.3 H), 3.43–3.35 (m, 2 H), 2.60–2.48 (m, 0.6 H), 1.94 (s, 1.7 H), 1.48 (s, 1.2 H), 0.93 (d, *J* = 7.0 Hz, 2.5 H), 0.65 (d, *J* = 6.8 Hz, 3.5 H); $^{13}C$ NMR (101 MHz, $CDCl_3$, 1.4:1 *E*:*Z*) δ 154.5, 153.2, 136.6, 136.5, 127.3, 127.3, 123.2, 123.0, 122.0, 121.9, 119.4, 119.4, 118.3, 118.2, 111.6, 111.6, 111.4, 111.3, 59.8, 58.9, 31.4, 28.4, 23.9, 23.4, 19.3, 18.3, 13.4, 13.1; HRMS (ESI) calcd for $C_{15}H_{21}N_2O^+$ $[M + H]^+$ 245.1648, found 245.1653.



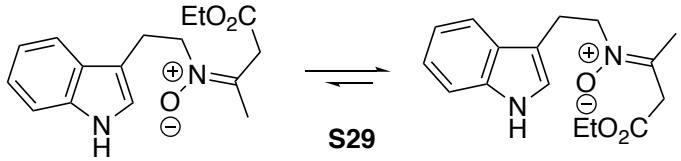
**S27**

**(*E/Z*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-fluoropropan-2-imine oxide (S27).** Prepared using the general procedure described above with **18** and fluoroacetone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S27** (0.060 g, 45% yield, 1:3.6 *E*:*Z*) as a white solid. **S27**: $R_f$ = 0.41 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3220, 1597, 1562, 1481,

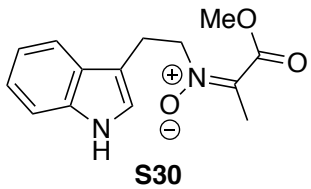
1448, 1389, 1219, 1157, 1030, 708, 745 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$, 1:3.6 *E*:*Z*) δ 8.11 (br s, 1 H, exchangeable), 7.65–7.57 (m, 1 H), 7.41–7.34 (m, 1 H), 7.24–7.19 (m, 1 H), 7.17–7.11 (m, 1 H), 7.09–7.03 (m, 1 H), 5.26 (d, *J* = 48.5 Hz, 1.5 H), 4.44 (d, *J* = 47.2 Hz, 0.4 H), 4.22 (t, *J* = 7.3 Hz, 0.4 H), 4.11 (t, *J* = 6.7 Hz, 1.6 H), 3.43–3.35 (m, 2 H), 2.09 (d, *J* = 4.2 Hz, 0.6 H), 1.67–1.57 (m, 2.6 H); $^{13}C$ NMR (101 MHz, $CDCl_3$, 1:3.6 *E*:*Z*) δ 145.29 (d, *J* = 28.3 Hz), 142.24 (d, *J* = 14.6 Hz), 136.4, 136.3, 127.2, 127.1, 122.8, 122.8, 122.5, 122.4, 119.8, 119.7, 118.3, 118.2, 111.6, 111.5, 111.4, 111.4, 80.7 (d, *J* = 169.9 Hz), 79.1 (d, *J* = 168.4 Hz), 61.2, 60.1, 24.1, 23.3, 16.7 (d, *J* = 2.9 Hz), 13.2 (d, *J* = 6.3 Hz); HRMS (CI) calcd for $C_{13}H_{16}FN_2O^+$ $[M + H]^+$ 235.1241, found 235.1242.




**(*E*/*Z*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-methoxypropan-2-imine oxide (S28).** Prepared using the general procedure described above with **18** and methoxyacetone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S28** (0.118 g, 84% yield, 1:1.9 *E*:*Z*) as a yellow solid. **S28**: $R_f$ = 0.49 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3220, 2925, 1597, 1562, 1449, 1389, 1198, 1105, 798, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$, 1:1.9 *E*:*Z*) δ 8.19 (br s, 1 H, exchangeable), 7.63 (d, *J* = 7.9 Hz, 1 H), 7.37 (d, *J* = 8.1 Hz, 1 H), 7.23–7.17 (m, 1 H), 7.16–7.11 (m, 1 H), 7.06 (d, *J* = 2.2 Hz, 1 H), 4.35 (s, 1.3 H), 4.19 (t, *J* = 6.9 Hz, 0.7 H), 4.11 (t, *J* = 6.9 Hz, 1.3 H), 3.61 (s, 0.7 H), 3.43–3.36 (m, 2 H), 3.28 (s, 1.8 H), 3.04 (s, 0.9 H), 2.09 (s, 1 H), 1.64 (s, 1.8 H); $^{13}C$ NMR (101 MHz, $CDCl_3$, 1:1.9 *E*:*Z*) δ 147.9, 145.6, 136.4, 136.4, 127.2 (2 C), 123.0, 122.9, 122.1 (2 C), 119.5 (2 C), 118.3, 118.3, 111.6 (2 C), 111.4 (2 C), 70.7, 70.1, 60.2, 60.1, 59.2, 58.3, 23.9, 23.3, 17.1, 13.7; HRMS (ESI) calcd for $C_{14}H_{19}N_2O_2^+$ $[M + H]^+$ 247.1441, found 247.1445.

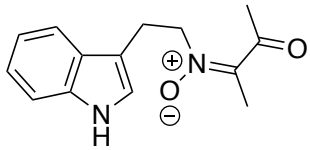



**(*E*/*Z*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-4-ethoxy-4-oxobutan-2-imine oxide (S29).** Prepared using the general procedure described above with **18** and ethyl acetoacetate (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S29** (0.144 g, 88% yield, 1:4.0 *E*:*Z*) as a white solid. **S29**: $R_f$ = 0.46 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3181, 2980, 1734, 1598, 1458, 1369, 1303, 1158, 1031, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$, 1:4.0 *E*:*Z*) δ 8.34 (br s, 1 H, exchangeable), 7.61 (d, *J* = 7.8 Hz, 1 H), 7.41–7.34 (m, 1 H), 7.23–7.16 (m, 1 H), 7.16–7.04 (m, 2 H), 4.23–4.12 (m, 3.4 H), 4.05 (q, *J* = 7.1 Hz, 0.4 H), 3.50 (s, 1.6 H), 3.43–3.36 (m, 2 H), 2.95 (s, 0.4 H), 2.12 (s, 0.6 H), 1.77 (s, 2.4 H), 1.26 (t, *J* = 7.1 Hz, 2.3 H), 1.19 (t, *J* = 7.1 Hz, 0.6 H); $^{13}C$ NMR (101 MHz, $CDCl_3$, 1:4.0 *E*:*Z*) δ 168.5, 167.5, 141.4, 140.9, 136.4, 127.2, 123.2, 123.0, 122.1, 122.0, 119.5, 119.4, 118.3, 118.2, 111.6 (2 C), 111.3, 111.2, 61.8, 61.2, 60.3, 59.7, 39.4, 38.9, 23.6, 23.4, 19.4, 19.3, 14.2, 14.1; HRMS (ESI) calcd for $C_{16}H_{21}N_2O_3^+$ $[M + H]^+$ 289.1547, found 289.1556.

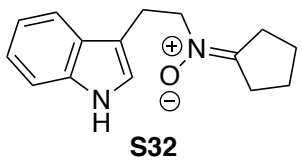



**(*E*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-methoxy-1-oxopropan-2-imine oxide (S30).** Prepared using the general procedure described above with **18** and methyl pyruvate (2.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC for 2 h, ultimately yielding **S30** (0.146 g, 99% yield) as a pink

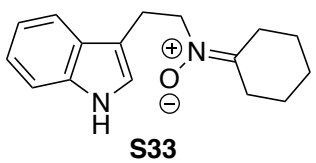
solid. **S30**: $R_f$ = 0.54 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3278, 1718, 1597, 1562, 1448, 1389, 1304, 1219, 1194, 1136, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.06 (br s, 1 H, exchangeable), 7.71 (d, *J* = 7.6 Hz, 1 H), 7.39–7.33 (m, 1 H), 7.23–7.18 (m, 1 H), 7.17–7.12 (m, 1 H), 7.06 (d, *J* = 2.3 Hz, 1 H), 4.78 (t, *J* = 7.5 Hz, 2 H), 3.55 (s, 3 H), 3.36 (t, *J* = 7.7 Hz, 2 H), 2.19 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 162.8, 138.5, 136.3, 127.2, 122.8, 122.2, 119.6, 118.9, 111.6, 111.2, 64.3, 52.5, 25.0, 15.4; HRMS (ESI) calcd for $C_{14}H_{17}N_2O_3^+$ $[M + H]^+$ 261.1234, found 261.1235.


**S31**

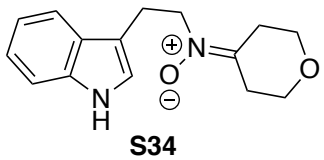
**(*E*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-3-oxobutan-2-imine oxide (S31).** Prepared using the general procedure described above with **18** and diacetyl (1.5 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC for 2 h, ultimately yielding **S31** (0.137 g, 99% yield) as a yellow solid. **S31**: $R_f$ = 0.65 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3283, 1679, 1508, 1458, 1426, 1358, 1292, 1111, 970, 745 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.07 (br s, 1 H, exchangeable), 7.73 (d, *J* = 7.8 Hz, 1 H), 7.38–7.32 (m, 1 H), 7.24–7.12 (m, 2 H), 7.08 (d, *J* = 2.1 Hz, 1 H), 4.62 (t, *J* = 7.4 Hz, 2 H), 3.31 (t, *J* = 7.4 Hz, 2 H), 2.19 (s, 3 H), 1.96 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 193.3, 144.5, 136.2, 127.3, 122.8, 122.2, 119.7, 118.9, 111.7, 111.2, 64.1, 29.3, 24.9, 16.1; HRMS (ESI) calcd for $C_{14}H_{17}N_2O_2^+$ $[M + H]^+$ 245.1285, found 245.1288.


**S32**

***N*-(2-(1*H*-indol-3-yl)ethyl)cyclopentanimine oxide (S32).** Prepared using the general procedure described above with **18** and cyclopentanone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S32** (0.135 g, 98% yield) as a white solid. **S32**: $R_f$ = 0.38 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3179, 2964, 1597, 1563, 1449, 1395, 1340, 1136, 972, 798, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.35 (br s, 1 H, exchangeable), 7.65 (d, *J* = 7.8 Hz, 1 H), 7.40–7.34 (m, 1 H), 7.22–7.16 (m, 1 H), 7.15–7.09 (m, 1 H), 7.07 (d, *J* = 2.4 Hz, 1 H), 4.02 (t, *J* = 6.7 Hz, 2 H), 3.40 (t, *J* = 6.7 Hz, 2 H), 2.58 (t, *J* = 7.4 Hz, 2 H), 1.92 (t, *J* = 7.2 Hz, 2 H), 1.63–1.54 (m, 2 H), 1.50–1.40 (m, 2 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 157.9, 136.5, 127.4, 123.0, 121.9, 119.3, 118.4, 111.6, 111.6, 61.7, 31.2, 31.0, 26.1, 24.4, 23.2; HRMS (CI) calcd for $C_{15}H_{19}N_2O^+$ $[M + H]^+$ 243.1492, found 243.1497.

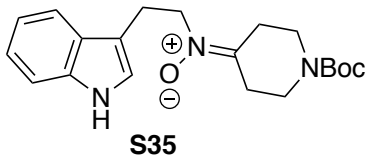

**S33**

***N*-(2-(1*H*-indol-3-yl)ethyl)cyclohexanimine oxide (S33).** Prepared using the general procedure described above with **18** and cyclohexanone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S33** (0.127 g, 87% yield) as a pale yellow solid. **S33**: $R_f$ = 0.36 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3170, 2932, 2861, 1597, 1561, 1448, 1342, 1198, 1133, 1105, 1073, 743 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.60 (br s, 1 H, exchangeable), 7.63 (d, *J* = 7.8 Hz, 1 H), 7.40–7.34 (m, 1 H), 7.21–7.15 (m, 1 H), 7.15–7.09 (m, 1 H), 7.06 (d, *J* = 2.2 Hz, 1 H), 4.17 (t, *J* = 6.7 Hz, 2 H), 3.38 (t, *J* = 6.7 Hz, 2 H), 2.69 (t, *J* = 6.5 Hz, 2 H), 1.99 (t, *J* = 6.5 Hz, 2 H), 1.54–1.46 (m, 2 H), 1.37–1.29 (m, 2 H), 1.09–1.00 (m, 2 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 151.6, 136.5, 127.4, 123.1, 122.0, 119.4, 118.3, 111.6 (2 C), 59.2, 29.9, 27.1, 25.2, 24.6, 24.5, 23.7; HRMS (ESI) calcd for $C_{16}H_{21}N_2O^+$ $[M + H]^+$ 257.1648, found 257.1658.


**S34**

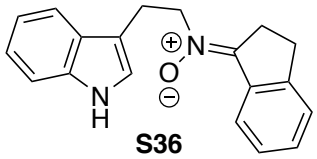
***N*-(2-(1*H*-indol-3-yl)ethyl)tetrahydro-4*H*-pyran-4-imine oxide (S34).** Prepared using the general procedure described above with **18**

and tetrahydro-4*H*-pyran-4-one (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S34** (0.120 g, 82% yield) as a yellow solid. **S34**: $R_f$ = 0.34 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3179, 2860, 1597, 1562, 1457, 1388, 1341, 1139, 1102, 1009, 746 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.38 (br s, 1 H, exchangeable), 7.65 (d, *J* = 7.8 Hz, 1 H), 7.41–7.35 (m, 1 H), 7.23–7.17 (m, 1 H), 7.15–7.10 (m, 1 H), 7.08 (d, *J* = 2.2 Hz, 1 H), 4.14 (t, *J* = 6.3 Hz, 2 H), 3.48 (t, *J* = 5.9 Hz, 2 H), 3.41 (t, *J* = 6.3 Hz, 2 H), 2.89 (t, *J* = 5.7 Hz, 2 H), 2.77 (t, *J* = 5.9 Hz, 2 H), 1.98 (t, *J* = 5.7 Hz, 2 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 145.8, 136.4, 127.5, 123.0, 122.4, 119.8, 118.3, 111.7, 111.6, 65.9, 65.5, 59.3, 30.3, 27.6, 23.5; HRMS (CI) calcd for $C_{15}H_{19}N_2O_2^+$ $[M + H]^+$ 259.1441, found 259.1444.



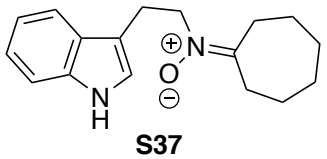
**S35**

***N*-(2-(1*H*-indol-3-yl)ethyl)-1-(*tert*-butoxycarbonyl)piperidin-4-imine oxide (S35).** Prepared using the general procedure described above with **18** and 1-Boc-4-piperidone (3.5 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S35** (0.184 g, 91% yield) as a white solid. **S35**: $R_f$ = 0.43 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 2972, 1695, 1597, 1564, 1394, 1363, 1223, 1148, 1000, 858, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.18 (br s, 1 H, exchangeable), 7.64 (d, *J* = 7.8 Hz, 1 H), 7.39–7.33 (m, 1 H), 7.22–7.17 (m, 1 H), 7.15–7.09 (m, 1 H), 7.07 (d, *J* = 2.2 Hz, 1 H), 4.14 (t, *J* = 6.3 Hz, 2 H), 3.40 (t, *J* = 6.3 Hz, 2 H), 3.30–3.19 (m, 2 H), 2.75 (t, *J* = 5.7 Hz, 2 H), 2.69 (t, *J* = 6.1 Hz, 2 H), 1.99 (t, *J* = 6.0 Hz, 2 H), 1.40 (s, 9 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 154.5, 146.6, 136.3, 127.5, 122.8, 122.5, 119.8, 118.4, 111.9, 111.6, 80.2, 59.8, 41.2, 40.7, 28.9, 28.5, 27.1, 23.6; HRMS (ESI) calcd for $C_{20}H_{28}N_3O_3^+$ $[M + H]^+$ 358.2125, found 358.2133.



**S36**

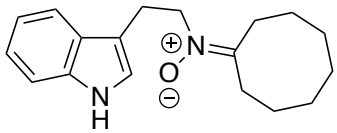
**(*Z*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-2,3-dihydro-1*H*-inden-1-imine oxide (S36).** Prepared using the general procedure described above with **18** and 1-indanone (3.0 equiv) in MeOH at 50 ºC, ultimately yielding **S36** (0.149 g, 90% yield) as a brown solid. **S36**: $R_f$ = 0.49 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 2850, 1595, 1561, 1445, 1400, 1174, 1097, 1067, 760, 747 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.96 (d, *J* = 7.3 Hz, 1 H), 8.09 (br s, 1 H, exchangeable), 7.65 (d, *J* = 7.9 Hz, 1 H), 7.41–7.30 (m, 3 H), 7.24–7.16 (m, 2 H), 7.13–7.08 (m, 1 H), 7.06 (d, *J* = 2.2 Hz, 1 H), 4.17 (t, *J* = 7.0 Hz, 2 H), 3.50 (t, *J* = 7.0 Hz, 2 H), 2.93–2.86 (m, 2 H), 2.59–2.53 (m, 2 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 150.0, 148.1, 136.3, 134.8, 131.1, 127.4, 127.2, 127.2, 124.7, 122.9, 122.3, 119.7, 118.5, 112.0, 111.5, 62.3, 29.1, 28.9, 23.4; HRMS (CI) calcd for $C_{19}H_{19}N_2O^+$ $[M + H]^+$ 291.1492, found 291.1503.



**S37**

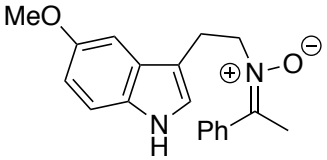
***N*-(2-(1*H*-indol-3-yl)ethyl)cycloheptanimine oxide (S37).** Prepared using the general procedure described above with **18** and cycloheptanone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S37** (0.153 g, 99% yield) as a yellow solid. **S37**: $R_f$ = 0.51 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3173, 2924, 2854, 1597, 1564, 1449, 1211, 1140, 1105, 743 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.37 (br s, 1 H, exchangeable), 7.63 (d, *J* = 7.8 Hz, 1 H), 7.41–7.33 (m, 1 H), 7.22–7.16 (m, 1 H), 7.15–7.10 (m, 1 H), 7.07 (d, *J* = 2.3 Hz, 1 H), 4.17 (t, *J* = 7.0 Hz, 2 H), 3.40 (t, *J* = 6.9 Hz, 2 H), 2.79–2.71 (m, 2 H), 2.20–2.14 (m, 2 H), 1.64–1.57 (m, 2 H), 1.46–1.38 (m, 2 H), 1.35–1.28 (m, 2 H), 1.25–1.19 (m, 2 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 155.0, 136.5, 127.4, 123.0, 121.9,

119.3, 118.3, 111.6, 111.4, 59.4, 31.9, 31.2, 29.7, 29.5, 26.1, 24.6, 23.8; HRMS (CI) calcd for $C_{17}H_{23}N_2O^+$ $[M + H]^+$ 271.1805, found 271.1815.



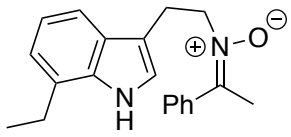
**S38**

***N*-(2-(1*H*-indol-3-yl)ethyl)cyclooctanimine oxide (S38).** Prepared using the general procedure described above with **18** and cyclooctanone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S38** (0.161 g, 99% yield) as a yellow solid. **S38**: $R_f$ = 0.49 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3173, 2924, 1597, 1562, 1448, 1400, 1355, 1217, 1142, 1109, 743 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.25 (br s, 1 H, exchangeable), 7.64 (d, *J* = 7.8 Hz, 1 H), 7.41–7.34 (m, 1 H), 7.23–7.17 (m, 1 H), 7.16–7.10 (m, 1 H), 7.08 (d, *J* = 2.4 Hz, 1 H), 4.13 (t, *J* = 7.2 Hz, 2 H), 3.42 (t, *J* = 7.2 Hz, 2 H), 2.69–2.60 (m, 2 H), 2.23–2.13 (m, 2 H), 1.80–1.73 (m, 2 H), 1.55–1.47 (m, 2 H), 1.45–1.38 (m, 2 H), 1.33–1.27 (m, 2 H), 1.26–1.20 (m, 2 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 154.5, 136.6, 127.3, 123.1, 121.9, 119.2, 118.3, 111.6, 111.4, 59.0, 30.7, 29.7, 28.1, 26.8, 25.9, 25.4, 23.5, 23.3; HRMS (ESI) calcd for $C_{18}H_{25}N_2O^+$ $[M + H]^+$ 285.1961, found 285.1972.



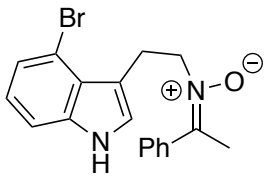
**S39**

**(*E*)-*N*-(2-(5-methoxy-1*H*-indol-3-yl)ethyl)-1-phenylethan-1-imine oxide (S39).** Prepared using the general procedure described above with **S7** and acetophenone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S39** (0.131 g, 88% yield) as a white solid. **S39**: $R_f$ = 0.44 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3325, 1597, 1486, 1447, 1394, 1216, 1071, 858, 798, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.06 (br s, 1 H, exchangeable), 7.26–7.22 (m, 2 H), 7.19–7.13 (m, 2 H), 6.97 (d, *J* = 2.4 Hz, 1 H), 6.82 (dd, *J* = 8.7, 2.4 Hz, 1 H), 6.75–6.70 (m, 3 H), 4.07 (t, *J* = 6.9 Hz, 2 H), 3.74 (s, 3 H), 3.33 (t, *J* = 7.0 Hz, 2 H), 2.35 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 154.0, 148.4, 136.2, 131.4, 128.8, 128.7, 127.8, 127.3, 123.5, 112.6, 112.0, 111.5, 100.0, 60.1, 56.0, 23.9, 20.8; HRMS (CI) calcd for $C_{19}H_{21}N_2O_2^+$ $[M + H]^+$ 309.1598, found 309.1599.



**S40**

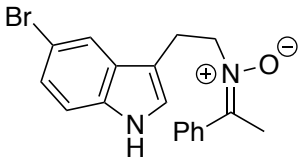
**(*E*)-*N*-(2-(7-ethyl-1*H*-indol-3-yl)ethyl)-1-phenylethan-1-imine oxide (S40).** Prepared using the general procedure described above with **S9** and acetophenone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S40** (0.131 g, 87% yield) as a pale yellow solid. **S40**: $R_f$ = 0.50 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3261, 1597, 1564, 1485, 1448, 1395, 1220, 1080, 858, 798 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.08 (br s, 1 H, exchangeable), 7.28–7.25 (m, 1 H), 7.22–7.15 (m, 2 H), 7.09 (d, *J* = 7.8 Hz, 1 H), 7.02–6.98 (m, 2 H), 6.97–6.92 (m, 1 H), 6.80–6.74 (m, 2 H), 4.07 (t, *J* = 7.2 Hz, 2 H), 3.36 (t, *J* = 7.2 Hz, 2 H), 2.86 (q, *J* = 7.6 Hz, 2 H), 2.37 (s, 3 H), 1.36 (t, *J* = 7.6 Hz, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 148.4, 136.2, 135.1, 128.8, 128.7, 128.6, 127.2, 126.8, 122.4, 120.6, 119.7, 116.2, 112.1, 60.4, 24.1, 24.0, 20.8, 14.2; HRMS (ESI) calcd for $C_{20}H_{23}N_2O^+$ $[M + H]^+$ 307.1805, found 307.1808.



**S41**

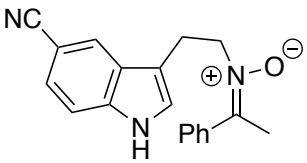
**(*E*)-*N*-(2-(4-bromo-1*H*-indol-3-yl)ethyl)-1-phenylethan-1-imine oxide (S41).** Prepared using the general procedure described above with **S11** and acetophenone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S41** (0.127 mg, 91% yield) as a pale yellow solid. **S41**: $R_f$ = 0.49 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3155, 1597, 1562, 1424,

1333, 1221, 1193, 1156, 1071, 1044, 738, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 9.36 (br s, 1 H, exchangeable), 7.37 (dd, *J* = 8.1, 0.9 Hz, 1 H), 7.22–7.15 (m, 2 H), 7.09 (dd, *J* = 7.6, 0.9 Hz, 1 H), 7.05–7.00 (m, 2 H), 6.97 (t, *J* = 7.8 Hz, 1 H), 6.58–6.52 (m, 2 H), 4.25 (t, *J* = 6.4 Hz, 2 H), 3.52 (t, *J* = 6.4 Hz, 2 H), 2.31 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 149.7, 138.0, 135.6, 128.8, 128.6, 127.0, 125.9, 125.6, 123.5, 122.6, 114.0, 111.5, 111.0, 61.3, 24.2, 20.8; HRMS (ESI) calcd for $C_{18}H_{18}BrN_2O^+$ $[M + H]^+$ 357.0597, found 357.0610.



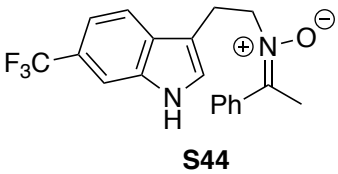
**S42**

**(*E*)-*N*-(2-(5-bromo-1*H*-indol-3-yl)ethyl)-1-phenylethan-1-imine oxide (S42).** Prepared using the general procedure described above with **S13** and acetophenone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S42** (0.114 g, 81% yield) as a white solid. **S42**: $R_f$ = 0.68 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3199, 1597, 1564, 1449, 1394, 1219, 1159, 1071, 882, 858, 798, 699 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.91 (br s, 1 H, exchangeable), 7.33–7.29 (m, 1 H), 7.28–7.27 (m, 1 H), 7.25–7.23 (m, 1 H), 7.23–7.17 (m, 3 H), 6.99 (d, *J* = 2.4 Hz, 1 H), 6.75–6.67 (m, 2 H), 4.06 (t, *J* = 6.6 Hz, 2 H), 3.29 (t, *J* = 6.9 Hz, 2 H), 2.36 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 148.8, 135.9, 135.0, 129.2, 129.2, 128.8, 127.1, 124.9, 124.2, 121.1, 112.8, 112.8, 111.4, 60.0, 23.8, 20.8; HRMS (ESI) calcd for $C_{18}H_{18}BrN_2O^+$ $[M + H]^+$ 357.0597, found 357.0598.



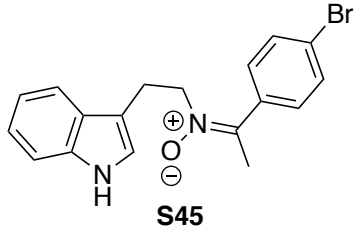
**S43**

**(*E*)-*N*-(2-(5-cyano-1*H*-indol-3-yl)ethyl)-1-phenylethan-1-imine oxide (S43).** Prepared using the general procedure described above with **S15** and acetophenone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S43** (0.094 g, 62% yield) as a white solid. **S43**: $R_f$ = 0.40 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3289, 2362, 2218, 1597, 1572, 1479, 1401, 1223, 1138, 1069, 802 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 9.71 (br s, 1 H, exchangeable), 7.46 (d, *J* = 8.4 Hz, 1 H), 7.42–7.39 (m, 1 H), 7.39–7.32 (m, 2 H), 7.24–7.18 (m, 2 H), 7.12 (d, *J* = 2.3 Hz, 1 H), 6.75–6.70 (m, 2 H), 4.10 (t, *J* = 6.9 Hz, 2 H), 3.33 (t, *J* = 6.9 Hz, 2 H), 2.35 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 149.2, 138.1, 135.8, 129.5, 128.9, 127.2, 127.1, 125.3, 124.9, 124.1, 120.7, 112.4, 112.4, 102.4, 59.8, 23.6, 20.7; HRMS (CI) calcd for $C_{19}H_{18}N_3O^+$ $[M + H]^+$ 304.1444, found 304.1446.



**S44**

**(*E*)-1-phenyl-*N*-(2-(6-(trifluoromethyl)-1*H*-indol-3-yl)ethyl)ethan-1-imine oxide (S44).** Prepared using the general procedure described above with **S17** and acetophenone (5.0 equiv) in $CH_2Cl_2$/MeOH (1/1) at 23 ºC, ultimately yielding **S44** (0.125 g, 88% yield) as a white solid. **S44**: $R_f$ = 0.57 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3182, 1597, 1564, 1448, 1393, 1336, 1220, 1158, 1111, 1072, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.65 (br s, 1 H, exchangeable), 7.69–7.62 (m, 1 H), 7.29 (d, *J* = 8.4 Hz, 1 H), 7.26–7.22 (m, 1 H), 7.19 (dd, *J* = 8.4, 1.6 Hz, 1 H), 7.17–7.11 (m, 3 H), 6.70–6.63 (m, 2 H), 4.09 (t, *J* = 6.9 Hz, 2 H), 3.37 (t, *J* = 6.8 Hz, 2 H), 2.33 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 149.5, 135.7, 135.4, 129.6, 129.1, 128.8, 127.0, 125.8, 125.4 (q, *J* = 271.4 Hz), 123.9 (q, *J* = 31.8 Hz), 118.7, 115.9, 111.6, 109.0, 60.0, 23.6, 20.8; HRMS (CI) calcd for $C_{19}H_{18}F_3N_2O^+$ $[M + H]^+$ 347.1366, found 347.1370.



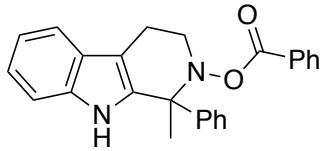
**S45**

**(*E*)-*N*-(2-(1*H*-indol-3-yl)ethyl)-1-(4-bromophenyl)ethan-1-imine oxide (S45).** Prepared using the general procedure described

above with **18** and 4′-bromoacetophenone (2.5 equiv) in MeOH at 50 ºC, ultimately yielding **S45** (0.170 g, 84% yield) as a white solid. **S45**: $R_f$ = 0.60 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) 3184, 1577, 1484, 1457, 1221, 1165, 1075, 1009, 825, 742 $\nu_{max}$ $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.25 (br s, 1 H, exchangeable), 7.37 (d, *J* = 8.1 Hz, 1 H), 7.28–7.24 (m, 1 H), 7.23–7.16 (m, 3 H), 7.05–7.00 (m, 1 H), 6.99 (d, *J* = 2.3 Hz, 1 H), 6.48–6.39 (m, 2 H), 4.06 (t, *J* = 6.2 Hz, 1 H), 3.35 (t, *J* = 6.2 Hz, 1 H) 2.29 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 147.3, 136.3, 134.9, 131.8, 128.9, 127.4, 123.1, 122.8, 122.2, 119.6, 118.5, 111.6, 111.3, 60.4, 23.7, 20.6; HRMS (CI) calcd for $C_{18}H_{18}BrN_2O^+$ $[M + H]^+$ 357.0597, found 357.0596.

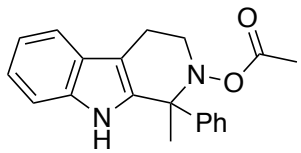
## E. General Procedure for Racemic Pictet–Spengler Reactions of Nitrones.

To a solution of nitrone (0.25 mmol, 1.0 equiv) in $CH_2Cl_2$ (1.25 mL, dried over 4Å MS beads) at 23 ºC was added molecular sieves (4Å, powder, ~150 mg), and the resultant slurry was stirred for 10 min under an argon atmosphere. Next, the acyl chloride (0.26 mmol, 1.05 equiv) was added and the reaction mixture was stirred for 30 min at 23 ºC. Upon completion, the contents were quenched by the addition of saturated aqueous $NaHCO_3$ (5 mL), poured into a separatory funnel, and extracted with $CH_2Cl_2$ (3 × 5 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, hexanes/EtOAc = 1/0→2/1) to yield **20**–**47**. *Note:* These reactions must be run under strictly anhydrous conditions to avoid hydrolysis of the *N*-acyloxyiminium species.



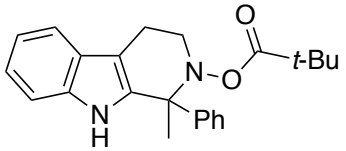
**20a**

**1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (20a).** Prepared using the general procedure described above with **19** and benzoyl chloride, ultimately yielding **20a** (0.083 g, 86% yield) as a white solid. **20a**: $R_f$ = 0.50 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3363, 1726, 1598, 1450, 1272, 1092, 1063, 1023, 745, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.00–7.84 (m, 3 H, 1 exchangeable), 7.63 (d, *J* = 7.7 Hz, 1 H), 7.53 (t, *J* = 7.4 Hz, 1 H), 7.43–7.35 (m, 5 H), 7.31–7.24 (m, 4 H), 7.23–7.19 (m, 1 H), 3.69–3.57 (m, 1 H), 3.44–3.26 (m, 1 H), 3.22–3.14 (m, 1 H), 2.93–2.78 (m, 1 H), 1.97 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 165.5, 136.2, 135.2, 133.2, 129.6, 129.3, 128.5, 128.4, 128.0, 127.9 (2 C), 127.1, 122.2, 119.8, 118.8, 111.2, 108.6, 65.9, 48.1, 25.2, 18.4; HRMS (CI) calcd for $C_{25}H_{23}N_2O_2^+$ $[M + H]^+$ 383.1754, found 383.1753.



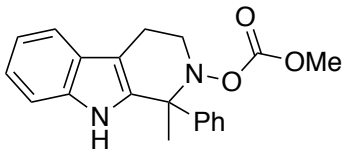
**20b**

**1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl acetate (20b).** Prepared using the general procedure described above with **19** and acetyl chloride, ultimately yielding **20b** (0.069 g, 86% yield) as a white solid. **20b**: $R_f$ = 0.40 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3363, 1238, 1744, 1597, 1448, 1366, 1297, 1221, 745, 701 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.76 (br s, 1 H, exchangeable), 7.57 (d, *J* = 7.8 Hz, 1 H), 7.37 (d, *J* = 8.0 Hz, 1 H), 7.35–7.30 (m, 2 H), 7.30–7.24 (m, 3 H), 7.24–7.20 (m, 1 H), 7.19–7.14 (m, 1 H), 3.58–3.44 (m, 1 H), 3.31–3.17 (m, 1 H), 3.10–3.02 (m, 1 H), 2.87–2.71 (m, 1 H), 1.98 (s, 3 H), 1.88 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 170.2, 136.1, 135.2, 128.4, 127.9 (2 C), 127.8, 127.0, 122.2, 119.8, 118.7, 111.1, 108.5, 65.5, 47.9, 24.7, 19.6, 18.3; HRMS (CI) calcd for $C_{20}H_{21}N_2O_2^+$ $[M + H]^+$ 321.1598, found 321.1601.



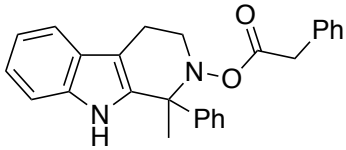
**20c**

**1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl pivalate (20c).** Prepared using the general procedure described above with **19** and pivaloyl chloride, ultimately yielding **20c** (0.080 g, 88% yield) as a white solid. **20c**: $R_f$ = 0.49 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3363, 2974, 1732, 1597, 1450, 1396, 1276, 1118, 1024, 744, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.83 (br s, 1 H, exchangeable), 7.59 (d, *J* = 7.7 Hz, 1 H), 7.41–7.33 (m, 3 H), 7.31–7.24 (m, 3 H), 7.24–7.15 (m, 2 H), 3.56–3.43 (m, 1 H), 3.34–3.19 (m, 1 H), 3.08–2.99 (m, 1 H), 2.92–2.77 (m, 1 H), 1.91 (s, 3 H), 1.11 (s, 9 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 176.8, 136.2, 135.6, 128.3, 127.9 (2 C), 127.8, 127.0, 122.0, 119.7, 118.7, 111.1, 108.3, 65.6, 47.8, 39.0, 27.3, 24.5, 18.5; HRMS (CI) calcd for $C_{23}H_{27}N_2O_2^+$ $[M + H]^+$ 363.2067, found 363.2066.



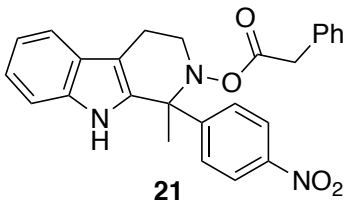
**20d**

**Methyl (1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl) carbonate (20d).** Prepared using the general procedure described above with **19** and methyl chloroformate, ultimately yielding **20d** (0.074 g, 87% yield) as a white solid. **20d**: $R_f$ = 0.39 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3380, 1755, 1597, 1440, 1229, 1128, 940, 858, 745, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.74 (br s, 1 H, exchangeable), 7.55 (d, *J* = 7.8 Hz, 1 H), 7.38–7.30 (m, 3 H), 7.30–7.25 (m, 3 H), 7.23–7.18 (m, 1 H), 7.18–7.12 (m, 1 H), 3.78 (s, 3 H), 3.63–3.51 (m, 1 H), 3.32–3.19 (m, 1 H), 3.14–3.06 (m, 1 H), 2.86–2.73 (m, 1 H), 1.92 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 156.2, 136.2, 134.8, 128.4, 127.9, 127.8, 127.7, 127.0, 122.2, 119.8, 118.7, 111.1, 108.4, 66.1, 55.2, 48.1, 24.4, 18.3; HRMS (CI) calcd for $C_{20}H_{21}N_2O_3^+$ $[M + H]^+$ 337.1547, found 337.1550.



**20e**

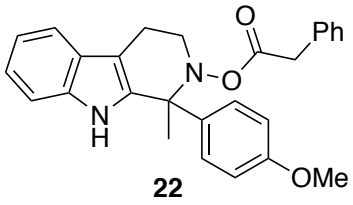
**1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (20e).** Prepared using the general procedure described above with **19** and phenylacetyl chloride, ultimately yielding **20e** (0.095 g, 95% yield) as a white solid. **20e**: $R_f$ = 0.44 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3374, 3058, 1745, 1453, 1298, 1232, 1116, 1025, 745, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.70 (br s, 1 H, exchangeable), 7.56 (d, *J* = 7.7 Hz, 1 H), 7.35 (d, *J* = 8.0 Hz, 1 H), 7.32–7.20 (m, 9 H), 7.19–7.14 (m, 3 H), 3.53 (s, 2 H), 3.48–3.41 (m, 1 H), 3.27–3.15 (m, 1 H), 3.05–2.92 (m, 1 H), 2.84–2.72 (m, 1 H), 1.78 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 170.4, 136.2, 135.3, 133.7, 129.3, 128.7, 128.3 (2 C), 127.8 (2 C), 127.2, 127.0, 122.1, 119.8, 118.7, 111.1, 108.4, 65.7, 48.0, 40.3, 24.3, 18.5; HRMS (ESI) calcd for $C_{26}H_{24}N_2O_2^+$ $[M + H]^+$ 397.1911, found 397.1912.



**21**

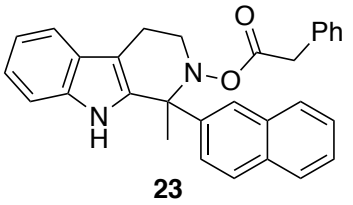
**1-methyl-1-(4-nitrophenyl)-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (21).** Prepared using the general procedure described above with **S18** and phenylacetyl chloride, ultimately yielding **21** (0.107 g, 97% yield) as a bright yellow solid. **21**: $R_f$ = 0.34 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3245, 1598, 1561, 1518, 1400, 1349, 1219, 1069, 857, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.4 Hz, 2 H), 7.66 (br s, 1 H, exchangeable), 7.57 (d, *J* = 7.8 Hz, 1 H), 7.53–7.39 (m, 2 H), 7.35 (d, *J* = 8.0 Hz, 1 H), 7.28–7.21 (m, 4 H), 7.20–7.11 (m, 3

H), 3.57–3.46 (m, 3 H), 3.23–3.12 (m, 1 H), 3.05–2.95 (m, 1 H), 2.92–2.80 (m, 1 H), 1.79 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.0, 147.3, 136.4, 134.0, 133.4, 129.1, 128.8, 128.7 (2 C), 127.4, 126.7, 123.4, 122.7, 120.1, 118.9, 111.3, 108.8, 65.4, 48.3, 40.3, 23.7, 18.7; HRMS (ESI) calcd for $C_{26}H_{24}N_3O_4^+$ $[M + H]^+$ 442.1761, found 442.1759.



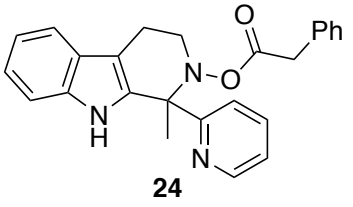
**22**

**1-(4-methoxyphenyl)-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (22).** Prepared using the general procedure described above with **S19** and phenylacetyl chloride, ultimately yielding **22** (0.088 g, 83% yield) as a yellow solid. **22**: $R_f$ = 0.62 (silica gel, hexanes/EtOAc = 2/1); IR (film) $\nu_{max}$ 3373, 1746, 1607, 1510, 1454, 1299, 1249, 1180, 1116, 744 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.69 (br s, 1 H, exchangeable), 7.56 (d, *J* = 7.7 Hz, 1 H), 7.34 (d, *J* = 7.9 Hz, 1 H), 7.30–7.09 (m, 9 H), 6.79–6.72 (m, 2 H), 3.77 (s, 3 H), 3.53 (s, 2 H), 3.47–3.39 (m, 1 H), 3.28–3.17 (m, 1 H), 3.02–2.92 (m, 1 H), 2.87–2.71 (m, 1 H), 1.77 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.4, 159.1, 136.2, 135.6, 133.8, 129.3, 129.1 (2 C), 128.6, 127.2, 127.0, 122.1, 119.7, 118.6, 113.5, 111.1, 108.2, 65.2, 55.4, 47.9, 40.3, 24.3, 18.6; HRMS (ESI) calcd for $C_{27}H_{27}N_2O_3^+$ $[M + H]^+$ 427.2016, found 427.2013.



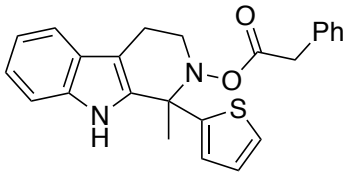
**23**

**1-methyl-1-(naphthalen-2-yl)-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (23).** Prepared using the general procedure described above with **S20** and phenylacetyl chloride, ultimately yielding **23** (0.106 g, 95% yield) as a pale yellow solid. **23**: $R_f$ = 0.44 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3373, 3058, 1745, 1597, 1454, 1297, 1230, 1115, 744, 696 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.80 (d, *J* = 7.8 Hz, 1 H), 7.77–7.68 (m, 3 H), 7.67–7.62 (m, 1 H), 7.59 (d, *J* = 7.6 Hz, 1 H), 7.55 (br s, 1 H, exchangeable), 7.49–7.41 (m, 2 H), 7.36 (d, *J* = 7.9 Hz, 1 H), 7.26–7.22 (m, 1 H), 7.21–7.13 (m, 4 H), 7.12–7.05 (m, 2 H), 3.56–3.46 (m, 3 H), 3.35–3.24 (m, 1 H), 3.05–2.96 (m, 1 H), 2.91–2.78 (m, 1 H), 1.87 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.4, 136.3, 135.5, 133.7, 132.9, 129.1, 128.7, 128.6, 128.4, 128.2 (2 C), 127.6, 127.2, 127.0, 126.5, 126.4, 126.2, 125.9, 122.2, 119.8, 118.7, 111.2, 108.4, 65.8, 48.0, 40.3, 23.9, 18.7; HRMS (CI) calcd for $C_{30}H_{27}N_2O_2^+$ $[M + H]^+$ 447.2067, found 447.2064.



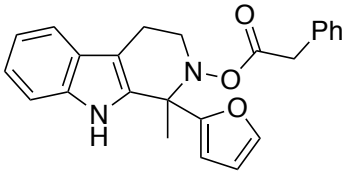
**24**

**1-methyl-1-(pyridin-2-yl)-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (24).** Prepared using the general procedure described above with **S21** and phenylacetyl chloride, ultimately yielding **24** (0.087 g, 87% yield) as a yellow solid. **24**: $R_f$ = 0.21 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3059, 2934, 1754, 1590, 1455, 1431, 1300, 1233, 1112, 742 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$, 45 ºC) δ 9.14 (br s, 1 H, exchangeable), 8.60–8.49 (m, 1 H), 7.79 (d, *J* = 8.0 Hz, 1 H), 7.56–7.47 (m, 2 H), 7.34 (d, *J* = 8.1 Hz, 1 H), 7.23–7.14 (m, 4 H), 7.14–7.05 (m, 4 H), 3.74–3.63 (m, 2 H), 3.53–3.40 (m, 2 H), 3.10–3.02 (m, 1 H), 2.92–2.86 (m, 1 H), 1.90 (s, 3 H); $^{13}$C NMR (126 MHz, $CDCl_3$, 45 ºC) δ 169.9, 163.4, 148.4, 137.1, 136.6, 136.4, 133.5, 129.2, 128.6, 127.2, 126.8, 122.2, 121.8, 120.9, 119.4, 118.5, 111.3, 106.5, 67.3, 48.5, 40.4, 22.2, 19.3; HRMS (ESI) calcd for $C_{25}H_{24}N_3O_2^+$ $[M + H]^+$ 398.1863, found 398.1867.



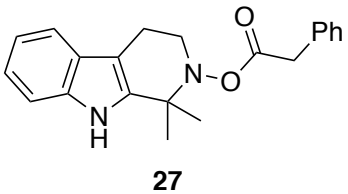
25

**1-methyl-1-(thiophen-2-yl)-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (25).** Prepared using the general procedure described above with **S22** and phenylacetyl chloride, ultimately yielding **25** (0.096 g, 96% yield) as a yellow solid. **25**: $R_f$ = 0.46 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3379, 1749, 1598, 1454, 1299, 1232, 1114, 1074, 743, 697 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.68 (br s, 1 H, exchangeable), 7.53 (d, *J* = 7.8 Hz, 1 H), 7.37–7.25 (m, 5 H), 7.24–7.17 (m, 3 H), 7.16–7.11 (m, 1 H), 6.92–6.81 (m, 1 H), 6.76–6.57 (m, 1 H), 3.62–3.54 (m, 2 H), 3.50–3.34 (m, 2 H), 3.09–2.93 (m, 1 H), 2.92–2.84 (m, 1 H), 1.86 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 170.1, 136.3, 135.1, 133.6, 129.3, 128.7, 127.2, 126.6 (2 C), 126.2, 126.1, 122.2, 119.7, 118.7, 111.2 (2 C), 107.9, 63.7, 48.4, 40.2, 25.4, 19.3; HRMS (ESI) calcd for $C_{24}H_{23}N_2O_2S^+$ $[M + H]^+$ 403.1475, found 403.1476.



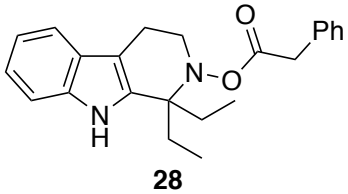
26

**1-(furan-2-yl)-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (26).** Prepared using the general procedure described above with **S23** and phenylacetyl chloride, ultimately yielding **26** (0.090 g, 93% yield) as a pale yellow solid. **26**: $R_f$ = 0.31 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3373, 1750, 1496, 1454, 1300, 1233, 1157, 1115, 1011, 744, 697 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.69 (br s, 1 H, exchangeable), 7.52 (d, *J* = 7.7 Hz, 1 H), 7.41–7.34 (m, 1 H), 7.33–7.25 (m, 4 H), 7.25–7.21 (m, 2 H), 7.21–7.16 (m, 1 H), 7.16–7.10 (m, 1 H), 6.30–6.20 (m, 1 H), 5.97 (d, *J* = 3.3 Hz, 1 H), 3.60–3.52 (m, 2 H), 3.51–3.41 (m, 2 H), 3.04–2.94 (m, 1 H), 2.93–2.86 (m, 1 H), 1.81 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 170.1, 154.4, 142.7, 136.3, 133.8, 133.6, 129.3, 128.6, 127.2, 126.6, 122.2, 119.6, 118.6, 111.2, 110.1, 109.7, 108.2, 62.3, 48.7, 40.2, 22.4, 19.2; HRMS (CI) calcd for $C_{24}H_{23}N_2O_3^+$ $[M + H]^+$ 387.1703, found 387.1703.



27

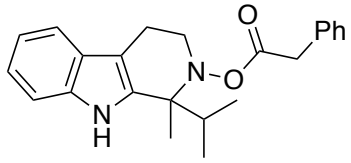
**1,1-dimethyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (27).** Prepared using the general procedure described above with **S24** and phenylacetyl chloride, ultimately yielding **27** (0.081 g, 97% yield) as a white solid. **27**: $R_f$ = 0.50 (silica gel, hexanes/EtOAc = 2/1); IR (film) $\nu_{max}$ 3364, 2981, 1746, 1598, 1454, 1317, 1299, 1231, 1120, 744, 696 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.68 (br s, 1 H, exchangeable), 7.48 (d, *J* = 7.7 Hz, 1 H), 7.33 (d, *J* = 8.0 Hz, 1 H), 7.30–7.22 (m, 5 H), 7.20–7.15 (m, 1 H), 7.15–7.08 (m, 1 H), 3.61 (s, 2 H), 3.52 (t, *J* = 5.6 Hz, 2 H), 2.83 (t, *J* = 5.0 Hz, 2 H), 1.46 (s, 6 H); $^{13}C$ NMR (126 MHz, $CDCl_3$, 45 ºC) δ 170.3, 137.6, 136.2, 133.8, 129.3, 128.7, 127.3, 127.2, 121.9, 119.7, 118.4, 111.0, 106.3, 59.8, 48.3, 40.4, 26.2, 18.8; HRMS (ESI) calcd for $C_{21}H_{23}N_2O_2^+$ $[M + H]^+$ 335.1754, found 335.1756.



28

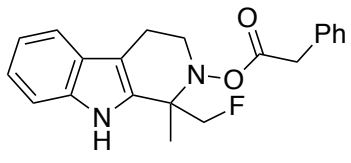
**1,1-diethyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (28).** Prepared using the general procedure described above with **S25** and phenylacetyl chloride, ultimately yielding **28** (0.077 g, 85% yield) as a yellow solid. **28**: $R_f$ = 0.42 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3387, 2972, 1746, 1597, 1496, 1454, 1339, 1231, 1119, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.65 (br s, 1 H, exchangeable), 7.49 (d, *J* = 7.8 Hz, 1 H), 7.33 (d, *J* = 8.0 Hz, 1

H), 7.31–7.21 (m, 5 H), 7.20–7.15 (m, 1 H), 7.13–7.09 (m, 1 H), 3.62–3.52 (m, 4 H), 2.83 (t, $J$ = 6.1 Hz, 2 H), 1.86–1.70 (m, 4 H), 0.85 (t, $J$ = 7.5 Hz, 6 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.0, 136.1, 135.9, 133.8, 129.2, 128.7, 127.3, 126.9, 121.7, 119.5, 118.3, 110.9, 107.6, 65.6, 47.5, 40.6, 28.0, 18.9, 8.7; HRMS (ESI) calcd for $C_{23}H_{27}N_2O_2^+$ $[M + H]^+$ 363.2067, found 363.2072.



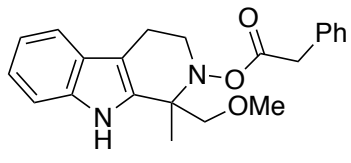
**29**

**1-isopropyl-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (29).** Prepared using the general procedure described above with **S26** and phenylacetyl chloride, ultimately yielding **29** (0.067 g, 74% yield) as a yellow solid. **29**: $R_f$ = 0.40 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3388, 2965, 1744, 1597, 1454, 1389, 1297, 1229, 1122, 744, 696 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.66 (br s, 1 H, exchangeable), 7.49 (d, $J$ = 7.7 Hz, 1 H), 7.33 (d, $J$ = 8.0 Hz, 1 H), 7.31–7.21 (m, 5 H), 7.20–7.15 (m, 1 H), 7.14–7.09 (m, 1 H), 3.58–3.50 (m, 3 H), 3.50–3.44 (m, 1 H), 2.90–2.81 (m, 1 H), 2.81–2.74 (m, 1 H), 2.03–1.94 (m, 1 H), 1.33 (s, 3 H), 1.06 (d, $J$ = 6.9 Hz, 3 H), 0.95 (d, $J$ = 6.8 Hz, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.2, 137.3, 135.9, 133.8, 129.3, 128.6, 127.2, 126.8, 121.8, 119.5, 118.4, 110.8, 107.4, 65.2, 47.7, 40.4, 37.2, 18.6, 17.9, 17.4; HRMS (CI) calcd for $C_{23}H_{27}N_2O_2^+$ $[M + H]^+$ 363.2067, found 363.2066.



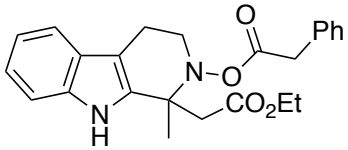
**30**

**1-(fluoromethyl)-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (30).** Prepared using the general procedure described above with **S27** and phenylacetyl chloride, ultimately yielding **30** (0.063 g, 71% yield) as a yellow solid. **30**: $R_f$ = 0.26 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3372, 1750, 1598, 1454, 1301, 1230, 1117, 1030, 745, 697 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 8.02 (br s, 1 H, exchangeable), 7.50 (d, $J$ = 7.8 Hz, 1 H), 7.37–7.23 (m, 6 H), 7.23–7.16 (m, 1 H), 7.15–7.08 (m, 1 H), 4.48 (ddd, $J$ = 62.2, 47.0, 8.5 Hz, 2 H), 3.61 (s, 2 H), 3.55–3.46 (m, 2 H), 3.00–2.88 (m, 1 H), 2.87–2.76 (m, 1 H), 1.54 (s, 3 H); $^{13}$C NMR (126 MHz, $CDCl_3$, 45 ºC) δ 169.8, 136.5, 134.2, 133.5, 129.3, 128.9, 127.5, 126.4, 122.4, 119.8, 118.6, 111.2, 107.5, 87.97 (d, $J$ = 172.9 Hz), 62.22 (d, $J$ = 19.4 Hz), 48.9, 40.4, 20.0, 19.1; HRMS (CI) calcd for $C_{21}H_{22}FN_2O_2^+$ $[M + H]^+$ 353.1660, found 353.1660.



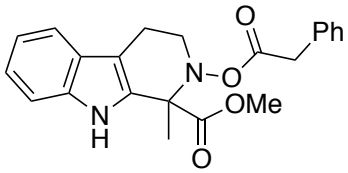
**31**

**1-(methoxymethyl)-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (31).** Prepared using the general procedure described above with **S28** and phenylacetyl chloride, ultimately yielding **31** (0.080 g, 87% yield) as a yellow solid. **31**: $R_f$ = 0.53 (silica gel, hexanes/EtOAc = 2/1); IR (film) $\nu_{max}$ 3437, 2922, 1754, 1598, 1454, 1318, 1301, 1230, 1109, 745, 696 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 8.47 (br s, 1 H, exchangeable), 7.48 (d, $J$ = 7.7 Hz, 1 H), 7.38–7.26 (m, 6 H), 7.19–7.13 (m, 1 H), 7.12–7.06 (m, 1 H), 3.61 (s, 2 H), 3.55–3.45 (m, 3 H), 3.33 (s, 4 H), 3.02–2.91 (m, 1 H), 2.81–2.72 (m, 1 H), 1.50 (s, 3 H); $^{13}$C NMR (126 MHz, $CDCl_3$, 45 ºC) δ 170.0, 136.6, 136.2, 133.8, 129.4, 128.8, 127.4, 126.5, 121.8, 119.4, 118.4, 111.1, 106.1, 78.4, 62.4, 59.7, 48.7, 40.6, 21.0, 19.2; HRMS (CI) calcd for $C_{22}H_{25}N_2O_3^+$ $[M + H]^+$ 365.1860, found 365.1862.



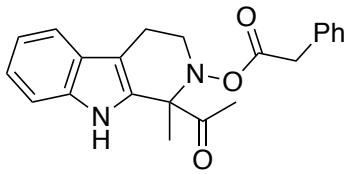
**32**

**1-(2-ethoxy-2-oxoethyl)-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (32).** Prepared using the general procedure described above with **S29** and phenylacetyl chloride, ultimately yielding **32** (0.097 g, 96% yield) as a white solid. **32**: $R_f$ = 0.29 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3364, 2903, 2383, 2315, 1760, 1597, 1454, 1226, 1117, 1031 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 9.46 (br s, 1 H, exchangeable), 7.47 (d, *J* = 7.8 Hz, 1 H), 7.36 (d, *J* = 8.1 Hz, 1 H), 7.33–7.24 (m, 5 H), 7.21–7.14 (m, 1 H), 7.13–7.05 (m, 1 H), 4.27–4.11 (m, 2 H), 3.62 (s, 2 H), 3.55–3.45 (m, 2 H), 2.96–2.85 (m, 1 H), 2.84–2.74 (m, 3 H), 1.57 (s, 3 H), 1.28 (t, *J* = 7.1 Hz, 3 H); $^{13}C$ NMR (126 MHz, $CDCl_3$, 45 ºC) δ 173.2, 169.9, 136.2, 136.0, 133.7, 129.3, 128.8, 127.4, 126.5, 122.0, 119.5, 118.4, 111.4, 106.6, 61.3, 61.2, 48.3, 43.3, 40.5, 23.0, 19.0, 14.2; HRMS (CI) calcd for $C_{24}H_{27}N_2O_4^+$ $[M + H]^+$ 407.1965, found 407.1963.



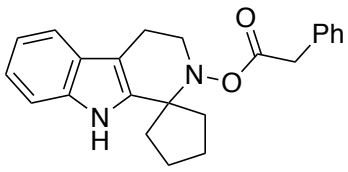
**33**

**Methyl 1-methyl-2-(2-phenylacetoxy)-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-*b*]indole-1-carboxylate (33).** Prepared using the general procedure described above with **S30** and phenylacetyl chloride, ultimately yielding **33** (0.087 g, 92% yield) as a yellow solid. **33**: $R_f$ = 0.38 (silica gel, hexanes/EtOAc = 2/1); IR (film) $\nu_{max}$ 3365, 2383, 2315, 1764, 1598, 1454, 1232, 1119, 1073, 736 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.50 (br s, 1 H, exchangeable), 7.50 (d, *J* = 7.8 Hz, 1 H), 7.37 (d, *J* = 8.1 Hz, 1 H), 7.34–7.23 (m, 5 H), 7.23–7.17 (m, 1 H), 7.15–7.09 (m, 1 H), 3.87–3.75 (m, 1 H), 3.59–3.47 (m, 3 H), 3.45 (s, 3 H), 3.03–2.94 (m, 1 H), 2.87–2.79 (m, 1 H), 1.74 (s, 3 H); $^{13}C$ NMR (126 MHz, $CDCl_3$, 45 ºC) δ 172.5, 169.4, 136.6, 133.6, 131.7, 129.3, 128.7, 127.3, 126.6, 122.5, 119.8, 118.6, 111.3, 108.1, 67.1, 52.6, 48.5, 40.3, 24.3, 18.7; HRMS (CI) calcd for $C_{22}H_{23}N_2O_4^+$ $[M + H]^+$ 379.1652, found 379.1651.



**34**

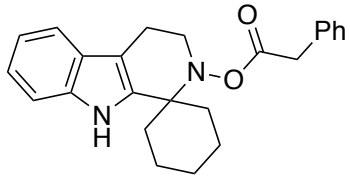
**1-acetyl-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (34).** Prepared using the general procedure described above with **S31** and phenylacetyl chloride, ultimately yielding **34** (0.072 g, 80% yield) as a white solid. **34**: $R_f$ = 0.34 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3379, 1757, 1713, 1597, 1454, 1352, 1300, 1231, 1112, 745, 695 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.36 (br s, 1 H, exchangeable), 7.50 (d, *J* = 7.8 Hz, 1 H), 7.36 (d, *J* = 8.1 Hz, 1 H), 7.33–7.16 (m, 6 H), 7.15–7.09 (m, 1 H), 3.76–3.66 (m, 1 H), 3.55 (s, 2 H), 3.49–3.41 (m, 1 H), 3.05–2.93 (m, 1 H), 2.83–2.73 (m, 1 H), 2.09 (s, 3 H), 1.60 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 209.9, 169.4, 136.6, 133.1, 132.1, 129.2, 128.8, 127.6, 126.4, 122.4, 119.7, 118.5, 111.4, 107.8, 71.7, 48.2, 40.3, 24.6, 21.1, 19.0; HRMS (CI) calcd for $C_{22}H_{23}N_2O_3^+$ $[M + H]^+$ 363.1703, found 363.1707.



**35**

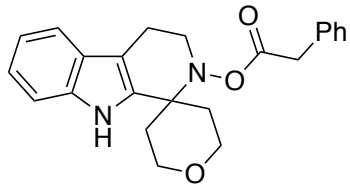
**4',9'-dihydrospiro[cyclopentane-1,1'-pyrido[3,4-*b*]indol]-2'(3'*H*)-yl 2-phenylacetate (35).** Prepared using the general procedure described above with **S32** and phenylacetyl chloride, ultimately yielding **35** (0.086 g, 95% yield) as a white solid. **35**: $R_f$ = 0.31 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3376, 2958, 1745, 1598, 1454, 1299, 1230, 1117, 744, 696 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.66 (br s, 1 H, exchangeable), 7.49 (d, *J* = 7.7 Hz, 1 H), 7.34 (d, *J* = 7.9 Hz, 1

H), 7.29–7.21 (m, 5 H), 7.21–7.15 (m, 1 H), 7.15–7.10 (m, 1 H), 3.74–3.60 (m, 1 H), 3.56 (s, 2 H), 3.51–3.36 (m, 1 H), 2.94–2.56 (m, 2 H), 2.12–2.05 (m, 2 H), 1.96–1.84 (m, 4 H), 1.82–1.73 (m, 2 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.4, 137.3, 135.9, 133.8, 129.2, 128.7, 127.3, 127.1, 121.8, 119.7, 118.3, 110.9, 106.6, 70.5, 49.1, 41.0, 40.4, 36.1, 25.7, 25.6, 17.7; HRMS (ESI) calcd for $C_{23}H_{25}N_2O_2^+$ $[M + H]^+$ 361.1911, found 361.1913.



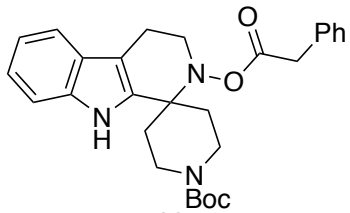

**36**

**4',9'-dihydrospiro[cyclohexane-1,1'-pyrido[3,4-*b*]indol]-2'(3'*H*)-yl 2-phenylacetate (36).** Prepared using the general procedure described above with **S33** and phenylacetyl chloride, ultimately yielding **36** (0.080 g, 86% yield) as a white solid. **36**: $R_f$ = 0.41 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3379, 2938, 2854, 1738, 1598, 1446, 1297, 1271, 1230, 1118, 744, 695 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.75 (br s, 1 H, exchangeable), 7.50 (d, *J* = 7.7 Hz, 1 H), 7.35 (d, *J* = 8.0 Hz, 1 H), 7.27–7.20 (m, 5 H), 7.20–7.16 (m, 1 H), 7.15–7.11 (m, 1 H), 3.80–3.66 (m, 1 H), 3.57–3.46 (m, 3 H), 2.98–2.77 (m, 1 H), 2.70–2.50 (m, 1 H), 2.02–1.88 (m, 3 H), 1.74–1.62 (m, 4 H), 1.50–1.42 (m, 1 H), 1.40–1.27 (m, 2 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.2, 138.0, 135.6, 133.8, 129.2, 128.6, 127.2 (2 C), 121.7, 119.6, 118.3, 111.0, 106.6, 60.9, 46.7, 40.5, 38.7, 33.2, 25.9, 21.5, 21.1, 17.2; HRMS (ESI) calcd for $C_{24}H_{27}N_2O_2^+$ $[M + H]^+$ 375.2067, found 375.2068.



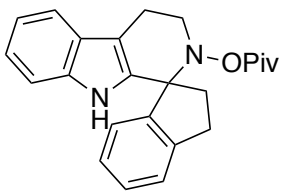

**37**

**2,3,4',5,6,9'-hexahydrospiro[pyran-4,1'-pyrido[3,4-*b*]indol]-2'(3'*H*)-yl 2-phenylacetate (37).** Prepared using the general procedure described above with **S34** and phenylacetyl chloride, ultimately yielding **37** (0.089 g, 94% yield) as a yellow solid. **37**: $R_f$ = 0.29 (silica gel, hexanes/EtOAc = 2/1); IR (film) $\nu_{max}$ 3295, 2956, 1748, 1597, 1453, 1305, 1264, 1229, 1105, 744 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.92 (br s, 1 H, exchangeable), 7.51 (d, *J* = 7.7 Hz, 1 H), 7.36 (d, *J* = 8.0 Hz, 1 H), 7.29–7.18 (m, 6 H), 7.17–7.11 (m, 1 H), 4.19–4.00 (m, 1 H), 3.81–3.64 (m, 3 H), 3.61–3.42 (m, 4 H), 3.03–2.79 (m, 1 H), 2.75–2.51 (m, 1 H), 2.05–1.95 (m, 2 H), 1.86–1.77 (m, 2 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 169.9, 136.1, 136.0, 133.5, 129.1, 128.8, 127.4, 126.9, 122.0, 119.6, 118.4, 111.3, 107.2, 63.3, 63.1, 59.0, 47.2, 40.5, 38.0, 32.9, 17.1; HRMS (ESI) calcd for $C_{23}H_{25}N_2O_3^+$ $[M + H]^+$ 377.1860, found 377.1865.



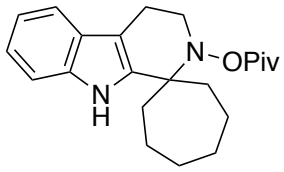

**38**

***tert*-butyl 2'-(2-phenylacetoxy)-2',3',4',9'-tetrahydrospiro[piperidine-4,1'-pyrido[3,4-*b*]indole]-1-carboxylate (38).** Prepared using the general procedure described above with **S35** and phenylacetyl chloride, ultimately yielding **38** (0.109 g, 91% yield) as a white solid. **38**: $R_f$ = 0.31 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3304, 2975, 1755, 1670, 1598, 1435, 1366, 1247, 1163, 1113, 744 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 8.36 (br s, 1 H, exchangeable), 7.51 (d, *J* = 7.7 Hz, 1 H), 7.36 (d, *J* = 8.0 Hz, 1 H), 7.25–7.10 (m, 7 H), 3.97–3.62 (m, 3 H), 3.58–3.32 (m, 4 H), 3.13–2.78 (m, 2 H), 2.77–2.54 (m, 1 H), 1.92–1.78 (m, 4 H), 1.48 (s, 9 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 169.9, 154.7, 136.2, 136.1, 133.5, 129.1, 128.7, 127.4, 126.7, 121.8, 119.4, 118.2, 111.5, 106.7, 79.9, 59.7, 47.2, 40.6, 40.0, 38.7, 37.4, 32.5, 28.7, 17.2; HRMS (CI) calcd for $C_{28}H_{34}N_3O_4^+$ $[M + H]^+$ 476.2544, found 476.2543.



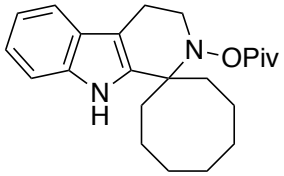

**39**

**2,3,4',9'-tetrahydrospiro[indene-1,1'-pyrido[3,4-*b*]indol]-2'(3'*H*)-yl pivalate (39).** Prepared using the general procedure described above with **S36** and pivaloyl chloride, ultimately yielding **39** (0.085 g, 90% yield) as a brown solid. **39**: $R_f$ = 0.57 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3388, 2970, 1739, 1597, 1478, 1460, 1396, 1303, 1274, 1125, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$, 45 ºC) δ 7.58–7.53 (m, 1 H), 7.40 (br s, 1 H, exchangeable), 7.34–7.27 (m, 2 H), 7.23–7.18 (m, 1 H), 7.17–7.08 (m, 4 H), 3.74–3.64 (m, 1 H), 3.58–3.50 (m, 1 H), 3.40–3.29 (m, 1 H), 3.25–3.16 (m, 1 H), 3.08–2.99 (m, 1 H), 2.96–2.89 (m, 1 H), 2.85–2.73 (m, 1 H), 2.47–2.36 (m, 1 H), 1.00 (s, 9 H); $^{13}C$ NMR (126 MHz, $CDCl_3$, 45 ºC) δ 176.0, 145.6, 142.9, 136.5, 136.2, 129.0, 127.0, 126.9, 126.5, 124.7, 122.0, 119.7, 118.5, 111.1, 108.5, 74.6, 49.7, 38.6, 30.8, 27.2, 27.1, 19.4; HRMS (CI) calcd for $C_{24}H_{27}N_2O_2^+$ $[M + H]^+$ 375.2067, found 375.2066.



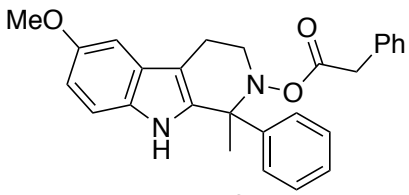

**40**

**4',9'-dihydrospiro[cycloheptane-1,1'-pyrido[3,4-*b*]indol]-2'(3'*H*)-yl pivalate (49).** Prepared using the general procedure described above with **S37** and pivaloyl chloride, ultimately yielding **40** (0.064 g, 72% yield) as a white solid. **40**: $R_f$ = 0.54 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3379, 2928, 1728, 1597, 1564, 1448, 1395, 1277, 1127, 744 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$, 45 ºC) δ 7.85 (br s, 1 H, exchangeable), 7.51 (d, *J* = 7.7 Hz, 1 H), 7.36 (d, *J* = 8.0 Hz, 1 H), 7.21–7.16 (m, 1 H), 7.15–7.11 (m, 1 H), 3.69–3.56 (m, 2 H), 2.94–2.72 (m, 2 H), 2.21–2.10 (m, 2 H), 1.98–1.88 (m, 4 H), 1.80–1.74 (m, 2 H), 1.69–1.57 (m, 4 H), 1.18 (s, 9 H); $^{13}C$ NMR (126 MHz, $CDCl_3$, 45 ºC) δ 176.4, 139.6, 135.9, 127.4, 121.6, 119.6, 118.4, 110.9, 105.6, 64.7, 47.1, 39.1, 30.0, 27.4, 27.3, 23.1, 17.6; HRMS (CI) calcd for $C_{22}H_{31}N_2O_2^+$ $[M + H]^+$ 355.2380, found 355.2378.




**41**

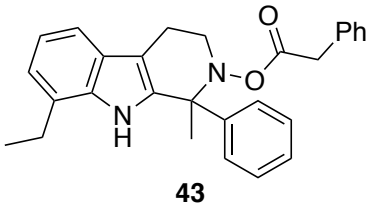
**4',9'-dihydrospiro[cyclooctane-1,1'-pyrido[3,4-*b*]indol]-2'(3'*H*)-yl pivalate (41).** Prepared using the general procedure described above with **S38** and pivaloyl chloride, ultimately yielding **41** (0.050 g, 54% yield) as a white solid. **41**: $R_f$ = 0.58 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3378, 2925, 1728, 1597, 1564, 1448, 1396, 1278, 1127, 1028, 743 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$, 45 ºC) δ 7.81 (br s, 1 H, exchangeable), 7.51 (d, *J* = 7.7 Hz, 1 H), 7.36 (d, *J* = 8.0 Hz, 1 H), 7.21–7.15 (m, 1 H), 7.14–7.09 (m, 1 H), 3.73–3.54 (m, 2 H), 2.99–2.65 (m, 2 H), 2.20–2.08 (m, 2 H), 2.05–1.95 (m, 4 H), 1.72–1.55 (m, 8 H), 1.15 (s, 9 H); $^{13}C$ NMR (126 MHz, $CDCl_3$, 45 ºC) δ 176.3, 139.4, 135.8, 127.4, 121.6, 119.6, 118.4, 110.9, 105.5, 64.2, 46.9, 39.1, 28.4, 27.4, 27.3, 25.3, 22.0, 17.6; HRMS (ESI) calcd for $C_{23}H_{33}N_2O_2^+$ $[M + H]^+$ 369.2537, found 369.2537.




**42**

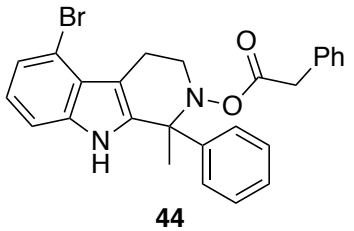
**6-methoxy-1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (42).** Prepared using the general procedure described above with **S39** and phenylacetyl chloride, ultimately yielding **42** (0.098 g, 92% yield) as a brown solid. **42**: $R_f$ = 0.37 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3372, 1746, 1597, 1564, 1484, 1453, 1217, 1165, 1116, 1027, 699 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.62 (br s, 1 H,

exchangeable), 7.33–7.20 (m, 9 H), 7.20–7.14 (m, 2 H), 7.01 (d, $J$ = 2.5 Hz, 1 H), 6.87 (dd, $J$ = 8.7, 2.5 Hz, 1 H), 3.89 (s, 3 H), 3.53 (s, 2 H), 3.48–3.39 (m, 1 H), 3.25–3.14 (m, 1 H), 3.00–2.89 (m, 1 H), 2.78–2.67 (m, 1 H), 1.77 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.5, 154.2, 136.1, 133.7, 131.2, 129.2, 128.6, 128.2 (2 C), 127.9, 127.7 (2 C), 127.3, 127.2, 111.9, 108.0, 100.7, 65.7, 56.0, 47.9, 40.2, 24.3, 18.4; HRMS (ESI) calcd for $C_{27}H_{27}N_2O_3^+$ $[M + H]^+$ 427.2016, found 427.2015.



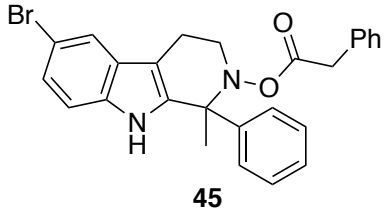
**43**

**8-ethyl-1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (43).** Prepared using the general procedure described above with **S40** and phenylacetyl chloride, ultimately yielding **43** (0.096 g, 90% yield) as a yellow solid. **43**: $R_f$ = 0.50 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3382, 2965, 1742, 1597, 1564, 1494, 1446, 1393, 1236, 1116, 700 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.60 (br s, 1 H, exchangeable), 7.43 (d, $J$ = 7.8 Hz, 1 H), 7.32–7.22 (m, 8 H), 7.21–7.17 (m, 2 H), 7.17–7.12 (m, 1 H), 7.11–7.05 (m, 1 H), 3.53 (s, 2 H), 3.47–3.40 (m, 1 H), 3.24–3.14 (m, 1 H), 3.03–2.93 (m, 1 H), 2.85 (q, $J$ = 7.6 Hz, 2 H), 2.79–2.68 (m, 1 H), 1.81 (s, 3 H), 1.36 (t, $J$ = 7.6 Hz, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.4, 135.0, 134.7, 133.7, 129.2, 128.6, 128.3, 128.0, 127.8 (2 C), 127.2, 126.7, 126.5, 120.7, 120.1, 116.4, 109.0, 65.7, 47.9, 40.2, 24.5, 24.0, 18.4, 13.9; HRMS (CI) calcd for $C_{28}H_{29}N_2O_2^+$ $[M + H]^+$ 425.2224, found 425.2225.



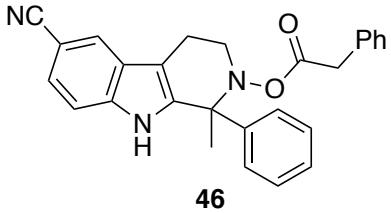
**44**

**5-bromo-1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (44).** Prepared using the general procedure described above with **S41** and phenylacetyl chloride, ultimately yielding **44** (0.099 g, 83% yield) as a white solid. **44**: $R_f$ = 0.44 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3357, 1743, 1597, 1494, 1446, 1317, 1237, 1118, 729, 700 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.85 (br s, 1 H, exchangeable), 7.32–7.20 (m, 10 H), 7.20–7.14 (m, 2 H), 7.01 (t, $J$ = 7.9 Hz, 1 H), 3.54 (s, 2 H), 3.47–3.39 (m, 1 H), 3.34–3.24 (m, 1 H), 3.23–3.11 (m, 2 H), 1.77 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.4, 137.1, 136.3, 133.6, 129.3, 128.7, 128.4, 127.9, 127.7, 127.6, 127.3, 125.9, 123.7, 122.9, 114.3, 110.3, 109.2, 65.6, 47.9, 40.3, 24.4, 20.5; HRMS (ESI) calcd for $C_{26}H_{24}BrN_2O_2^+$ $[M + H]^+$ 475.1016, found 475.1017.



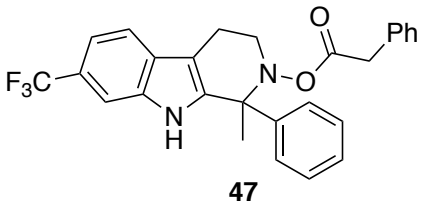
**45**

**6-bromo-1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (45).** Prepared using the general procedure described above with **S42** and phenylacetyl chloride, ultimately yielding **45** (0.089 g, 74% yield) as a white solid. **45**: $R_f$ = 0.44 (silica gel, hexanes/EtOAc = 2/1); IR (film) $\nu_{max}$ 3362, 1743, 1597, 1447, 1301, 1220, 1117, 858, 798, 700 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.76 (br s, 1 H, exchangeable), 7.67 (d, $J$ = 1.9 Hz, 1 H), 7.31–7.27 (m, 1 H), 7.26–7.19 (m, 9 H), 7.18–7.12 (m, 2 H), 3.53 (s, 2 H), 3.47–3.38 (m, 1 H), 3.24–3.12 (m, 1 H), 2.97–2.86 (m, 1 H), 2.78–2.65 (m, 1 H), 1.76 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 170.3, 136.7, 134.8, 133.6, 129.2, 128.7, 128.7, 128.4, 128.0, 127.7, 127.6, 127.3, 124.9, 121.3, 113.0, 112.6, 108.0, 65.6, 47.7, 40.3, 24.3, 18.3; HRMS (ESI) calcd for $C_{26}H_{24}BrN_2O_2^+$ $[M + H]^+$ 475.1016, found 475.1014.



**46**

**6-cyano-1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (46).** Prepared using the general procedure described above with **S43** and phenylacetyl chloride, ultimately yielding **46** (0.069 g, 65% yield) as a white solid. **46**: $R_f$ = 0.44 (silica gel, hexanes/EtOAc = 2/1); IR (film) $\nu_{max}$ 3328, 2219, 1747, 1598, 1473, 1446, 1319, 1232, 1184, 1116, 699 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 8.20 (br s, 1 H, exchangeable), 7.92–7.84 (m, 1 H), 7.46–7.35 (m, 2 H), 7.31–7.17 (m, 8 H), 7.17–7.11 (m, 2 H), 3.53 (s, 2 H), 3.48–3.40 (m, 1 H), 3.25–3.15 (m, 1 H), 2.98–2.89 (m, 1 H), 2.81–2.68 (m, 1 H), 1.78 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 170.3, 138.0, 137.8, 133.5, 129.2, 128.7, 128.4, 128.1, 127.6, 127.6, 127.3, 126.8, 125.1, 124.1, 120.9, 112.0, 109.0, 102.6, 65.6, 47.6, 40.2, 24.3, 18.1; HRMS (ESI) calcd for $C_{27}H_{24}N_3O_2^+$ $[M + H]^+$ 422.1863, found 422.1863.



**47**

**1-methyl-1-phenyl-7-(trifluoromethyl)-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl 2-phenylacetate (47).** Prepared using the general procedure described above with **S44** and phenylacetyl chloride, ultimately yielding **47** (0.072 g, 62% yield) as a white solid. **47**: $R_f$ = 0.44 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3355, 1743, 1597, 1564, 1448, 1392, 1336, 1220, 1159, 1114, 1052, 699 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.95 (br s, 1 H, exchangeable), 7.66–7.59 (m, 2 H), 7.40 (d, *J* = 8.4 Hz, 1 H), 7.29–7.20 (m, 8 H), 7.18–7.12 (m, 2 H), 3.53 (s, 2 H), 3.49–3.42 (m, 1 H), 3.28–3.16 (m, 1 H), 3.01–2.91 (m, 1 H), 2.83–2.71 (m, 1 H), 1.79 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 170.4, 138.3, 135.1, 133.6, 129.2, 129.0, 128.7, 128.4, 128.3, 128.0, 127.8, 127.7, 127.3, 125.3 (q, *J* = 271.2 Hz), 124.1 (q, *J* = 31.9 Hz), 119.0, 116.6, 108.6, 65.7, 47.7, 40.3, 24.3, 18.3; HRMS (ESI) calcd for $C_{27}H_{24}F_3N_2O_2^+$ $[M + H]^+$ 465.1784, found 465.1784.

## F. Identification of Hydrolysis By-product

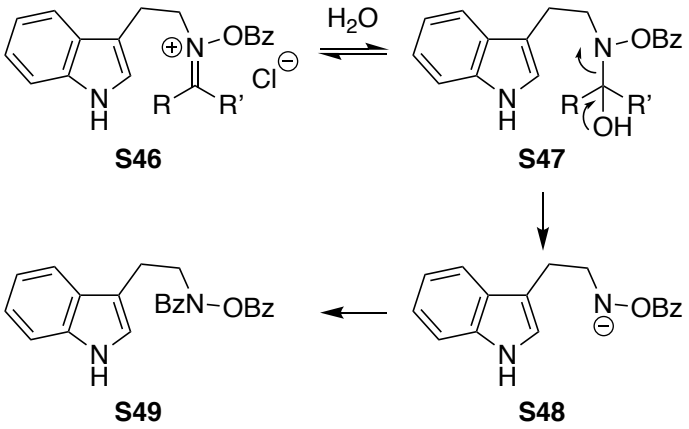
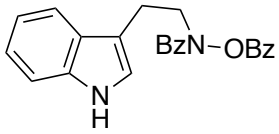



**Figure S1.** Proposed hydrolysis pathway.

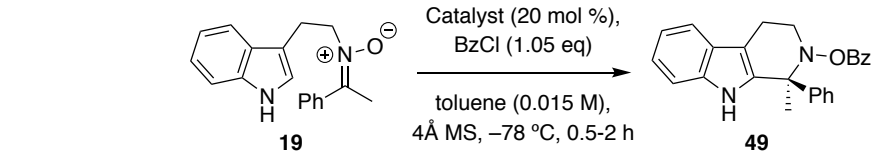


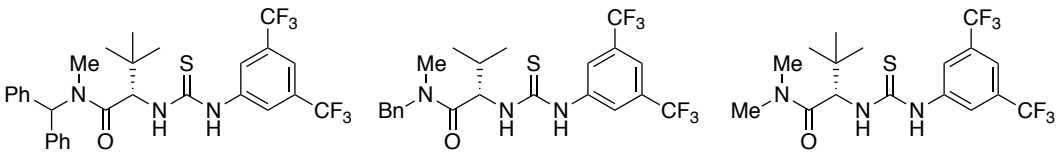

**S49**

***N*-(2-(1*H*-indol-3-yl)ethyl)-*N*-(benzoyloxy)benzamide (S49)**: $R_f$ = 0.16 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3406, 3059, 2925, 1762, 1654, 1451, 1239, 1010, 742, 704 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.16 (br s, 1 H, exchangeable), 7.93 (d, *J* = 7.5 Hz, 2 H), 7.64–7.57 (m, 1 H), 7.50–7.39 (m, 5 H), 7.37–7.30 (m, 2 H), 7.26–7.14 (m, 3 H), 7.09–7.02 (m, 2 H), 4.20 (t, *J* = 7.2 Hz, 2 H), 3.23 (t, *J* = 7.2 Hz, 2 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 170.5, 164.4, 136.4, 134.2, 133.7, 130.9, 130.0, 128.8, 128.3, 127.8, 127.4, 127.1, 122.6, 122.2, 119.6, 118.6, 112.1, 111.4, 51.2, 23.4; HRMS (ESI) calcd for $C_{24}H_{21}N_2O_3^+$ $[M + H]^+$ 385.1547, found 385.1547.

## G. Catalyst Screening and Optimization

**Table S1.** Selected exploration of varied catalysts to achieve asymmetric cyclization of nitrone **19** using BzCl.[a]

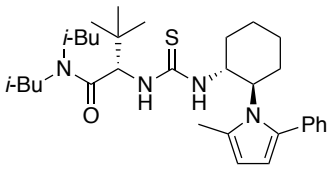


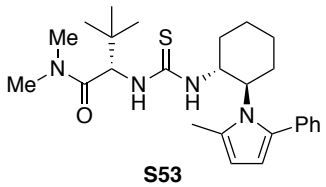
**48**
($CH_2Cl_2$: 79%, 51% *ee*)
(Toluene: 52%, 64% *ee*)

**S50**
($CH_2Cl_2$: 77%, 36% *ee*)
(Toluene: 52%, 55% *ee*)

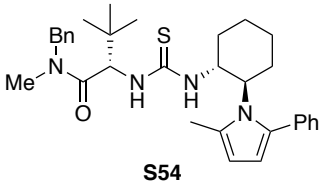
**S51**
(48% *ee*)



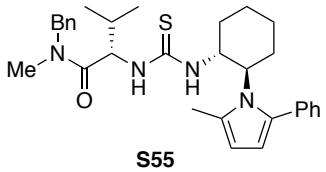
**S52**
(racemic)



**S53**
(<20%, 76% *ee*)



**S54**
(<20%, 81% *ee*)



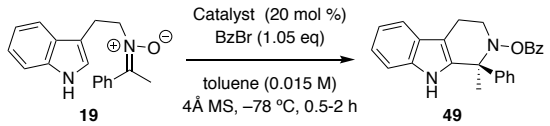
**S55**
(<20%, 77% *ee*)

[a] Final reactions were performed with **19** (0.09 mmol) under argon.

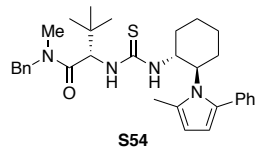
*Note:* All other acyl chlorides tested did not provide substantial improvements in enantioselectivity (4-OMeBzCl, 4-ClBzCl, 4-$NO_2$BzCl, 4-$CF_3$BzCl, 2-$CF_3$BzCl, 3,5-$CF_3$BzCl, AcCl, PivCl, methyl chloroformate, $PhCH_2COCl$, $Ph_2CHCOCl$, 9-anthracenecarbonyl chloride, 1-naphthoyl chloride), except 2-naphthoyl chloride that provided an ~10% *ee* increase with catalyst **S50**. Chiral auxiliary-based acyl chlorides were not able to induce good diastereoselectivity (~1:1). $Bz_2O$ was unable to form the desired *N*-acyloxyiminium species, and thus no reaction occurred. All acid (HCl) and base (2,6-lutidine, 2,6-di-*tert*-butylpyridine, pyridine, 4-DMAP, *i*-$Pr_2NEt$, TMPDA) additives tested caused detrimental effects to the enantioselectivity of the reaction. Other solvents investigated led to no reaction ($Et_2O$ or hexanes) or lower enantioselectivity (MTBE). Chiral phosphoric acids were not successful in promoting the desired cyclization with or without acyl chloride additive.

After exhaustive screening of catalysts under the BzCl system (only selected examples shown above in Table S1), we opted to change to BzBr based on the known effect halide counter ions can have on thiourea binding.[8,9b] We then rescreened our collection of catalysts that were purchased, donated by Merck, or synthesized according to literature procedures,[9] with key results shown in Table S2.

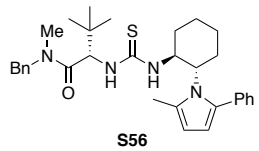
**Table S2.** Exploration of varied catalysts to achieve asymmetric cyclization of nitrone **19** using BzBr.[a]



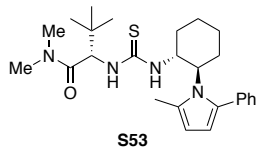

**19** → **49**



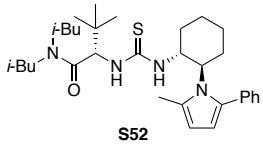
**S54**
(60%, 80% *ee*)



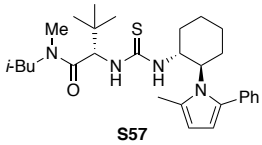
**S56**
(40% *ee*)



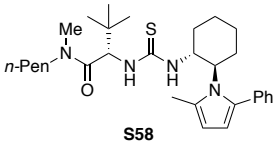
**S53**
(45%, 79% *ee*)



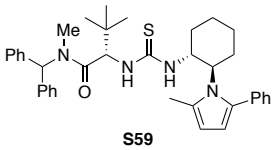
**S52**
(15% *ee*)



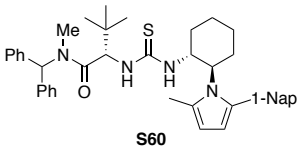
**S57**
(69% *ee*)



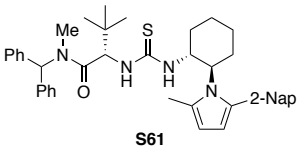
**S58**
(70% *ee*)



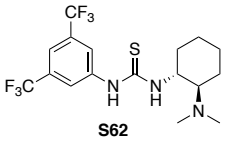
**S59**
(55%, 87% *ee*)[b][c]



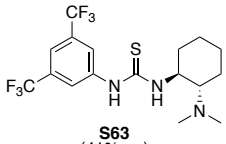
**S60**
(81% *ee*)[b]



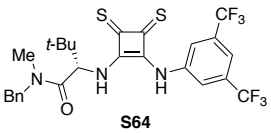
**S61**
(85% *ee*)[b][c]



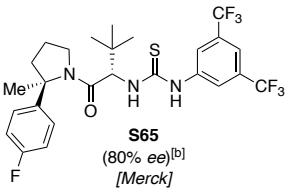
**S62**
(-41% *ee*)



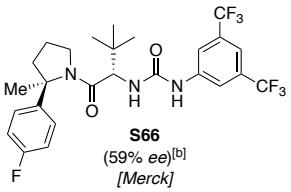
**S63**
(41% *ee*)



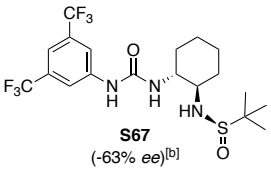
**S64**
(21% *ee*)



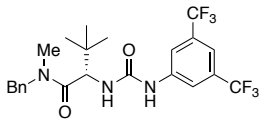
**S65**
(80% *ee*)[b]
*[Merck]*



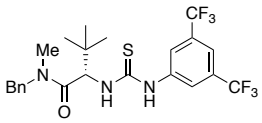
**S66**
(59% *ee*)[b]
*[Merck]*



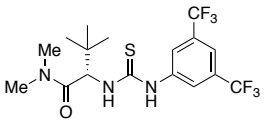
**S67**
(-63% *ee*)[b]
*[Merck]*



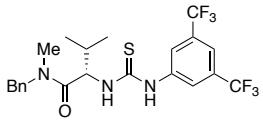
**S68**
(73% *ee*)



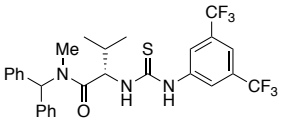
**S69**
(52%, 79% *ee*)



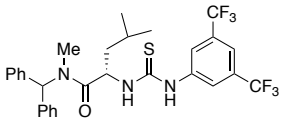
**S51**
(50%, 80% *ee*)



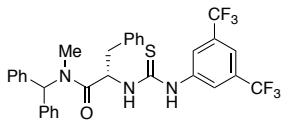
**S50**
(53%, 82% *ee*)



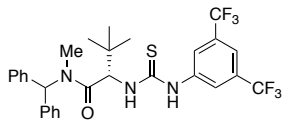
**S70**
(83% *ee*)



**S71**
(79% *ee*)



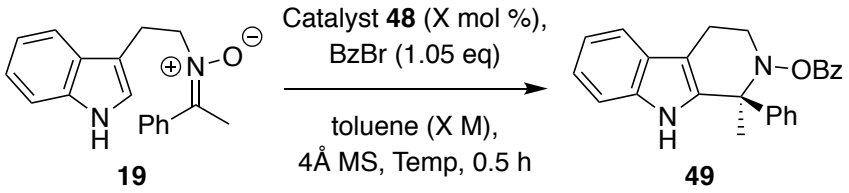
**S72**
(68% *ee*)



**48**
(75%, 83% *ee*)

[a] Final reactions were performed with **19** (0.09 mmol) under argon; [b] Catalyst (10 mol %); [c] very challenging or unsuccesful separation of catalyst and product.

**Table S3.** Optimization of reaction conditions with thiourea **48**.[a]




**19** **49**

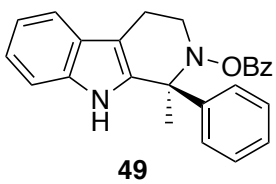
| Entry | (X mol %) | M (mol/L) | Temp (ºC) | Yield [%] | *ee* [%] |
|---|---|---|---|---|---|
| 1 | 20 mol % | 0.015 | –78 ºC | 75 | 83 |
| 2 | 5 mol % | 0.015 | –78 ºC | 59 | 77 |
| 3 | 10 mol % | 0.015 | –78 ºC | 83 | 83 |
| 4 | 10 mol % | 0.02 | –78 ºC | 83 | 78 |
| 5 | 10 mol % | 0.005 | –78 ºC | 85 | 85 |
| 6 | 10 mol % | 0.01 | –78 ºC | 85 | 84 |
| 7 | 10 mol % | 0.01 | –93 ºC | 90 | 82 |

[a] Final reactions were performed with **19** (0.09 mmol) under argon.

*Note:* Entry 6 (Table S3) was chosen as the optimal conditions, because it provided the best results in combination with ease of reaction set-up. When the reaction was run on scale (0.25 mmol) the yield and enantioselectivity slightly decreased to 83% and 82% *ee*, respectively (see section H, below).

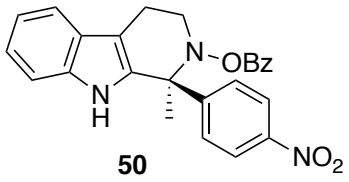
## H. General Procedure for Enantioselective Pictet–Spengler Reactions of Nitrones.

Molecular sieves (4Å, powder 1.25 g) were flame-dried *in vacuo* and then allowed to cool to 23 °C before being suspended in toluene (25.0 mL) under an argon atmosphere. Nitrone (0.25 mmol, 1.0 equiv) and catalyst **48**[10] (0.015 g, 0.025 mmol, 0.1 equiv) were added sequentially. The reaction contents were then cooled to –78 ºC and stirred for 10 min before benzoyl bromide (0.031 mL, 0.26 mmol, 1.05 equiv) was added. The reaction mixture was then stirred for an additional 30 min at –78 ºC. Upon completion, the contents were quenched by the addition of saturated aqueous $NaHCO_3$ (25 mL), warmed to 23 ºC, poured into a separatory funnel, and extracted with EtOAc (3 × 75 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, hexanes/$Et_2O$ = 1/0→4/1) to yield **49**–**57**. *Note:* These reactions must be run under strictly anhydrous conditions to avoid hydrolysis of the *N*-acyloxyiminium species. In addition, the enantiomeric excess was determined by chiral HPLC (ChiralPak AD-H, 90:10 hexanes/*i*-PrOH, 1 mL/min, 254 nm).



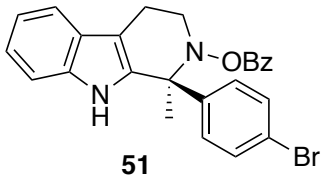

**49**

**(*S*)-1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (49).** Prepared using the general procedure described above with **19**, ultimately yielding **49** (0.080 g, 83% yield, 82% *ee*) as a white solid. **49**: see above for data; $[\alpha]_D^{25} = -24.6^\circ$ (c = 1.00, $CHCl_3$).



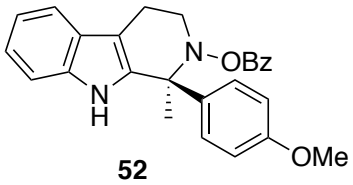
**50**

**(*S*)-1-methyl-1-(4-nitrophenyl)-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (50).** Prepared using the general procedure described above with **S18**, ultimately yielding **50** (0.080 g, 75% yield, 81% *ee*) as a yellow solid. **50**: $R_f$ = 0.38 (silica gel, hexanes/EtOAc = 4/1); $[\alpha]_D^{25}$ = –11.0º (c = 1.00, $CHCl_3$); IR (film) $\nu_{max}$ 3370, 1726, 1520, 1450, 1348, 1233, 1058, 1023, 746, 708 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.13 (d, *J* = 9.1 Hz, 2 H), 7.90 (d, *J* = 8.2 Hz, 2 H), 7.86 (br s, 1 H, exchangeable), 7.69–7.60 (m, 3 H), 7.58–7.51 (m, 1 H), 7.45–7.36 (m, 3 H), 7.31–7.26 (m, 1 H), 7.25–7.19 (m, 1 H), 3.71–3.61 (m, 1 H), 3.32–3.13 (m, 2 H), 2.95–2.82 (m, 1 H), 1.97 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 165.4, 147.4, 136.4, 133.7, 133.5, 129.6, 129.4, 128.9, 128.7, 126.9, 124.0, 123.5, 122.7, 120.1, 119.0, 111.4, 109.0, 65.7, 48.5, 24.8, 18.5; HRMS (ESI) calcd for $C_{25}H_{22}N_3O_4^+$ $[M + H]^+$ 428.1605, found 428.1604.



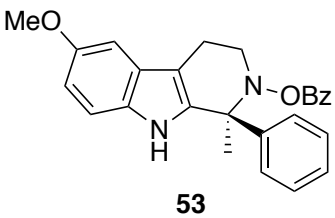
**51**

**(*S*)-1-(4-bromophenyl)-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (51).** Prepared using the general procedure described above with **S45**, ultimately yielding **51** (0.093 g, 80% yield, 80% *ee*) as a white solid. **51:** $R_f$ = 0.58 (silica gel, hexanes/EtOAc = 4/1); $[\alpha]_D^{25}$ = –9.6º (c = 1.00, $CHCl_3$); IR (film) $\nu_{max}$ 3361, 1725, 1485, 1450, 1271, 1177, 1059, 1009, 745, 709 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.1 Hz, 2 H), 7.80 (br s, 1 H, exchangeable), 7.61 (d, *J* = 7.8 Hz, 1 H), 7.57–7.49 (m, 1 H), 7.44–7.34 (m, 5 H), 7.31–7.27 (m, 2 H), 7.25–7.17 (m, 2 H), 3.68–3.56 (m, 1 H), 3.37–3.25 (m, 1 H), 3.21–3.11 (m, 1 H), 2.91–2.78 (m, 1 H), 1.93 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 165.5, 136.3, 134.6, 133.3, 131.5 (2 C), 129.6, 129.6, 129.1, 128.6, 127.0, 122.4, 122.0, 119.9, 118.9, 111.3, 108.7, 65.5, 48.2, 24.9, 18.5; HRMS (ESI) calcd for $C_{25}H_{22}BrN_2O_2^+$ $[M + H]^+$ 461.0859, found 461.0855.



**52**

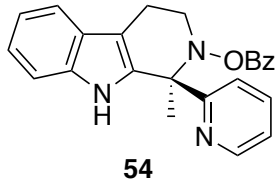
**(*S*)-1-(4-methoxyphenyl)-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (52).** Prepared using the general procedure described above with **S19**, ultimately yielding **52** (0.079 g, 77% yield, 83% *ee*) as a white solid. **52**: $R_f$ = 0.33 (silica gel, hexanes/EtOAc = 4/1); $[\alpha]_D^{25}$ = –20.8º (c = 1.00, $CHCl_3$); IR (film) $\nu_{max}$ 3364, 2934, 1726, 1508, 1451, 1248, 1179, 1024, 745, 710 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J* = 8.2 Hz, 2 H), 7.82 (br s, 1 H, exchangeable), 7.61 (d, *J* = 7.5 Hz, 1 H), 7.56–7.49 (m, 1 H), 7.42–7.34 (m, 3 H), 7.32–7.27 (m, 2 H), 7.25–7.16 (m, 2 H), 6.81 (d, *J* = 9.1 Hz, 2 H), 3.77 (s, 3 H), 3.66–3.56 (m, 1 H), 3.42–3.29 (m, 1 H), 3.21–3.11 (m, 1 H), 2.91–2.78 (m, 1 H), 1.94 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 165.5, 159.1, 136.2, 135.5, 133.1, 129.6 (2 C), 129.4, 129.1, 128.5, 127.1, 122.1, 119.7, 118.7, 113.6, 111.2, 108.4, 65.4, 55.4, 48.0, 25.1, 18.5; HRMS (CI) calcd for $C_{26}H_{25}N_2O_3^+$ $[M + H]^+$ 413.1860, found 413.1860.



**53**

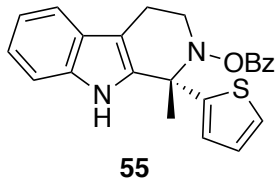
**(*S*)-6-methoxy-1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (53).** Prepared using the general procedure described above with **S39** in toluene:$CH_2Cl_2$ (4:1), ultimately yielding **53** (0.083 g, 81% yield, 80% *ee*) as a white solid. **53**: $R_f$ = 0.35 (silica gel, hexanes/EtOAc = 4/1); $[\alpha]_D^{25}$ = –37.0º (c = 1.00, $CHCl_3$); IR (film) $\nu_{max}$ 3362, 2936, 1728, 1486, 1451, 1246, 1166, 1062, 1023, 709 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 7.1 Hz, 2 H), 7.70 (br s,

1 H, exchangeable), 7.55–7.49 (m, 1 H), 7.41–7.34 (m, 4 H), 7.32–7.24 (m, 4 H), 7.06 (d, $J$ = 2.4 Hz, 1 H), 6.90 (dd, $J$ = 8.7, 2.4 Hz, 1 H), 3.90 (s, 3 H), 3.66–3.58 (m, 1 H), 3.38–3.27 (m, 1 H), 3.18–3.08 (m, 1 H), 2.86–2.74 (m, 1 H), 1.95 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 165.5, 154.3, 136.1, 133.2, 131.3, 129.6, 129.3, 128.5, 128.4 (2 C), 127.9 (2 C), 127.5, 112.0, 111.9, 108.4, 100.9, 66.0, 56.1, 48.1, 25.1, 18.5; HRMS (ESI) calcd for $C_{26}H_{25}N_2O_3^+$ $[M + H]^+$ 413.1860, found 413.1861.



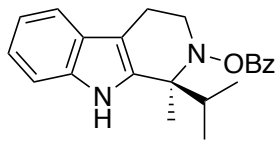
**54**

**(*R*)-1-methyl-1-(pyridin-2-yl)-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (54).** Prepared using the general procedure described above with **S21** in toluene:$CH_2Cl_2$ (4:1), ultimately yielding **54** (0.069 g, 72% yield, 55% *ee*) as a white solid. **54**: $R_f$ = 0.21 (silica gel, hexanes/EtOAc = 4/1); $[\alpha]_D^{25}$ = +21.2 (c = 1.00, $CHCl_3$); IR (film) $\nu_{max}$ 3395, 2991, 2937, 1739, 1588, 1451, 1245, 1058, 737, 709 cm$^{-1}$; $^1$H NMR (400 MHz, $CDCl_3$) δ 8.62–8.55 (m, 1 H), 8.02–7.92 (m, 1 H), 7.91–7.70 (m, 2 H), 7.66–7.58 (m, 1 H), 7.57–7.46 (m, 2 H), 7.43–7.29 (m, 3 H), 7.21–7.06 (m, 4 H), 3.92–3.69 (m, 2 H), 3.22–3.10 (m, 1 H), 3.05–2.94 (m, 1 H), 2.05 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 165.3, 163.4, 148.5, 137.3, 136.6, 136.3, 133.2, 129.5, 129.2, 128.5, 126.7, 122.3, 121.8, 120.9, 119.4, 118.5, 111.3, 106.6, 67.5, 48.5, 24.0, 19.5; HRMS (ESI) calcd for $C_{24}H_{22}N_3O_2^+$ $[M + H]^+$ 384.1707, found 384.1707.



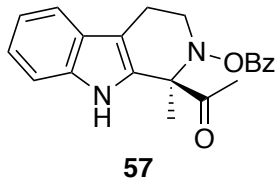
**55**

**(*S*)-1-methyl-1-(thiophen-2-yl)-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (55).** Prepared using the general procedure described above with **S22**, ultimately yielding **55** (0.080 g, 82% yield, -53% *ee*) as a white solid. **55**: $R_f$ = 0.43 (silica gel, hexanes/EtOAc = 4/1); $[\alpha]_D^{25}$ = +11.1º (c = 1.00, $CHCl_3$); IR (film) $\nu_{max}$ 3365, 2924, 1730, 1451, 1265, 1177, 1062, 1024, 740, 708 cm$^{-1}$; $^1$H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, $J$ = 7.2 Hz, 2 H), 7.78 (br s, 1 H, exchangeable), 7.62–7.51 (m, 2 H), 7.44–7.33 (m, 3 H), 7.31 (d, $J$ = 5.4 Hz, 1 H), 7.25–7.13 (m, 2 H), 6.94–6.87 (m, 1 H), 6.79 (s, 1 H), 3.68–3.49 (m, 2 H), 3.25–3.11 (m, 1 H), 3.01–2.91 (m, 1 H), 2.06 (s, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 165.2, 136.4, 135.1, 133.2, 129.7 (2 C), 129.2, 128.5 (2 C), 126.7, 126.3, 126.2, 122.3, 119.8, 118.8, 111.3, 108.1, 63.9, 48.5, 26.3, 19.4; HRMS (CI) calcd for $C_{23}H_{21}N_2O_2S^+$ $[M + H]^+$ 389.1318, found 389.1317.



**56**

**(*S*)-1-isopropyl-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (56).** Prepared using the general procedure described above with **S26**, ultimately yielding **56** (0.052 g, 60% yield, 62% *ee*) as a white solid. **56**: $R_f$ = 0.50 (silica gel, hexanes/EtOAc = 4/1); $[\alpha]_D^{25}$ = –30.8º (c = 1.00, $CHCl_3$); IR (film) $\nu_{max}$ 3383, 2965, 1724, 1451, 1270, 1089, 1064, 1024, 738, 710 cm$^{-1}$; $^1$H NMR (500 MHz, $CDCl_3$) δ 7.96–7.91 (m, 2 H), 7.76 (br s, 1 H, exchangeable), 7.57–7.50 (m, 2 H), 7.43–7.35 (m, 3 H), 7.23–7.18 (m, 1 H), 7.17–7.11 (m, 1 H), 3.75–3.62 (m, 2 H), 3.04–2.96 (m, 1 H), 2.96–2.88 (m, 1 H), 2.18–2.09 (m, 1 H), 1.54 (s, 3 H), 1.16 (d, $J$ = 6.8 Hz, 3 H), 1.05 (d, $J$ = 6.8 Hz, 3 H); $^{13}$C NMR (101 MHz, $CDCl_3$) δ 165.3, 137.4, 136.0, 133.1, 129.6 (2 C), 128.6, 126.9, 121.8, 119.5, 118.5, 110.9, 107.6, 65.5, 48.1, 37.4, 18.9, 18.7, 18.1, 18.0; HRMS (CI) calcd for $C_{22}H_{25}N_2O_2^+$ $[M + H]^+$ 349.1911, found 349.1910.

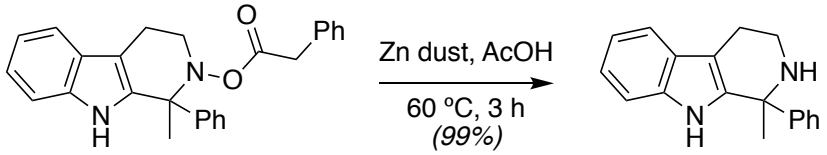


**57**

**(*R*)-1-acetyl-1-methyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-yl benzoate (57).** Prepared using the general procedure described above with **S31**, ultimately yielding **57** (0.064 g, 74% yield, 16% *ee*) as a white

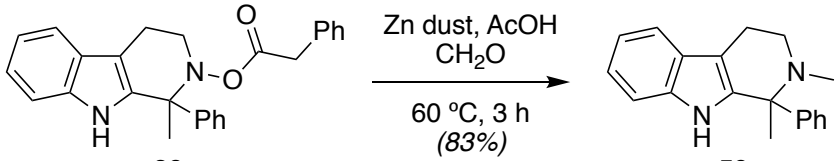
solid. **57**: $R_f$ = 0.38 (silica gel, hexanes/EtOAc = 4/1); $[\alpha]_D^{25}$ = –6.2º (c = 1.00, $CHCl_3$); IR (film) $\nu_{max}$ 3378, 2943, 1745, 1631, 1452, 1244, 1057, 1024, 737, 709 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.49 (br s, 1 H, exchangeable), 7.90 (d, *J* = 8.1 Hz, 2 H), 7.60–7.51 (m, 2 H), 7.45–7.35 (m, 3 H), 7.25–7.19 (m, 1 H), 7.17–7.11 (m, 1 H), 3.98–3.85 (m, 1 H), 3.65–3.52 (m, 1 H), 3.21–3.09 (m, 1 H), 2.96–2.83 (m, 1 H), 2.35 (s, 3 H), 1.77 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 210.0, 164.8, 136.7, 133.7, 132.2, 129.6, 128.7, 128.7, 126.5, 122.5, 119.8, 118.6, 111.5, 108.0, 72.1, 48.4, 24.9, 21.3, 19.0; HRMS (ESI) calcd for $C_{21}H_{21}N_2O_3^+$ $[M + H]^+$ 349.1547, found 349.1546.

## I. Derivatizations of Pictet–Spengler Products.




**20e** **58**

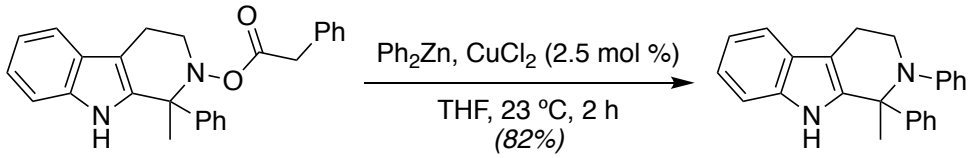
**1-methyl-1-phenyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-*b*]indole (58).**[11,12] To a solution of **20e** (0.041 g, 0.10 mmol, 1.0 equiv) in AcOH (1.5 mL) at 23 ºC was added activated Zn powder (0.101 g, 1.55 mmol, 15.0 equiv) in a microwave tube open to air. The microwave tube was then sealed and the reaction was heated to 60 ºC with stirring for 3 h. Upon completion, the contents were cooled to 23 ºC, filtered through a pad of Celite, washed with MeOH, and concentrated. The crude product was then diluted with $CH_2Cl_2$ (10 mL) and washed with a 1:1 mixture of aqueous $NH_3$ (5 mL, 30 wt. %) and saturated aqueous $NaHCO_3$ (5 mL). The remaining aqueous layer was extracted with $CH_2Cl_2$ (3 × 10 mL). Next, the combined organic extracts were washed with saturated aqueous $NaHCO_3$ (10 mL) and the new aqueous layer was extracted with $CH_2Cl_2$ (2 × 10 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated to yield pure **58** (0.027 g, 99% yield) as a white solid. **58**: $R_f$ = 0.29 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3404, 1597, 1564, 1449, 1392, 1295, 1121, 858, 744, 700 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.94 (br s, 1 H, exchangeable), 7.56 (d, *J* = 6.8 Hz, 1 H), 7.32–7.22 (m, 5 H), 7.21–7.10 (m, 2 H), 3.19–3.07 (m, 1 H), 2.95–2.69 (m, 3 H), 1.91 (br s, 1 H, exchangeable), 1.84 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 146.2, 138.2, 135.8, 128.4, 127.4, 127.4, 127.0, 121.9, 119.5, 118.5, 111.0, 109.7, 57.0, 39.8, 28.3, 22.8; HRMS (ESI) calcd for $C_{18}H_{19}N_2^+$ $[M + H]^+$ 263.1543, found 263.1545.




**20e** **59**

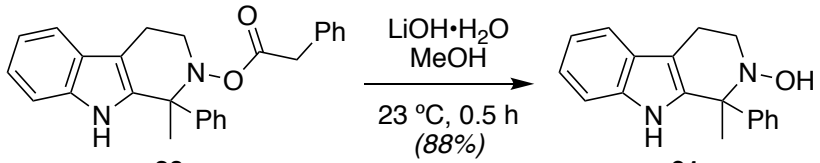
**1,2-dimethyl-1-phenyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-*b*]indole (59).**[11,13] To a solution of **20e** (0.041 g, 0.10 mmol, 1.0 equiv) in AcOH (1.5 mL) at 23 ºC sequentially added $CH_2O$ (0.050 mL, 37 wt. % in $H_2O$, 0.62 mmol, 6.0 equiv) and activated Zn powder (0.101 g, 1.55 mmol, 15.0 equiv) in a microwave tube open to air. The microwave tube was then sealed and the reaction was heated to 60 ºC with stirring for 3 h. Upon completion, the contents were cooled to 23 ºC, filtered through a pad of Celite, washed with MeOH, and concentrated. The

crude product was then diluted with $CH_2Cl_2$ (10 mL) and washed with a 1:1 mixture of aqueous $NH_3$ (5 mL, 30 wt. %) and saturated aqueous $NaHCO_3$ (5 mL). The remaining aqueous layer was extracted with $CH_2Cl_2$ (3 × 10 mL). Next, the combined organic extracts were washed with saturated aqueous $NaHCO_3$ (10 mL) and the new aqueous layer was extracted with $CH_2Cl_2$ (2 × 10 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated to yield pure **59** (0.024 g, 84% yield) as a yellow solid. **59**: $R_f$ = 0.44 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3412, 2942, 1447, 1297, 1251, 1179, 1026, 909, 741, 702 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.57–7.53 (m, 1 H), 7.45–7.40 (m, 2 H), 7.34–7.29 (m, 3 H), 7.29–7.24 (m, 1 H), 7.22–7.19 (m, 1 H), 7.16–7.09 (m, 2 H), 3.04–2.94 (m, 3 H), 2.94–2.86 (m, 1 H), 2.27 (s, 3 H), 1.79 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 144.5, 139.4, 136.3, 128.2, 127.9, 127.4, 127.2, 121.6, 119.4, 118.5, 110.9, 108.3, 61.0, 47.9, 37.7, 21.2, 19.3; HRMS (ESI) calcd for $C_{19}H_{21}N_2^+$ $[M + H]^+$ 277.1699, found 277.1698.




**20e** **60**

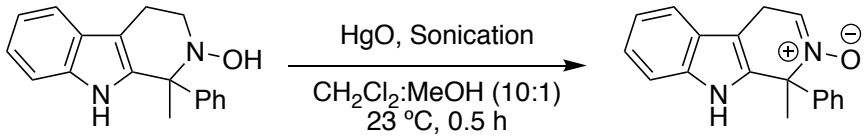
**1-methyl-1,2-diphenyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-*b*]indole (60).**[14] To a solution of PhMgBr (1.0 M in THF, 1.50 mL, 1.5 mmol, 1.0 equiv) in THF (1.5 mL) at 0 °C was added a freshly prepared solution of $ZnCl_2$ (1.0 M in THF, 0.75 mL, 0.75 mmol, 0.5 equiv) under an argon atmosphere. The resultant mixture warmed to 23 °C and stirred for 15 min. Upon completion, the diorganozinc reagent was titrated using iodine to determine the concentration (here as 0.19 M).[15] Then, the freshly prepared solution of $Ph_2Zn$ (0.19 M, 0.73 mL, 0.14 mmol, 1.1 equiv) was added to a solution of **20e** (0.050 g, 0.13 mmol, 1.0 equiv) and $CuCl_2$ (0.4 mg, 0.003 mmol, 0.025 equiv) in THF (1.0 mL) at 23 °C under an argon atmosphere. The resultant mixture was stirred at 23 °C for 2 h. Upon completion, the contents were quenched with saturated aqueous $NaHCO_3$ (5 mL), poured into a separatory funnel, and extracted with EtOAc (3 × 5 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, hexanes/EtOAc = 1/0→4/1) to yield **60** (0.035 g, 82% yield) as a white solid. **60**: $R_f$ = 0.74 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3413, 2909, 1594, 1490, 1449, 1288, 1231, 908, 739, 701 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.65–7.57 (m, 1 H), 7.40 (br s, 1 H, exchangeable), 7.29–7.19 (m, 6 H), 7.19–7.08 (m, 4 H), 7.03 (t, $J$ = 7.3 Hz, 1 H), 6.75 (d, $J$ = 7.8 Hz, 2 H), 3.55 (t, $J$ = 6.0 Hz, 2 H), 3.10–2.96 (m, 2 H), 1.80 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 149.5, 145.0, 139.8, 136.4, 128.8, 128.2, 128.0, 127.4, 127.1, 126.8, 123.9, 121.8, 119.5, 118.5, 111.0, 109.2, 62.1, 47.4, 22.3, 22.2; HRMS (ESI) calcd for $C_{24}H_{23}N_2^+$ $[M + H]^+$ 339.1856, found 339.1869.




**20e** **61**

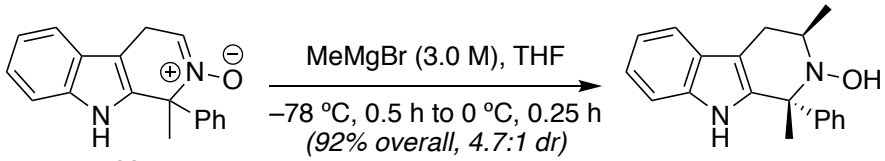
**1-methyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-ol (61).**[16] To a solution of **20e** (0.100 g, 0.25 mmol, 1.0 equiv) in MeOH (2.0 mL) at 23 °C was added LiOH•$H_2O$ (0.012

mg, 0.28 mmol, 1.1 equiv) open to air. The resultant mixture was stirred at 23 ºC for 30 min, during which time the product crashed out as a white precipitate. Upon completion, the reaction contents were concentrated directly and then diluted with $CH_2Cl_2$/MeOH (9/1, 10 mL). Deionized $H_2O$ (5 mL) was then added, the contents were poured into a separatory funnel, and the product was extracted with $CH_2Cl_2$/MeOH (9/1, 3 × 10 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, hexanes/EtOAc = 1/0→2/1) or recrystallization ($CH_2Cl_2$) to yield **61** (0.062 mg, 88% yield) as a white solid. **61**: $R_f$ = 0.59 (silica gel, $CH_2Cl_2$/MeOH = 9/1); IR (film) $\nu_{max}$ 3410, 1597, 1564, 1449, 1393, 1232, 858, 799, 735, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, DMSO-$d_6$) δ 10.75 (br s, 1 H, exchangeable), 7.94 (br s, 1 H, exchangeable), 7.42 (d, $J$ = 7.7 Hz, 1 H), 7.32–7.23 (m, 3 H), 7.22–7.12 (m, 3 H), 7.07–7.01 (m, 1 H), 7.00–6.94 (m, 1 H), 3.21–3.05 (m, 1 H), 2.99–2.84 (m, 2 H), 2.66–2.52 (m, 1 H), 1.81 (s, 3 H); $^{13}C$ NMR (101 MHz, DMSO-$d_6$) δ 137.3, 136.2, 127.8, 127.5, 127.1, 126.7, 126.3, 120.6, 118.3, 117.8, 111.0, 106.3, 64.6, 49.0, 24.1, 18.4; HRMS (ESI) calcd for $C_{18}H_{19}N_2O^+$ $[M + H]^+$ 279.1492, found 279.1495.



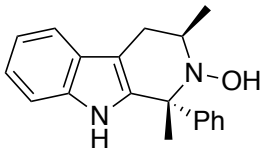
**61** **62**

**1-methyl-1-phenyl-4,9-dihydro-1*H*-pyrido[3,4-*b*]indole 2-oxide (62).**[17] To a solution of **61** (0.042 g, 0.15 mmol, 1.0 equiv) in $CH_2Cl_2$/MeOH (10/1, 1.5 mL) at 23 ºC was added yellow HgO (0.098 g, 0.44 mmol, 3.0 equiv) under an argon atmosphere. The reaction contents were then sonicated for 0.5 h. Upon completion, $MgSO_4$ (0.055 g, 0.45 mmol, 3.0 equiv) was added and the reaction contents were stirred for an additional 10 min. The resulting grey heterogeneous mixture was filtered through a pad of Celite with a layer of $MgSO_4$ on top, washed with $CH_2Cl_2$ (15 mL), and then concentrated to afford nitrone **62** (0.041 g, 99% yield) that was carried forward without further purification.



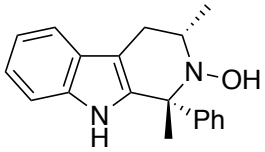
**62** **(±)-63**

To a solution of **62** (0.041 g, 0.15 mmol, 1.0 equiv) in THF (3.0 mL) at –78 ºC was added dropwise MeMgBr (3.0 M in $Et_2O$, 0.49 mL, 1.49 mmol, 10 equiv) over the course of 15 min under an argon atmosphere. The resultant mixture was then stirred at –78 ºC for an additional 30 min before being warmed to 0 ºC and stirred for 15 min. Upon completion, the reaction contents were quenched with saturated aqueous $NH_4Cl$ (5 mL) and extracted with EtOAc (3 × 5 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, hexanes/EtOAc = 1/0→3/1) to yield **63a** (0.033 g, 76% yield) and **63b** (0.007 g, 16% yield) as white solids (0.040 g combined, 92% yield overall, 4.7:1 *dr*).[18]



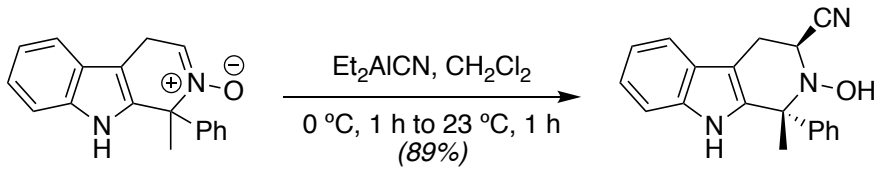

**(±)-63a**

**(±)-(1*R*,3*R*)-1,3-dimethyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-ol (63a):** $R_f$ = 0.25 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3410, 2975, 2932, 1449, 1299, 1234, 1184, 910, 738, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.89 (br s, 1 H, exchangeable), 7.56 (d, *J* = 7.8 Hz, 1 H), 7.39 (d, *J* = 8.1 Hz, 1 H), 7.26–7.18 (m, 6 H), 7.18–7.13 (m, 1 H), 4.52 (br s, 1 H, exchangeable), 3.20–3.09 (m, 1 H), 2.85–2.77 (m, 1 H), 2.70–2.56 (m, 1 H), 1.94 (s, 3 H), 1.26 (d, *J* = 6.6 Hz, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 136.6, 133.7, 128.4, 127.8, 127.4, 127.3, 126.9, 122.2, 119.8, 118.8, 111.2, 109.1, 67.4, 52.7, 29.8, 26.1, 19.5; HRMS (ESI) calcd for $C_{19}H_{21}N_2O^+$ $[M + H]^+$ 293.1648, found 293.1658.



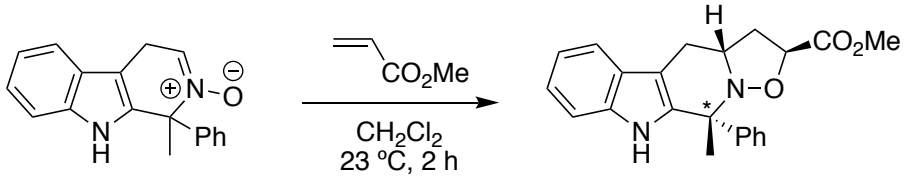

**(±)-63b**

**(±)-(1*R*,3*S*)-1,3-dimethyl-1-phenyl-1,3,4,9-tetrahydro-2*H*-pyrido[3,4-*b*]indol-2-ol (63b):** $R_f$ = 0.37 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3532, 3399, 2928, 1452, 1374, 1303, 1238, 908, 734, 701 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.56–7.47 (m, 3 H), 7.36–7.28 (m, 3 H), 7.25–7.15 (m, 2 H), 7.14–7.07 (m, 2 H), 4.48 (br s, 1 H, exchangeable), 3.63–3.52 (m, 1 H), 2.99–2.89 (m, 1 H), 2.85–2.76 (m, 1 H), 1.90 (s, 3 H), 1.43 (d, *J* = 6.1 Hz, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 144.5, 138.9, 136.5, 130.6, 128.4, 127.6, 126.7, 121.7, 119.5, 118.5, 111.0, 107.3, 66.1, 53.5, 29.9, 29.3, 20.5; HRMS (ESI) calcd for $C_{19}H_{21}N_2O^+$ $[M + H]^+$ 293.1648, found 293.1648.



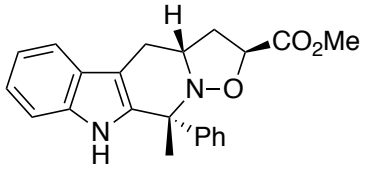

**62** **(±)-64**

**(±)-(1*R*,3*S*)-2-hydroxy-1-methyl-1-phenyl-2,3,4,9-tetrahydro-1*H*-pyrido[3,4-*b*]indole-3-carbonitrile (64).**[19] To a solution of **62** (0.041 g, 0.15 mmol, 1.0 equiv) in $CH_2Cl_2$ (3.0 mL) at 0 ºC was added $Et_2AlCN$ (1.0 M in toluene, 0.45 mL, 0.45 mmol, 3.0 equiv) under an argon atmosphere. The resultant mixture was stirred at 0 ºC for 1 h and then warmed to 23 ºC and stirred for an additional 1 h. Upon completion, the reaction contents were quenched with saturated aqueous $NaHCO_3$ (5 mL), poured into a separatory funnel, and extracted with $CH_2Cl_2$ (3 × 5 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by flash column chromatography (silica gel, hexanes/EtOAc = 1/0→3/1) to yield **64** (0.40 mg, 89% yield) as a white solid. **64**: $R_f$ = 0.24 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3404, 3058, 2920, 2258, 1453, 1300, 1183, 1028, 739, 701 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.93 (br s, 1 H, exchangeable), 7.56 (d, *J* = 7.9 Hz, 1 H), 7.40 (d, *J* = 8.1 Hz, 1 H), 7.30–7.26 (m, 3 H), 7.26–7.23 (m, 1 H), 7.21–7.12 (m, 3 H), 5.26 (br s, 1 H, exchangeable), 4.09–4.00 (m, 1 H), 3.57–3.47 (m, 1 H), 3.06–2.97 (m, 1 H), 1.96 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 136.2, 133.6, 128.7, 128.4, 127.3, 127.1, 126.4, 122.7, 120.3, 119.7, 118.7, 111.3, 106.2, 66.3, 50.2, 25.6, 22.1; HRMS (ESI) calcd for $C_{19}H_{18}N_3O^+$ $[M + H]^+$ 304.1444, found 304.1454.



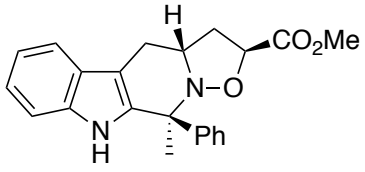

**62** **(±)-65**

To a solution of **62** (0.041 g, 0.15 mmol, 1.0 equiv) in $CH_2Cl_2$ (3.0 mL) at 23 ºC was added methyl acrylate (0.13 mL, 1.5 mmol, 10 equiv) under an argon atmosphere and stirred for 2 h. Upon completion, the reaction contents were quenched with saturated aqueous $NaHCO_3$ (5 mL) and extracted with $CH_2Cl_2$ (3 × 5 mL). The combined organic extracts were then dried ($Na_2SO_4$), filtered, and concentrated. The resultant crude material was purified by preparative thin layer chromatography (silica gel, $CH_2Cl_2$/MeOH = 15/1) to yield **65a** (0.025 mg, 46% yield) and **65b** (0.019 mg, 35% yield) as yellow solids (0.044 mg combined, 82% yield overall, 1.3:1 *dr*).[20]




**(±)-65a**

**(±)-methyl (2*S*,3a*R*,10*R*)-10-methyl-10-phenyl-2,3,3a,4,9,10-hexahydroisoxazolo[2',3':1,6]pyrido[3,4-*b*]indole-2-carboxylate (65a)**: $R_f$ = 0.32 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3386, 2924, 1741, 1454, 1373, 1213, 1102, 1028, 742, 703 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.61–7.54 (m, 2 H), 7.52–7.46 (m, 1 H), 7.38–7.26 (m, 4 H), 7.21–7.17 (m, 1 H), 7.16–7.07 (m, 2 H), 4.61 (dd, *J* = 8.0, 5.4 Hz, 1 H), 3.76 (s, 3 H), 3.65–3.56 (m, 1 H), 3.23–3.14 (m, 1 H), 2.89–2.79 (m, 1 H), 2.63–2.56 (m, 2 H), 1.99 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 172.3, 143.9, 139.6, 136.9, 128.6, 127.8, 127.5, 126.4, 122.0, 119.7, 118.4, 111.2, 107.8, 74.4, 64.7, 55.7, 52.3, 38.9, 26.1, 17.6; HRMS (ESI) calcd for $C_{22}H_{23}N_2O_3^+$ $[M + H]^+$ 363.1703, found 363.1717.




**(±)-65b**

**(±)-methyl (2*S*,3a*R*,10*S*)-10-methyl-10-phenyl-2,3,3a,4,9,10-hexahydroisoxazolo[2',3':1,6]pyrido[3,4-*b*]indole-2-carboxylate (65b)**: $R_f$ = 0.26 (silica gel, hexanes/EtOAc = 4/1); IR (film) $\nu_{max}$ 3373, 2924, 1738, 1453, 1376, 1210, 1103, 1029, 741, 700 $cm^{-1}$; $^1H$ NMR (500 MHz, $CDCl_3$) δ 7.75 (br s, 1 H, exchangeable), 7.54 (d, *J* = 8.7 Hz, 1 H), 7.34 (d, *J* = 7.9 Hz, 1 H), 7.26–7.11 (m, 7 H), 4.62 (dd, *J* = 9.2, 4.0 Hz, 1 H), 3.52 (s, 3 H), 3.22–3.01 (m, 2 H), 2.81–2.71 (m, 1 H), 2.52–2.36 (m, 2 H), 2.09 (s, 3 H); $^{13}C$ NMR (101 MHz, $CDCl_3$) δ 171.6, 137.0, 136.5, 130.1, 130.0, 127.7, 127.3, 126.4, 122.2, 119.9, 118.6, 111.3, 109.3, 74.4, 64.9, 55.0, 52.2, 38.4, 26.0, 25.2; HRMS (ESI) calcd for $C_{22}H_{23}N_2O_3^+$ $[M + H]^+$ 363.1703, found 363.1714.

## J. Mechanistic Understanding

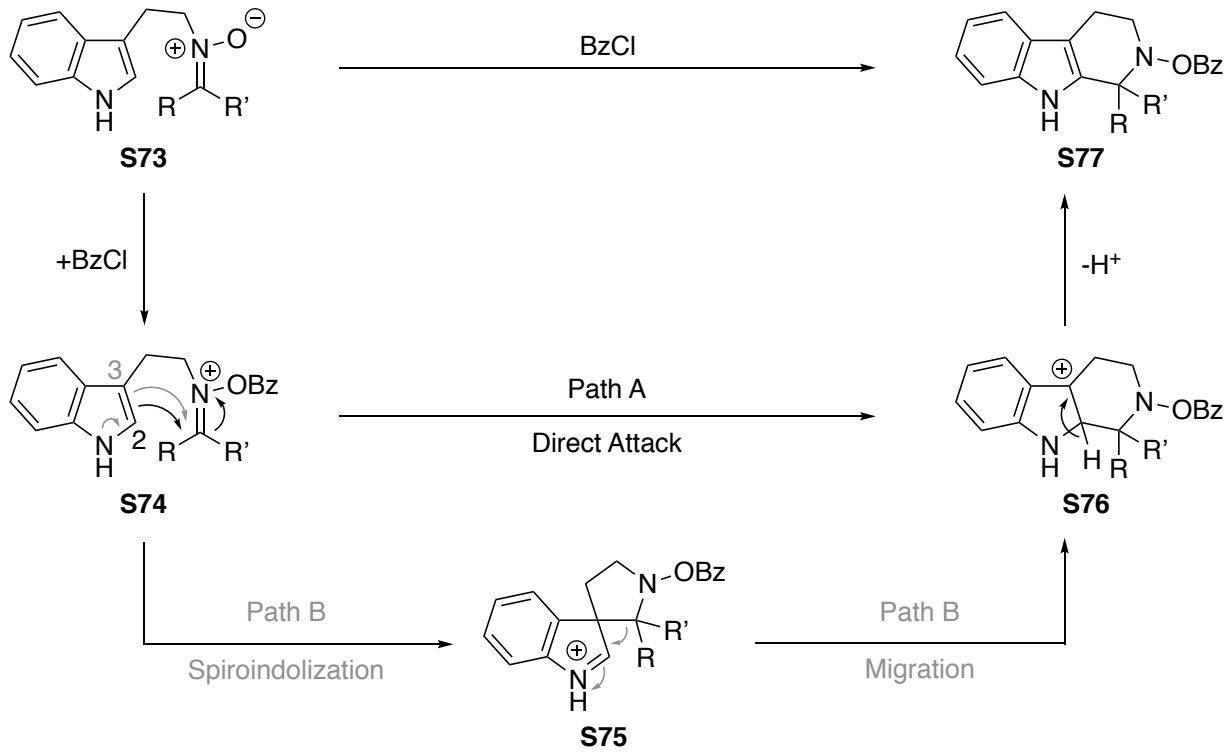



**Figure S2.** Current mechanistic understanding of the developed ketonitrone-based Pictet–Spengler reaction.

Investigations into the mechanism of Pictet–Spengler-type reactions have been of high interest for several decades. There are two possible reaction mechanisms (Figure S2): direct attack of the C2 position of indole to the *N*-acyloxyiminium species (Path A) or attack of the C3 position of the indole to undergo a stepwise spiroindolization/migration sequence (Path B). Although historically there has been experimental evidence supporting the fast and reversible formation of the spiroindolenine (like **S75**), it is still unclear if this intermediate ultimately rearranges to the carbonium ion (like **S76**).[21] Nonetheless, according to recent computational studies, there is a strong energetic preference for C2 addition over C3 addition.[9d,22] These studies also propose that rearomatization via deprotonation of the carbonium ion intermediate is both the rate- and enantioselective-determining step. Hence, it is challenging to propose which pathway our developed reaction undergoes without kinetic, computational, and/or structure–activity relationship studies, especially since it involves an *N*-acyloxyiminium species that has not been previously explored in this reaction type. Nonetheless, these mechanistic studies are of current interest.

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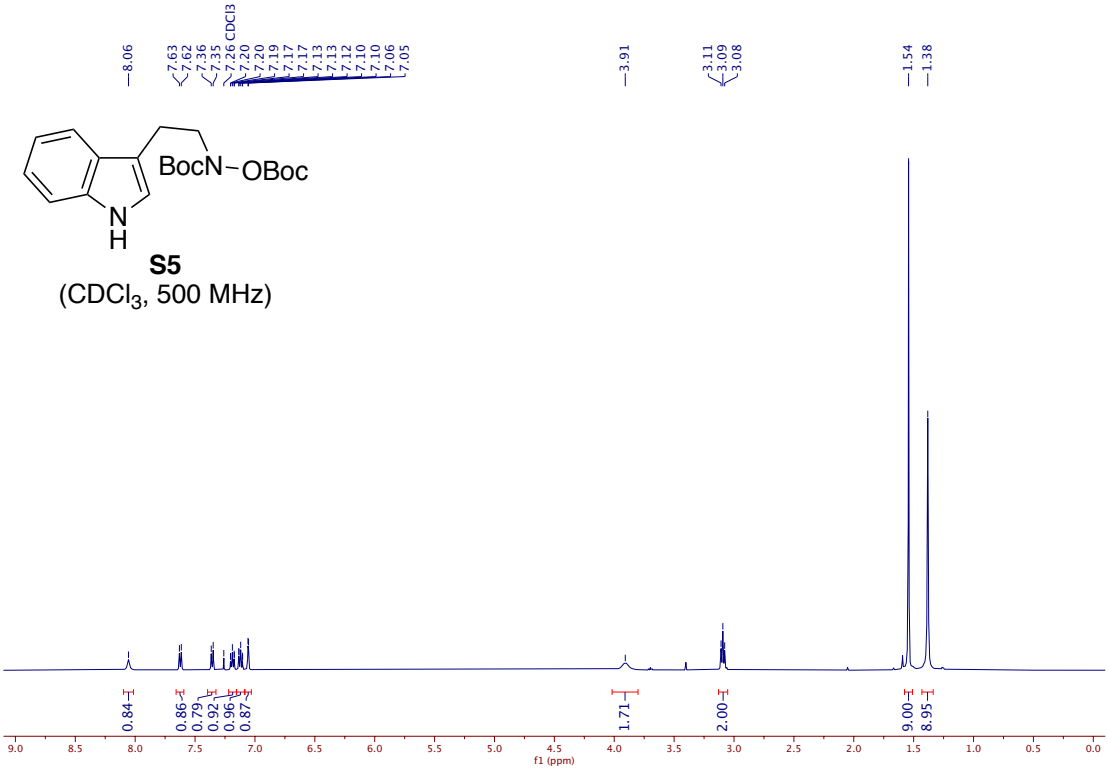
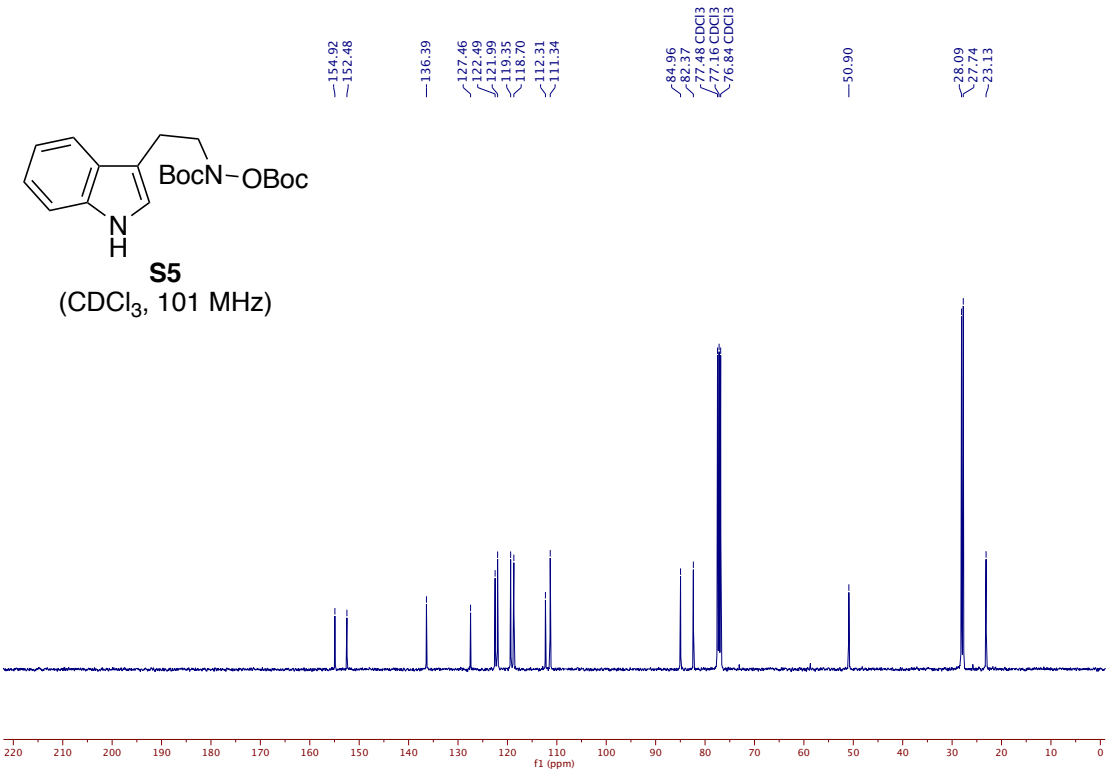
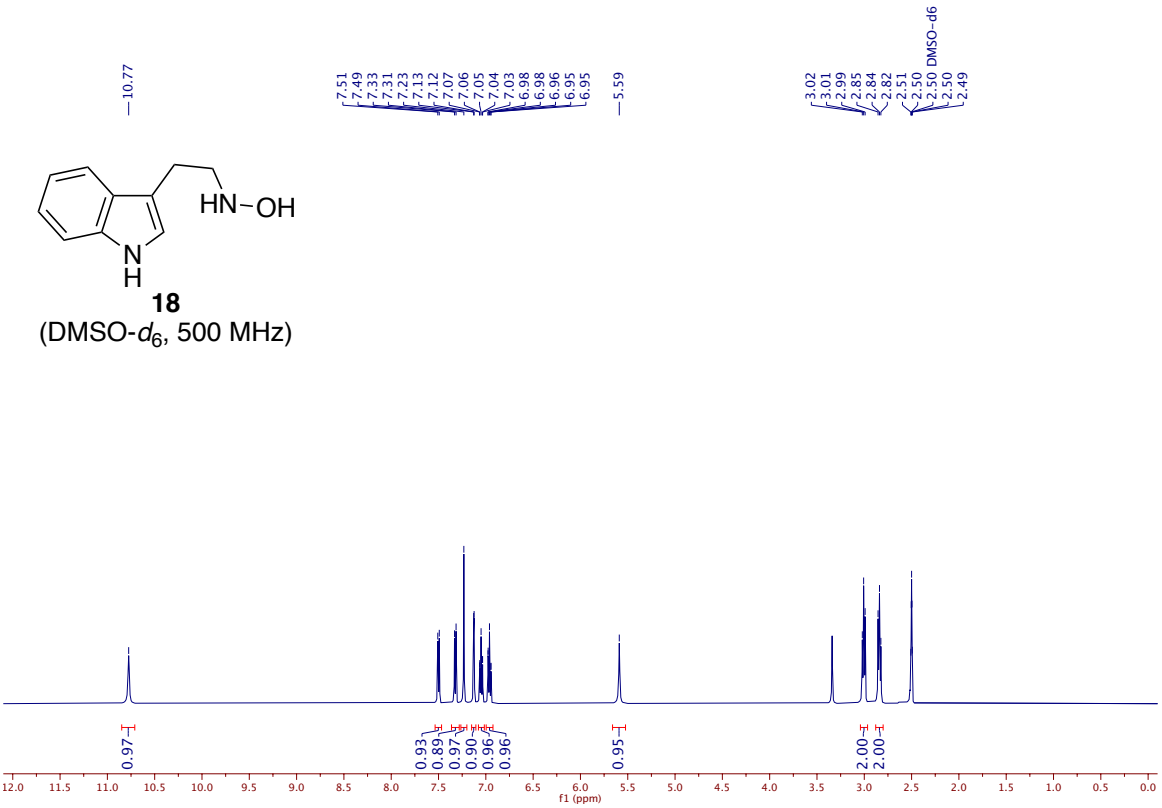
## L. NMR Spectra




**S5**
($CDCl_3$, 500 MHz)

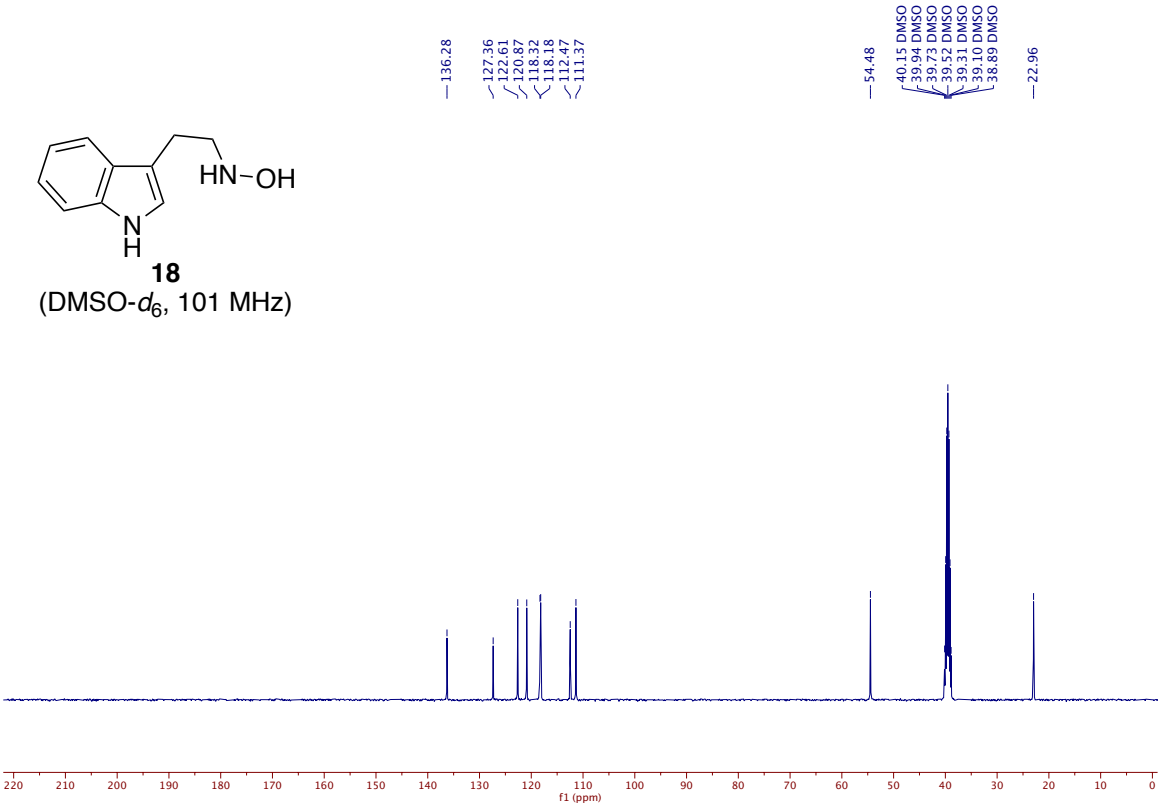



**S5**
($CDCl_3$, 101 MHz)



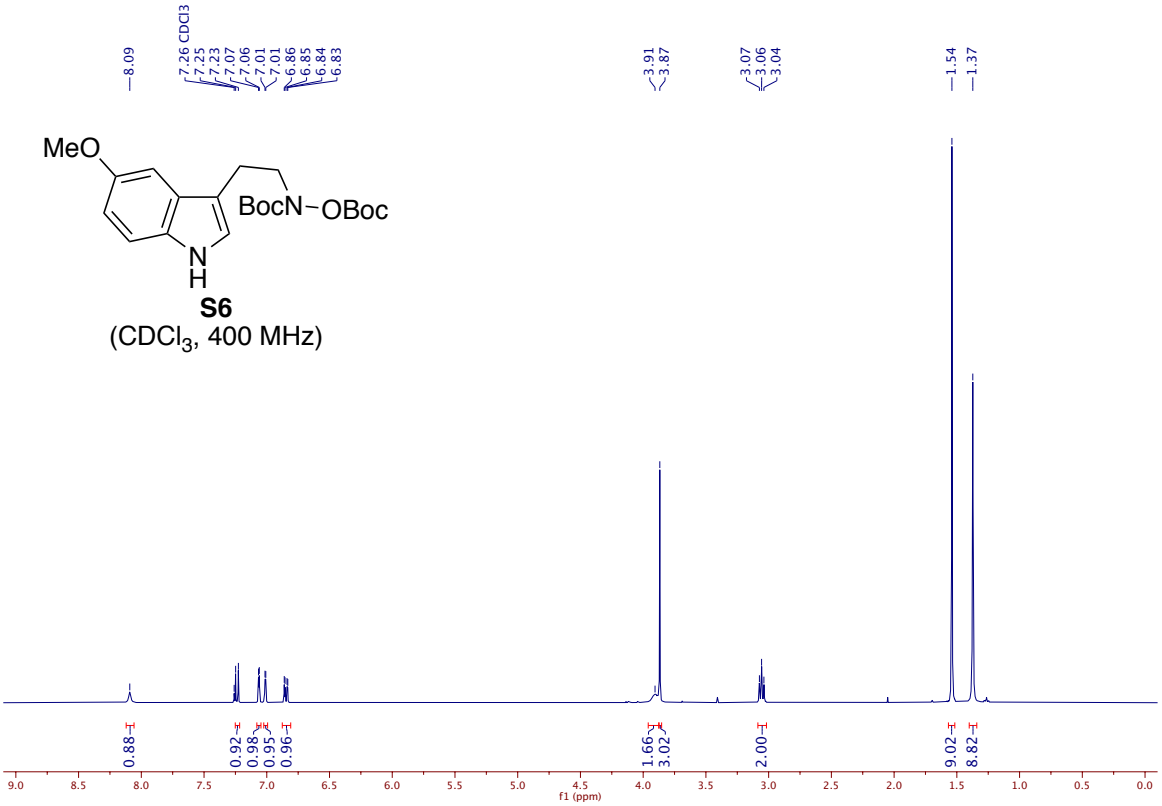

**18**

(DMSO-$d_6$, 500 MHz)



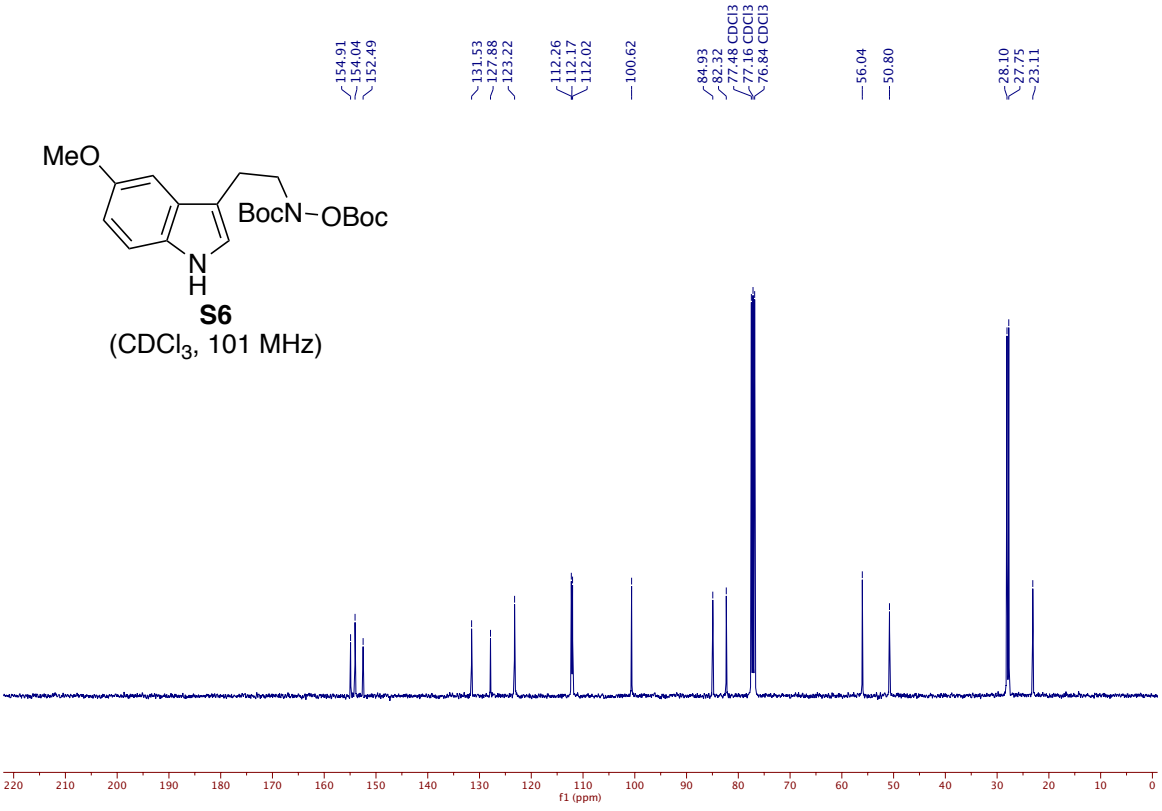

**18**

(DMSO-$d_6$, 101 MHz)




**S6**

($CDCl_3$, 400 MHz)




**S6**

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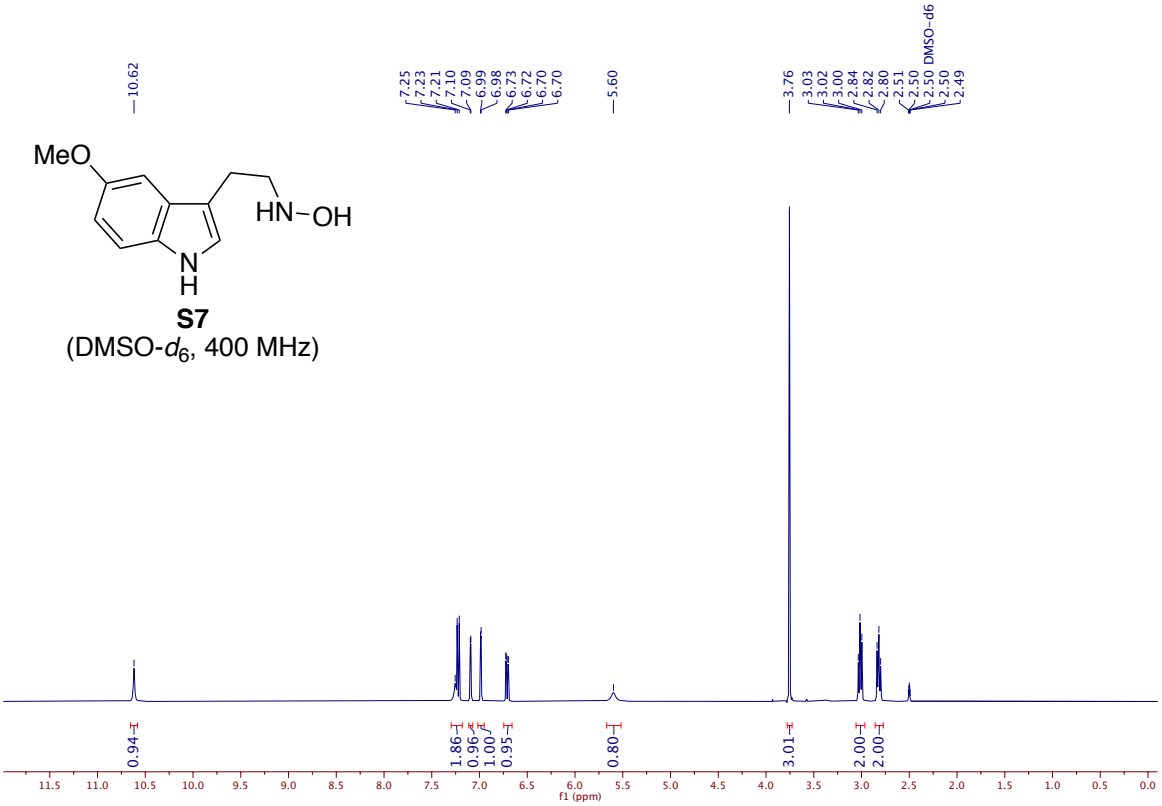
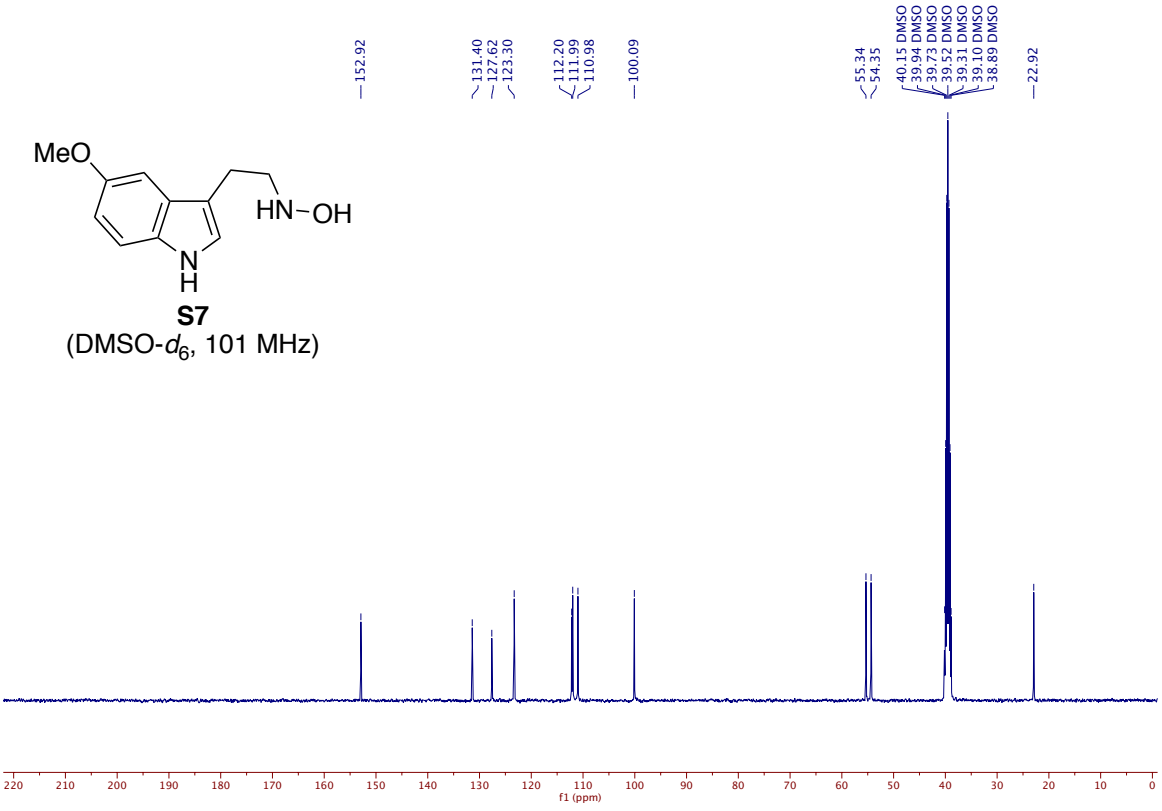


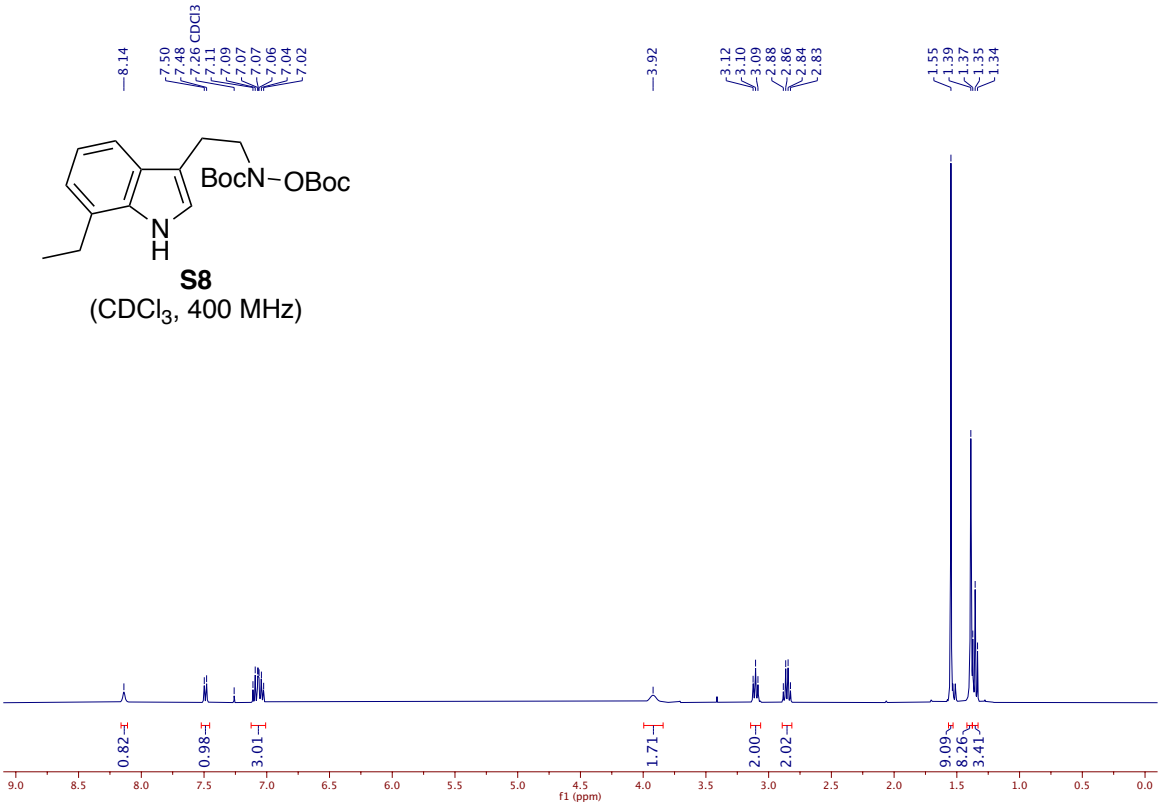

**S7**

(DMSO-$d_6$, 400 MHz)



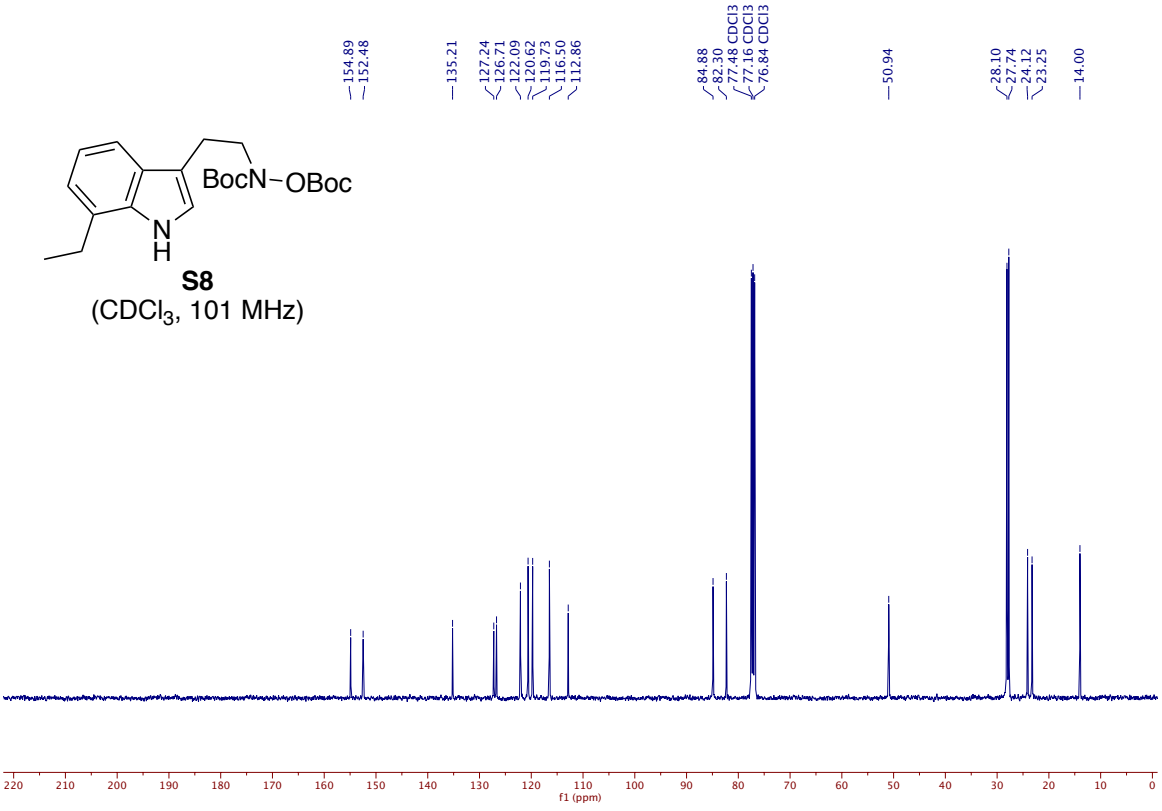

**S7**

(DMSO-$d_6$, 101 MHz)



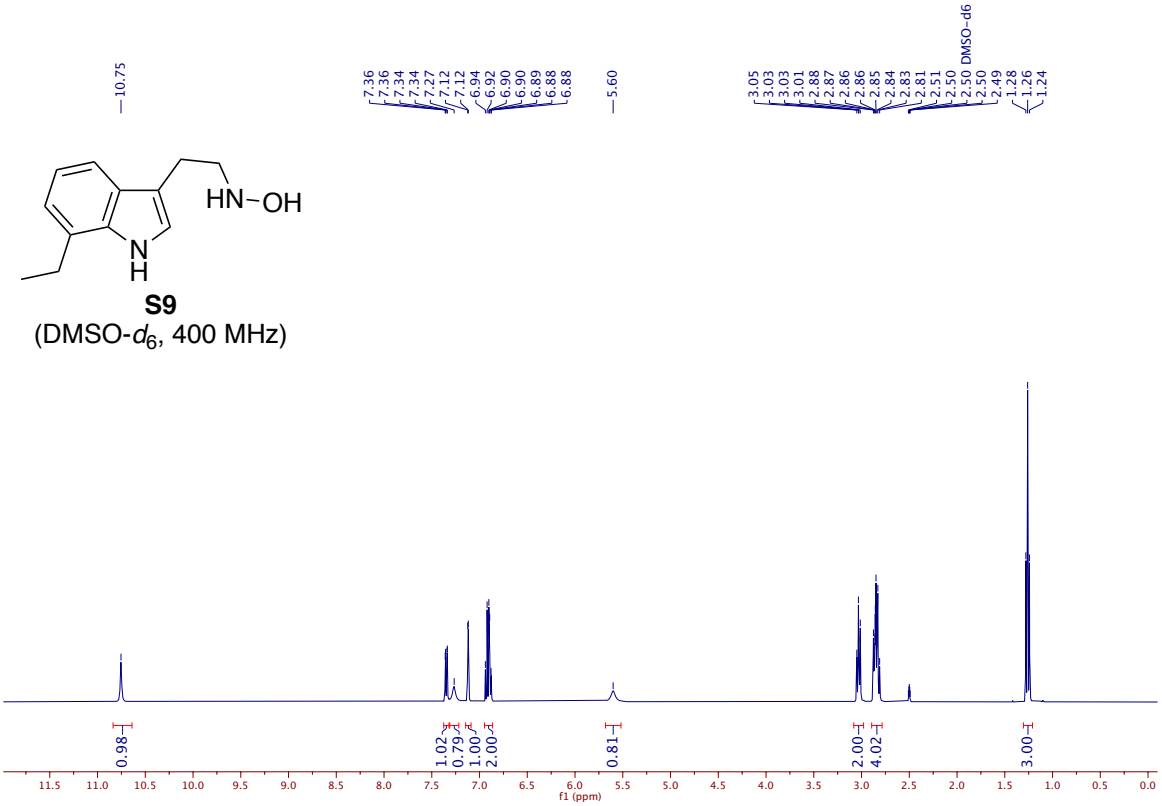

**S8**

($CDCl_3$, 400 MHz)



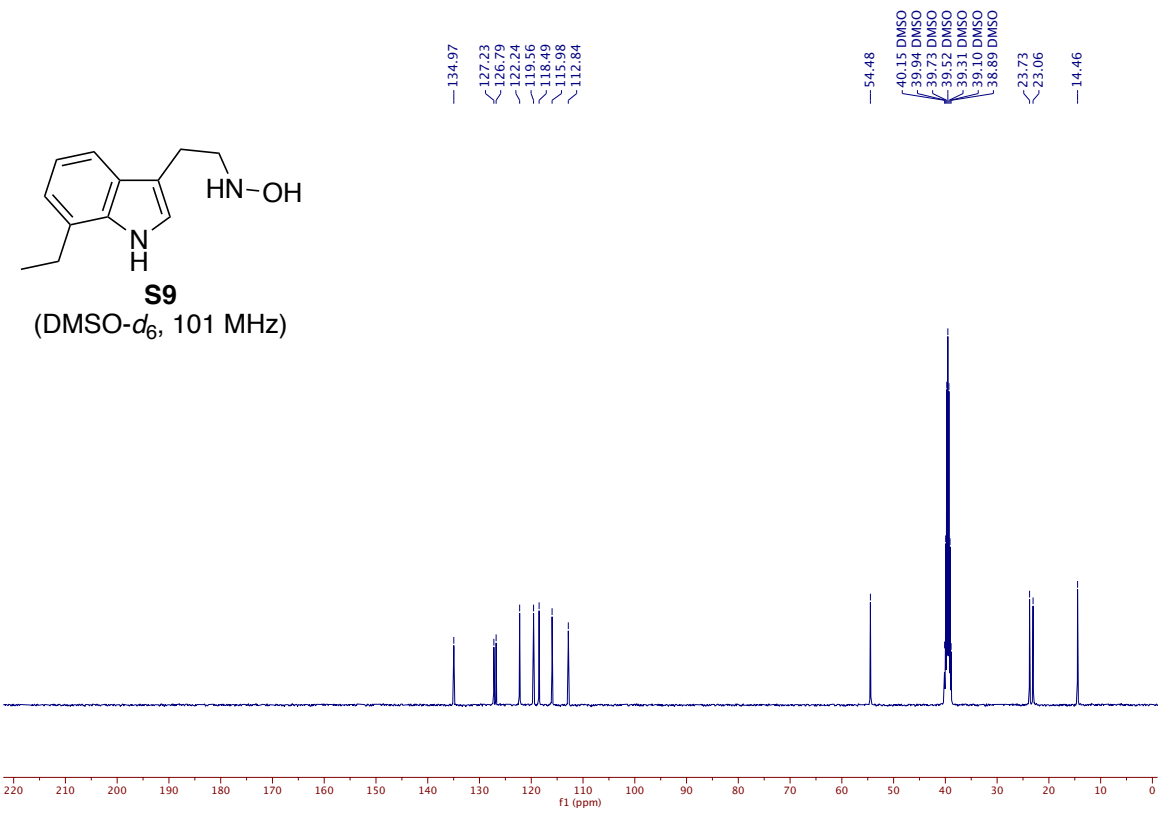

**S8**

($CDCl_3$, 101 MHz)



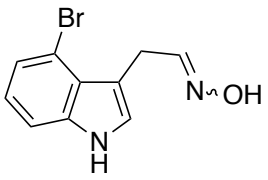

**S9**

(DMSO-$d_6$, 400 MHz)



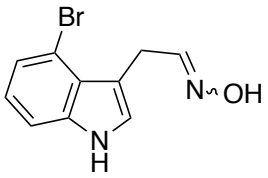

**S9**

(DMSO-$d_6$, 101 MHz)




**S10**
(DMSO-$d_6$, 500 MHz)

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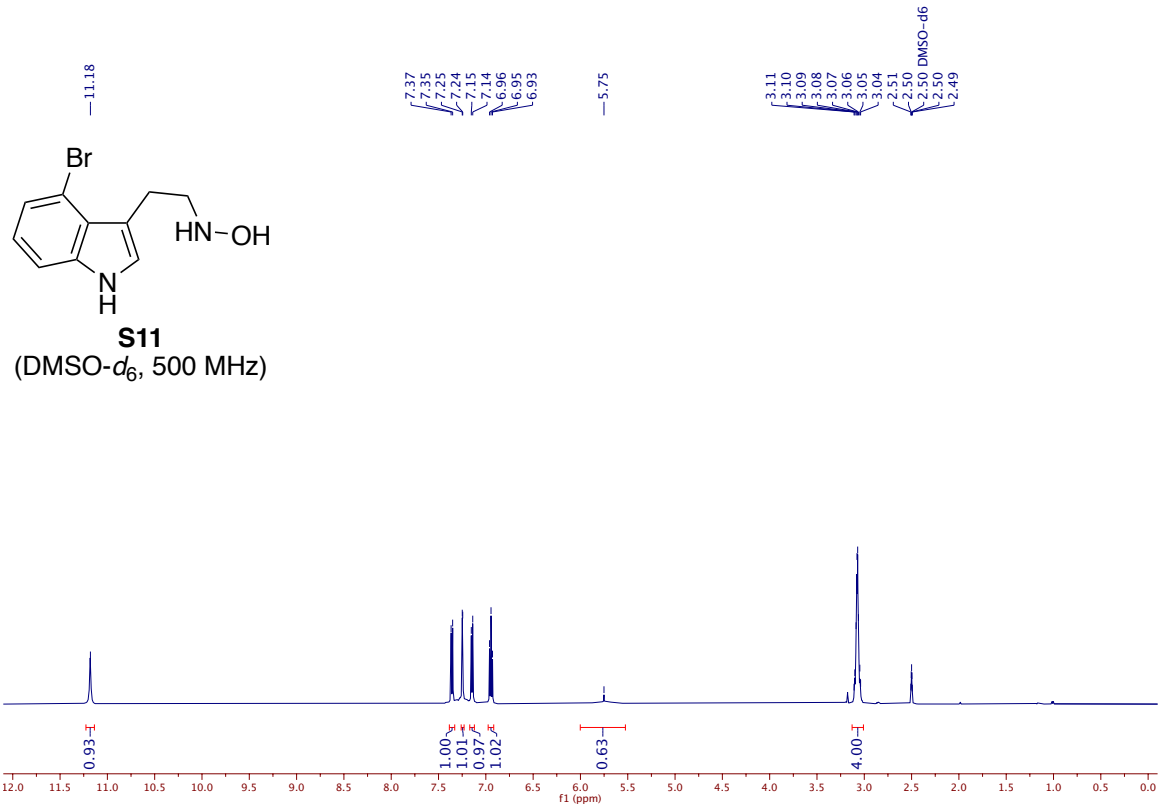
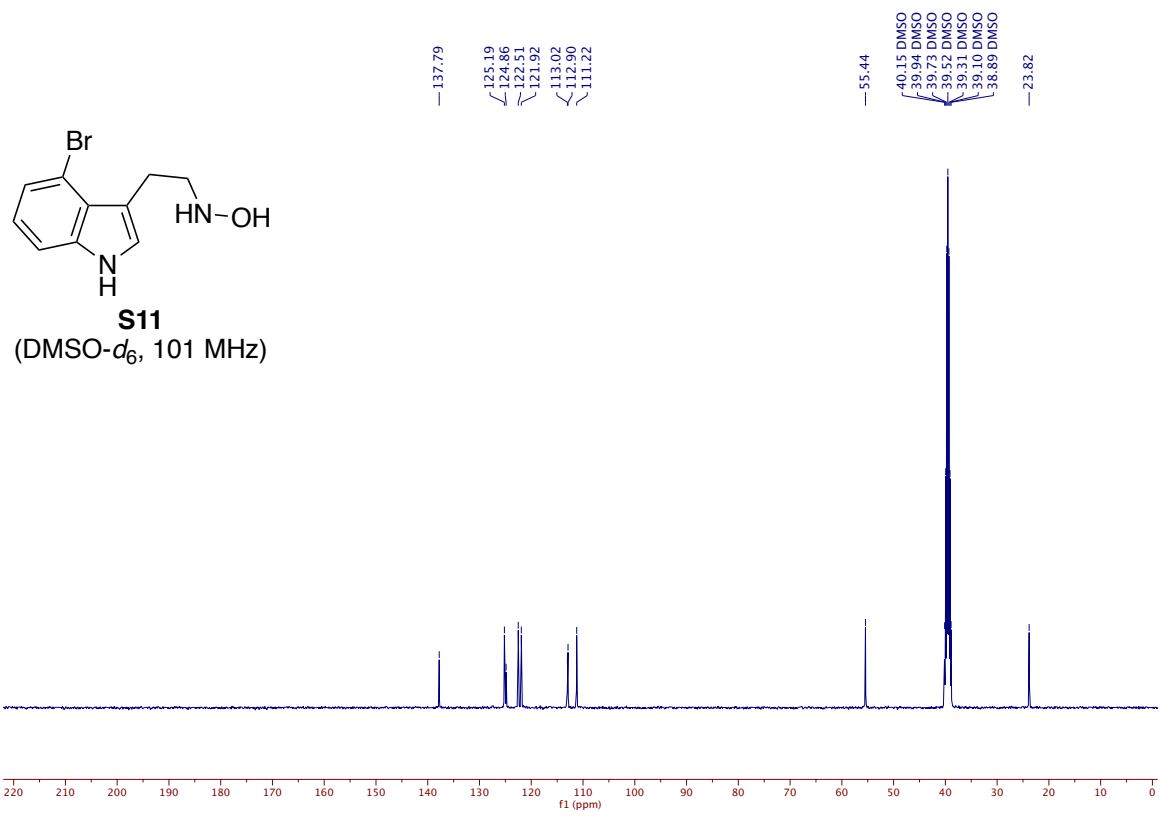
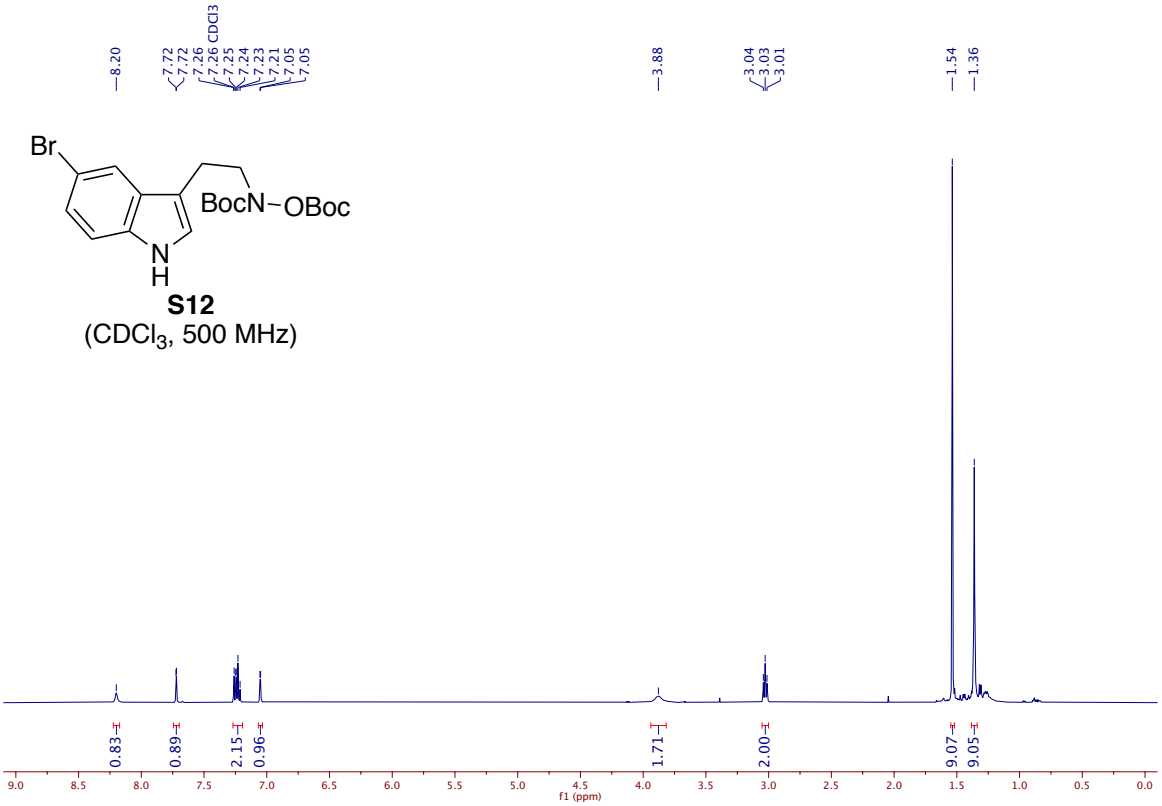
(DMSO-$d_6$, 101 MHz)




**S11**
(DMSO-$d_6$, 500 MHz)




**S11**
(DMSO-$d_6$, 101 MHz)

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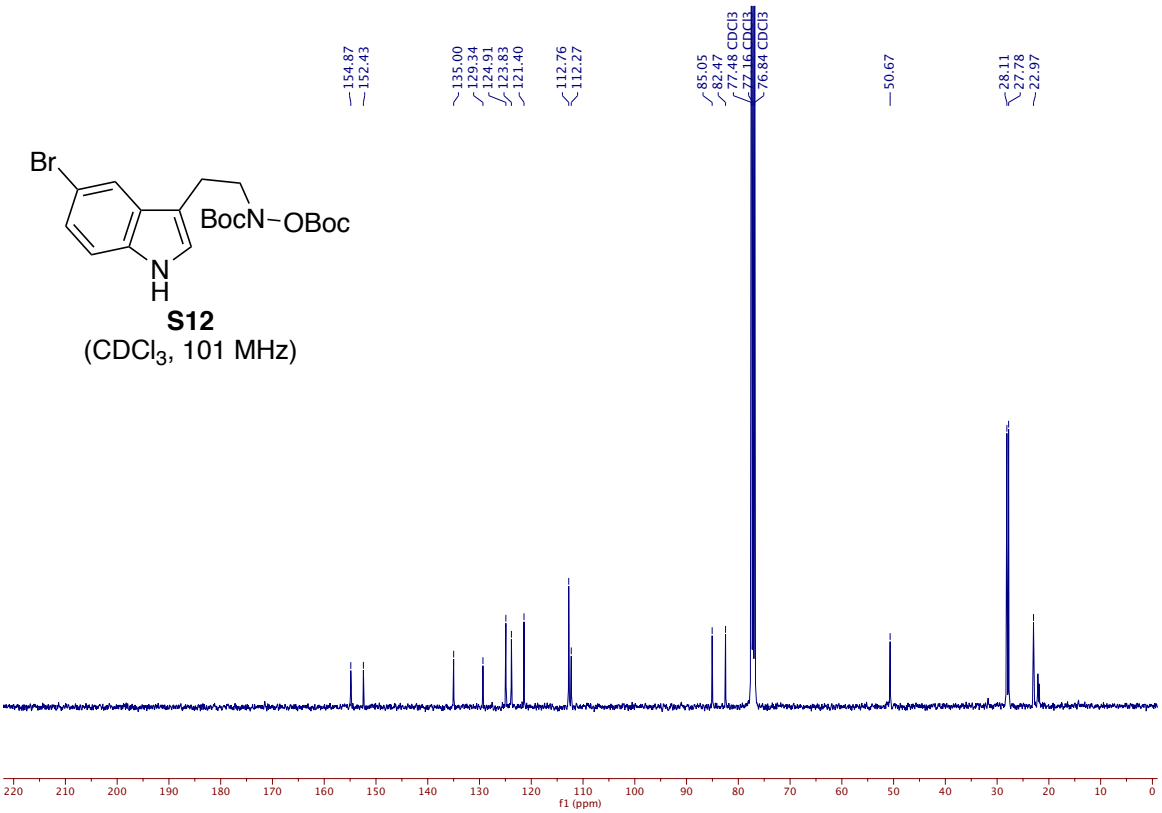
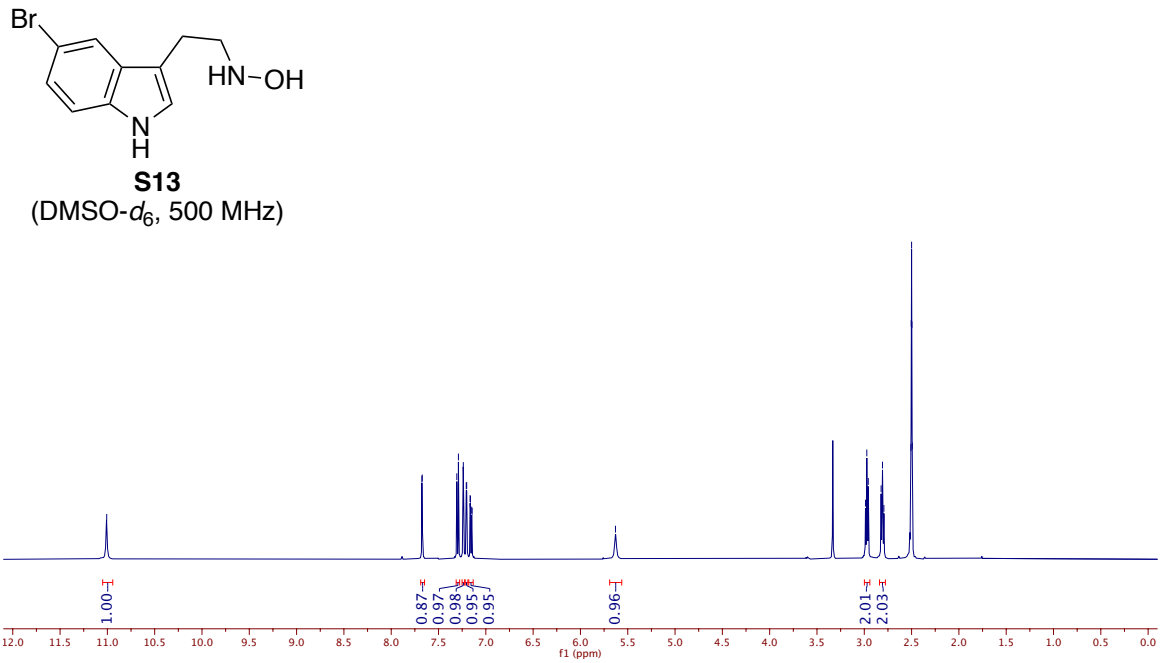
($CDCl_3$, 500 MHz)

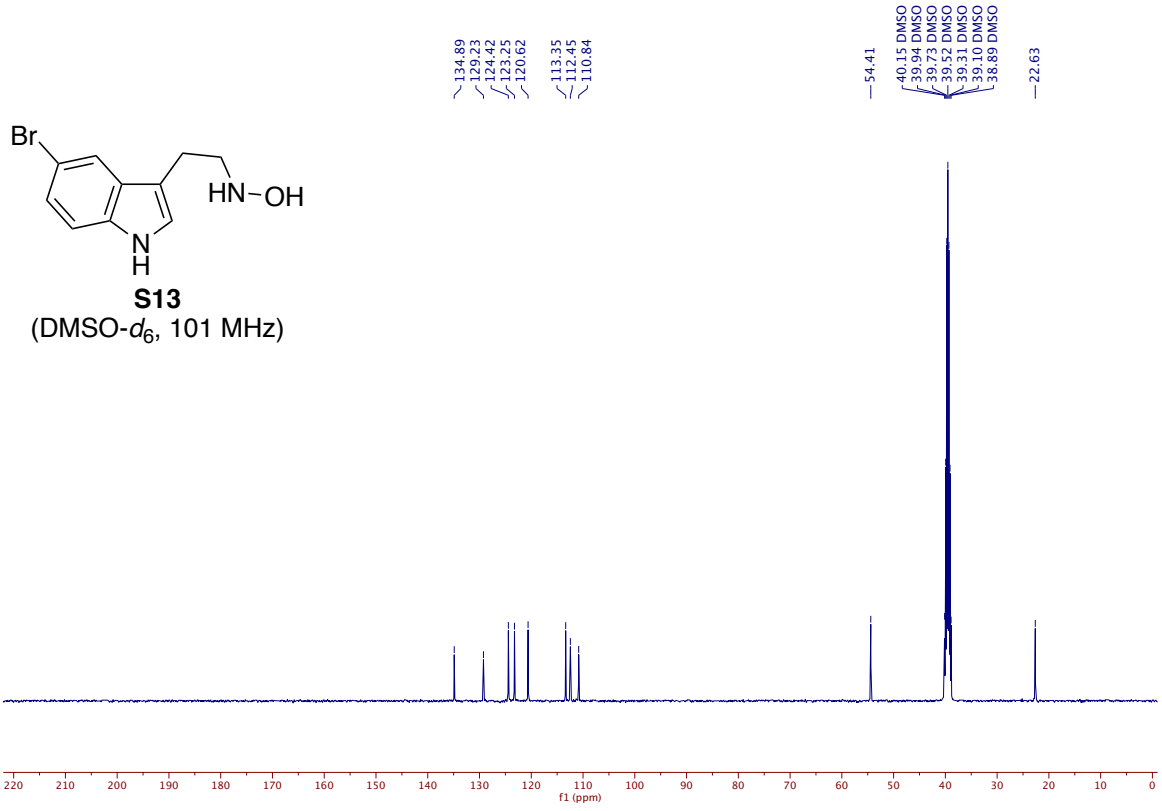



**S12**

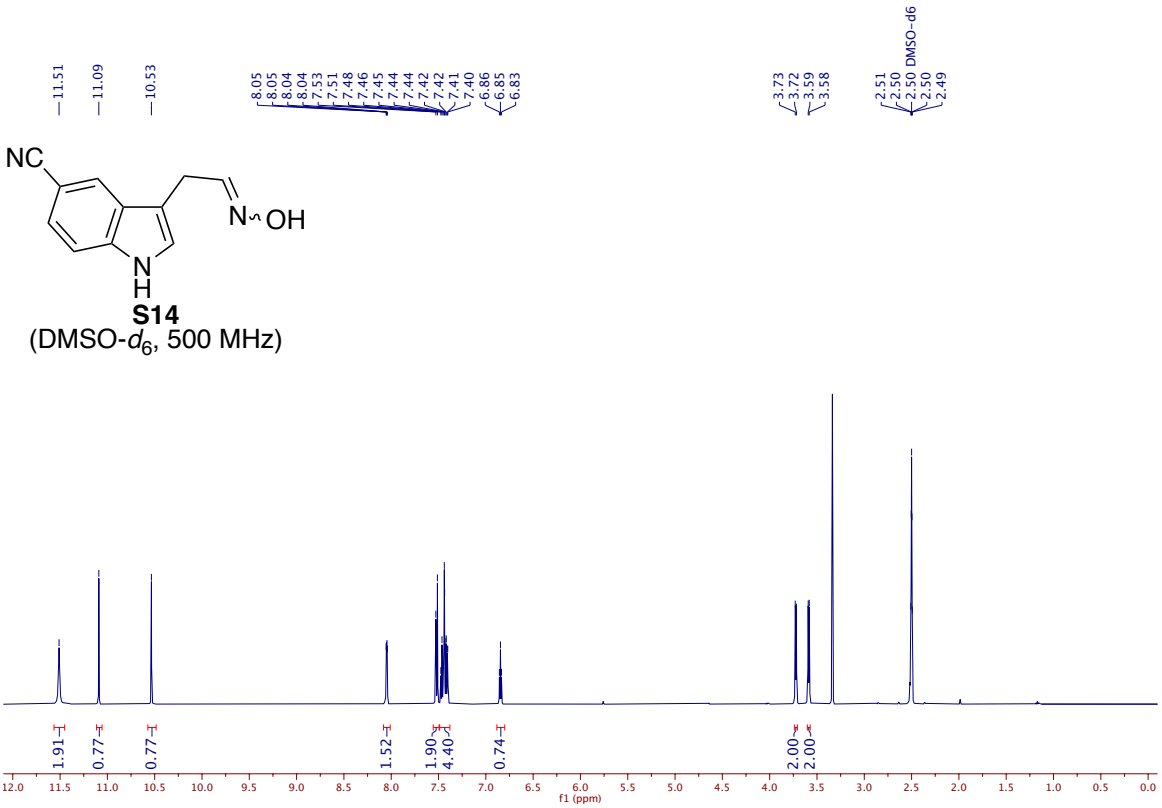
($CDCl_3$, 101 MHz)



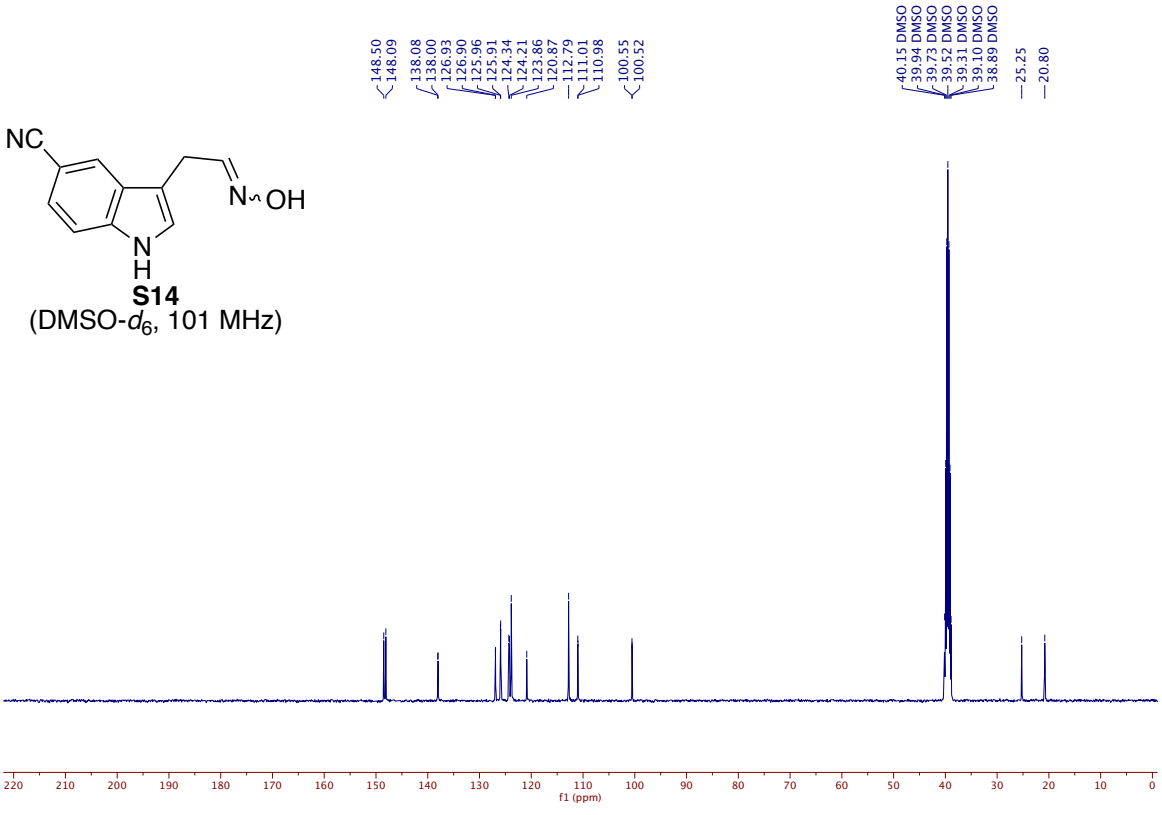

**S13**
(DMSO-$d_6$, 500 MHz)



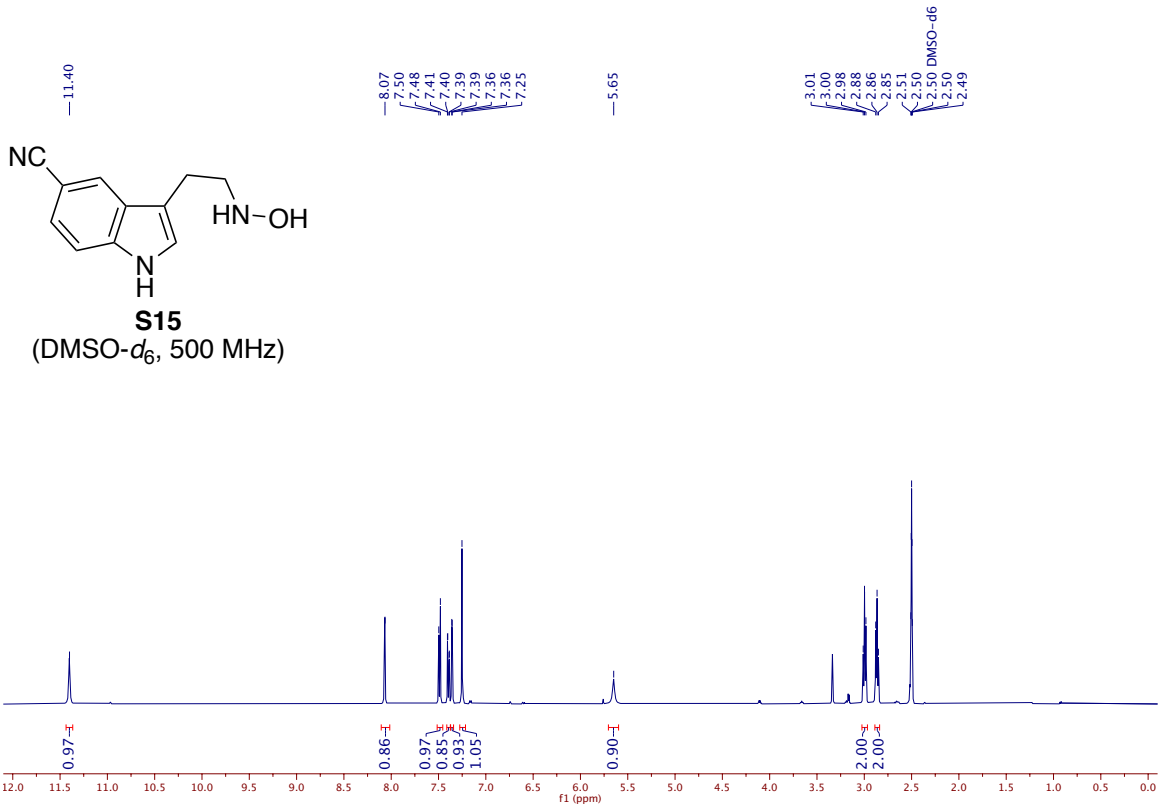

**S13**
(DMSO-$d_6$, 101 MHz)



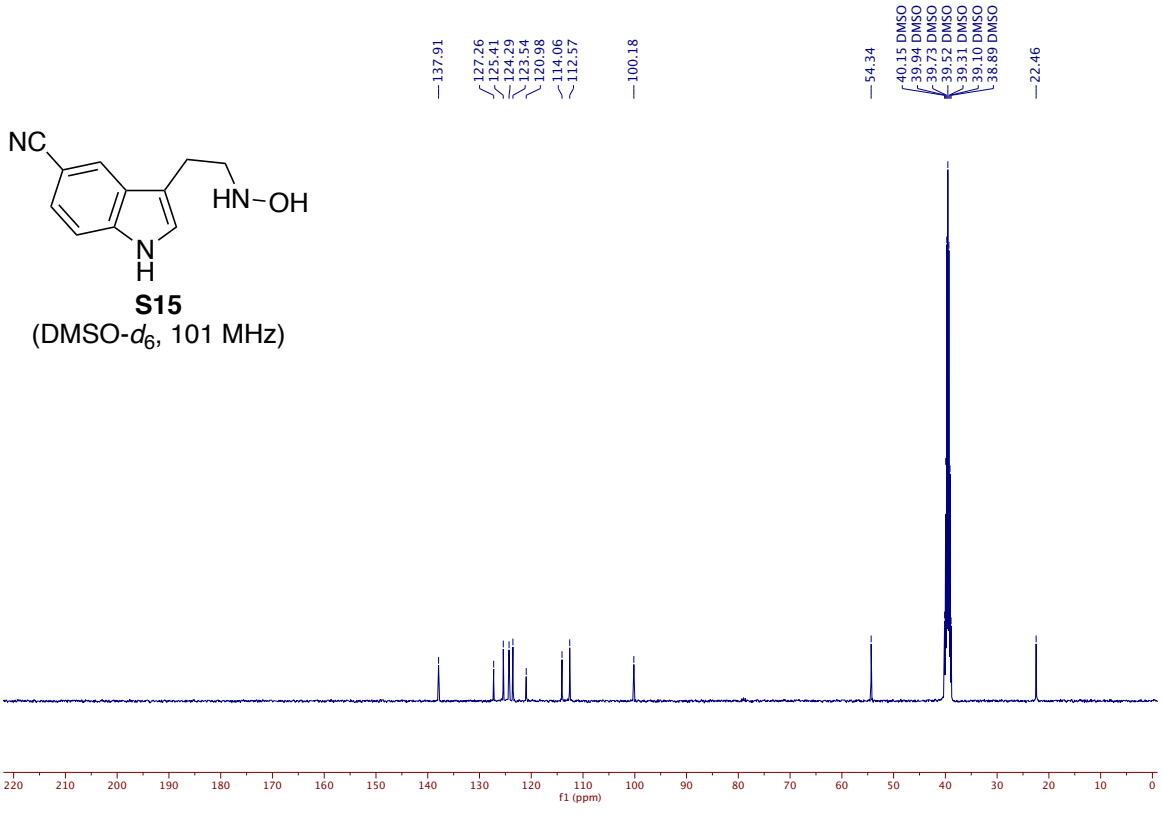

**S14**
(DMSO-$d_6$, 500 MHz)




**S14**
(DMSO-$d_6$, 101 MHz)




**S15**
(DMSO-$d_6$, 500 MHz)

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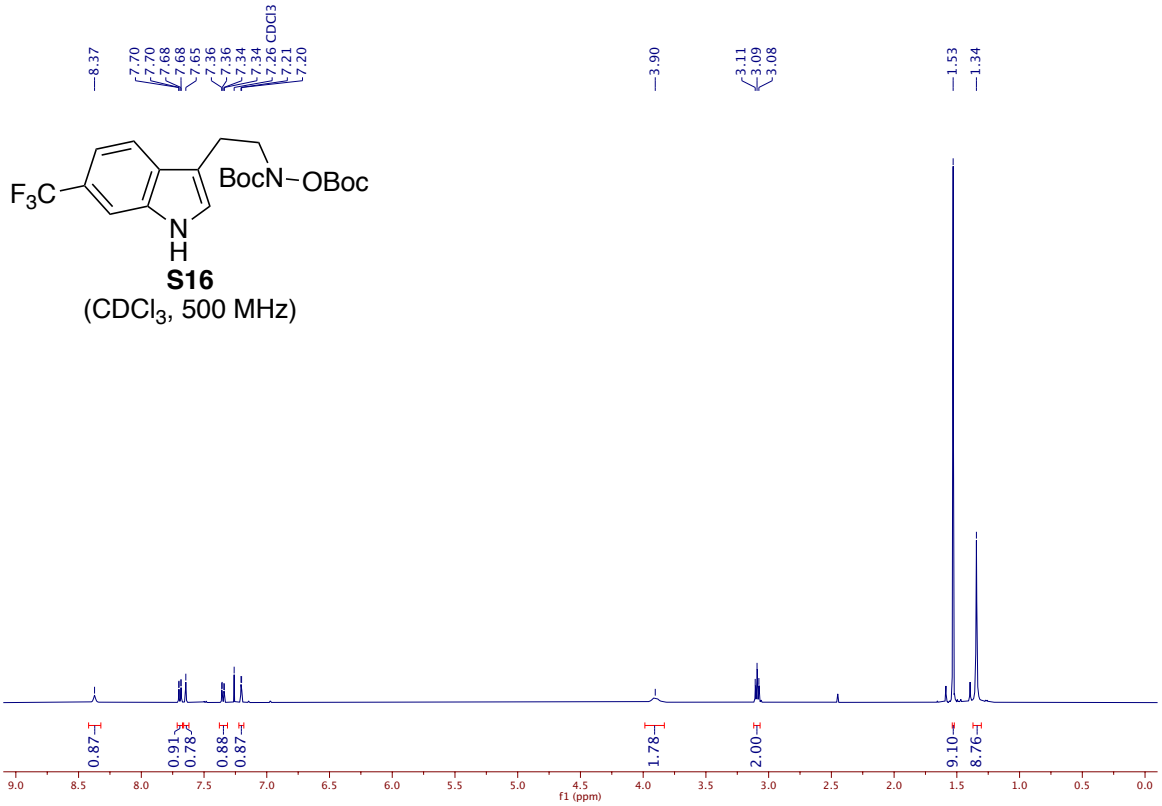
(DMSO-$d_6$, 101 MHz)

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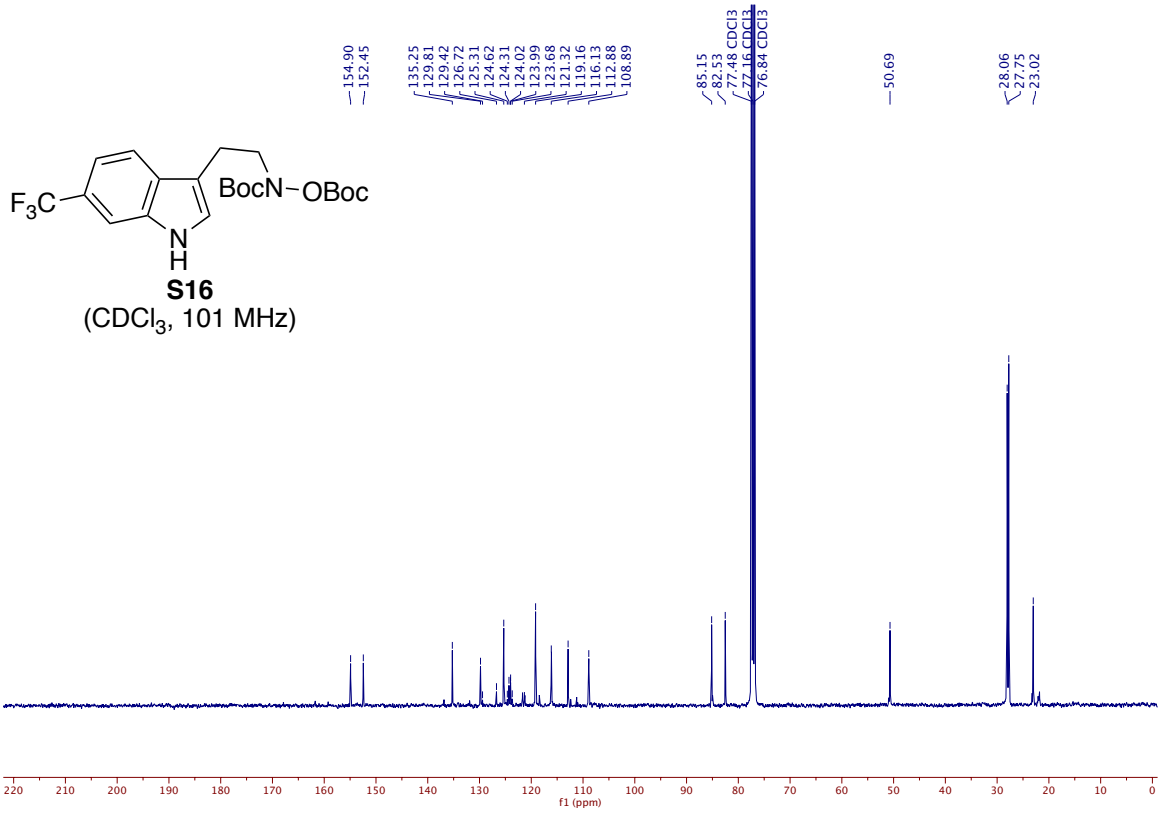
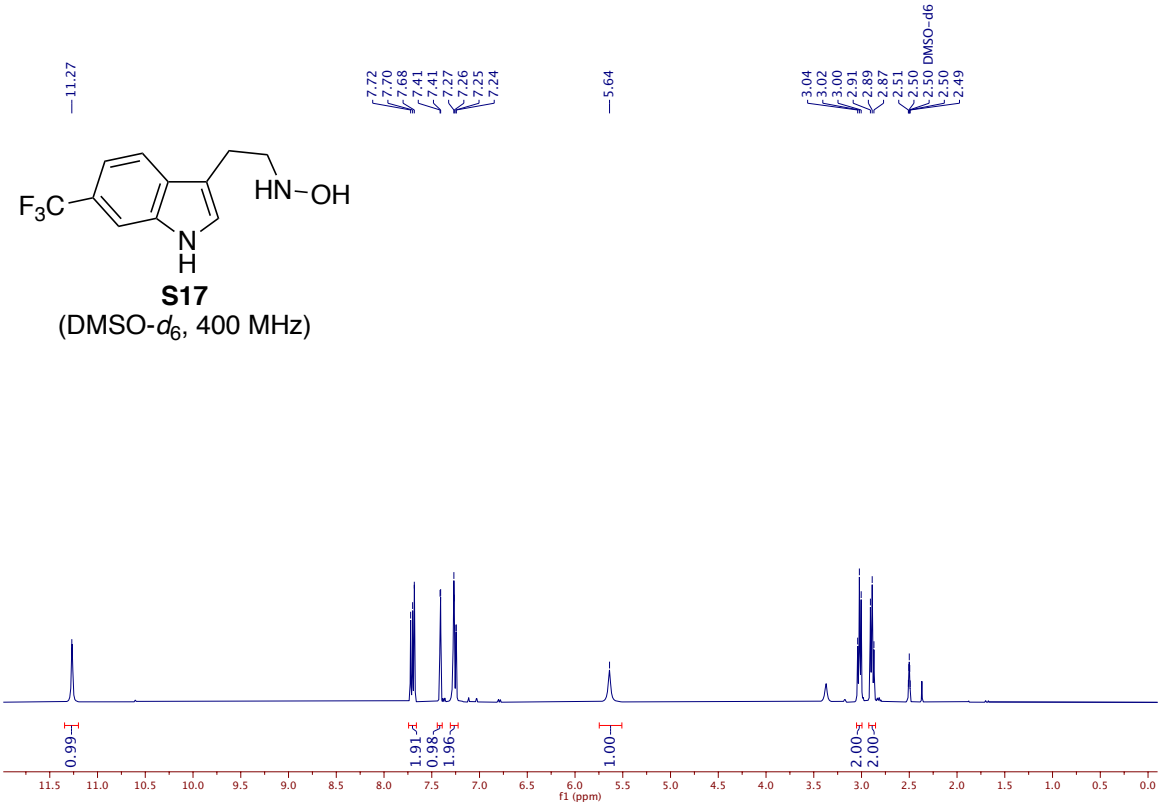
($CDCl_3$, 500 MHz)

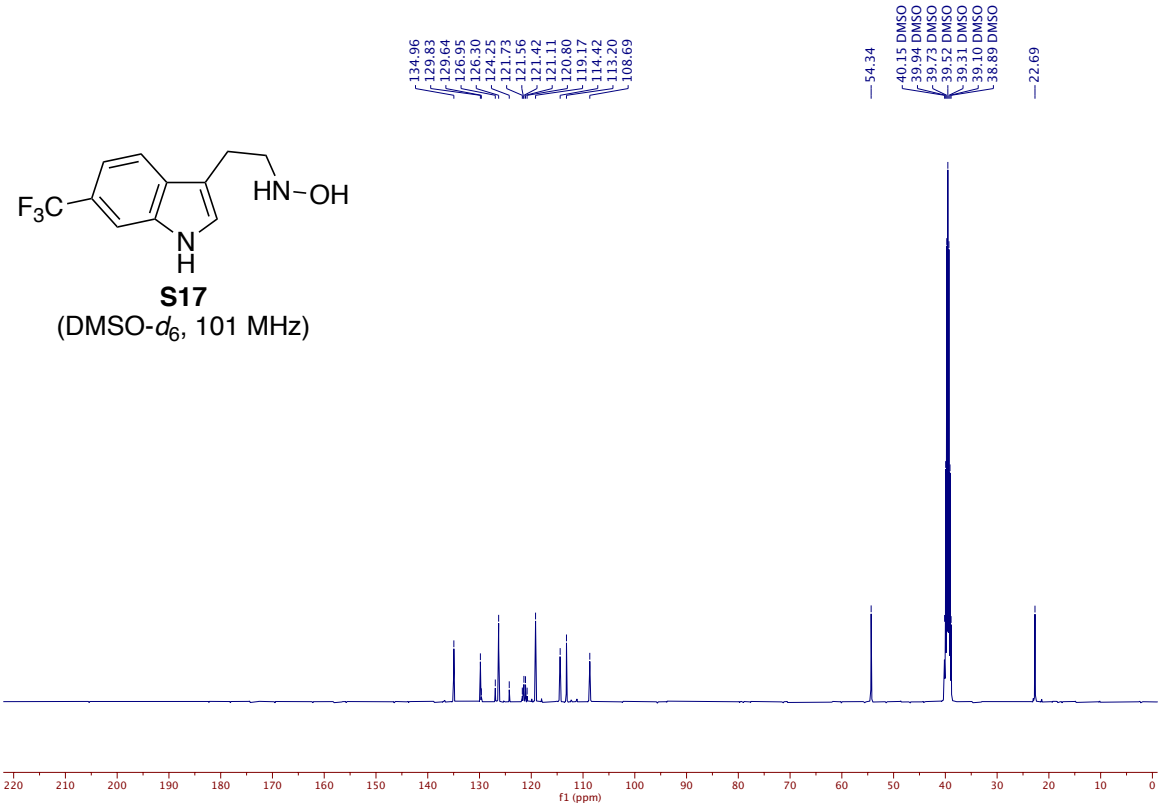



**S16**

($CDCl_3$, 101 MHz)




**S17**
(DMSO-$d_6$, 400 MHz)

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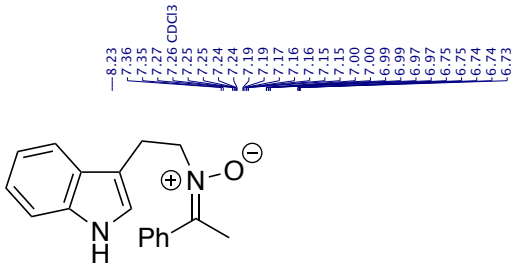
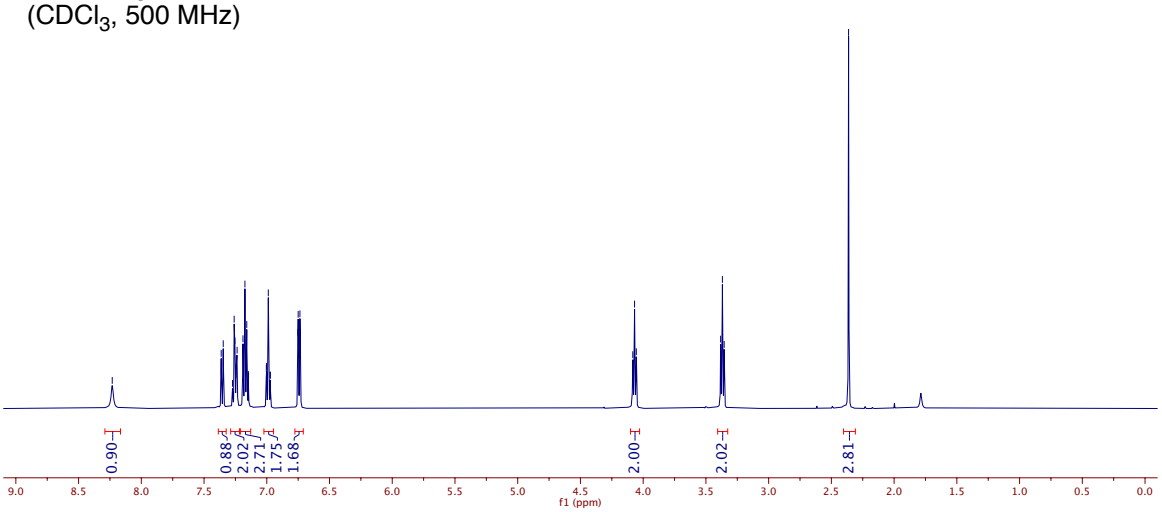
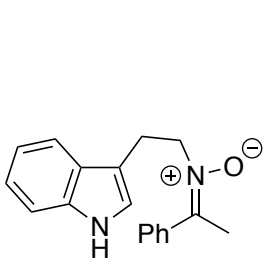
(DMSO-$d_6$, 101 MHz)

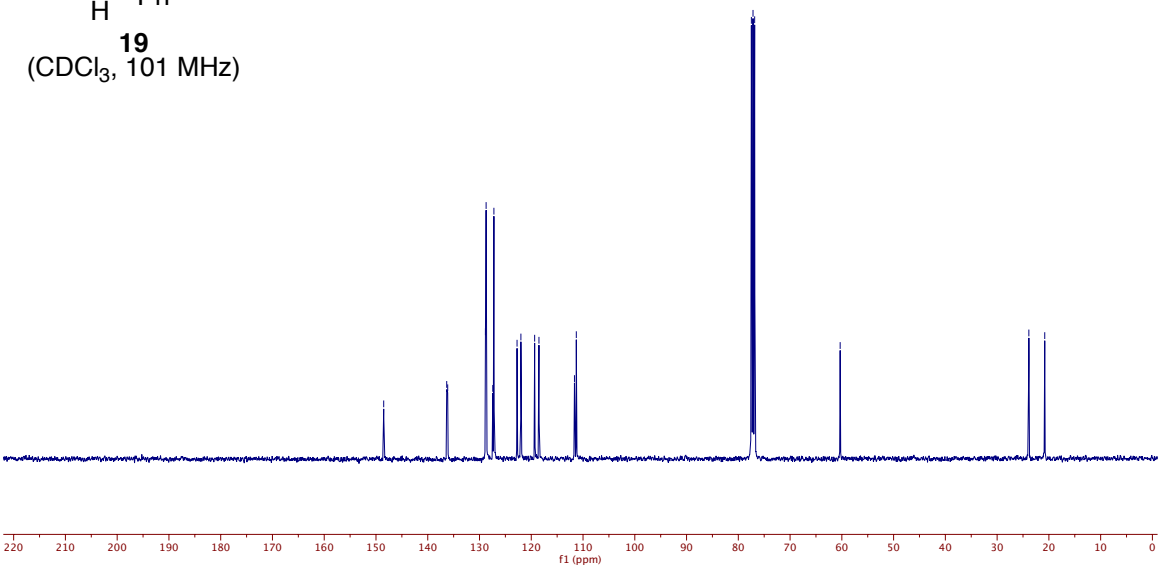


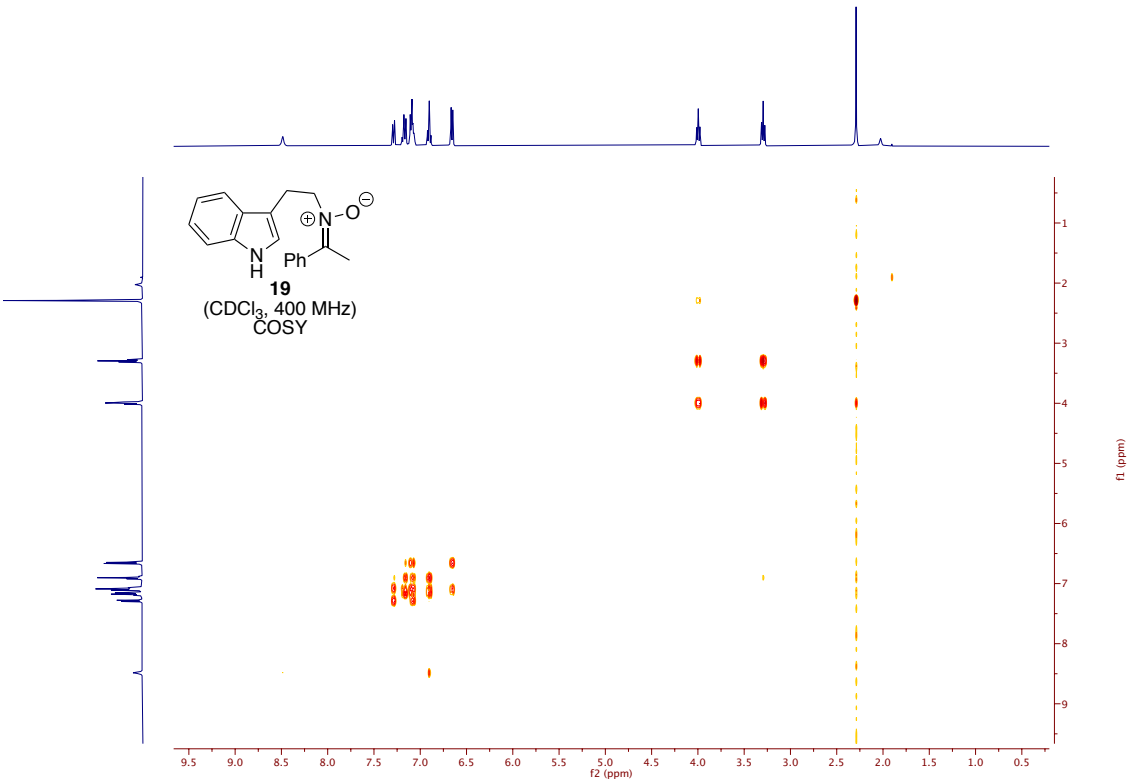
**19**
($CDCl_3$, 500 MHz)

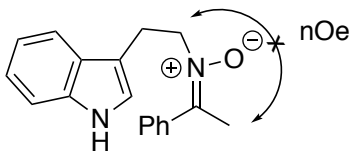




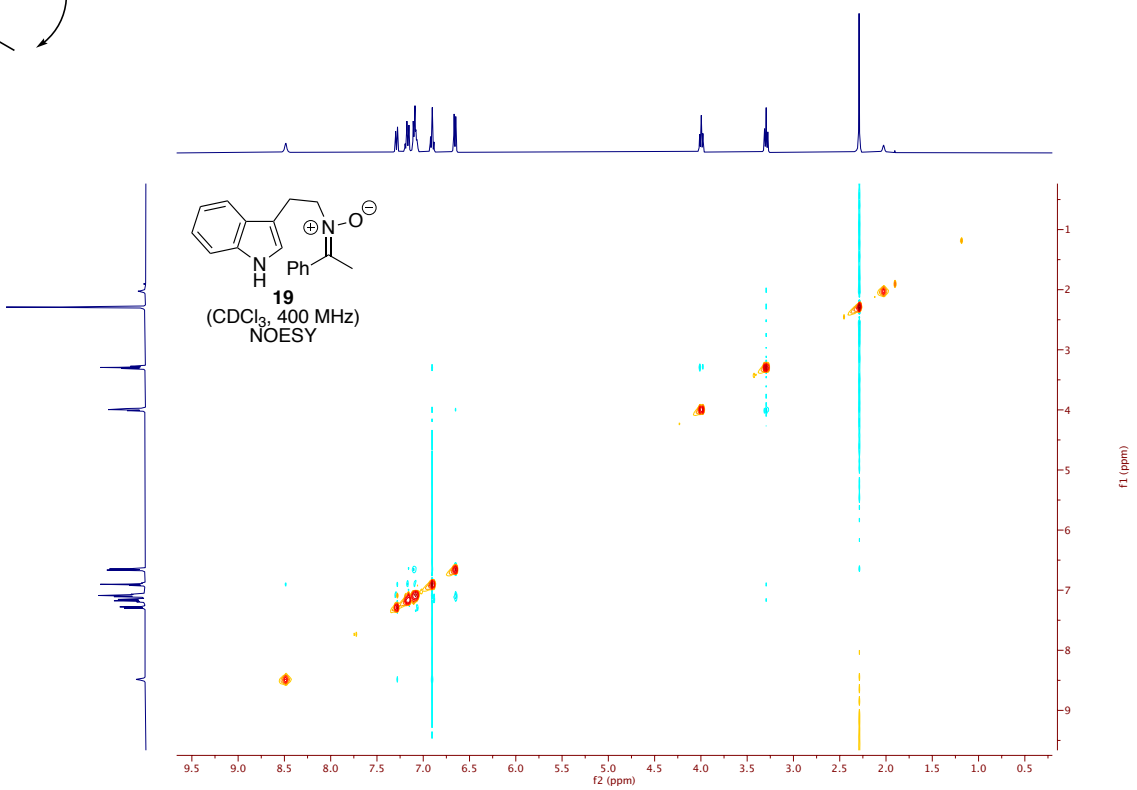
**19**
($CDCl_3$, 101 MHz)

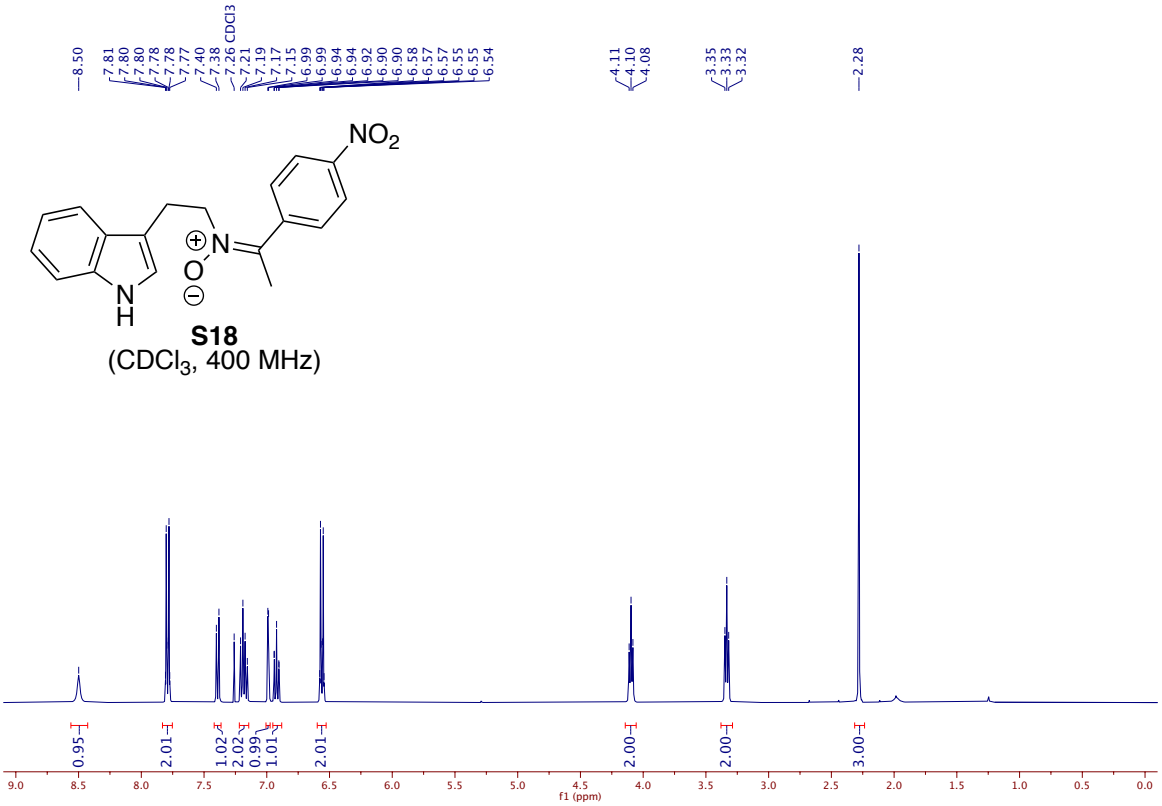



19
(CDCl3, 400 MHz)
COSY
f2 (ppm)
f1 (ppm)

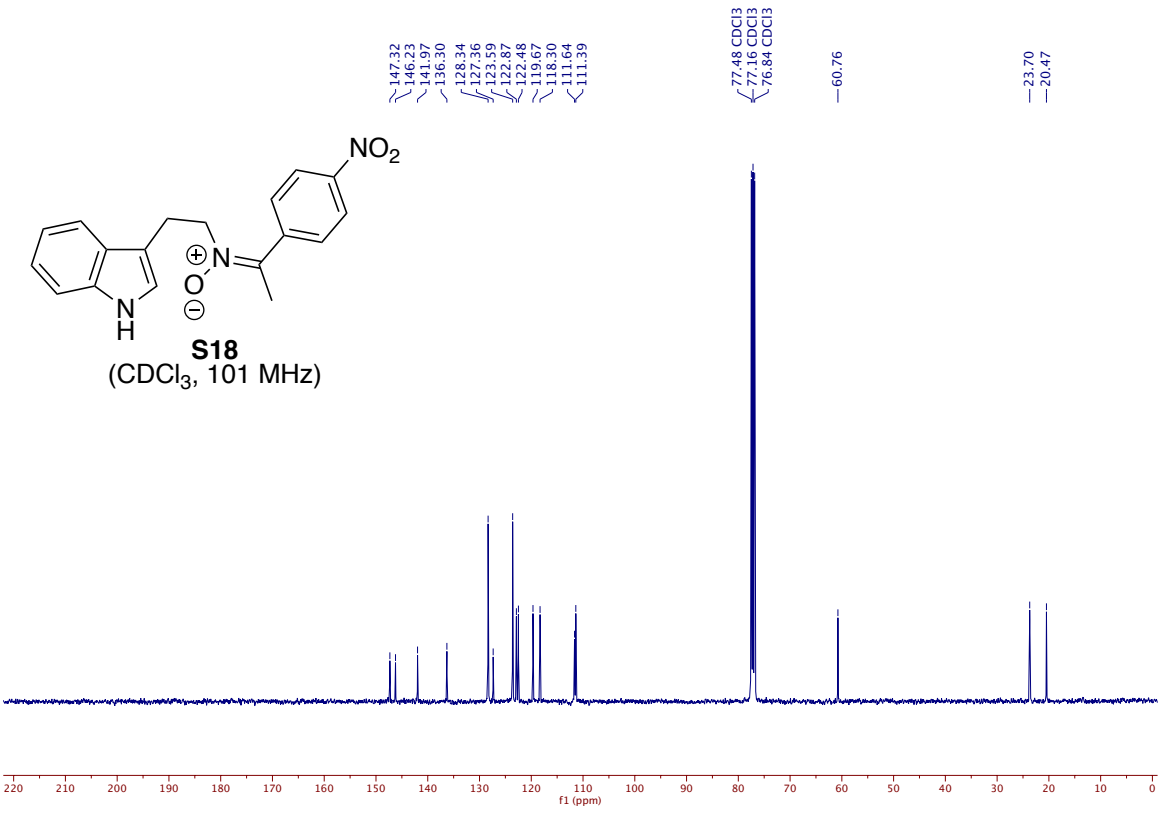

nOe
Ph

**19**

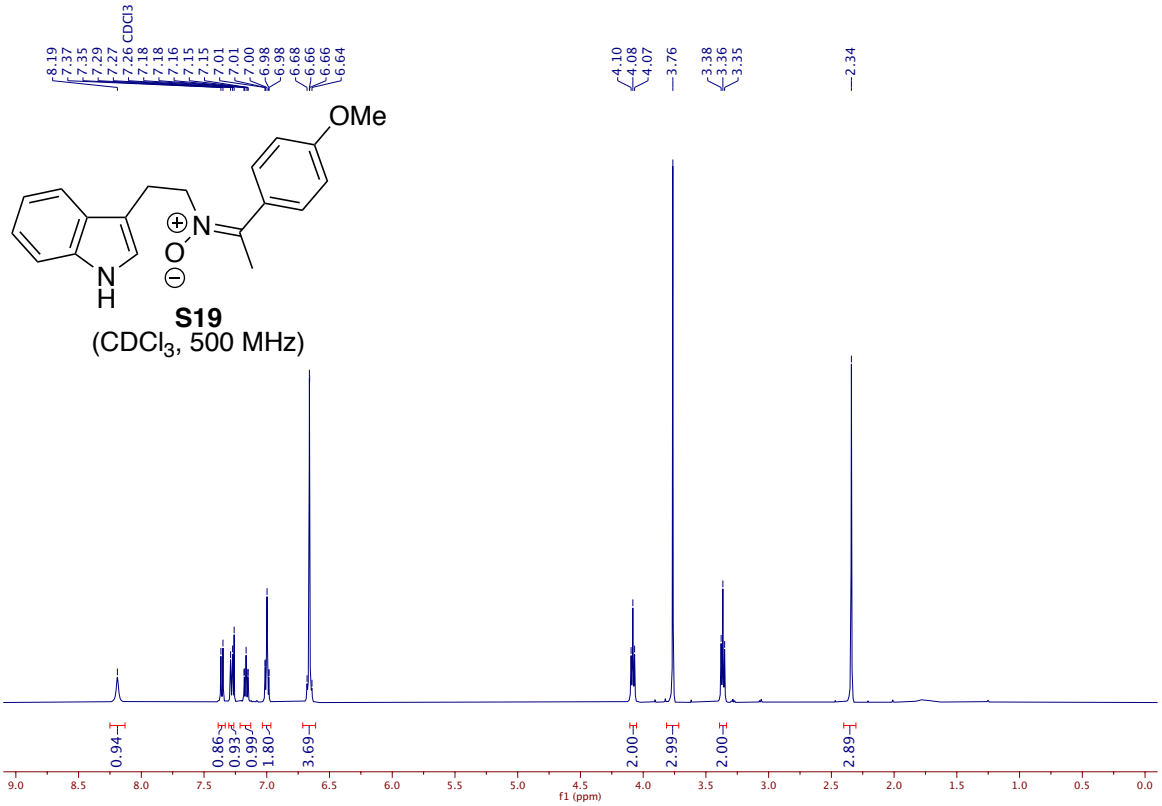

19
(CDCl3, 400 MHz)
NOESY
f2 (ppm)
f1 (ppm)



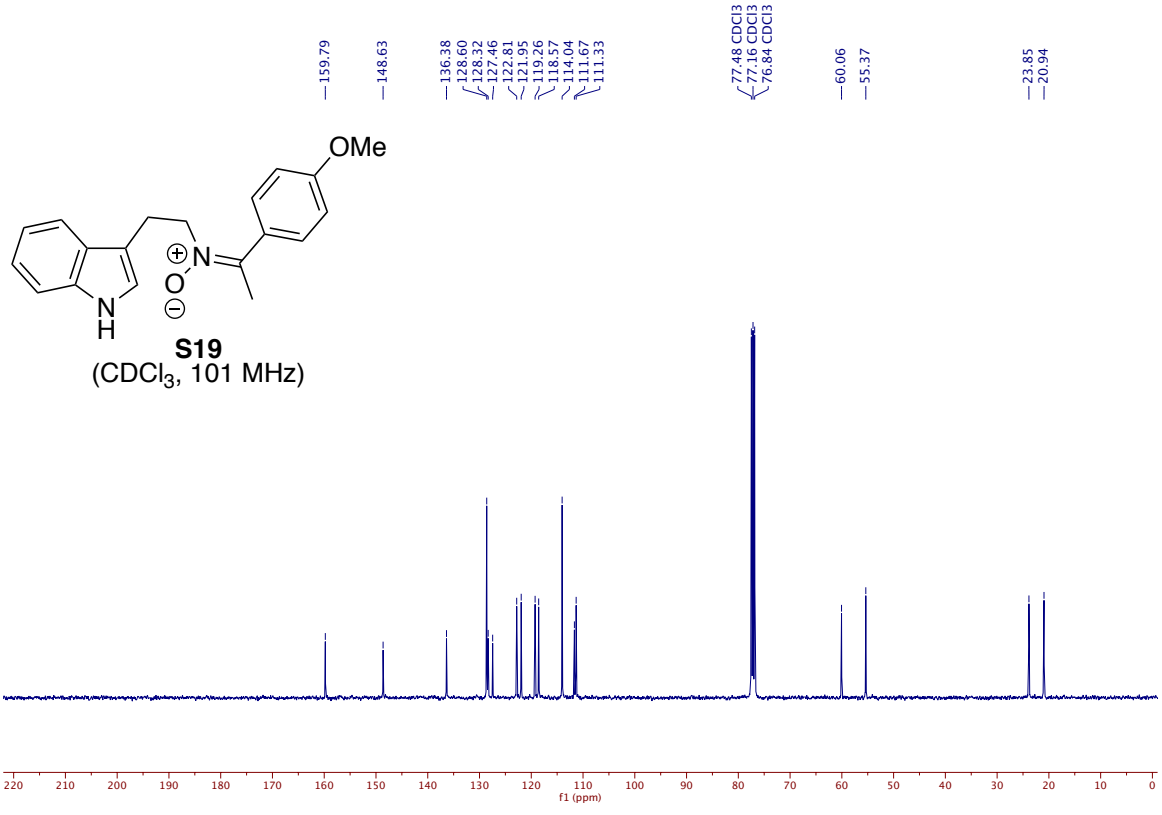

**S18**
($CDCl_3$, 400 MHz)



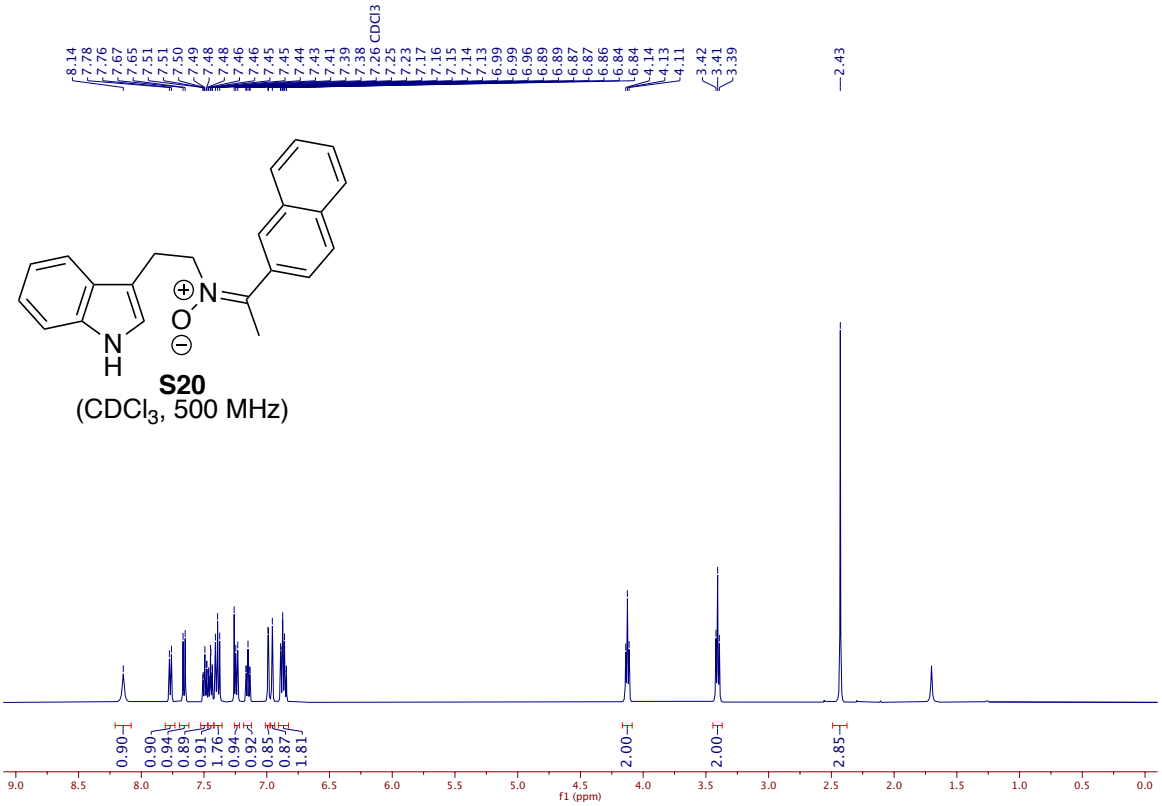

**S18**
($CDCl_3$, 101 MHz)



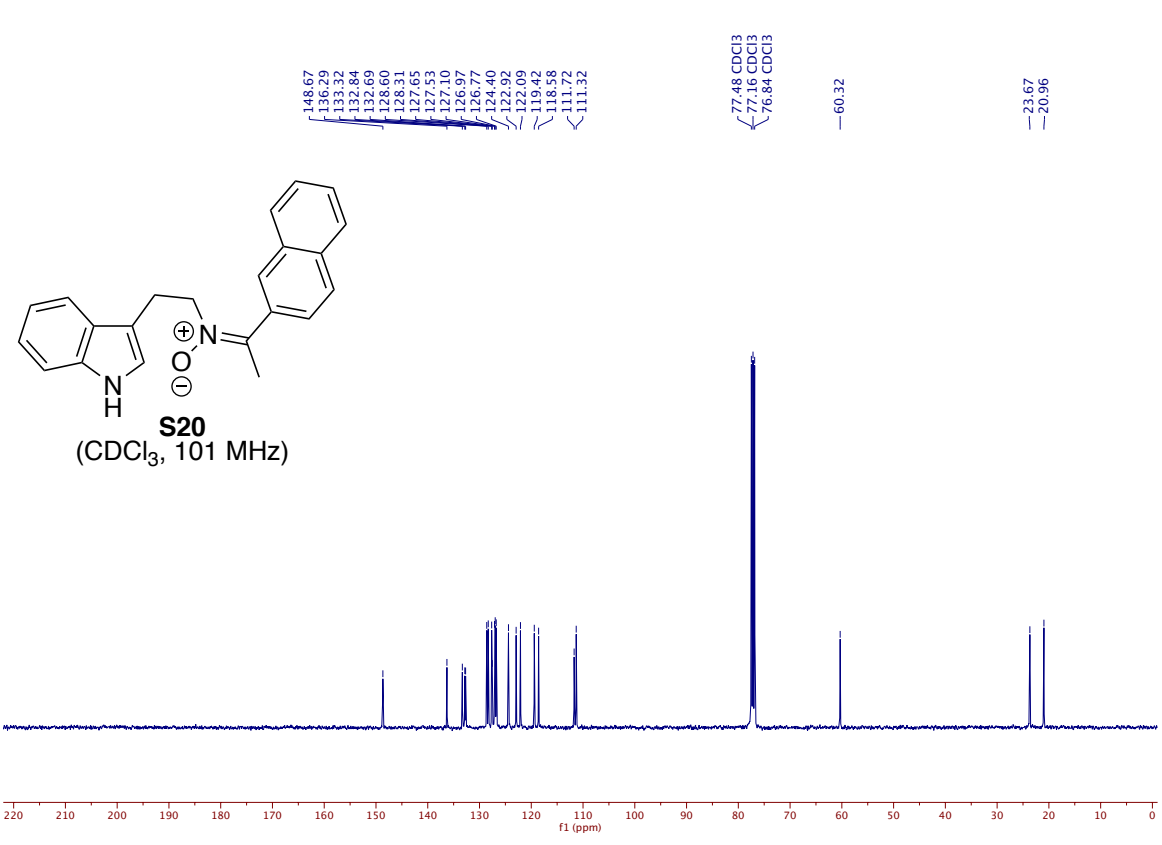

**S19**
($CDCl_3$, 500 MHz)



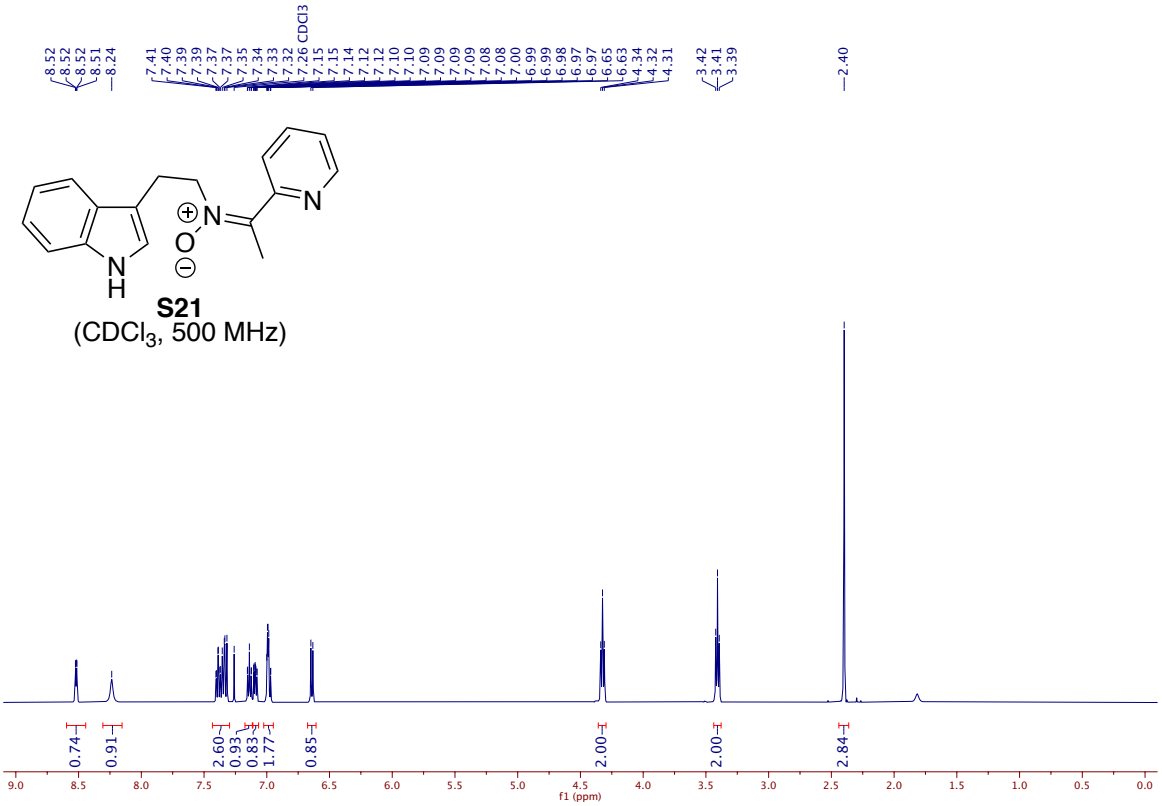

**S19**
($CDCl_3$, 101 MHz)



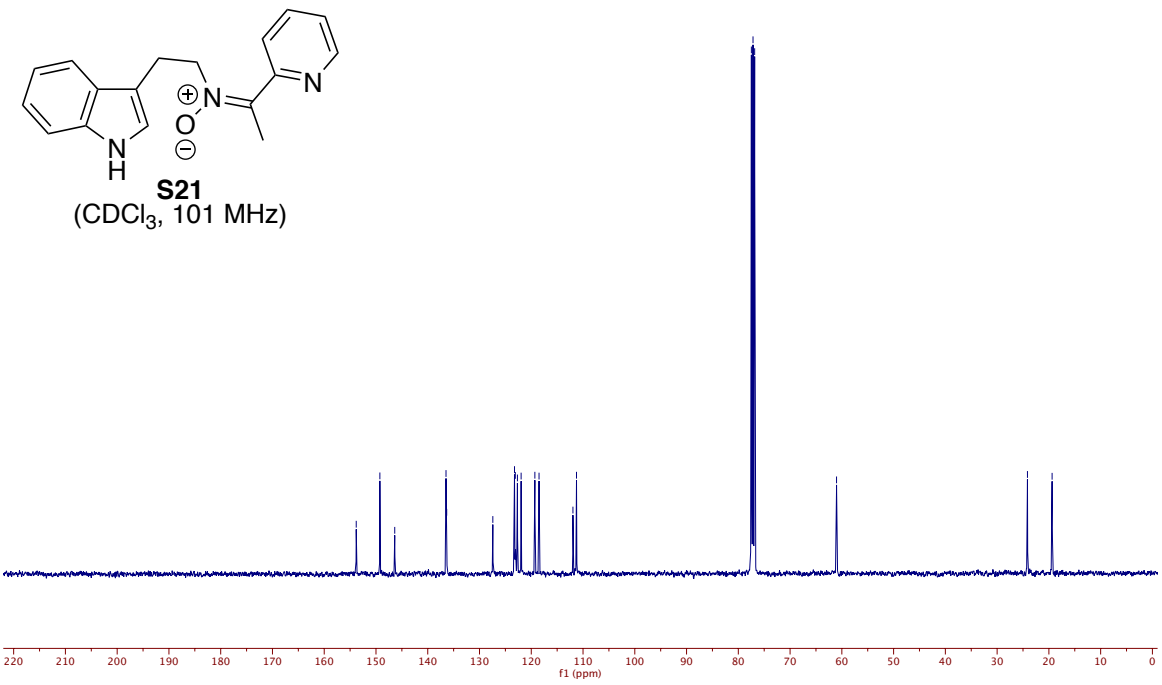

**S20**
($CDCl_3$, 500 MHz)



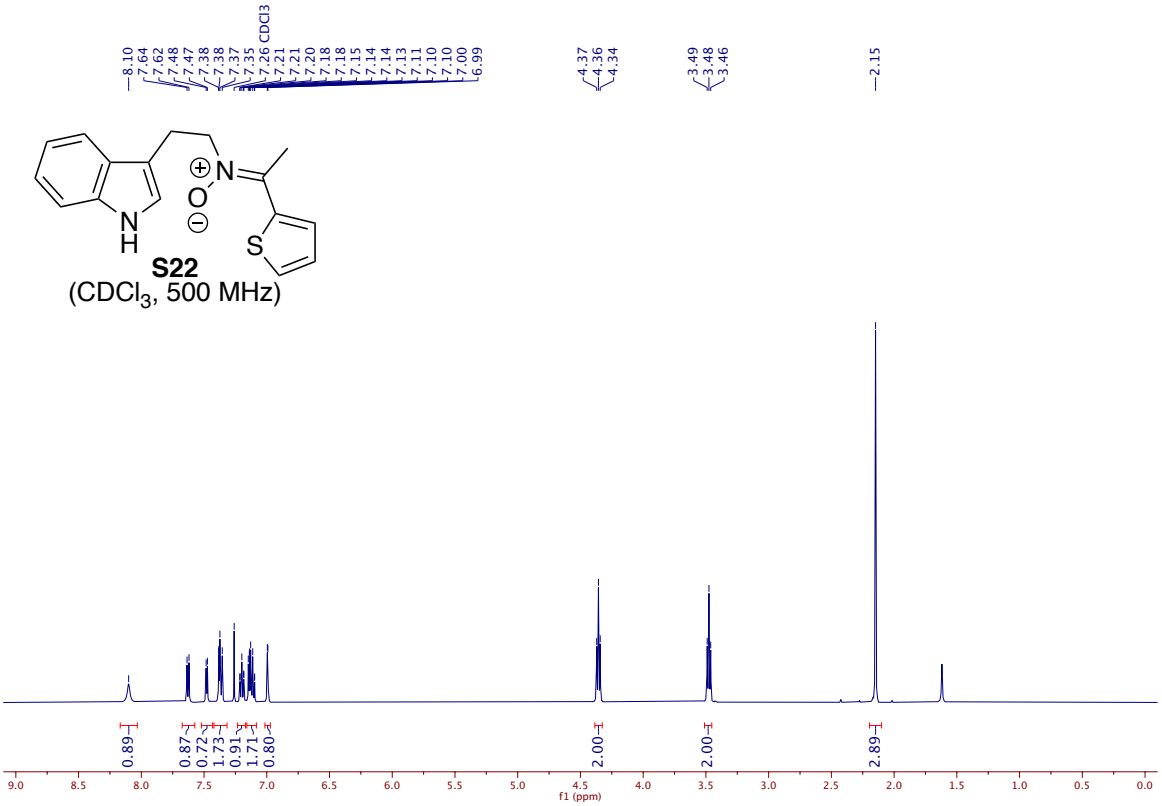

**S20**
($CDCl_3$, 101 MHz)



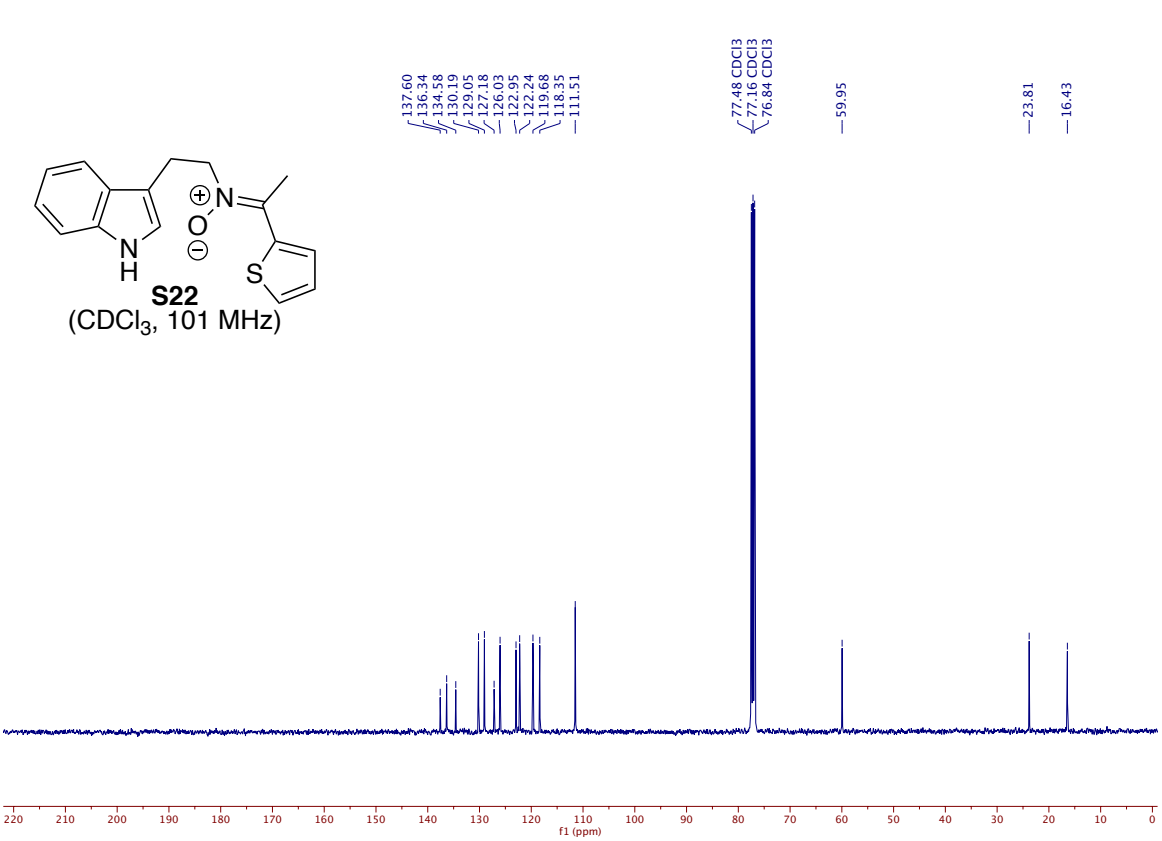

**S21**
($CDCl_3$, 500 MHz)



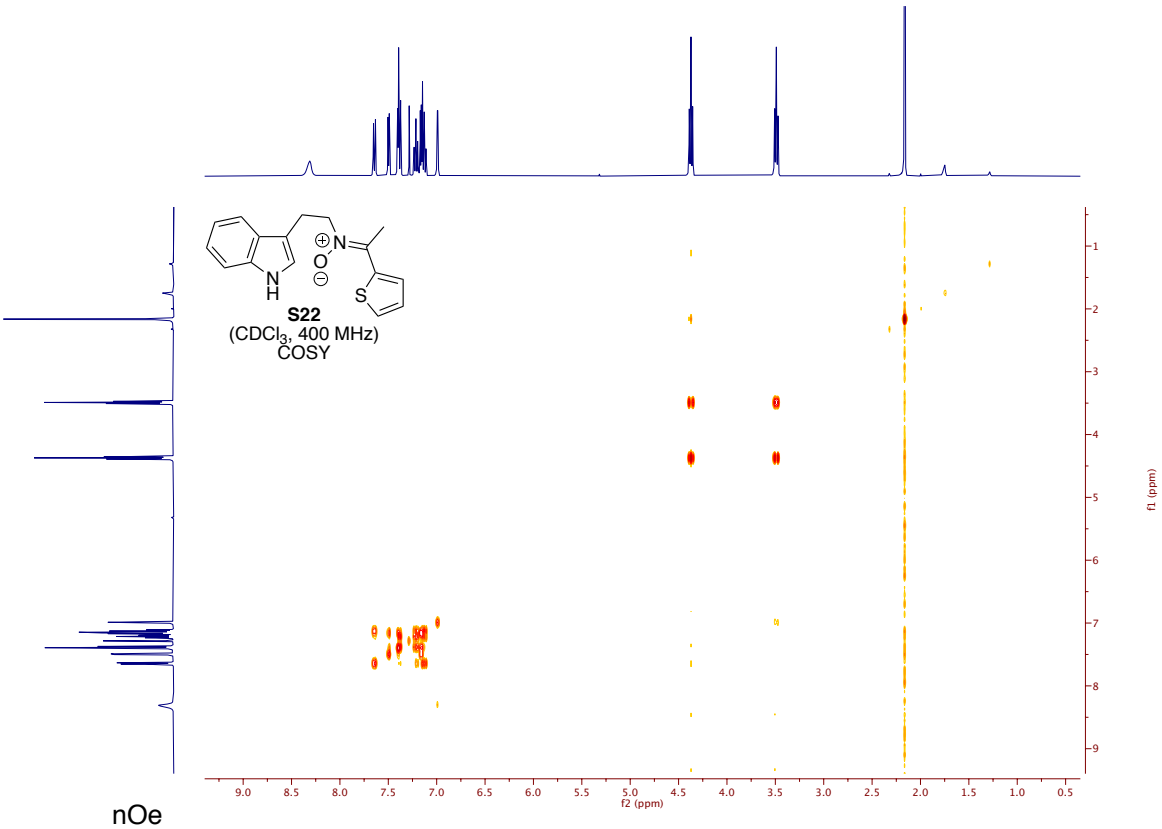

**S21**
($CDCl_3$, 101 MHz)

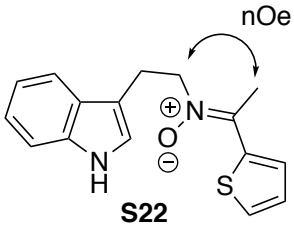


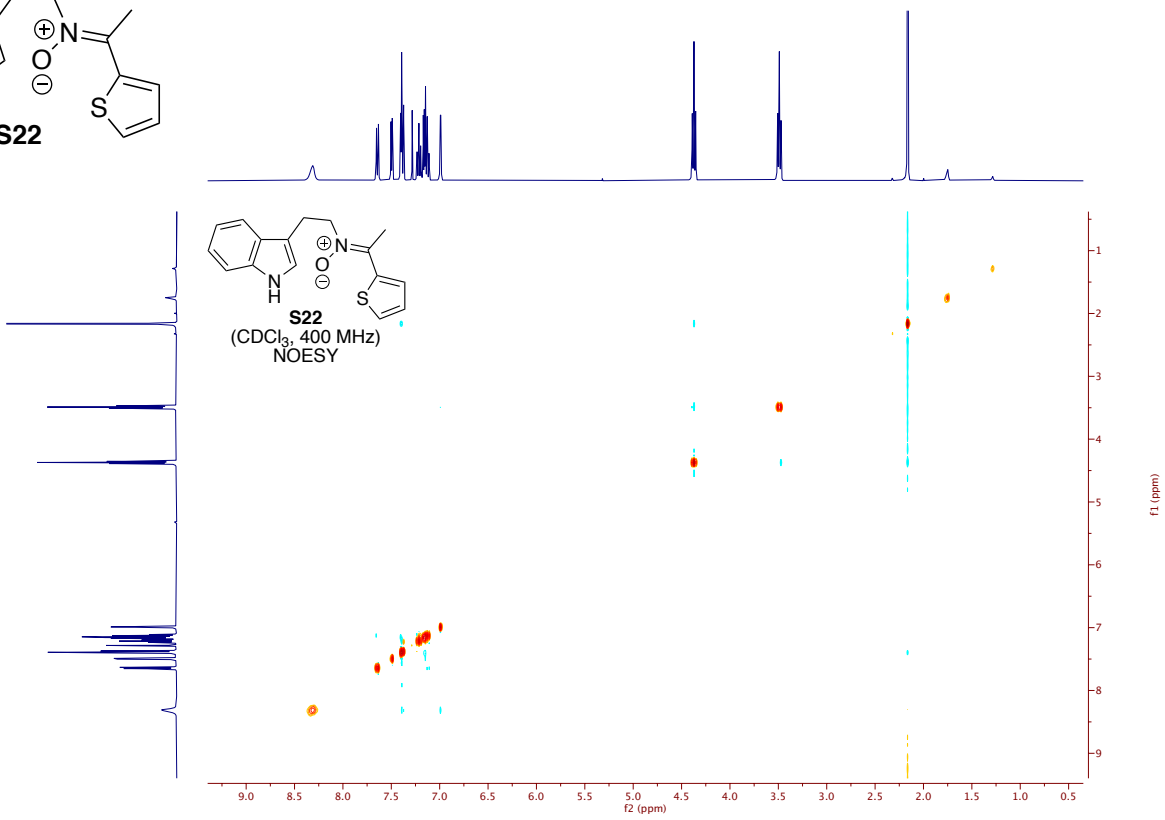

**S22**
($CDCl_3$, 500 MHz)

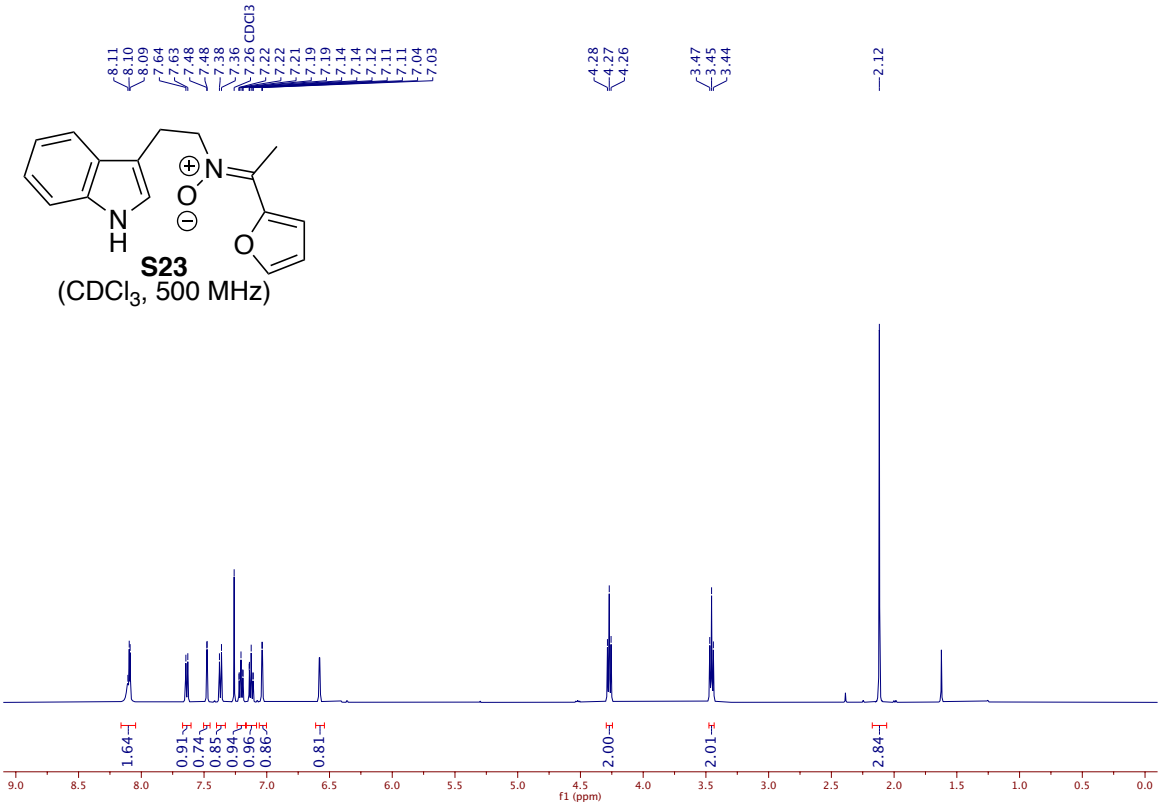



**S22**
($CDCl_3$, 101 MHz)

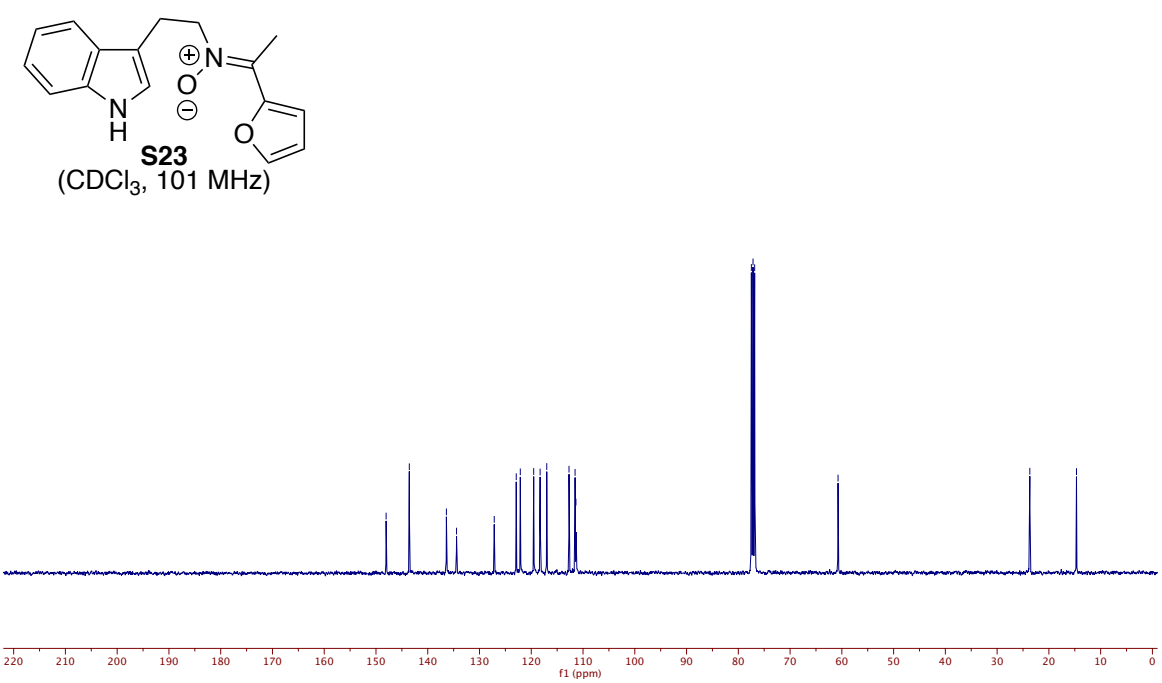

S22
(CDCl3, 400 MHz)
COSY
f2 (ppm)
f1 (ppm)


nOe
S22

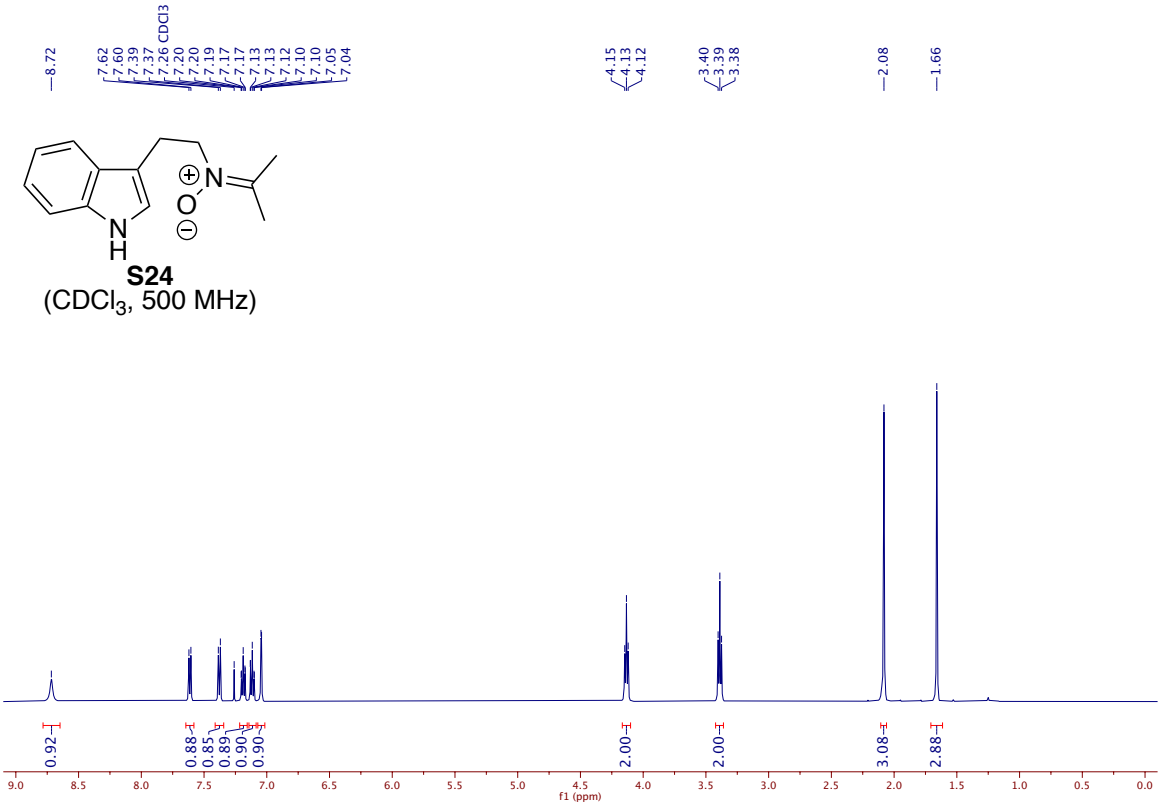

S22
(CDCl3, 400 MHz)
NOESY
f2 (ppm)
f1 (ppm)



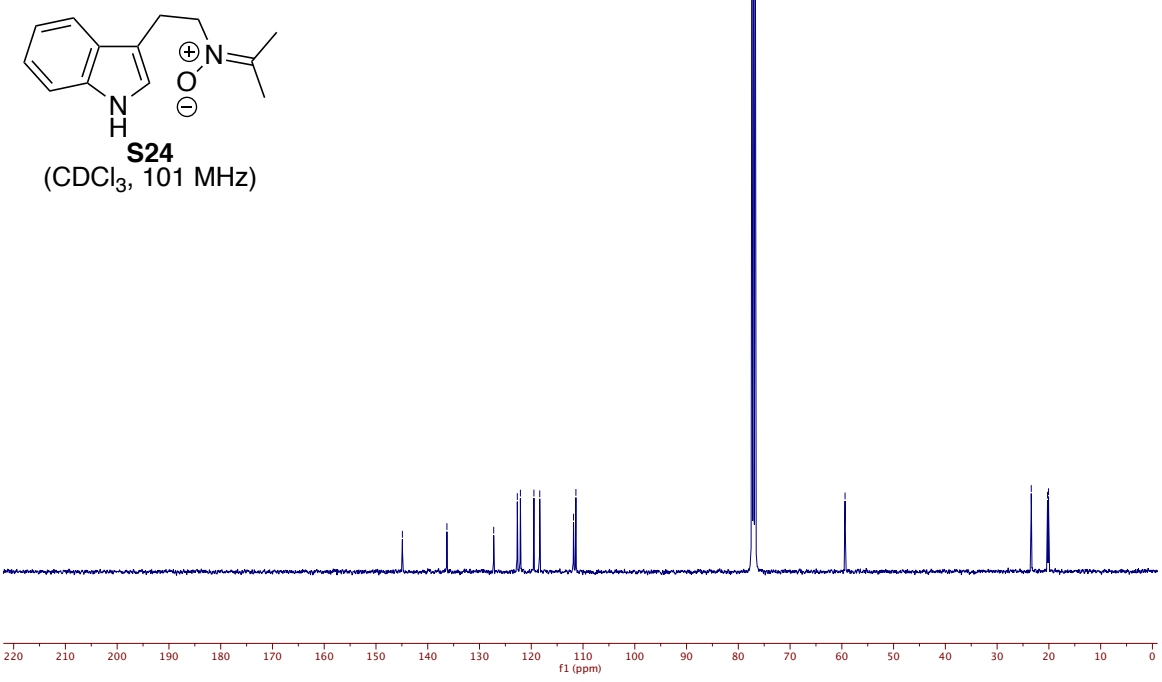

**S23**
($CDCl_3$, 500 MHz)



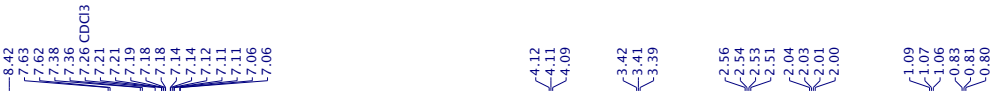

**S23**
($CDCl_3$, 101 MHz)

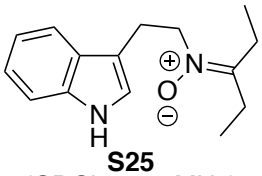



**S24**
($CDCl_3$, 500 MHz)

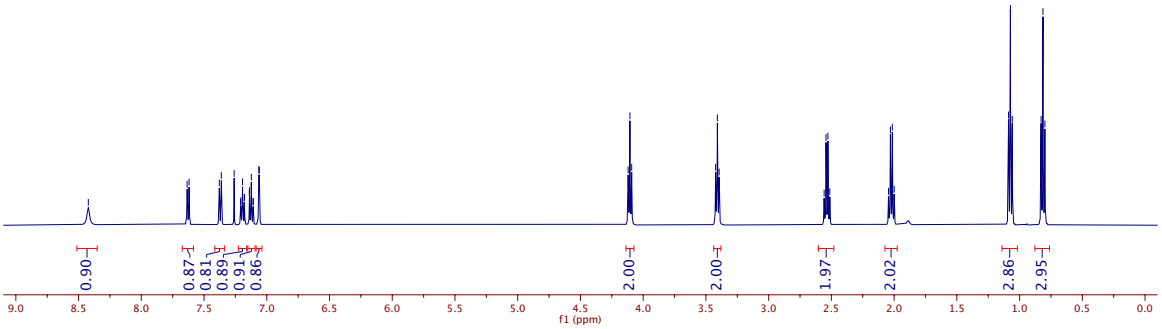



**S24**
($CDCl_3$, 101 MHz)

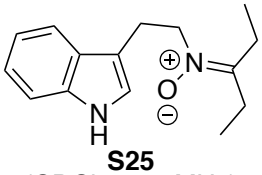


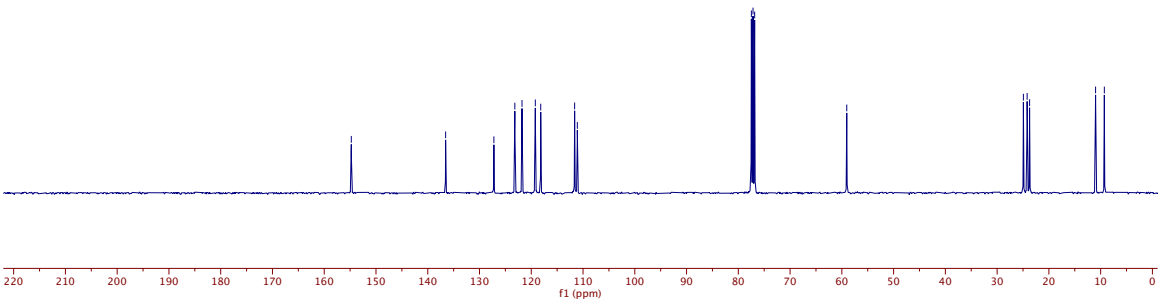
**S25**
($CDCl_3$, 500 MHz)

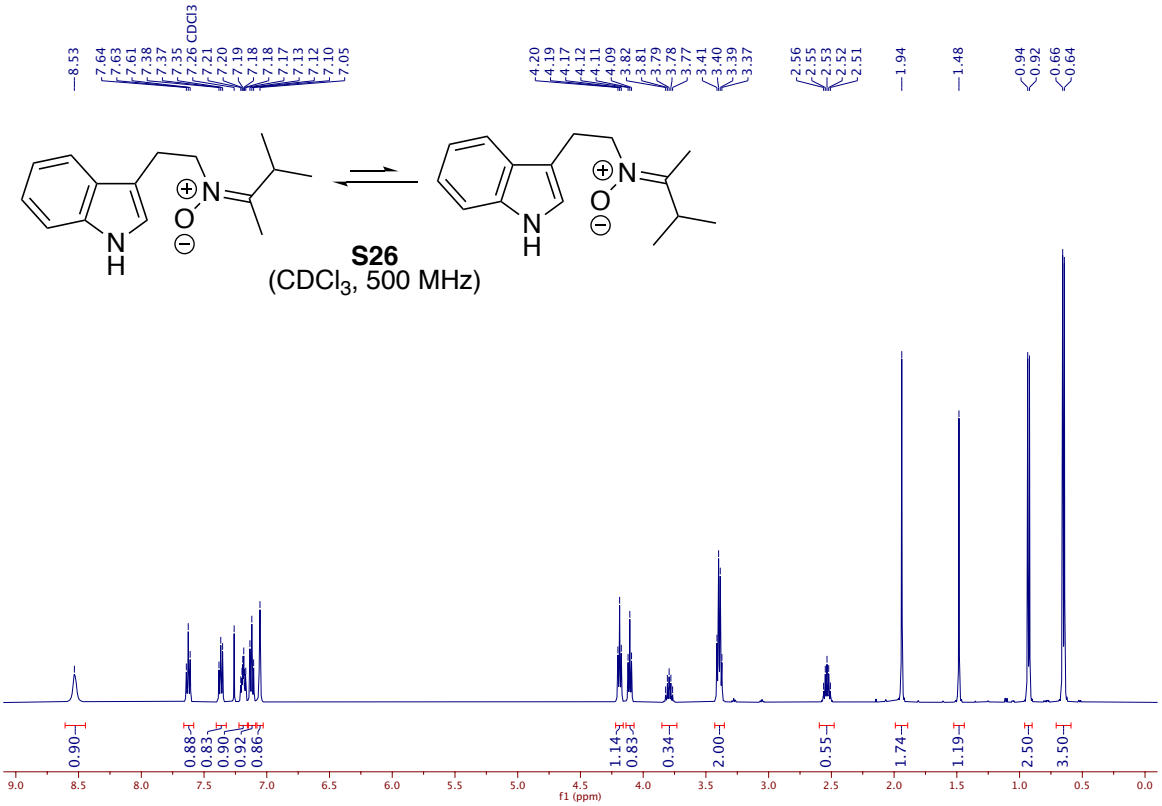


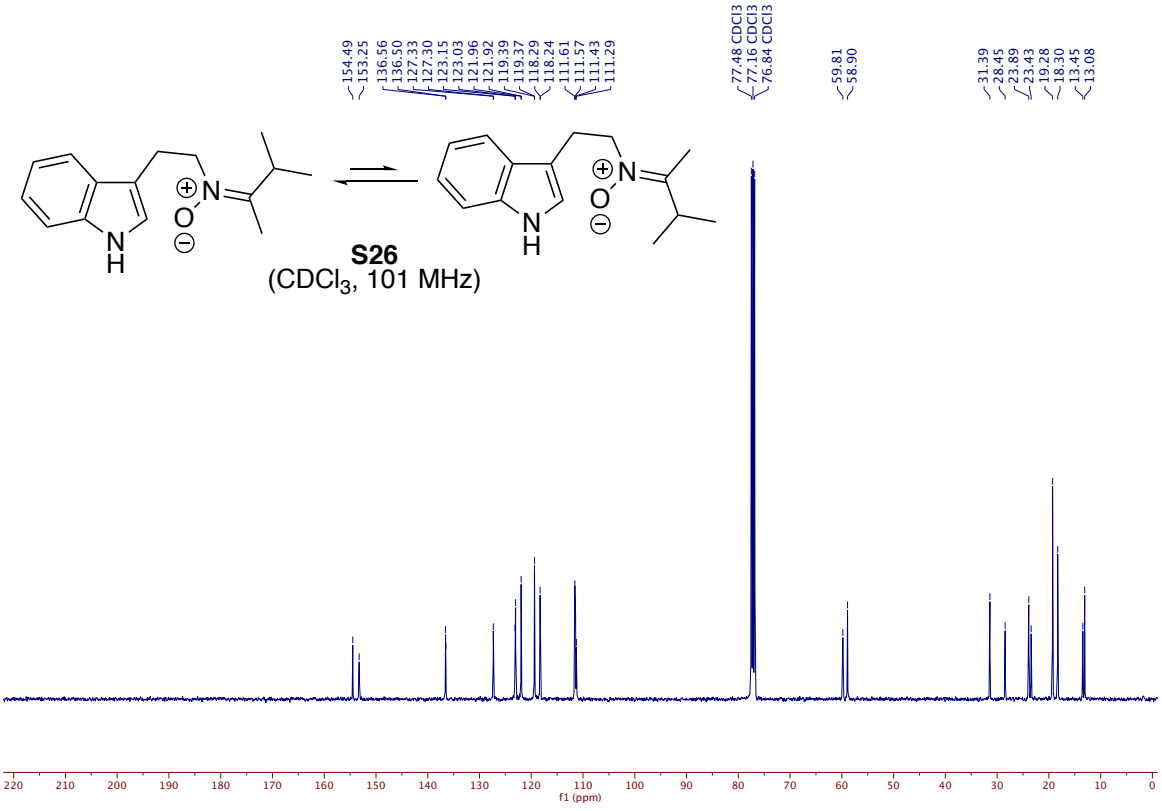


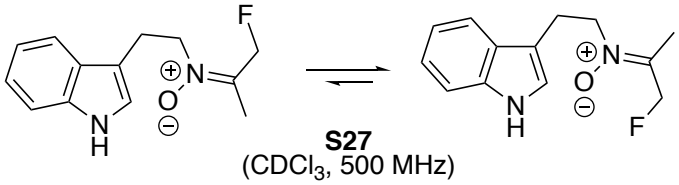


**S25**
($CDCl_3$, 101 MHz)

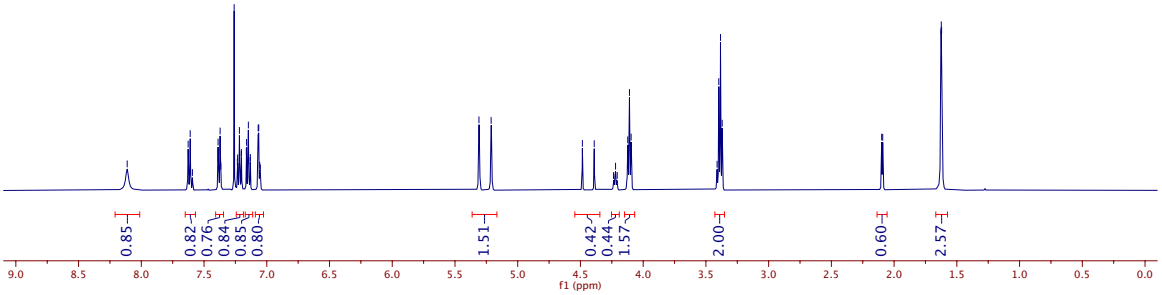



8.53
7.64
7.63
7.61
7.38
7.37
7.35
7.26 CDCl3
7.21
7.20
7.19
7.18
7.18
7.17
7.13
7.12
7.10
7.05
4.20
4.19
4.17
4.12
4.11
4.09
3.82
3.81
3.79
3.78
3.77
3.41
3.40
3.39
3.37
2.56
2.55
2.53
2.52
2.51
1.94
1.48
0.94
0.92
0.66
0.64
S26
(CDCl3, 500 MHz)
0.90
0.88
0.83
0.90
0.92
0.86
1.14
0.83
0.34
2.00
0.55
1.74
1.19
2.50
3.50
f1 (ppm)

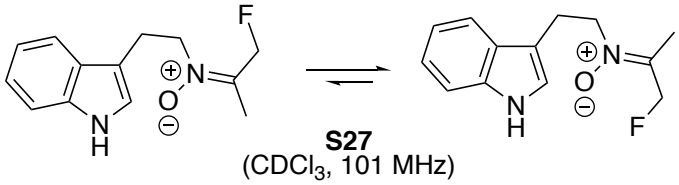

154.49
153.25
136.56
136.50
127.33
127.30
123.15
123.03
121.96
121.92
119.39
119.37
118.29
118.24
111.61
111.57
111.43
111.29
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
59.81
58.90
31.39
28.45
23.89
23.43
19.28
18.30
13.45
13.08
S26
(CDCl3, 101 MHz)
f1 (ppm)

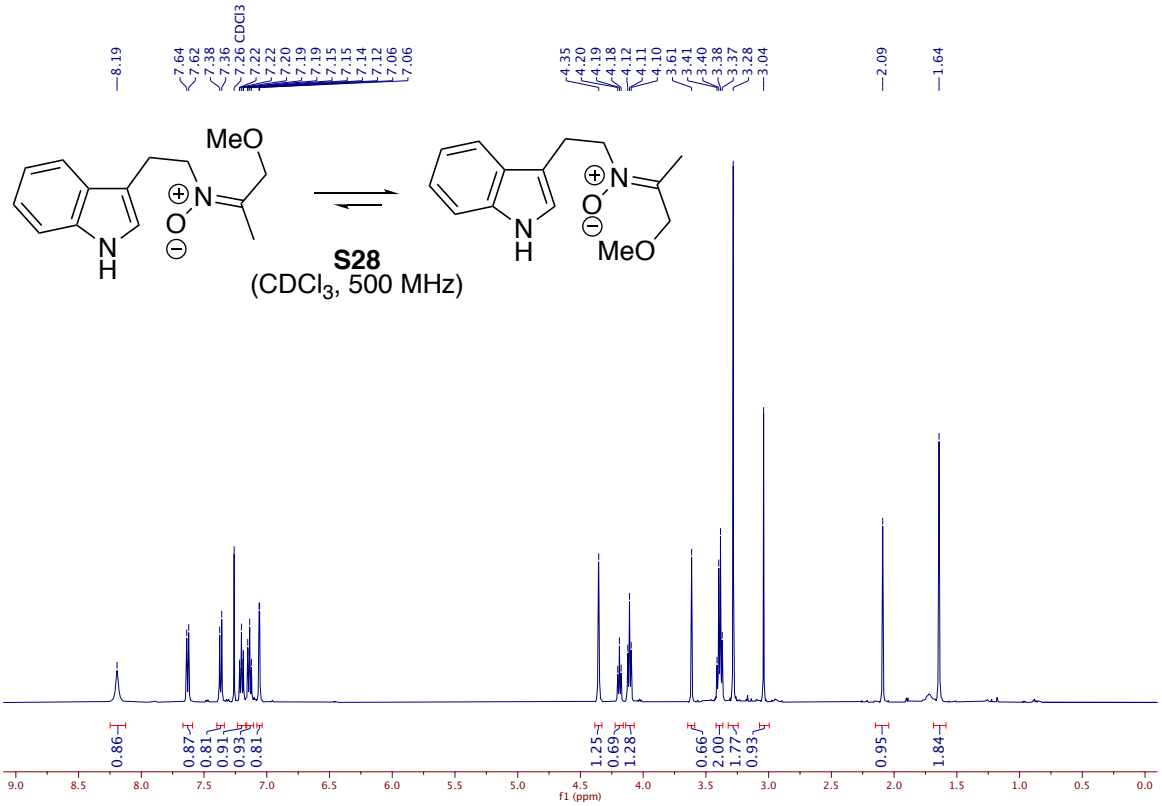

**S27**
($CDCl_3$, 500 MHz)

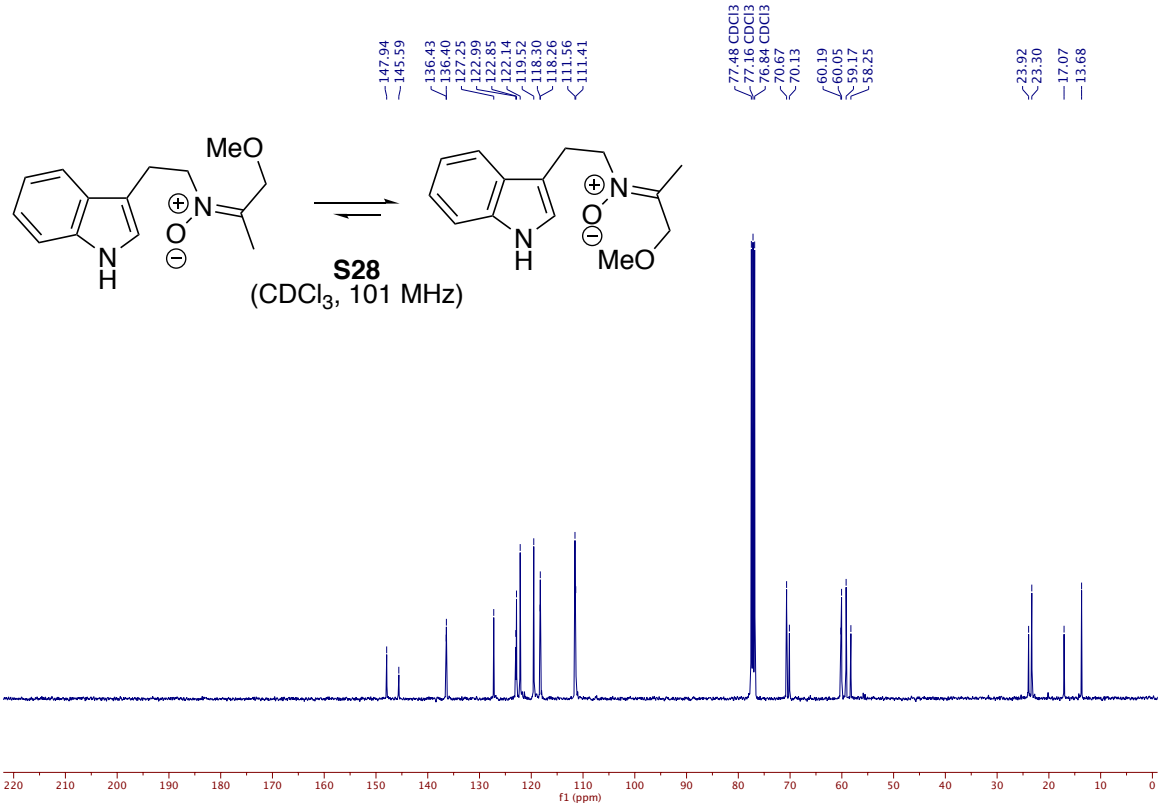


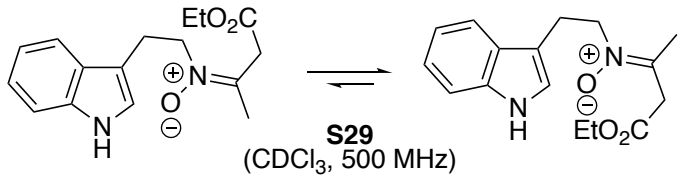




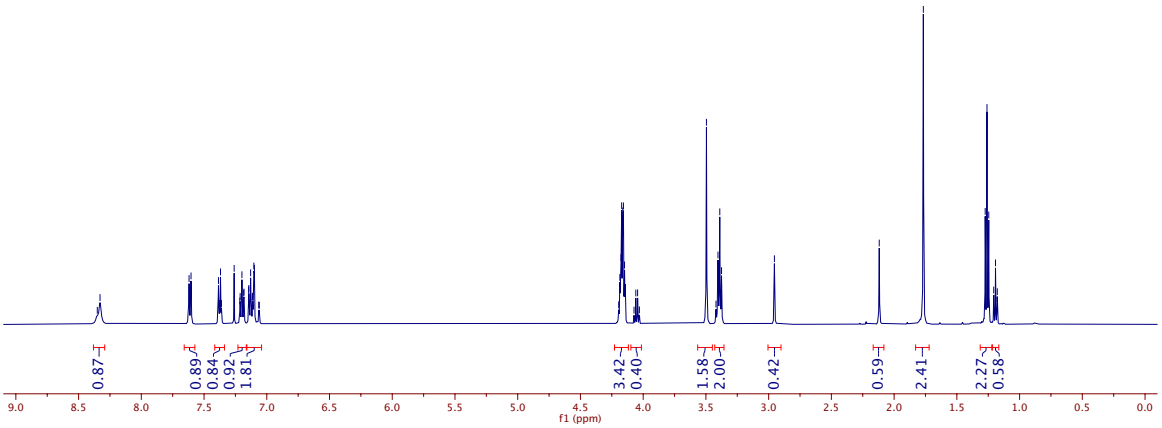

**S27**
($CDCl_3$, 101 MHz)

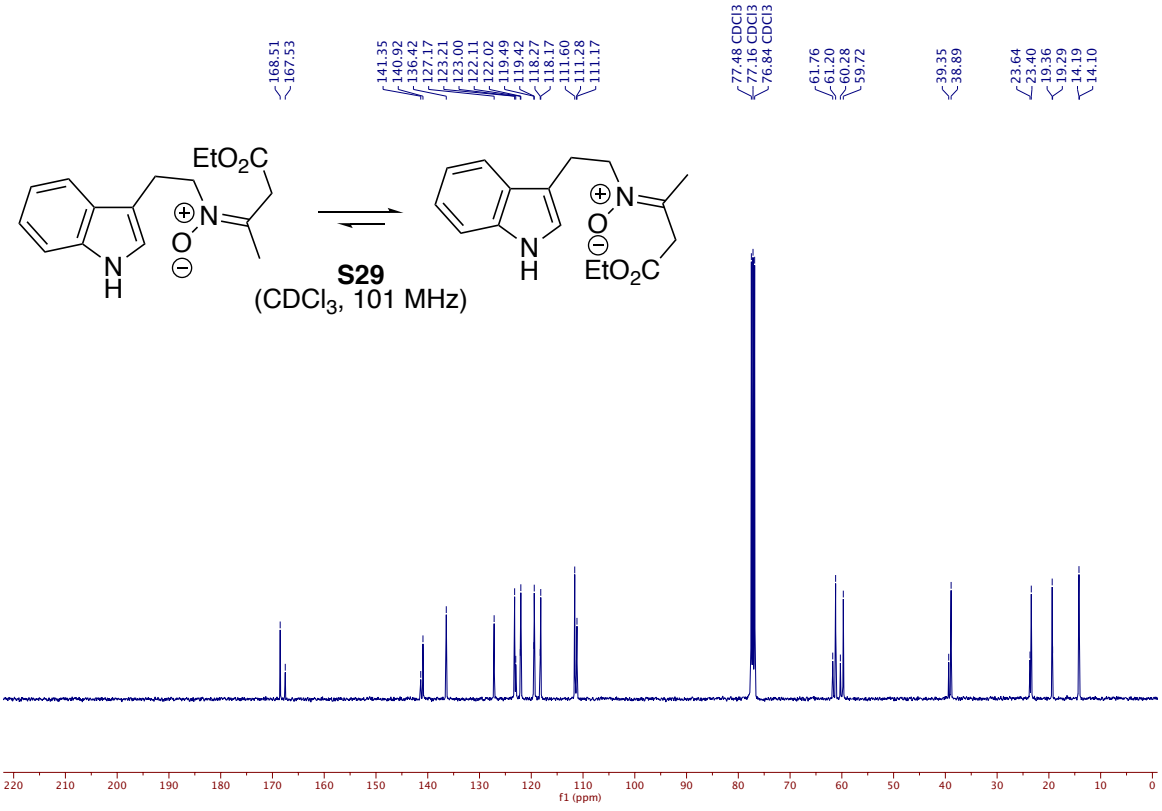

MeO
N
H
N
O
MeO
S28
(CDCl3, 500 MHz)
f1 (ppm)


MeO
N
H
N
O
MeO
S28
(CDCl3, 101 MHz)
f1 (ppm)


**S29**
($CDCl_3$, 500 MHz)

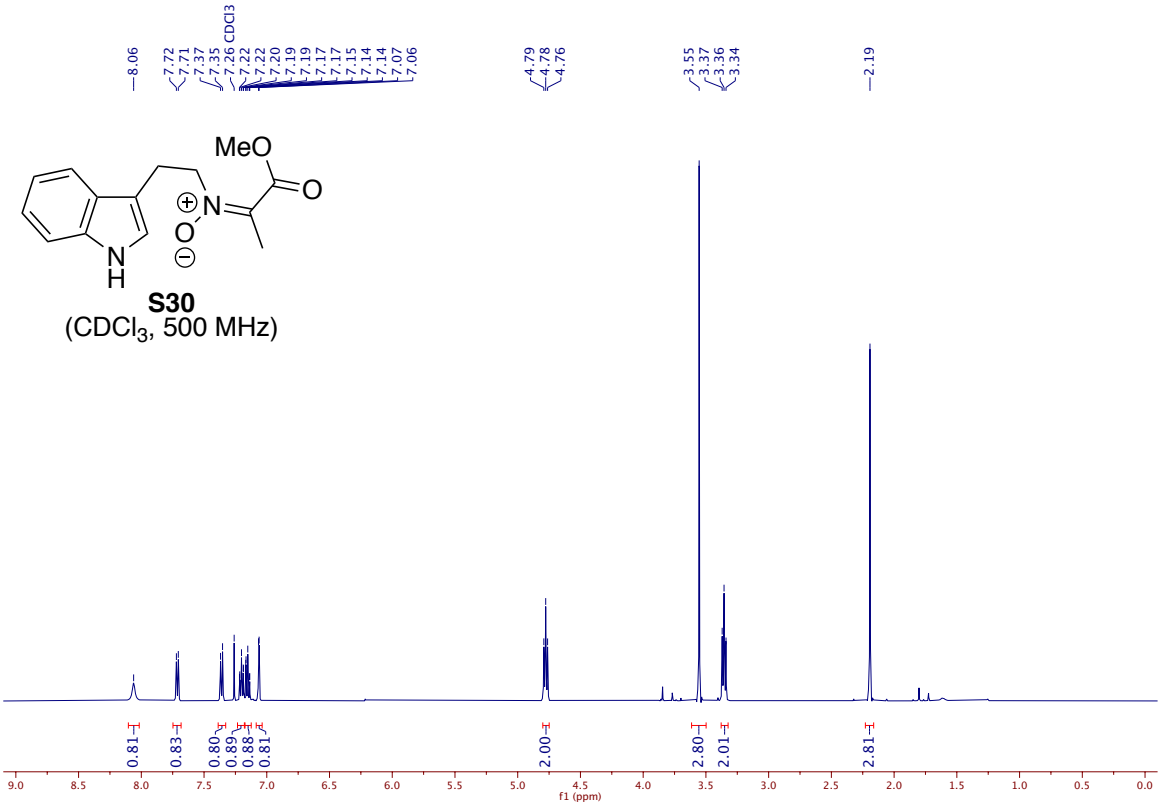


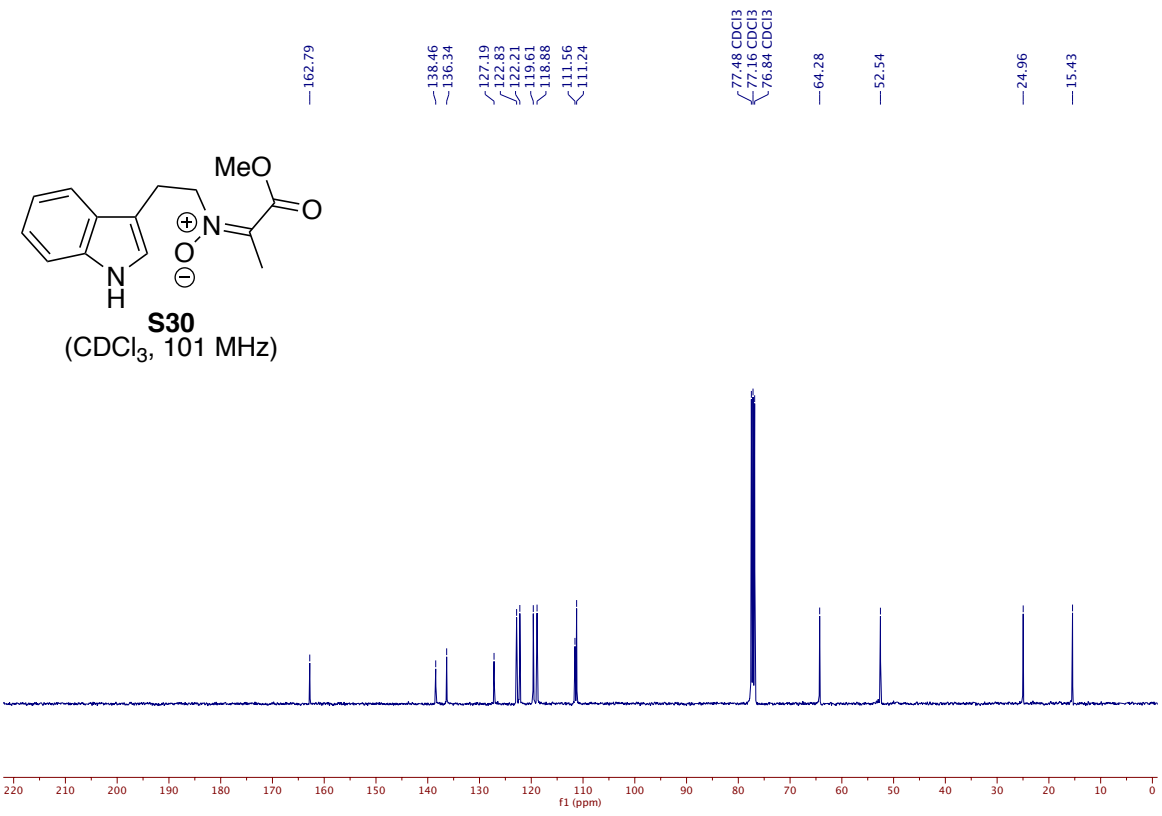




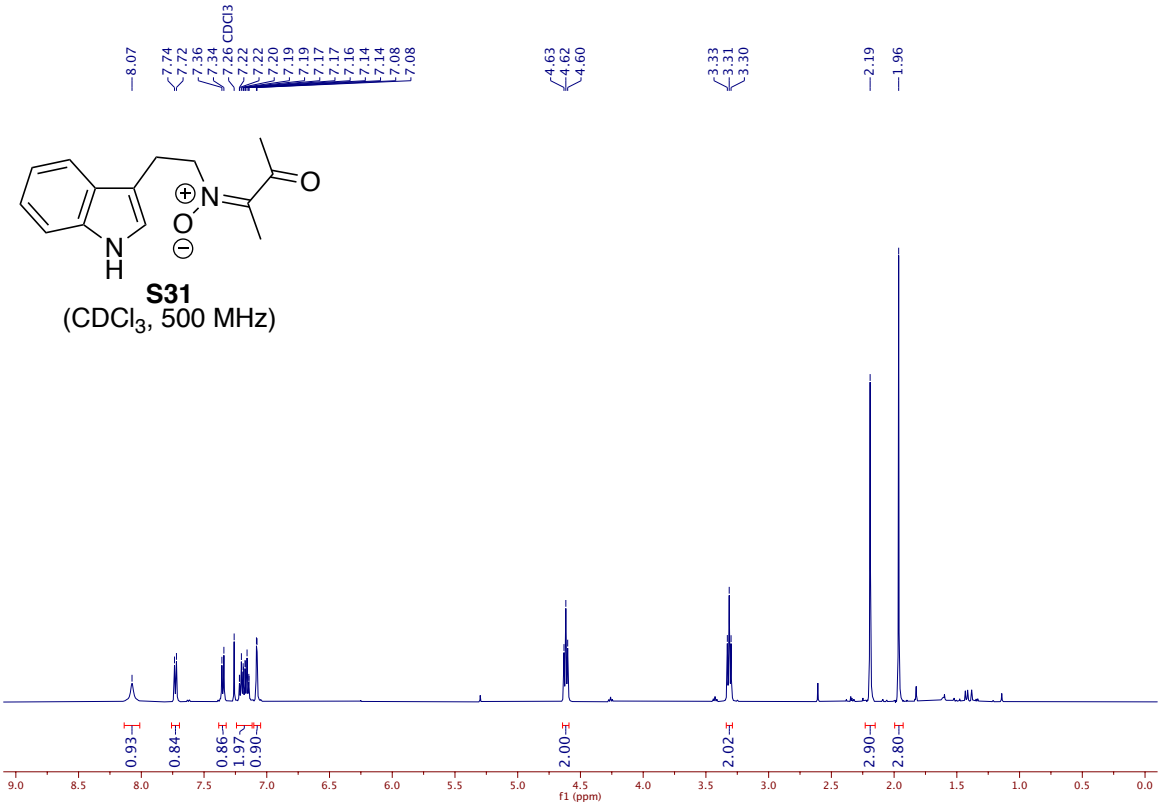
**S29**
($CDCl_3$, 101 MHz)



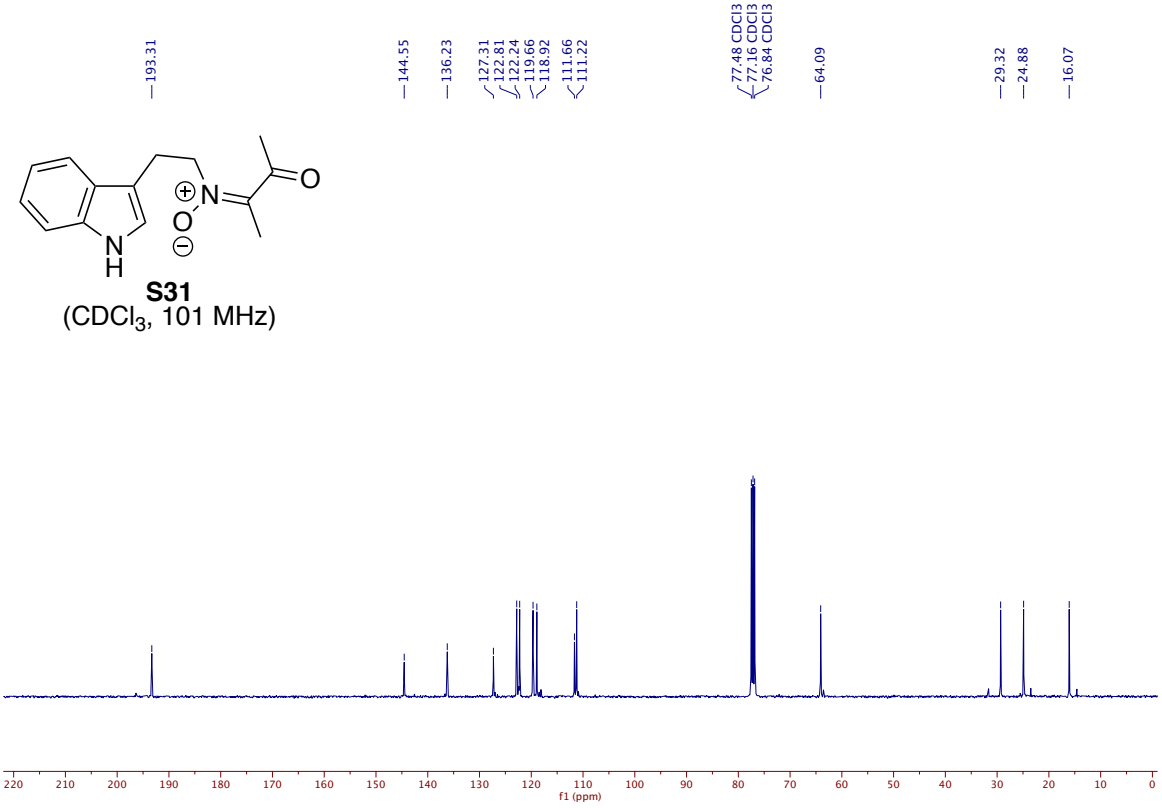

**S30**
($CDCl_3$, 500 MHz)



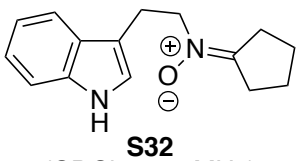

**S30**
($CDCl_3$, 101 MHz)



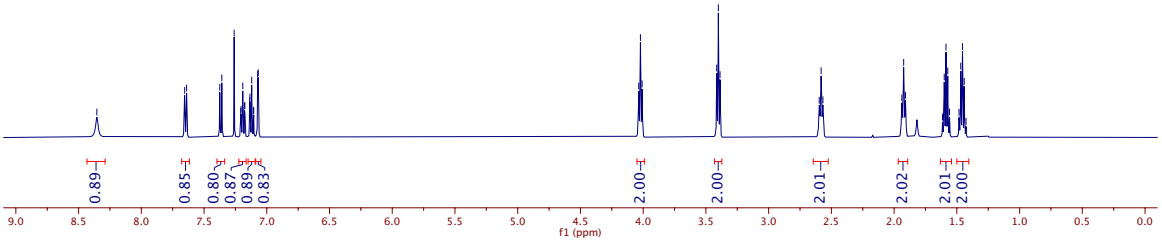

**S31**
($CDCl_3$, 500 MHz)

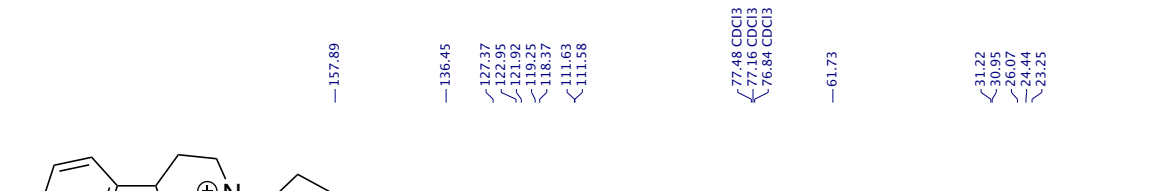


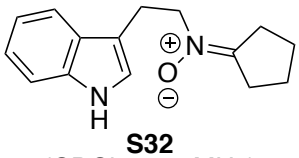

**S31**
($CDCl_3$, 101 MHz)

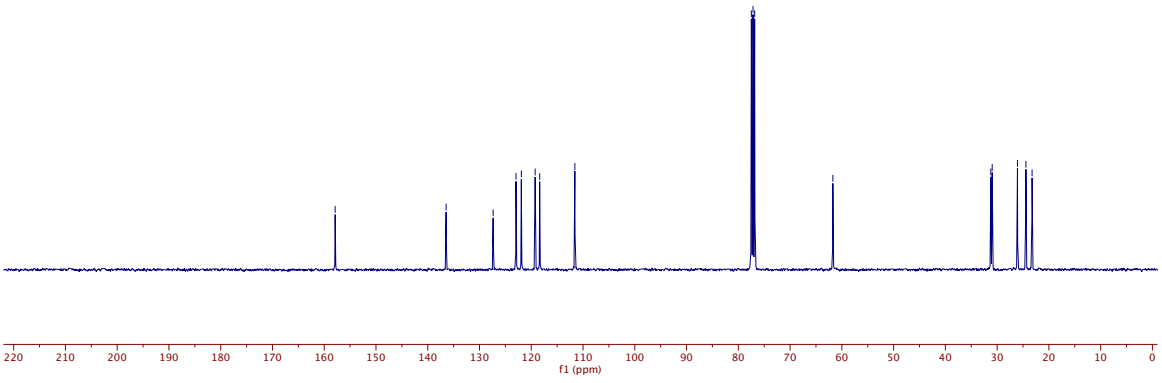
**S32**
($CDCl_3$, 500 MHz)

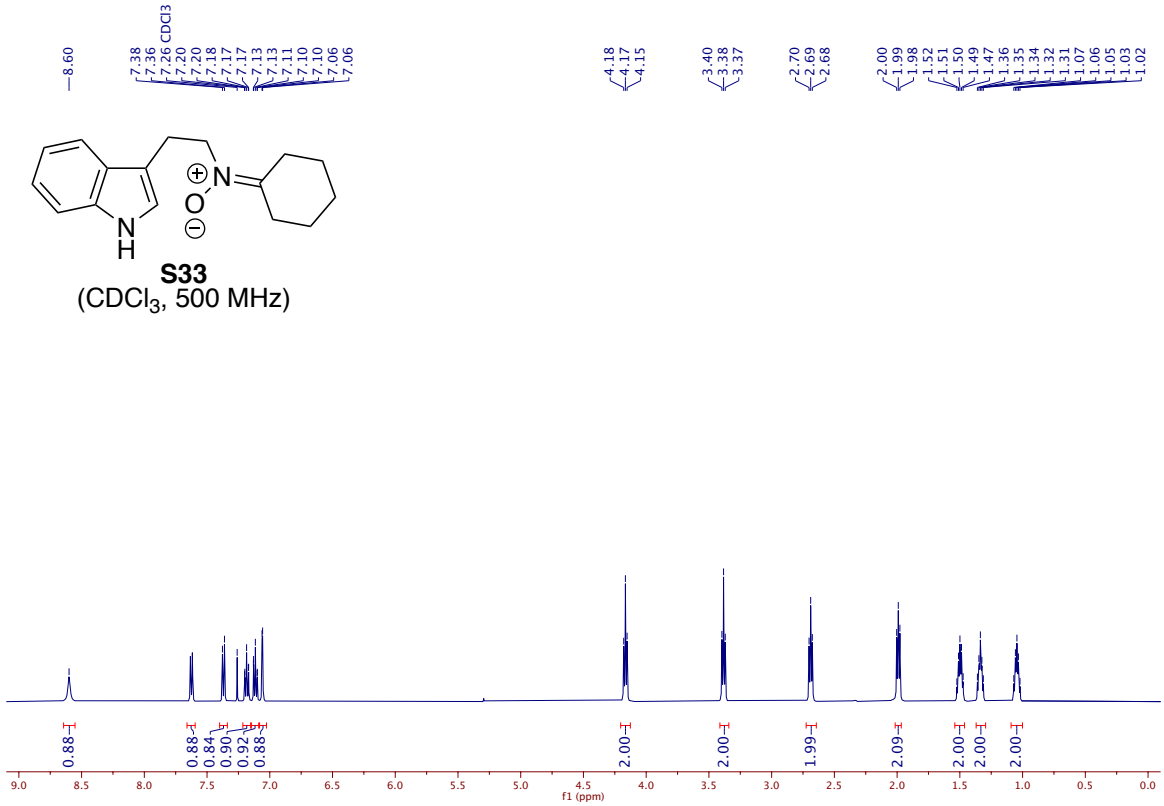


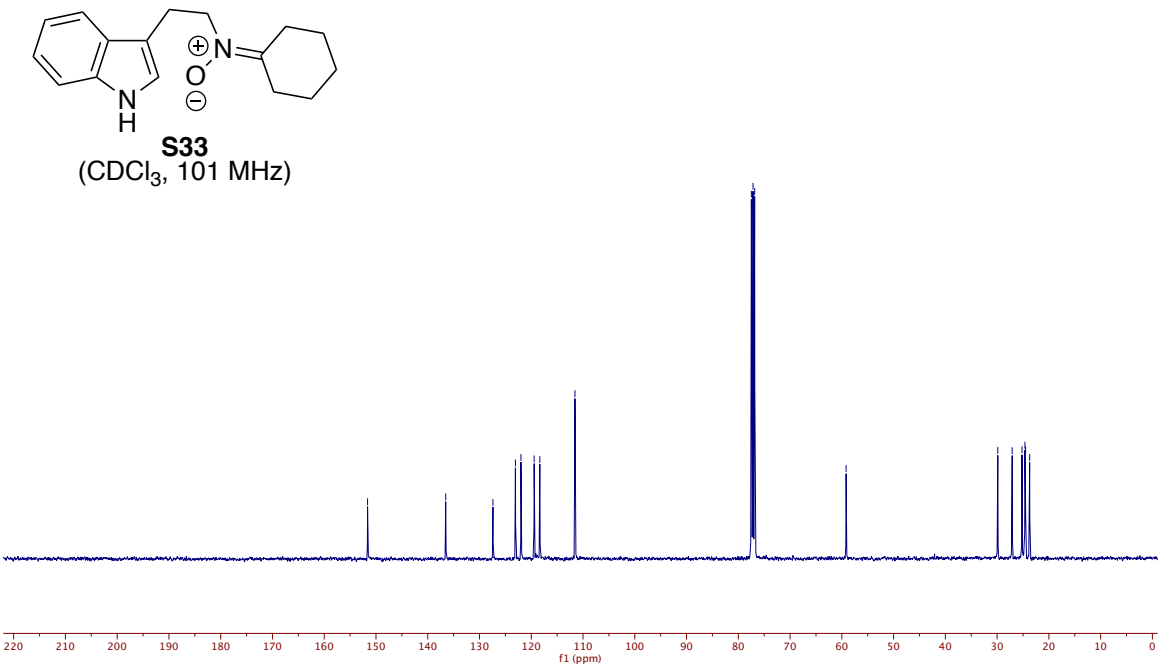



**S32**
($CDCl_3$, 101 MHz)

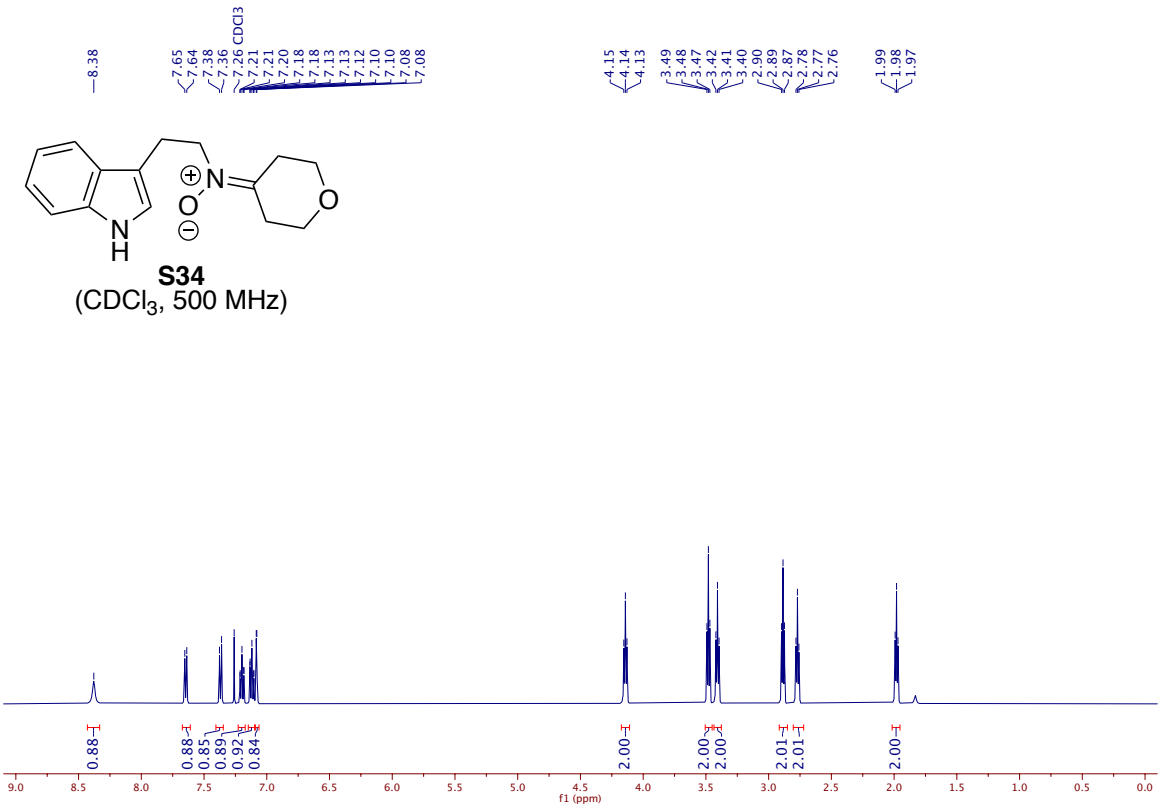




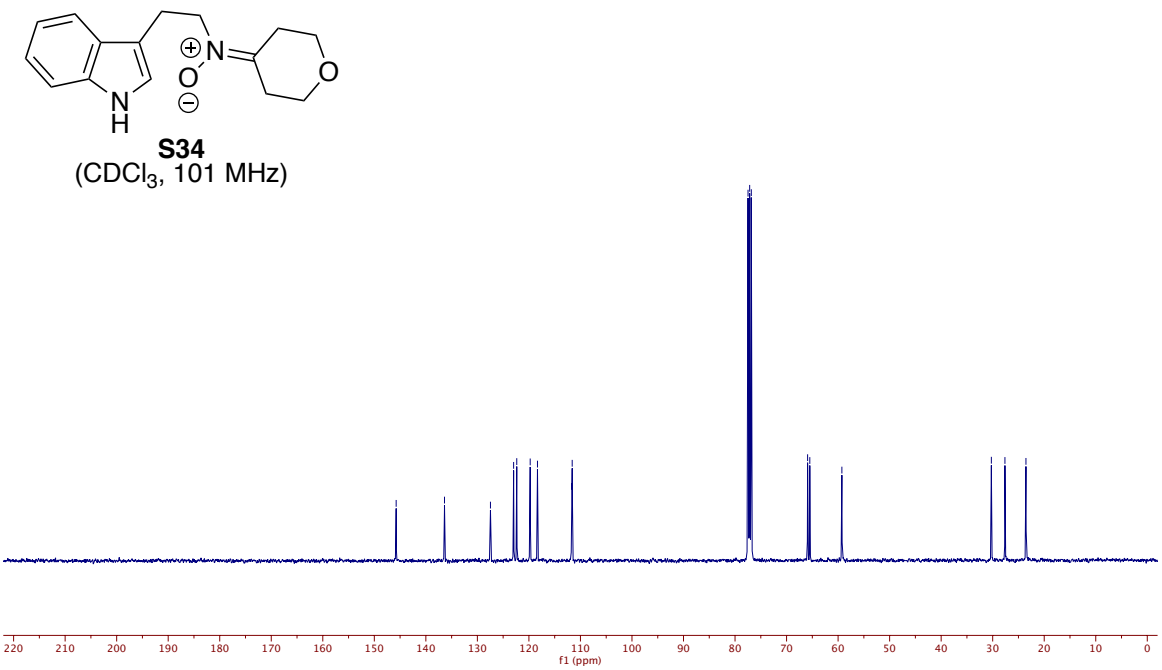

**S33**
($CDCl_3$, 500 MHz)



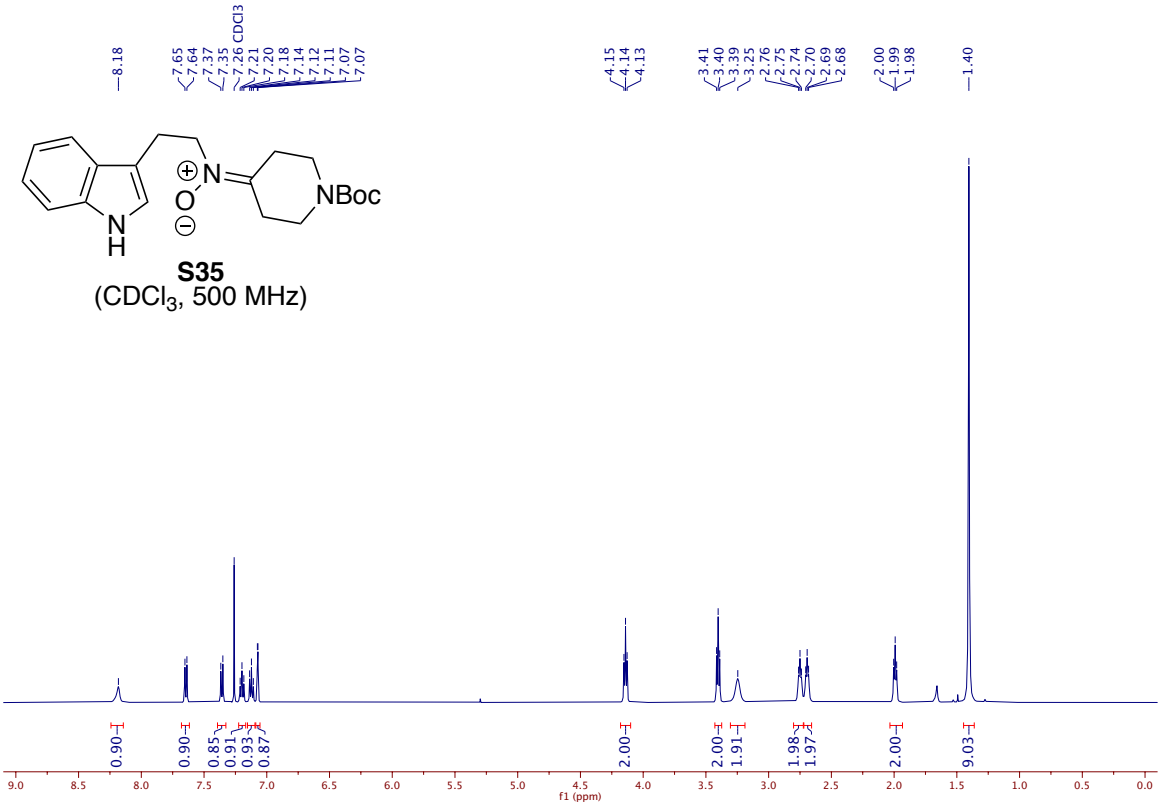

**S33**
($CDCl_3$, 101 MHz)



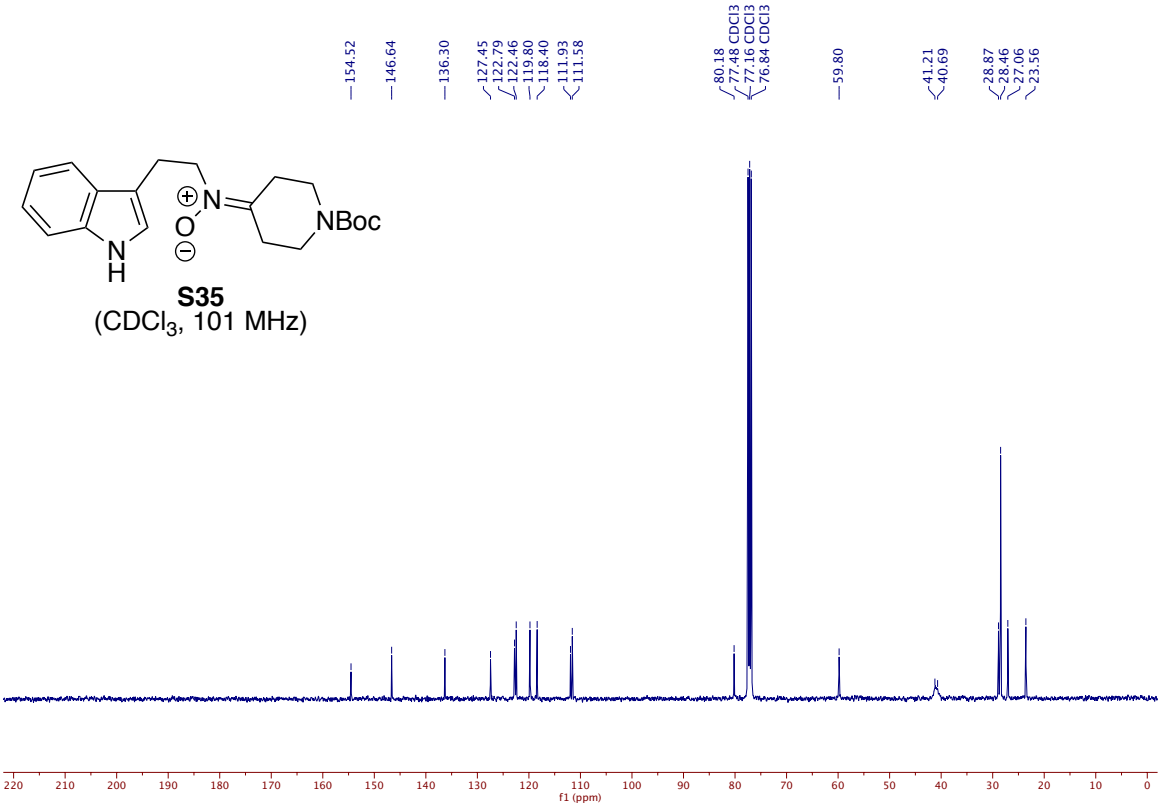

**S34**
($CDCl_3$, 500 MHz)



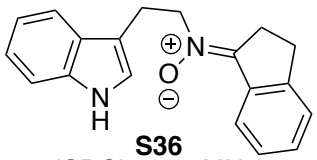

**S34**
($CDCl_3$, 101 MHz)



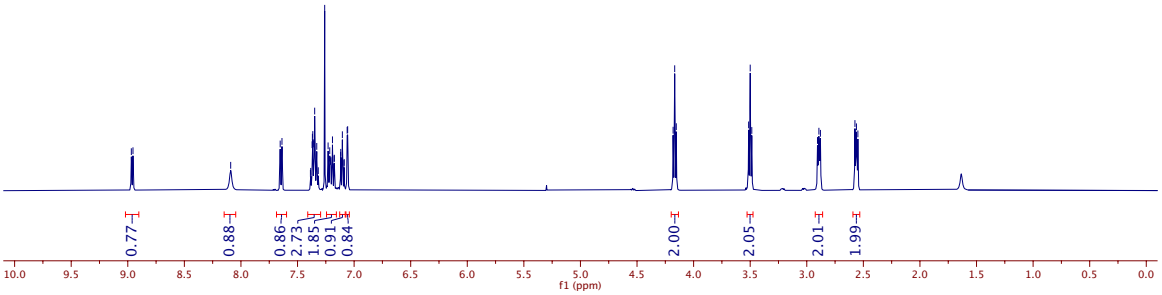

**S35**
($CDCl_3$, 500 MHz)



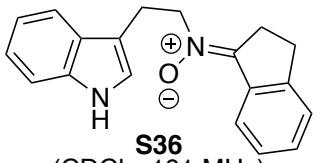

**S35**
($CDCl_3$, 101 MHz)

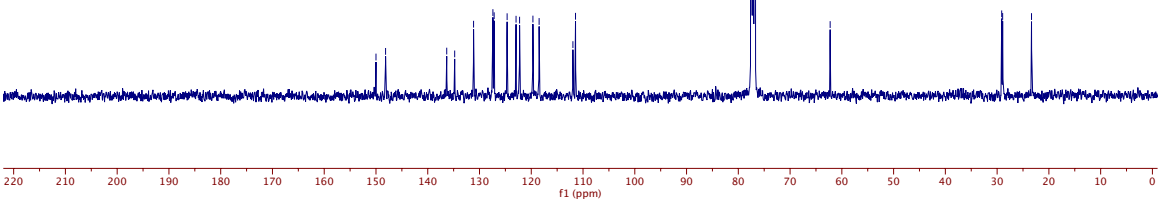

**S36**
($CDCl_3$, 500 MHz)

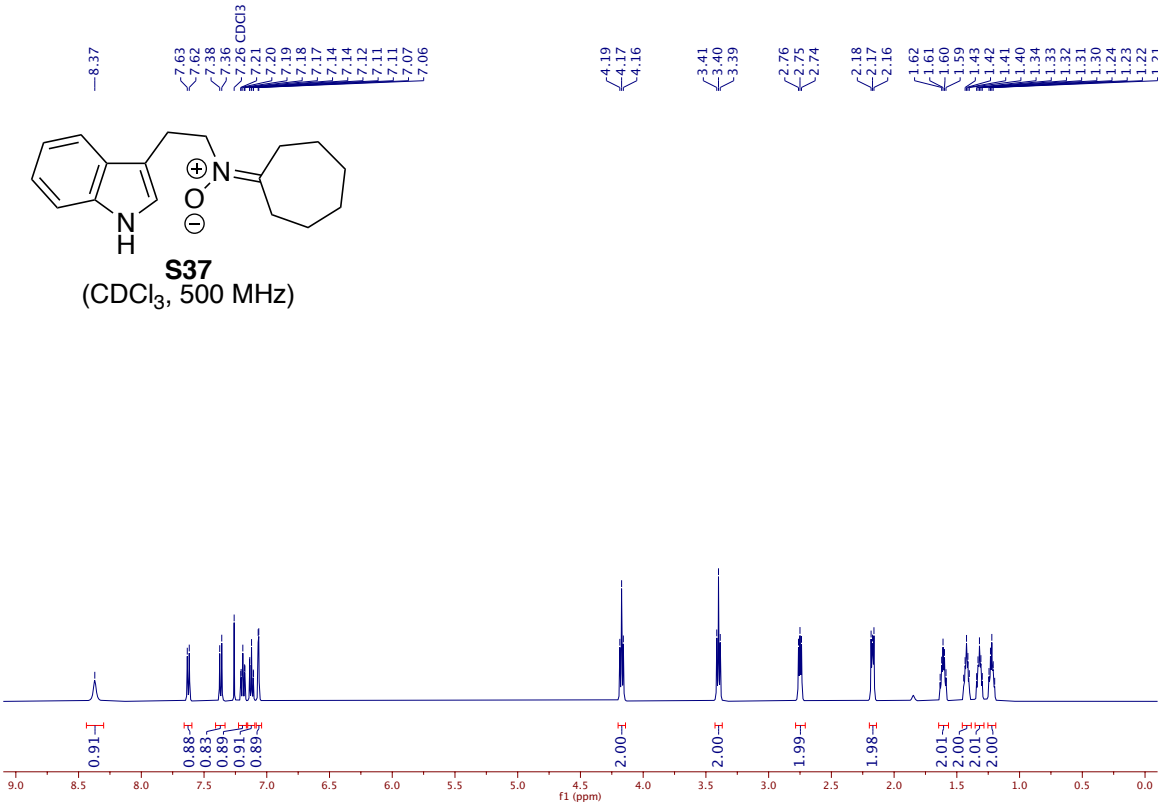




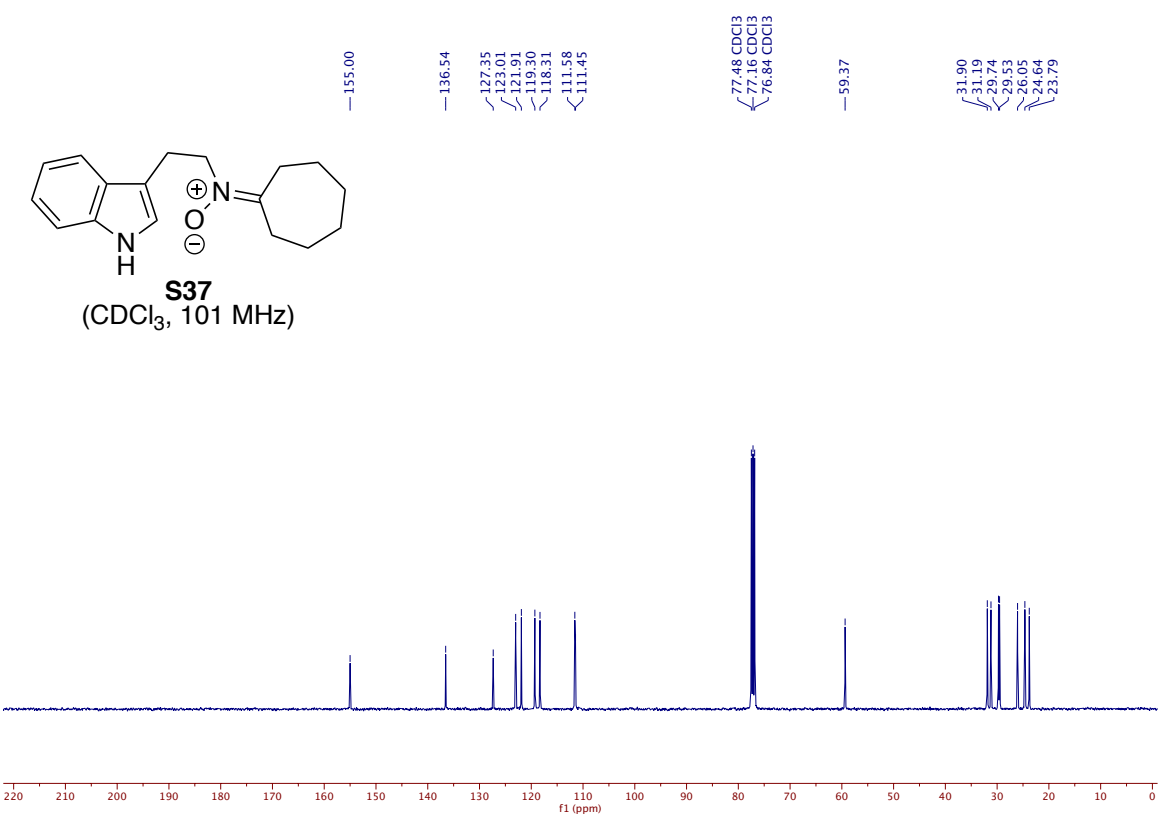



**S36**
($CDCl_3$, 101 MHz)

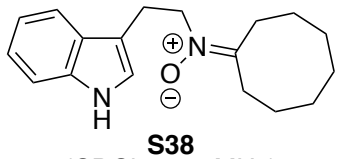




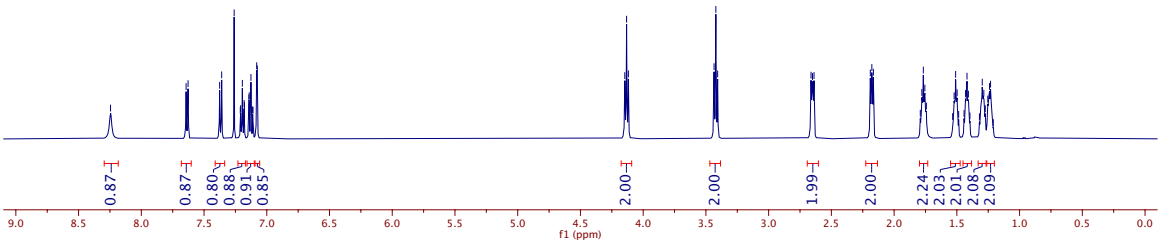

**S37**
($CDCl_3$, 500 MHz)



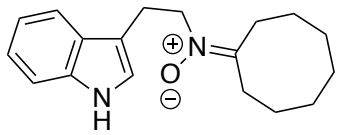

**S37**
($CDCl_3$, 101 MHz)

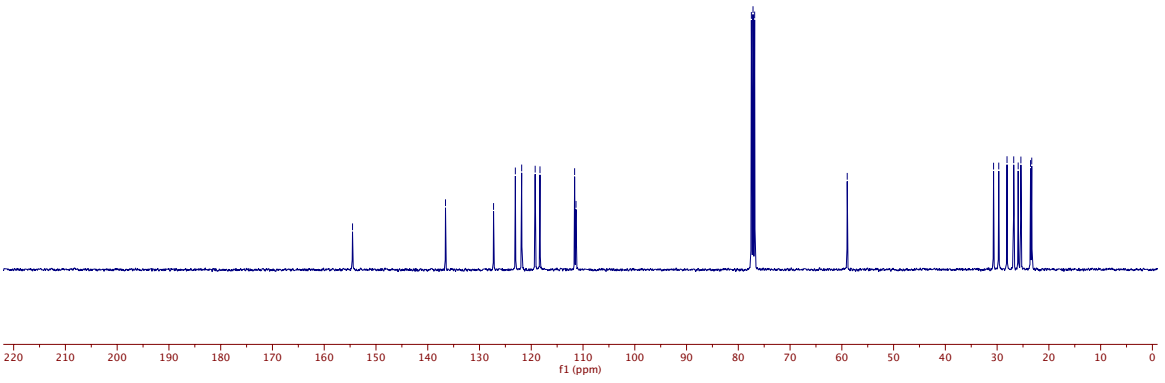
**S38**
($CDCl_3$, 500 MHz)

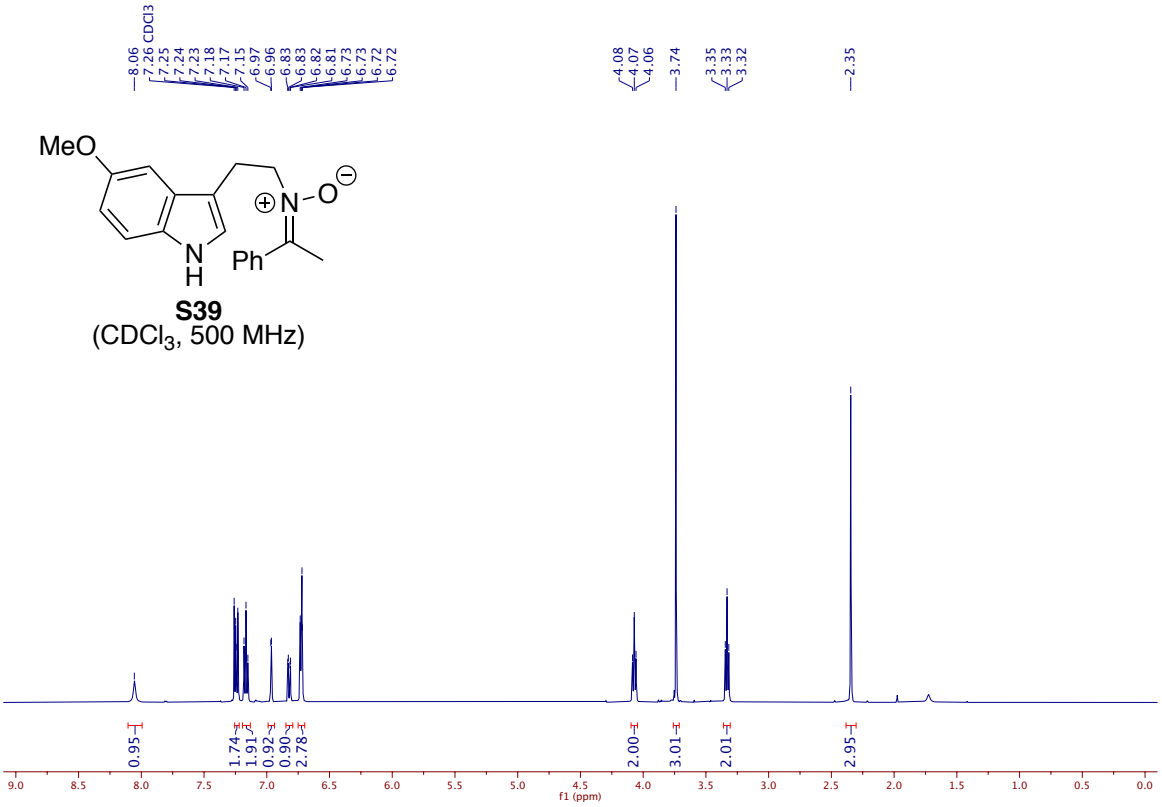




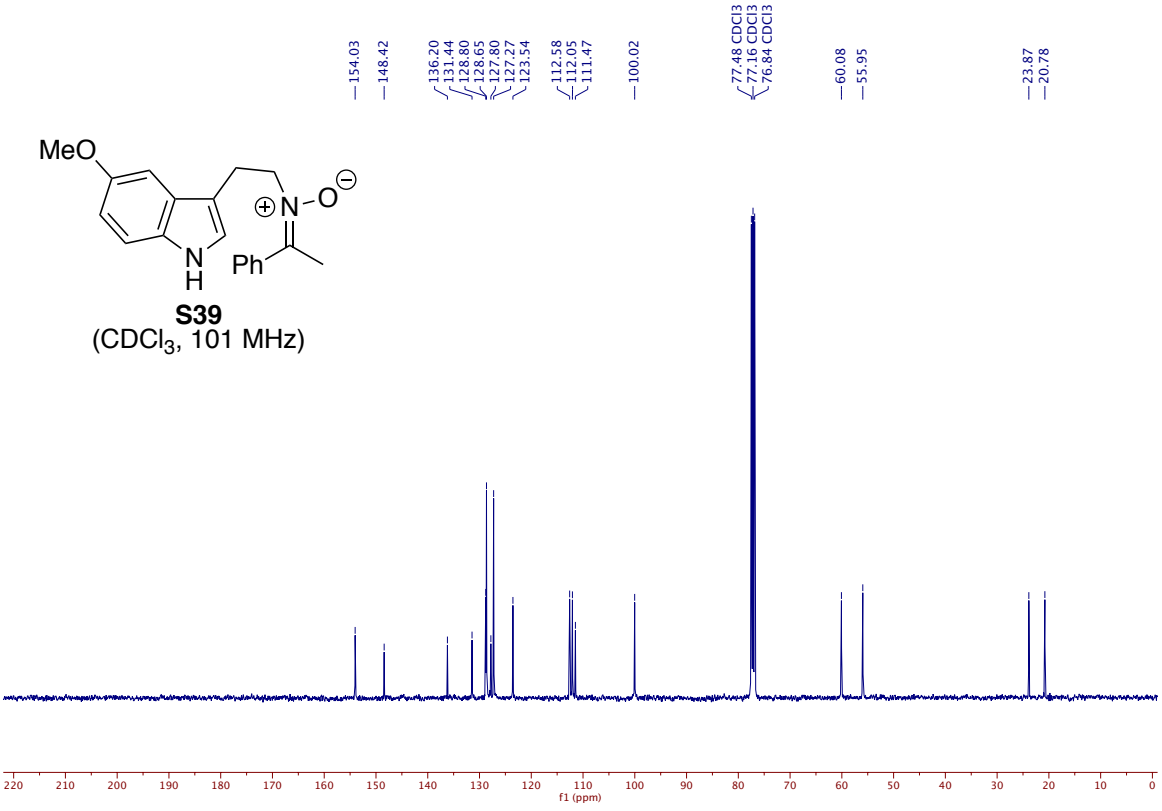


**S38**
($CDCl_3$, 101 MHz)

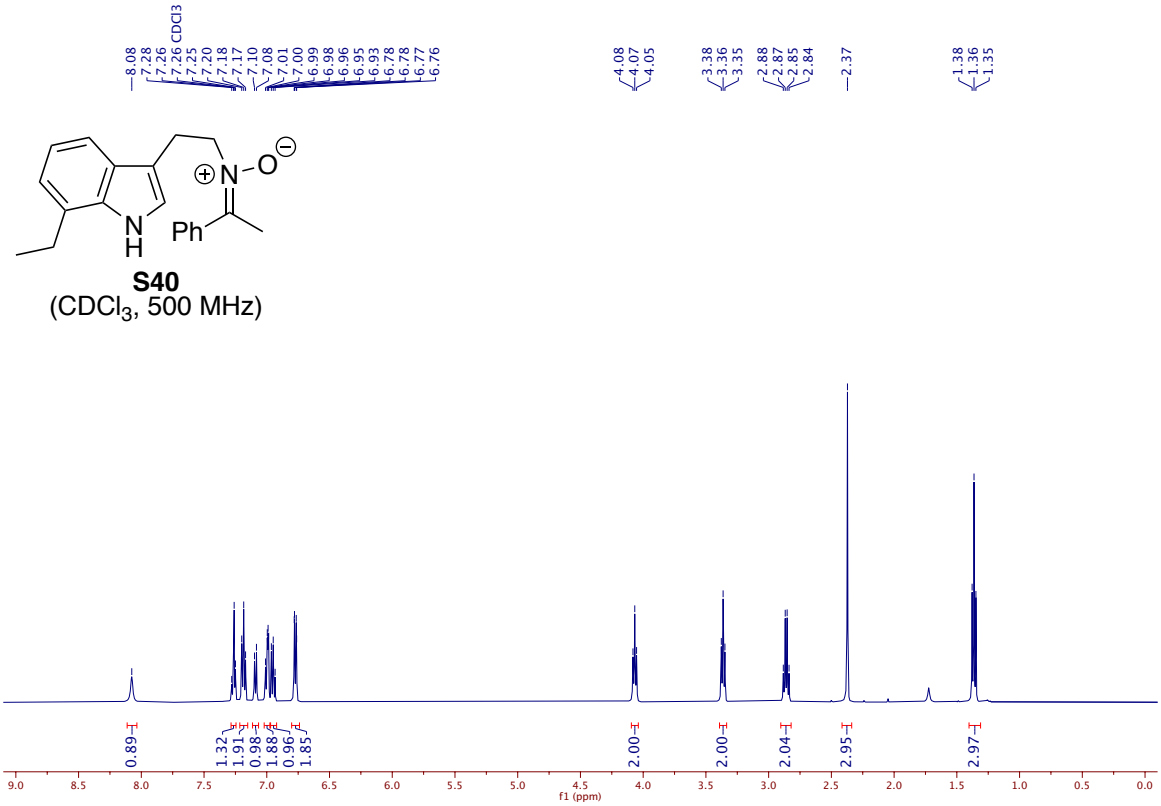




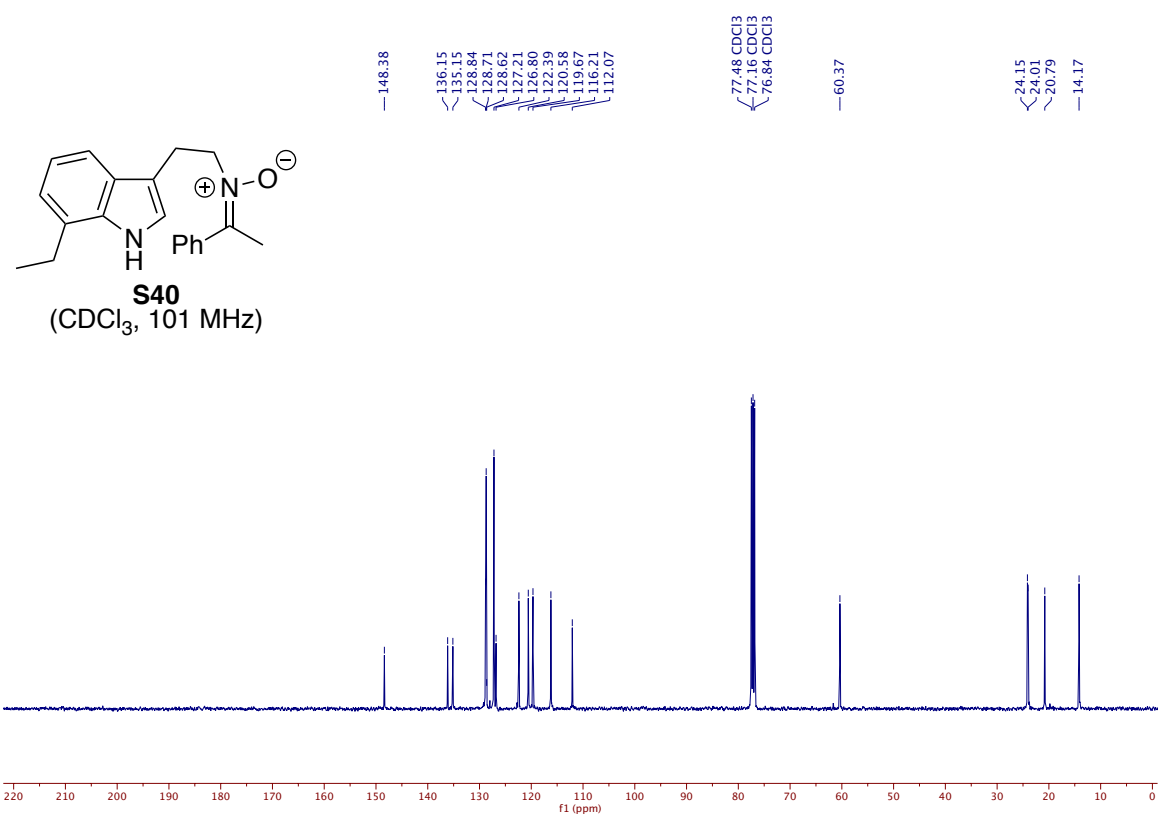

**S39**
($CDCl_3$, 500 MHz)



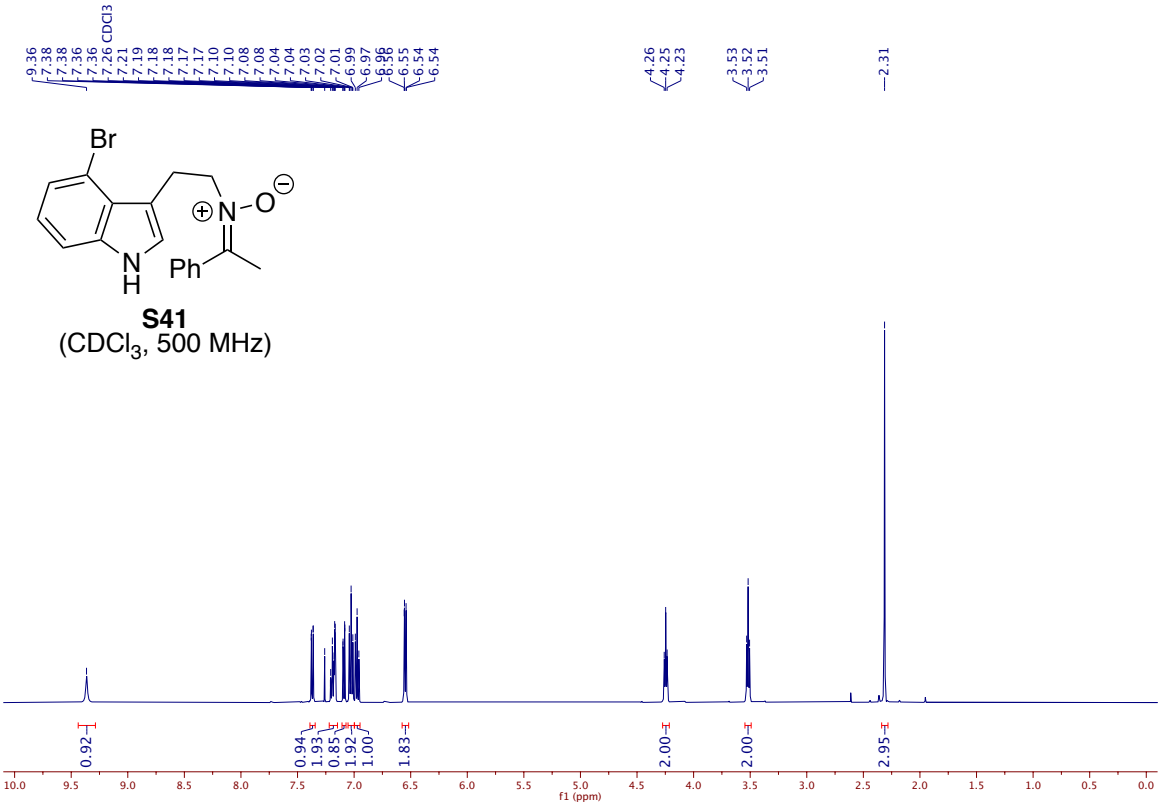

**S39**
($CDCl_3$, 101 MHz)



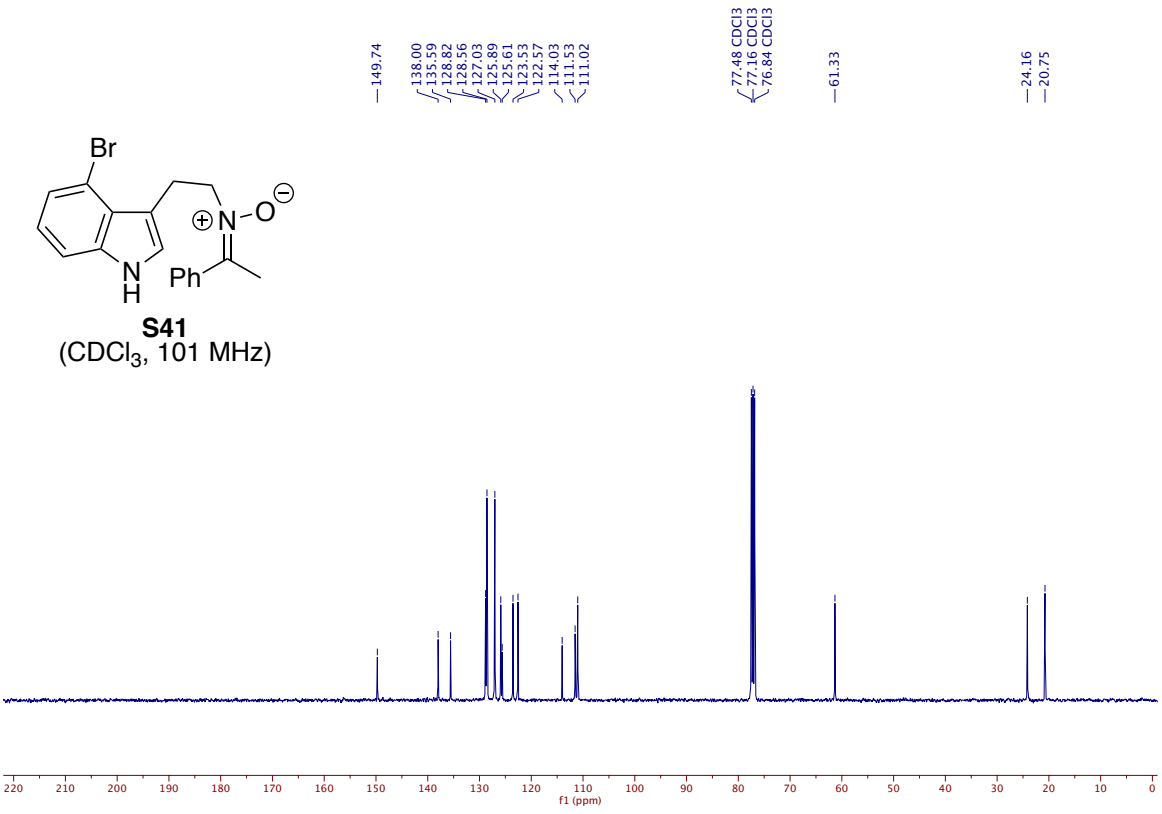

**S40**
($CDCl_3$, 500 MHz)



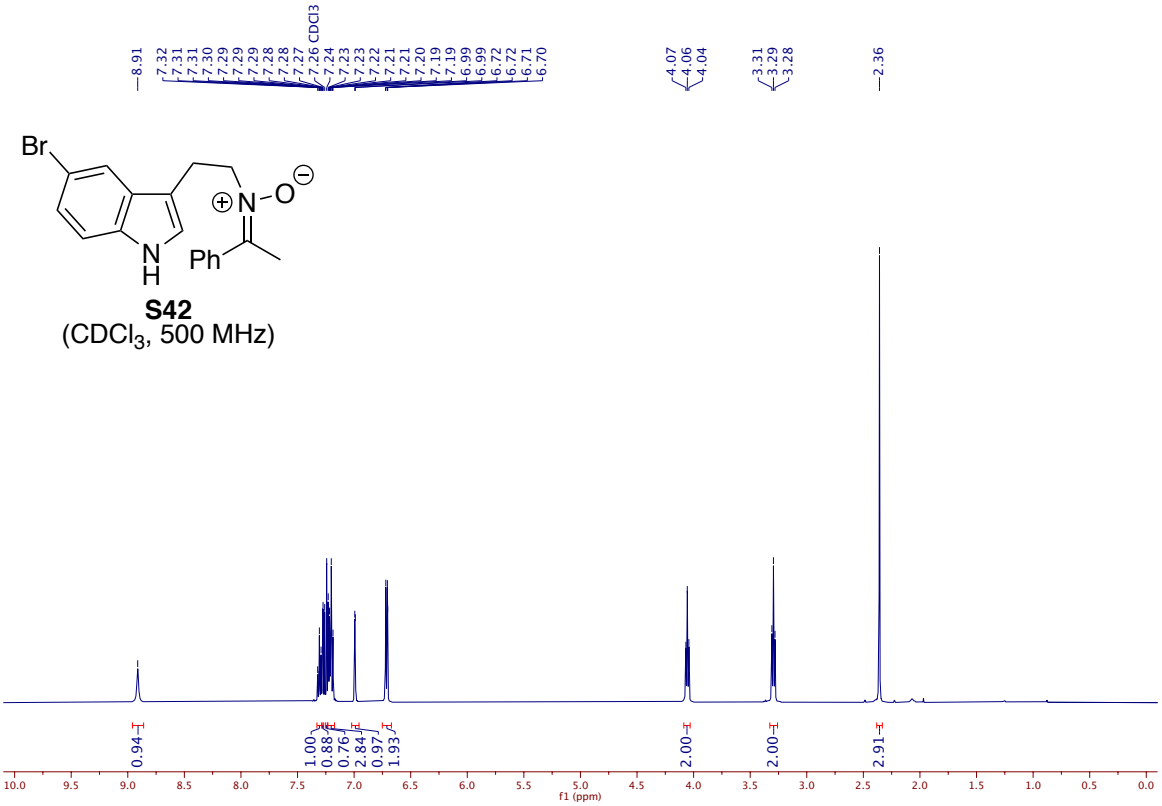

**S40**
($CDCl_3$, 101 MHz)



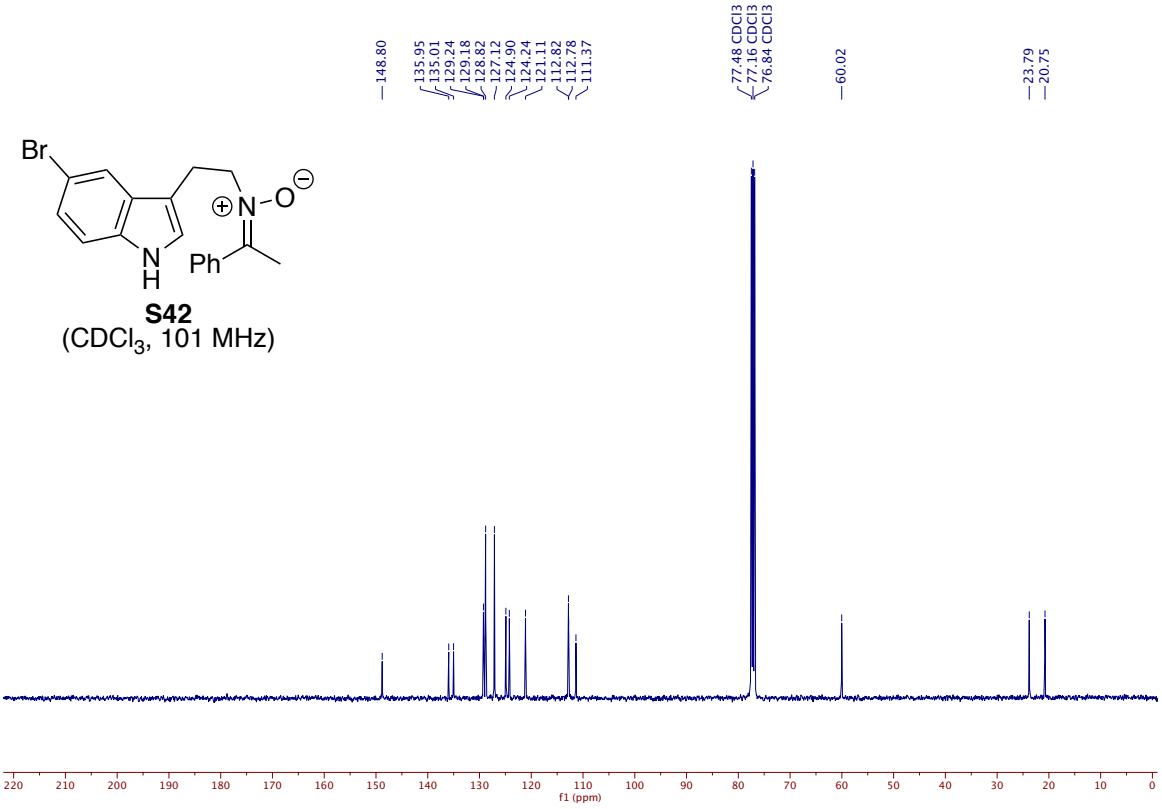

**S41**
($CDCl_3$, 500 MHz)



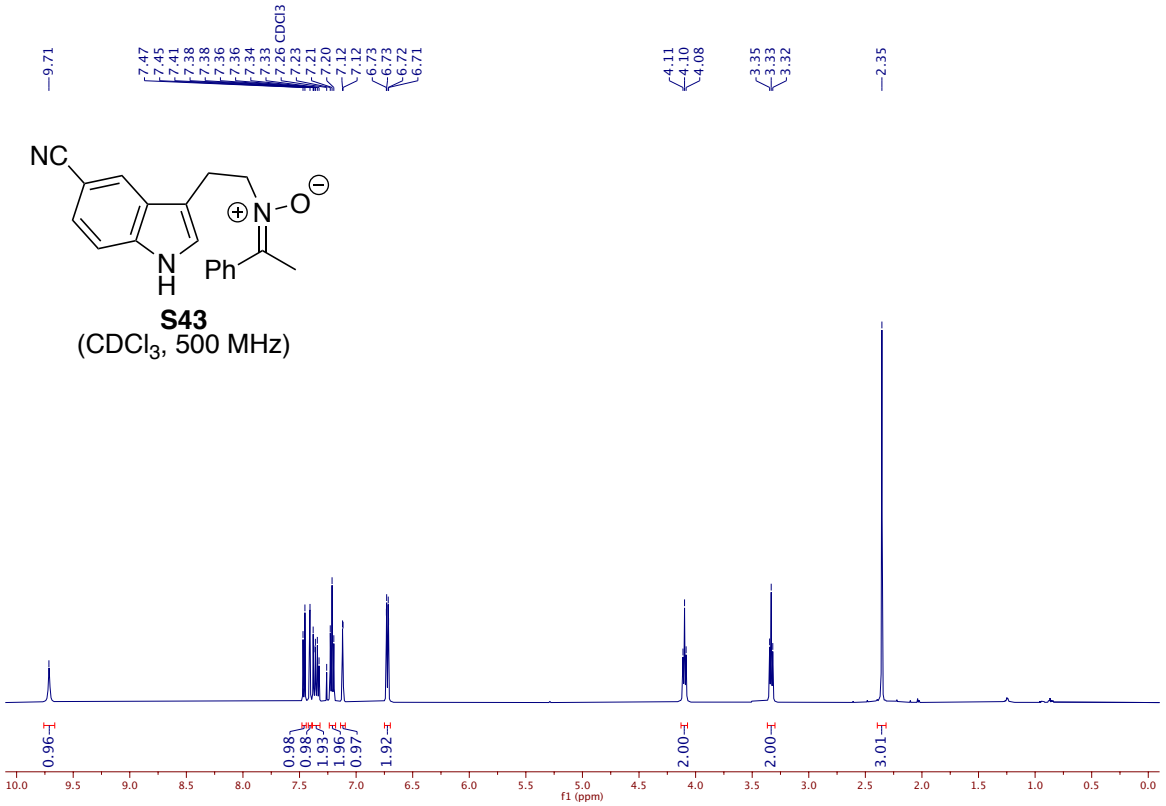

**S41**
($CDCl_3$, 101 MHz)



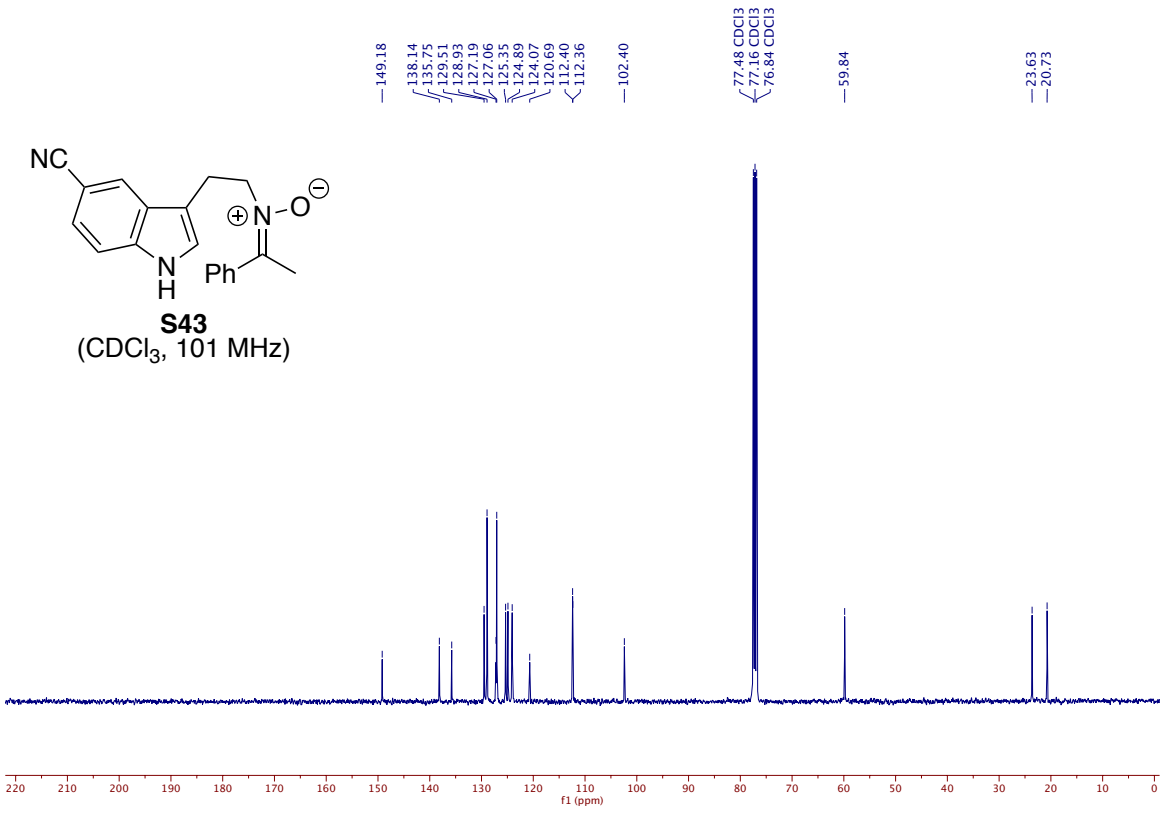

**S42**
($CDCl_3$, 500 MHz)



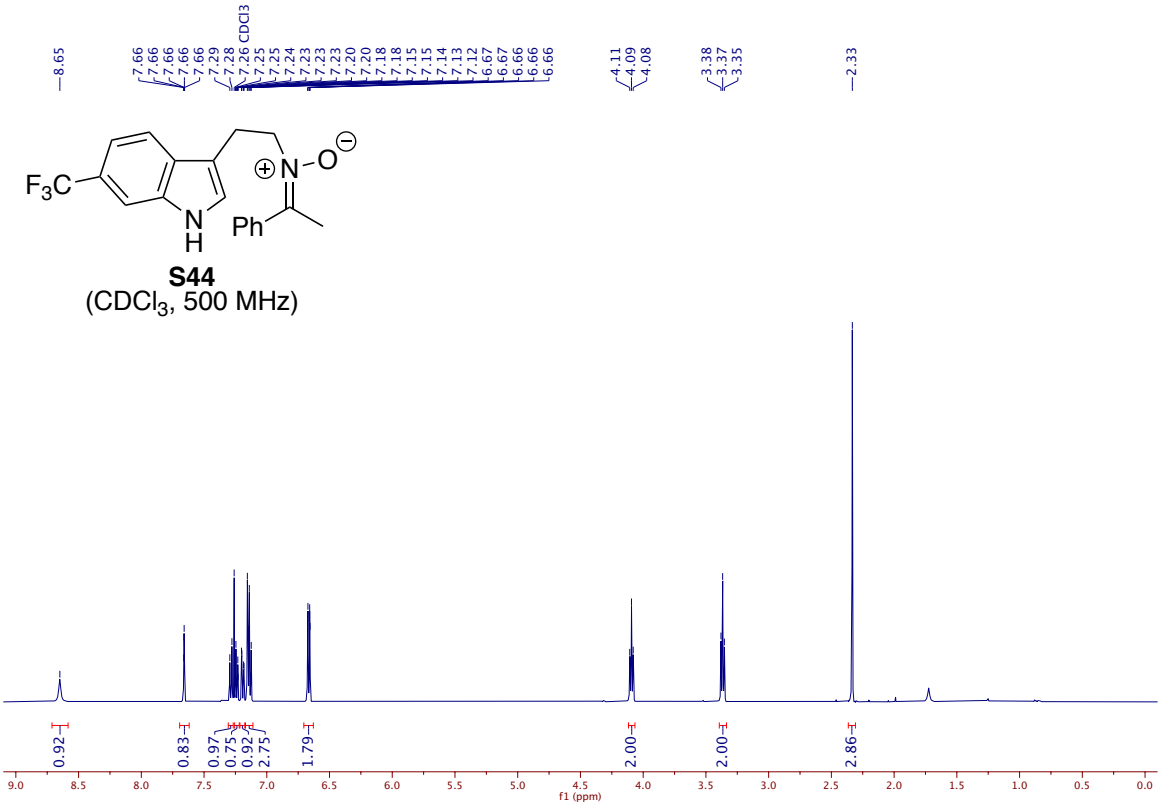

**S42**
($CDCl_3$, 101 MHz)



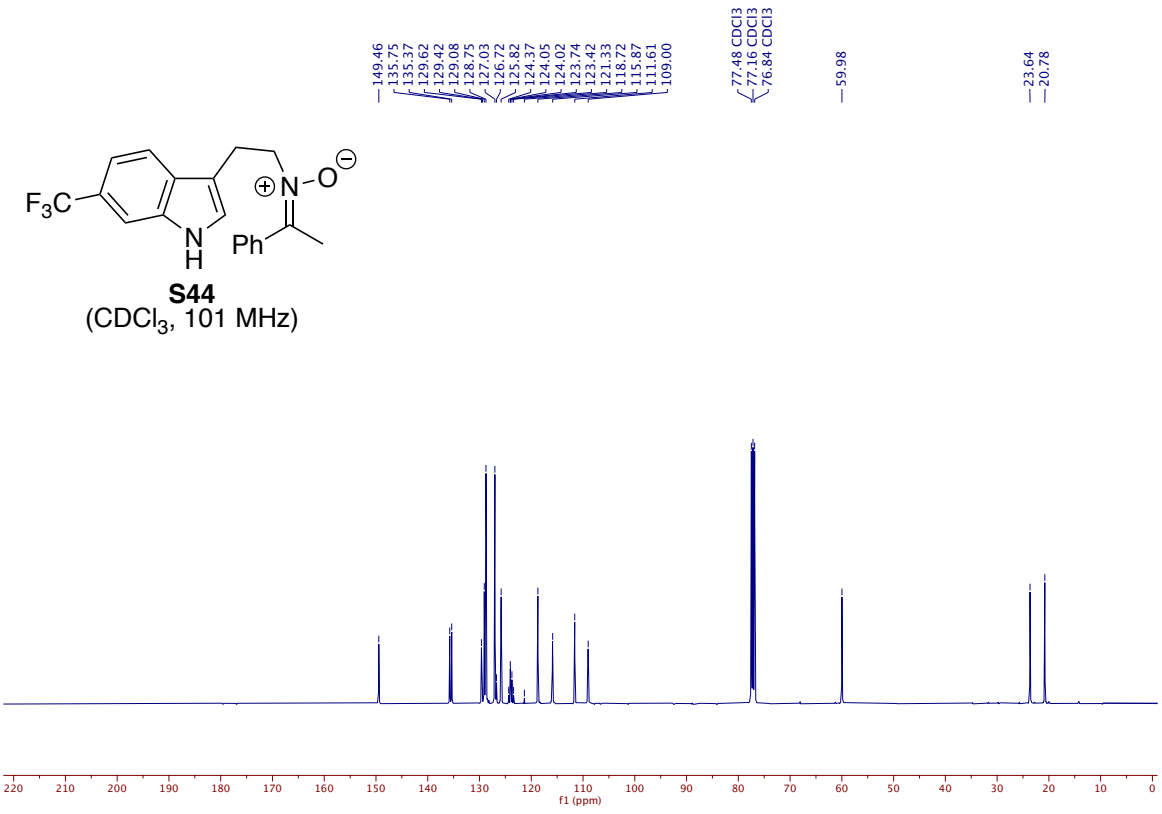

**S43**
($CDCl_3$, 500 MHz)



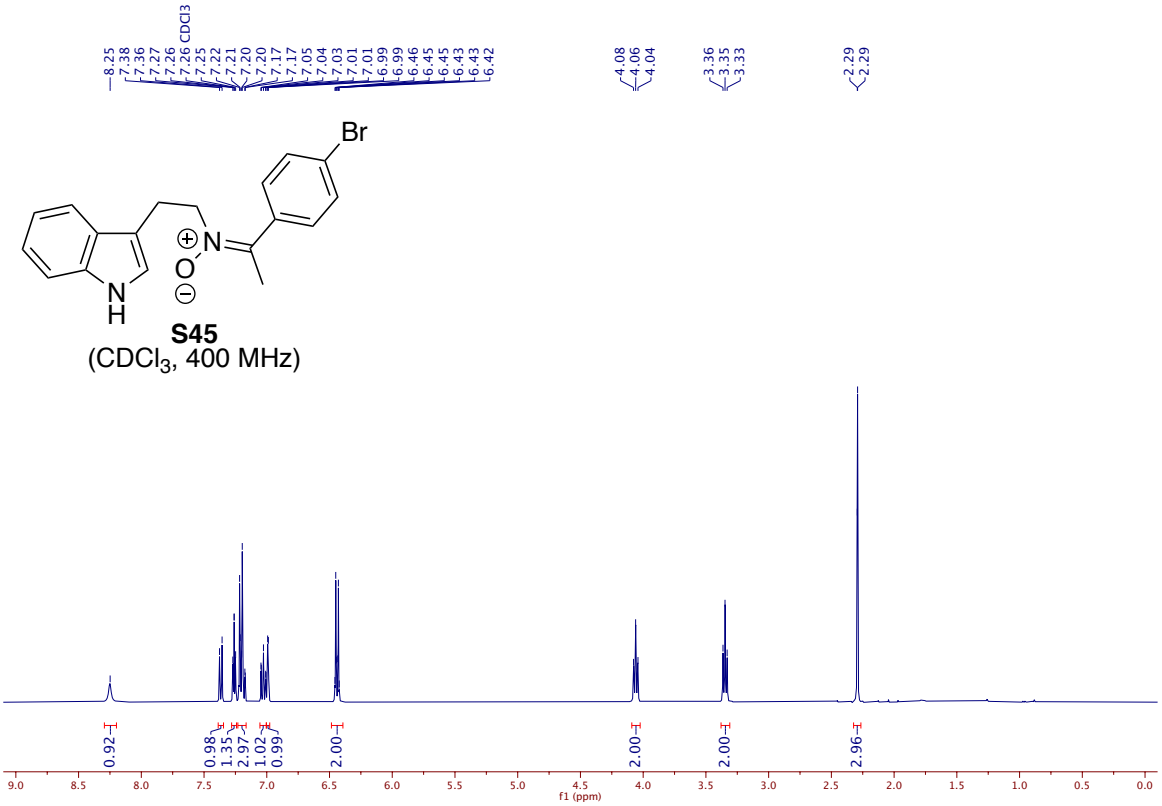

**S43**
($CDCl_3$, 101 MHz)



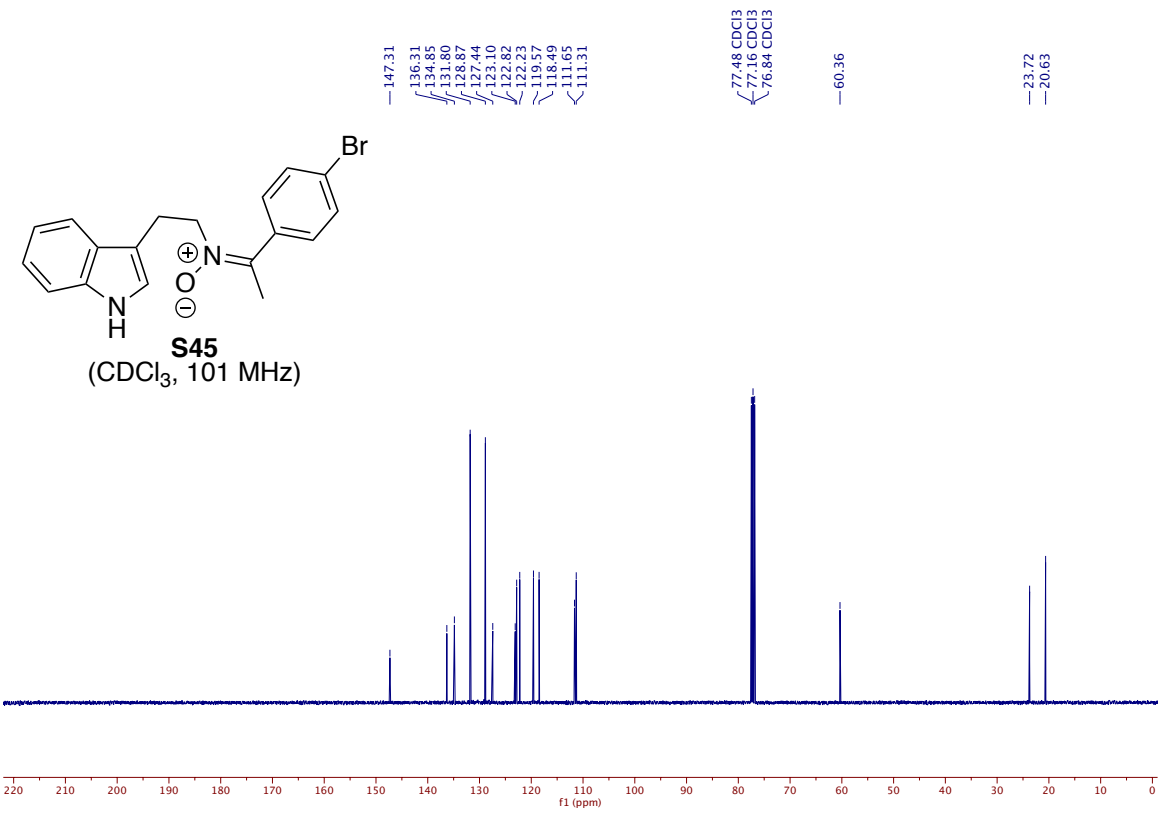

**S44**
($CDCl_3$, 500 MHz)



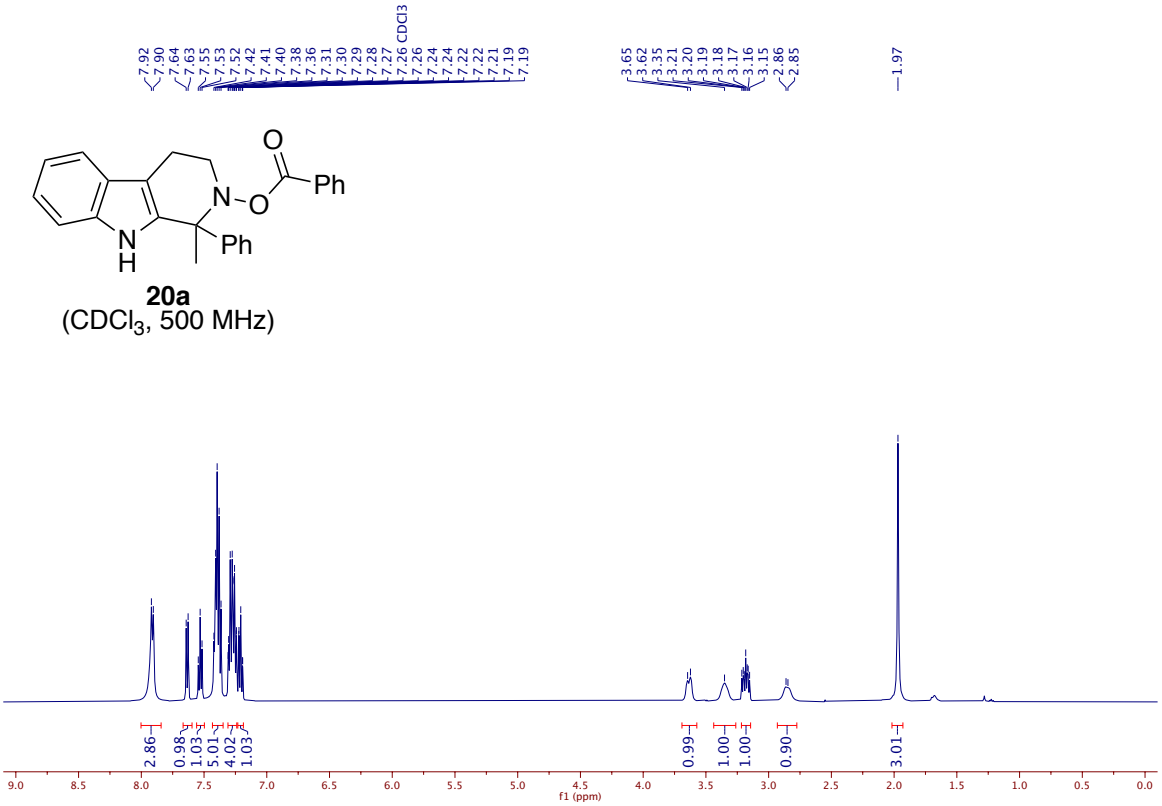

**S44**
($CDCl_3$, 101 MHz)



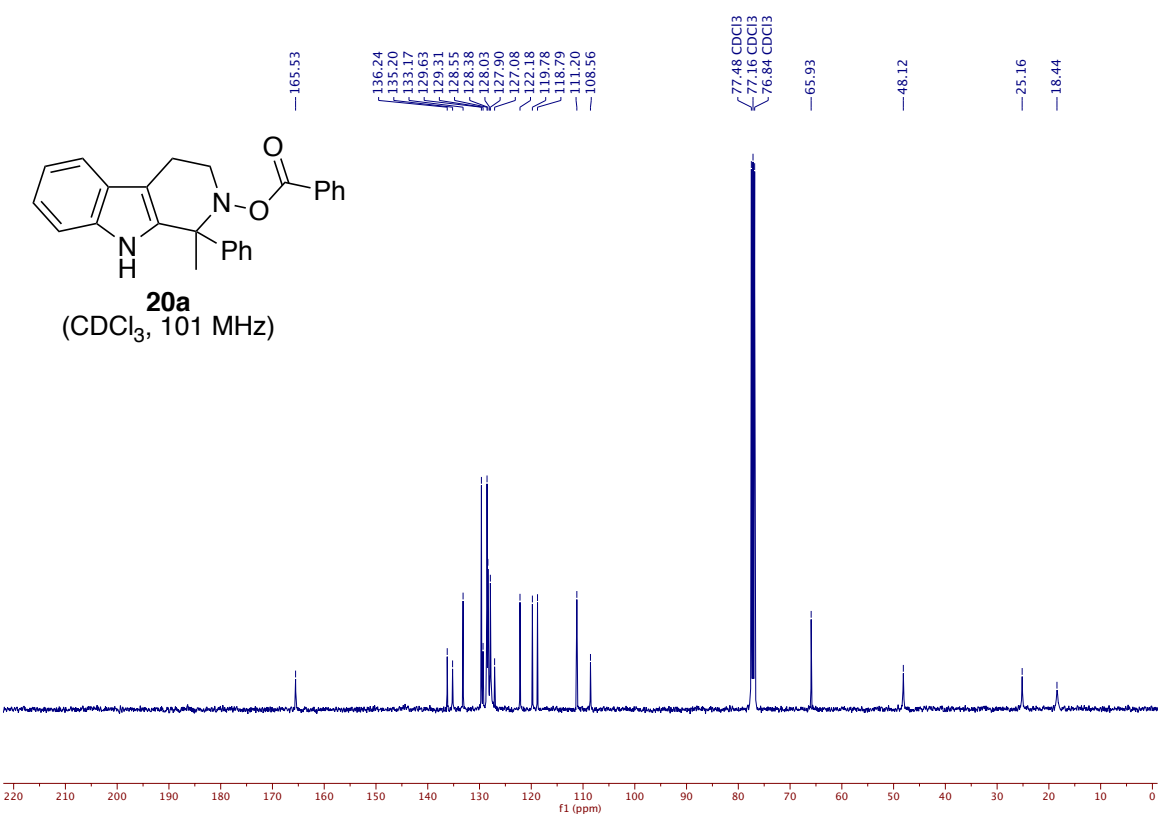

**S45**
($CDCl_3$, 400 MHz)



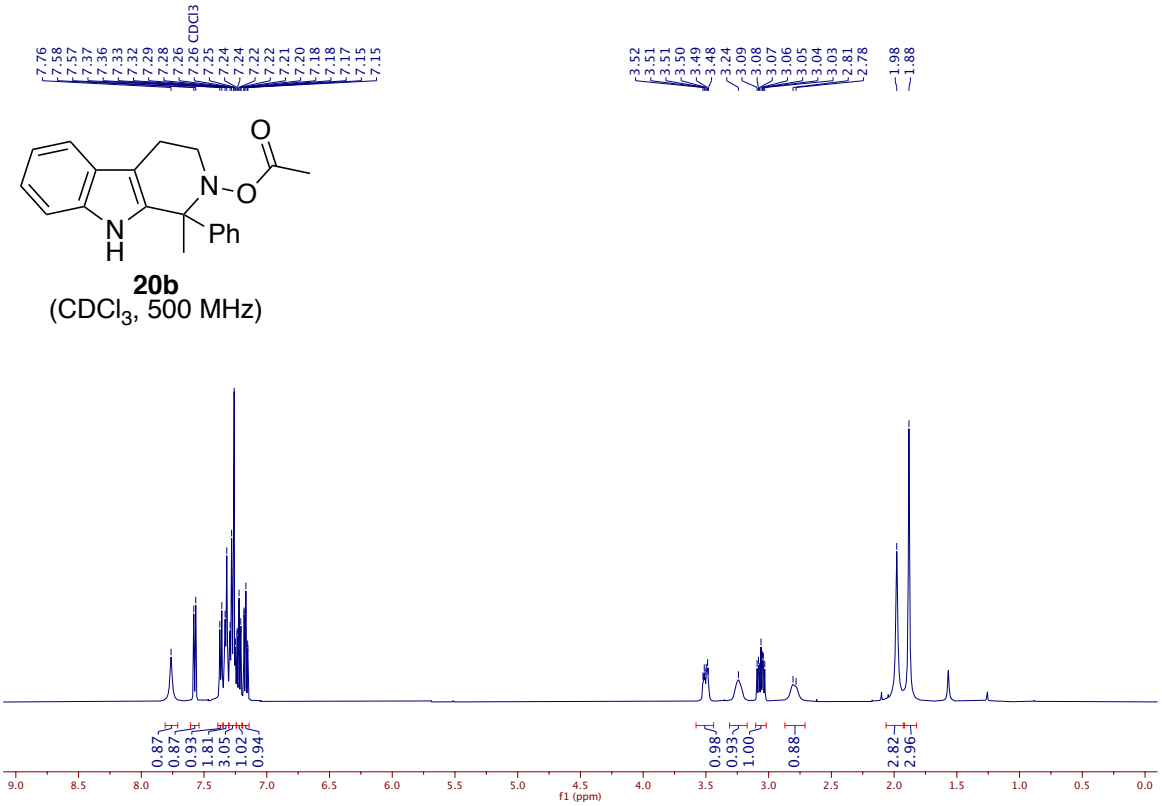

**S45**
($CDCl_3$, 101 MHz)



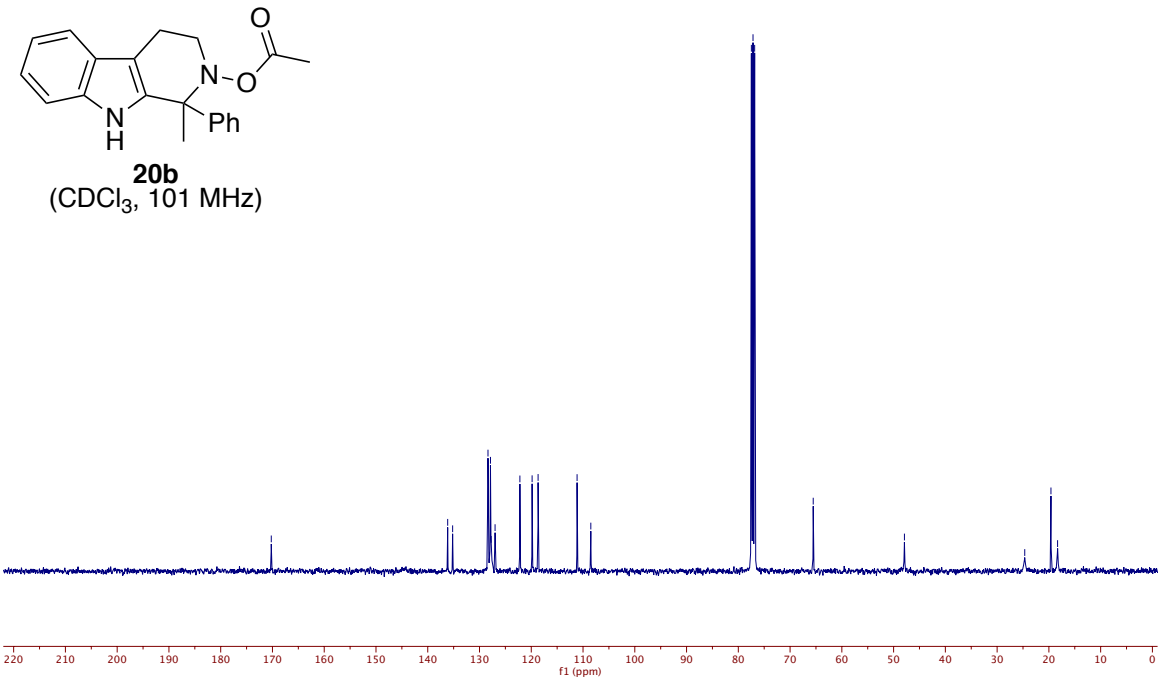

**20a**
($CDCl_3$, 500 MHz)



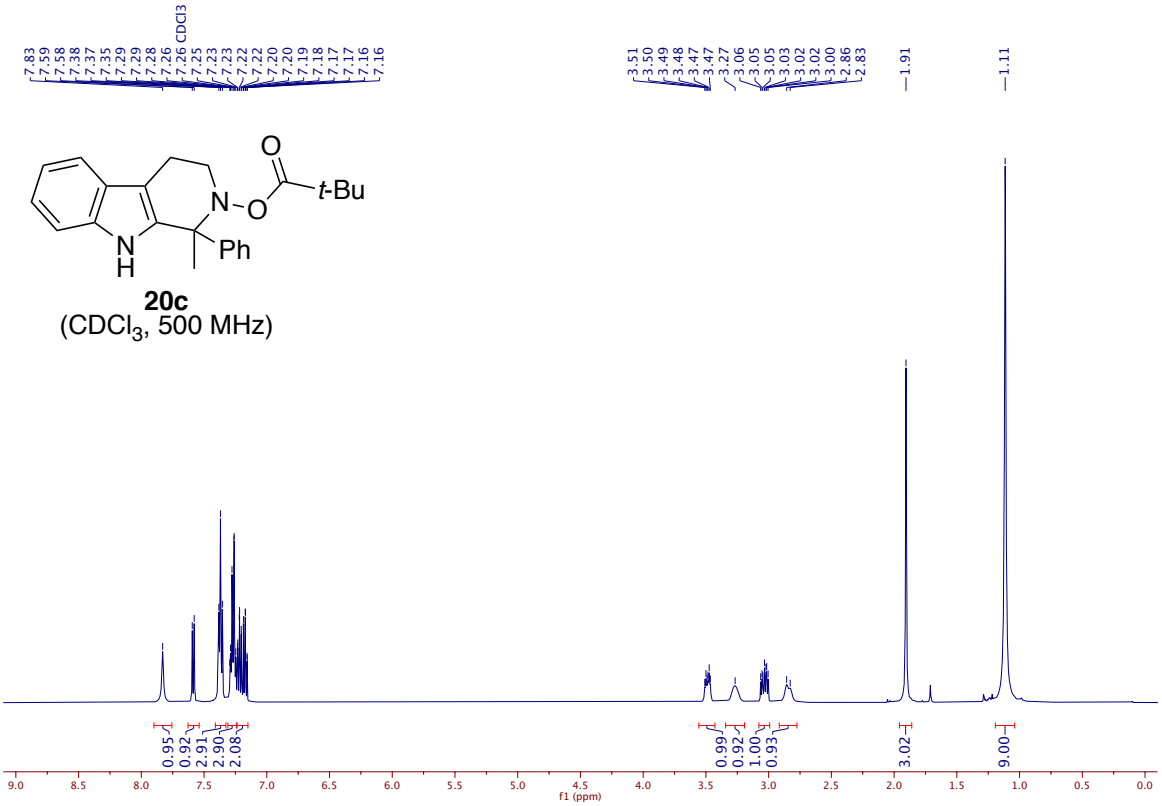

**20a**
($CDCl_3$, 101 MHz)



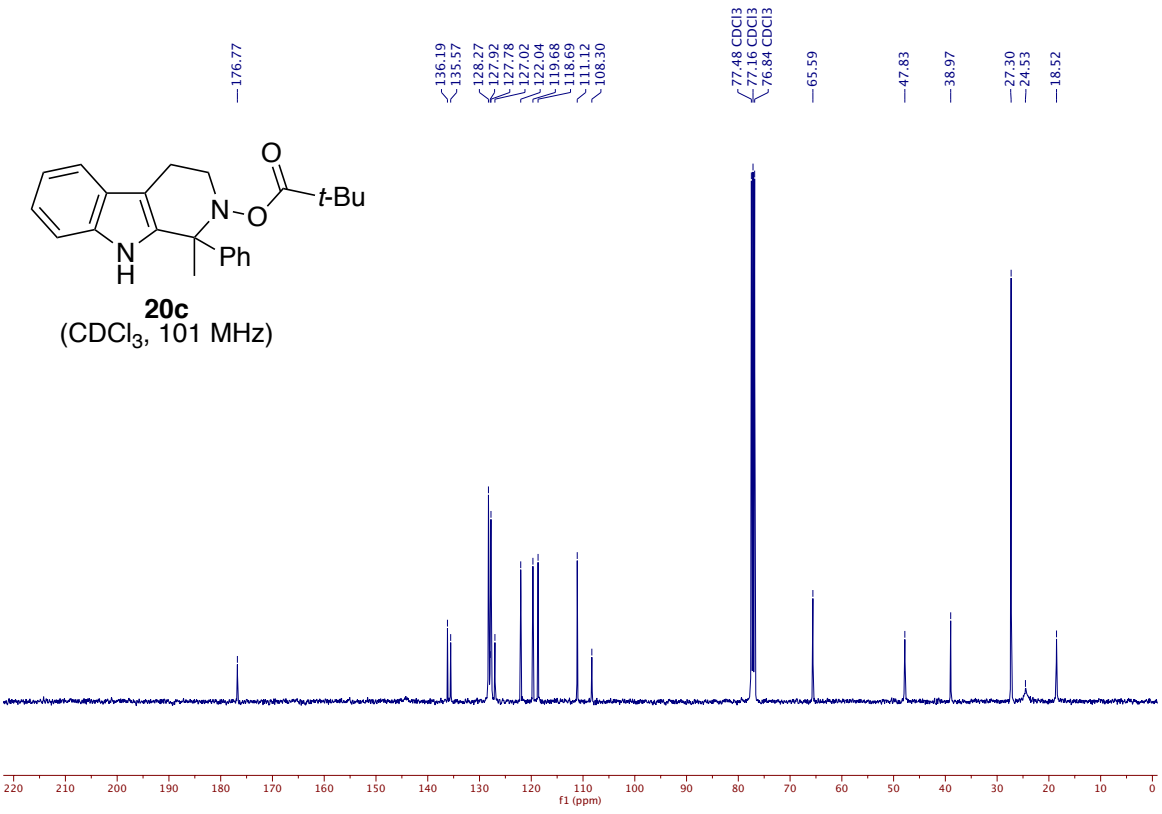

**20b**
($CDCl_3$, 500 MHz)



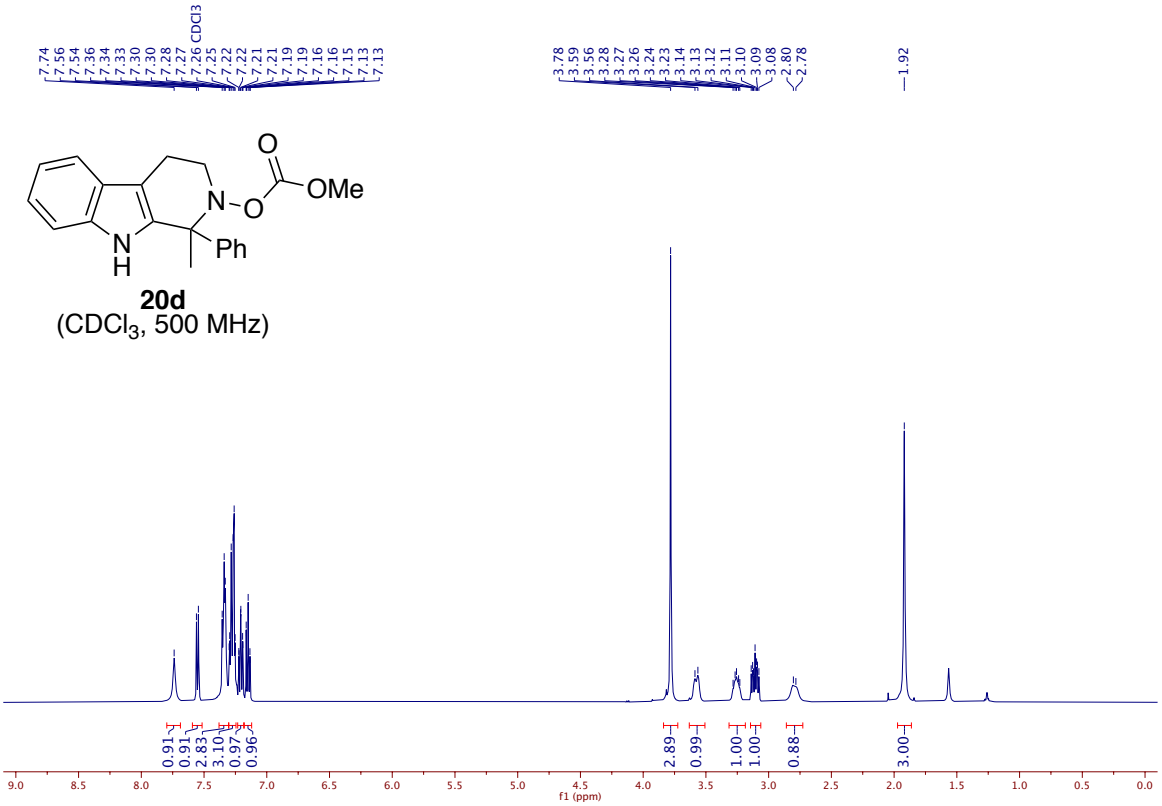

**20b**
($CDCl_3$, 101 MHz)

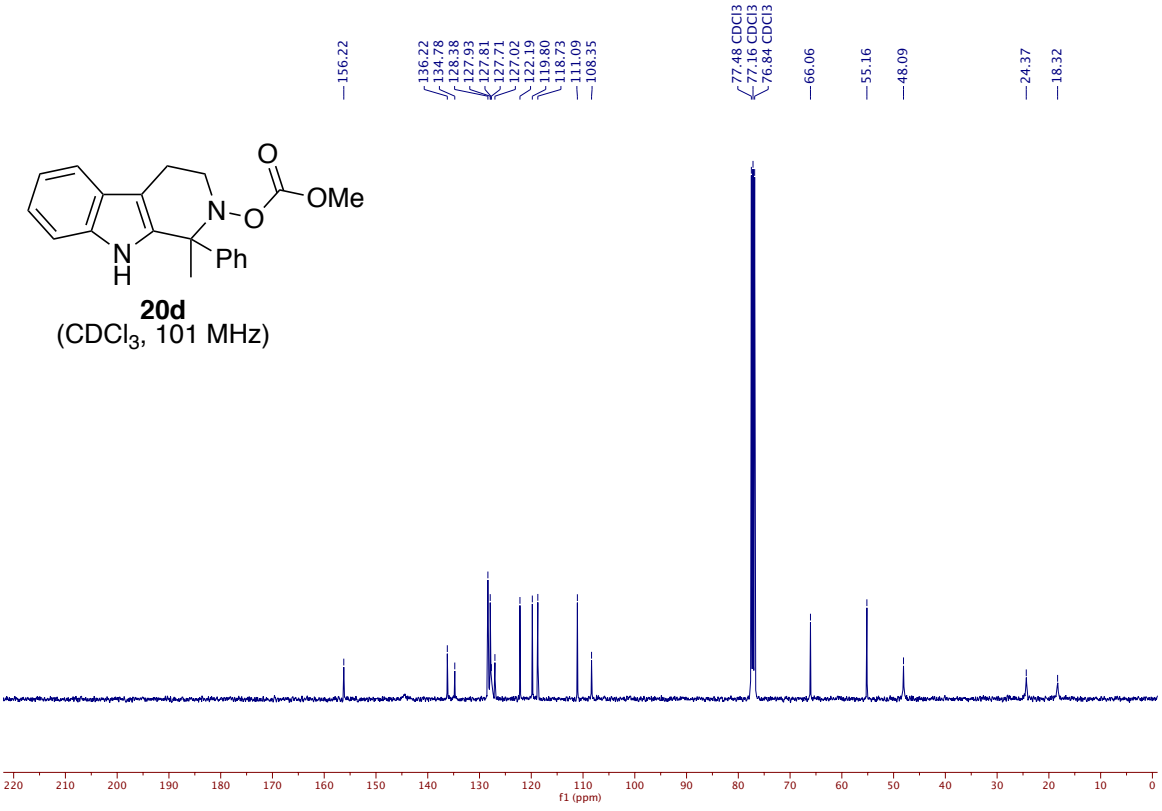


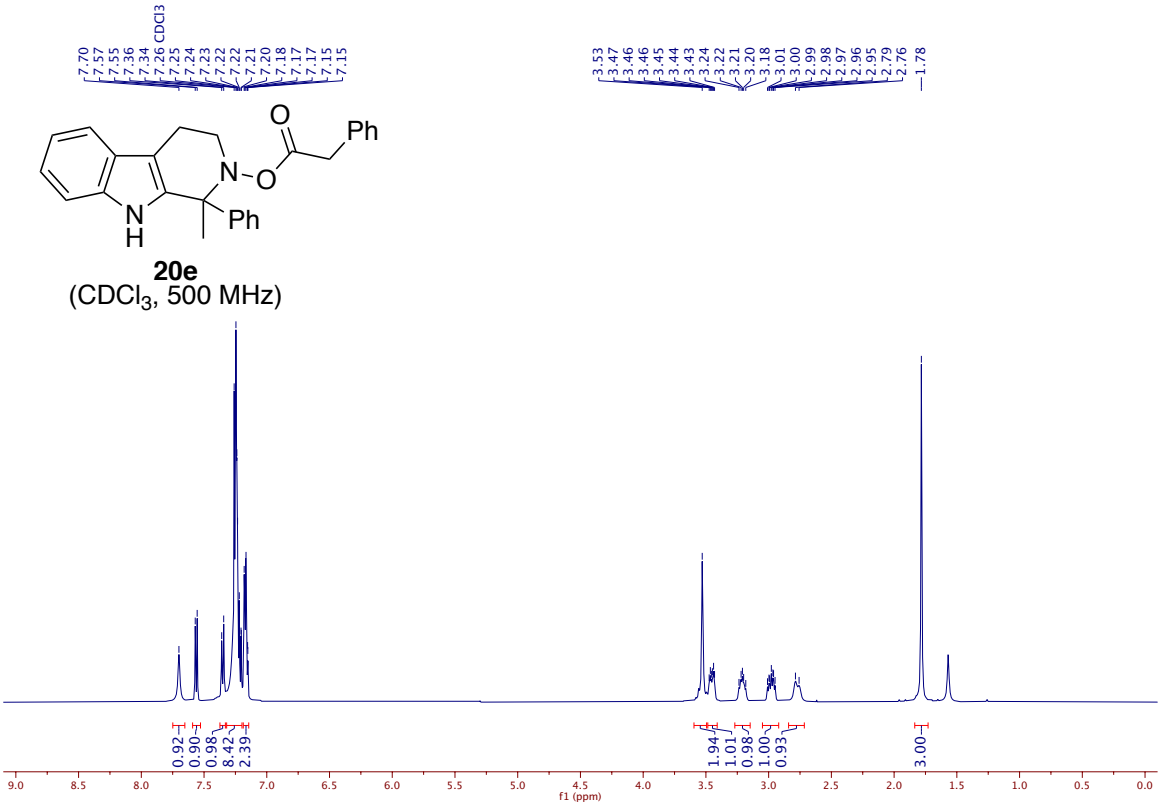

**20c**
($CDCl_3$, 500 MHz)



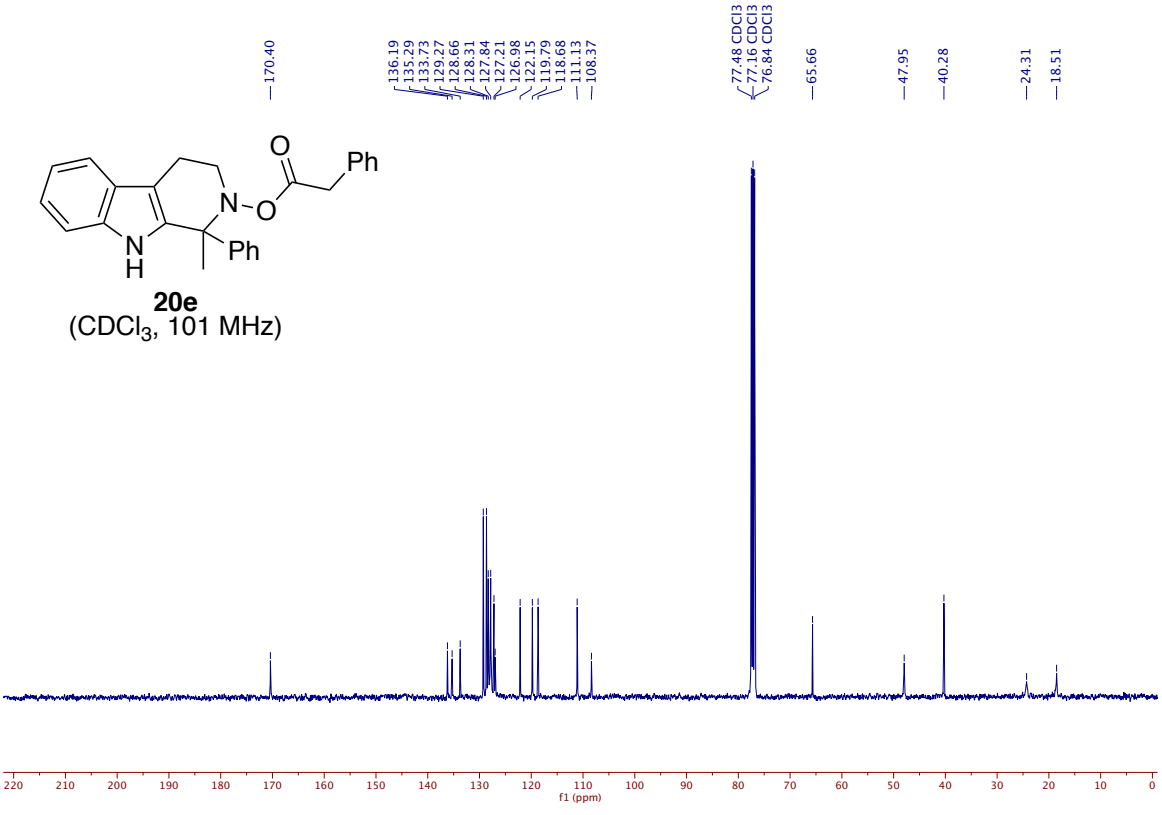

**20c**
($CDCl_3$, 101 MHz)


7.74
7.56
7.54
7.36
7.34
7.33
7.30
7.30
7.28
7.27
7.26 CDCl3
7.25
7.22
7.22
7.21
7.21
7.19
7.19
7.16
7.16
7.15
7.13
7.13
3.78
3.59
3.56
3.28
3.27
3.26
3.24
3.23
3.14
3.13
3.12
3.11
3.10
3.09
3.08
2.80
2.78
1.92
O
OMe
N
O
N
H
Ph
20d
(CDCl3, 500 MHz)
0.91
0.91
2.83
3.10
0.97
0.96
2.89
0.99
1.00
1.00
0.88
3.00
f1 (ppm)

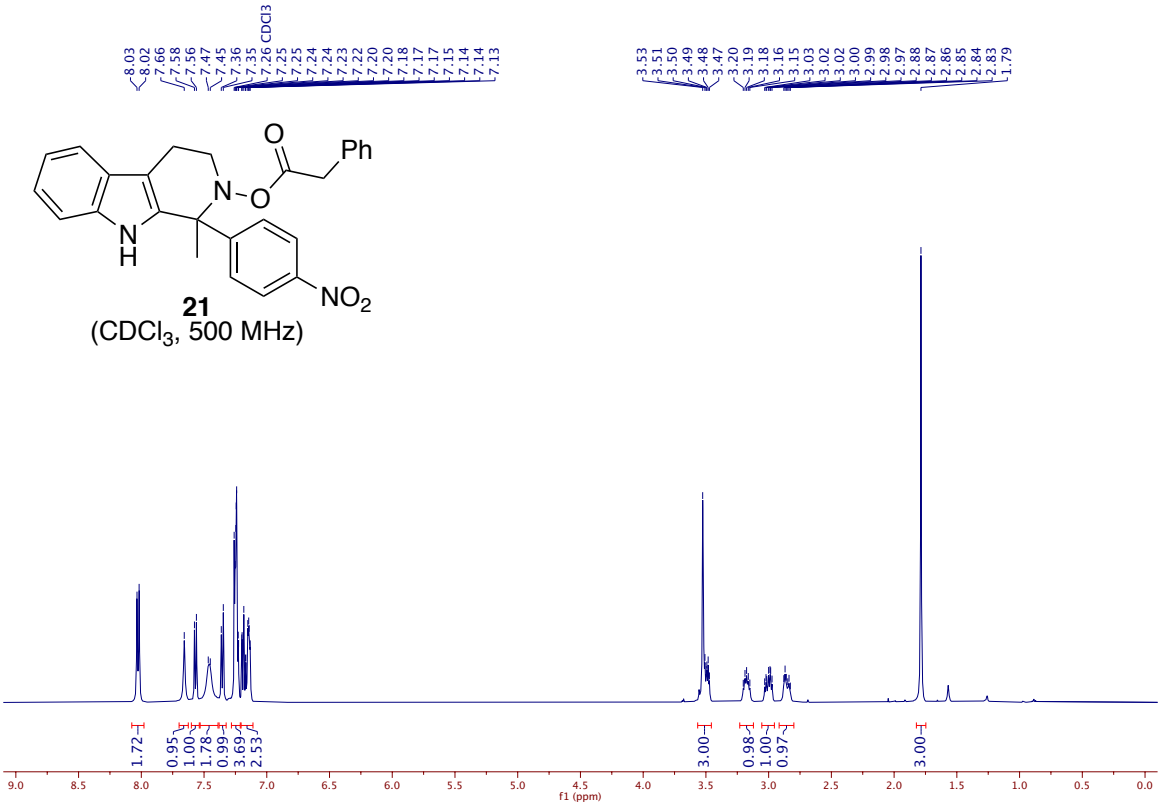

156.22
136.22
134.78
128.38
127.93
127.81
127.71
127.02
122.19
119.80
118.73
111.09
108.35
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
66.06
55.16
48.09
24.37
18.32
O
OMe
N
O
N
H
Ph
20d
(CDCl3, 101 MHz)
f1 (ppm)

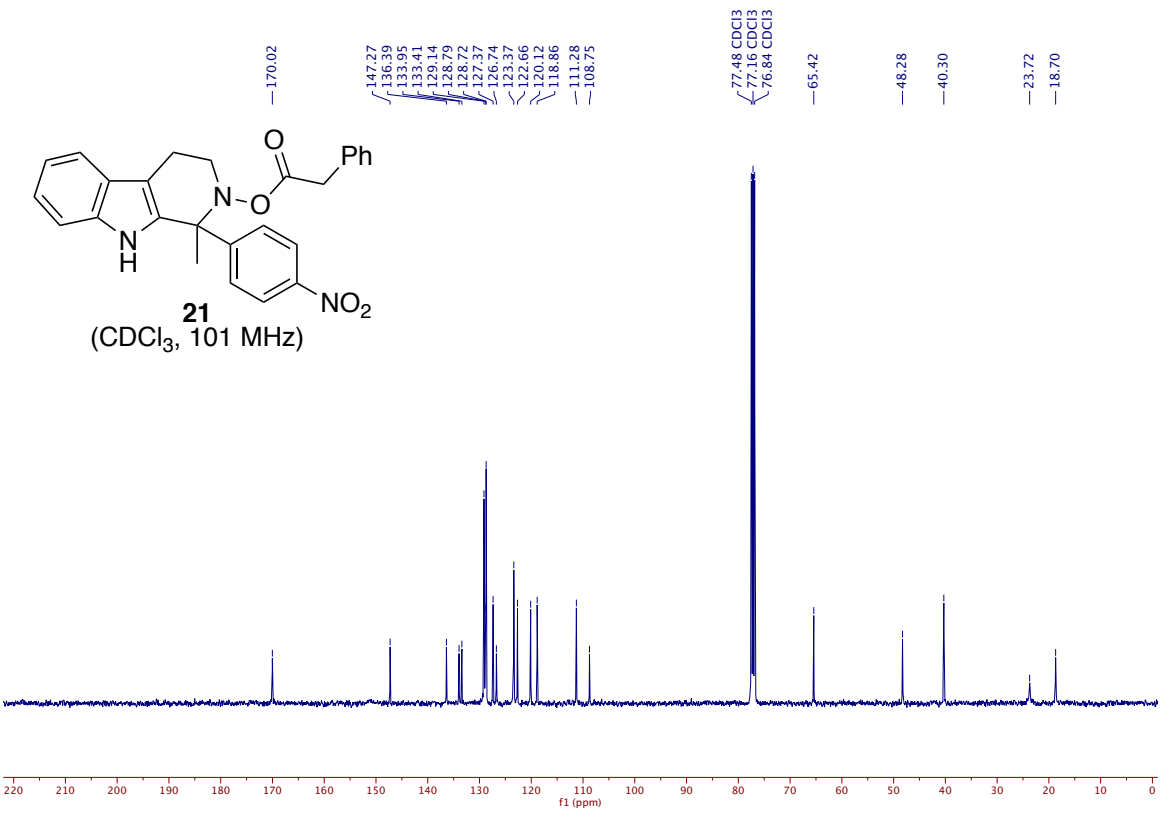


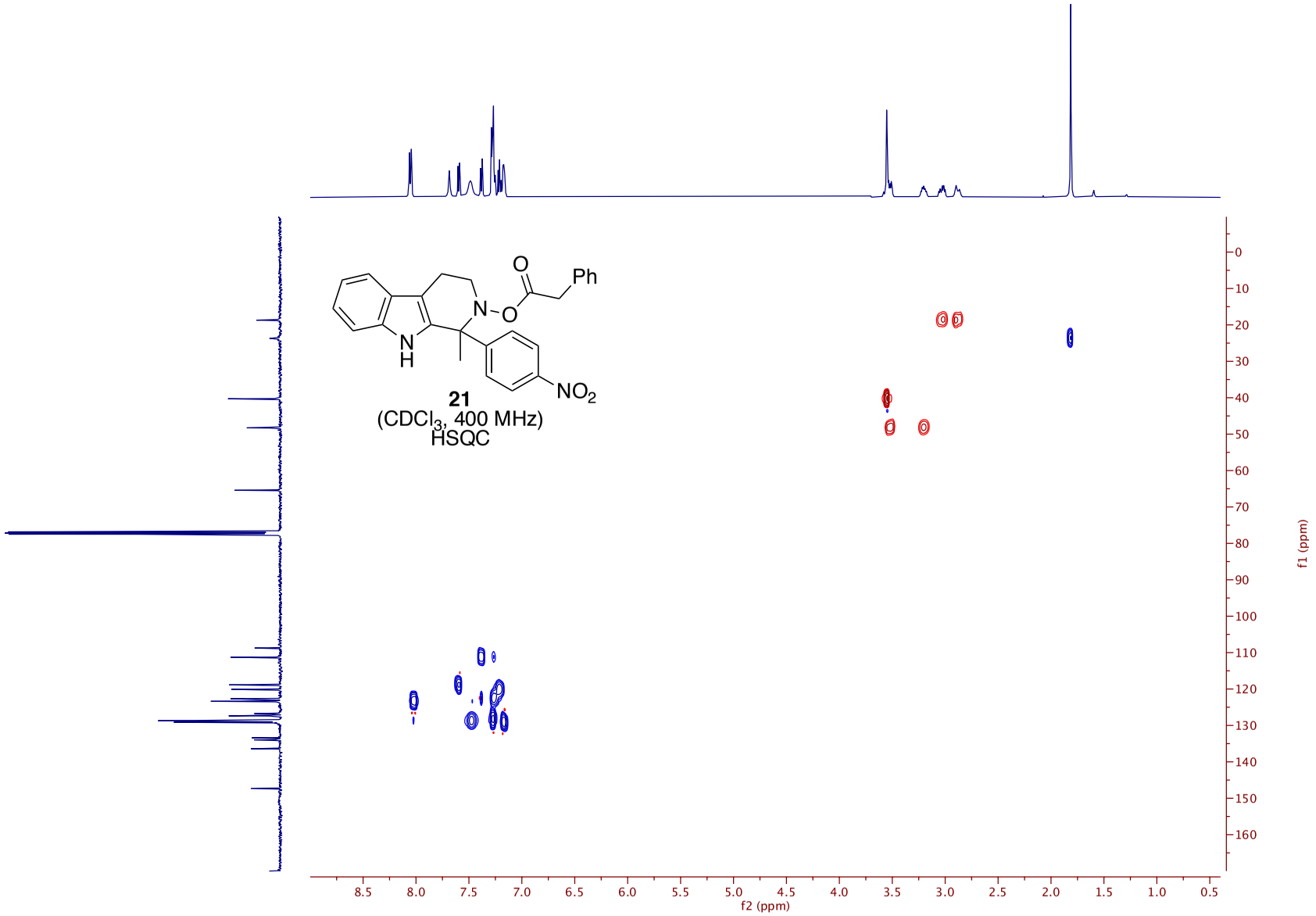

**20e**
($CDCl_3$, 500 MHz)

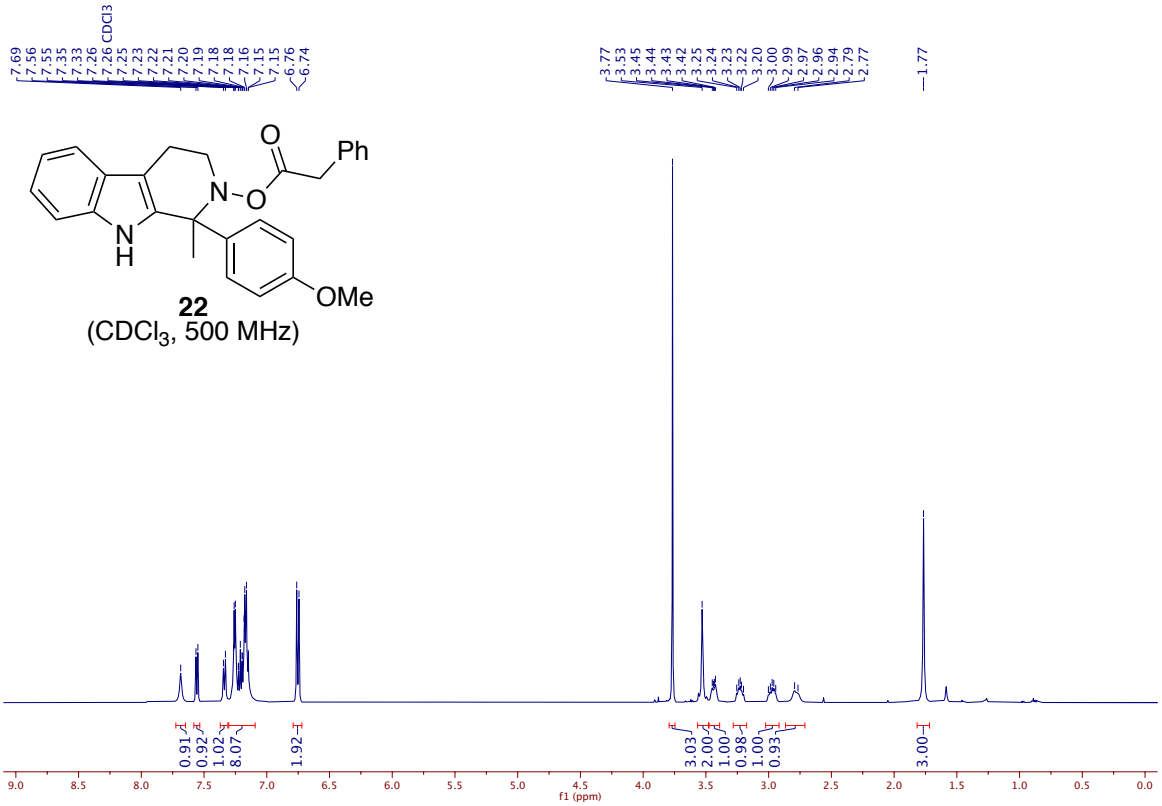


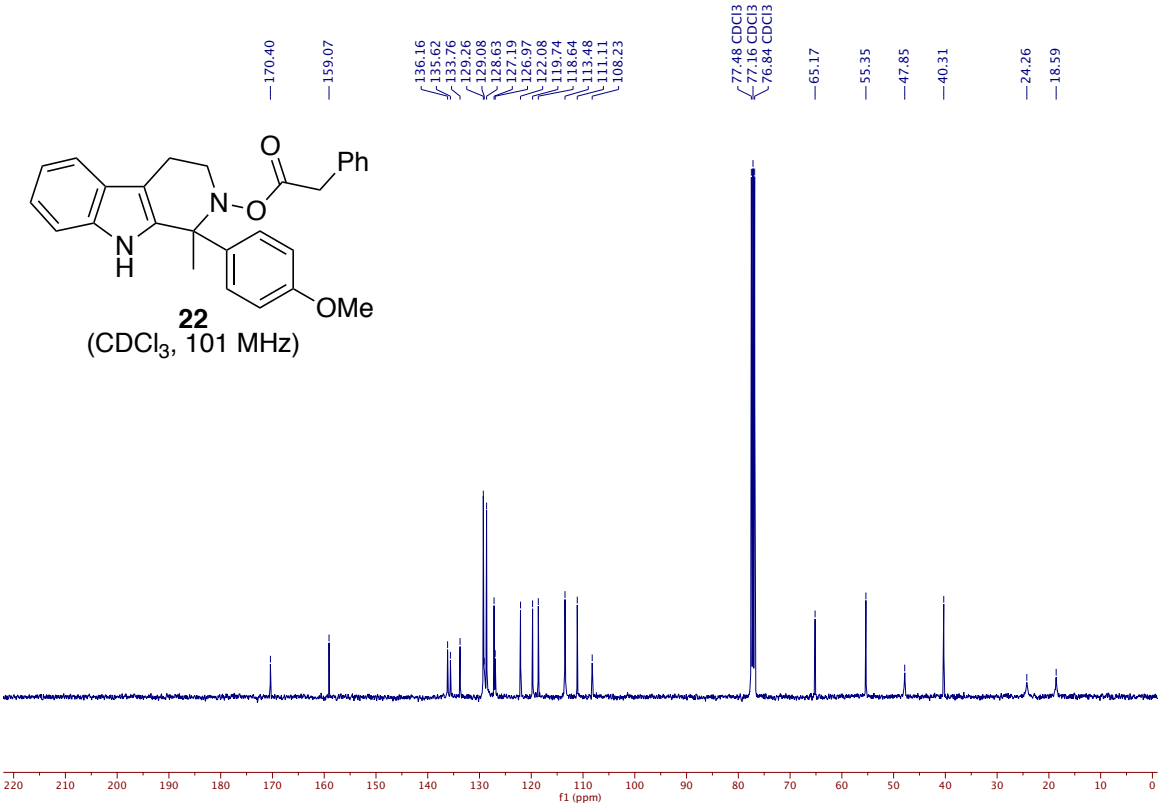

**20e**
($CDCl_3$, 101 MHz)

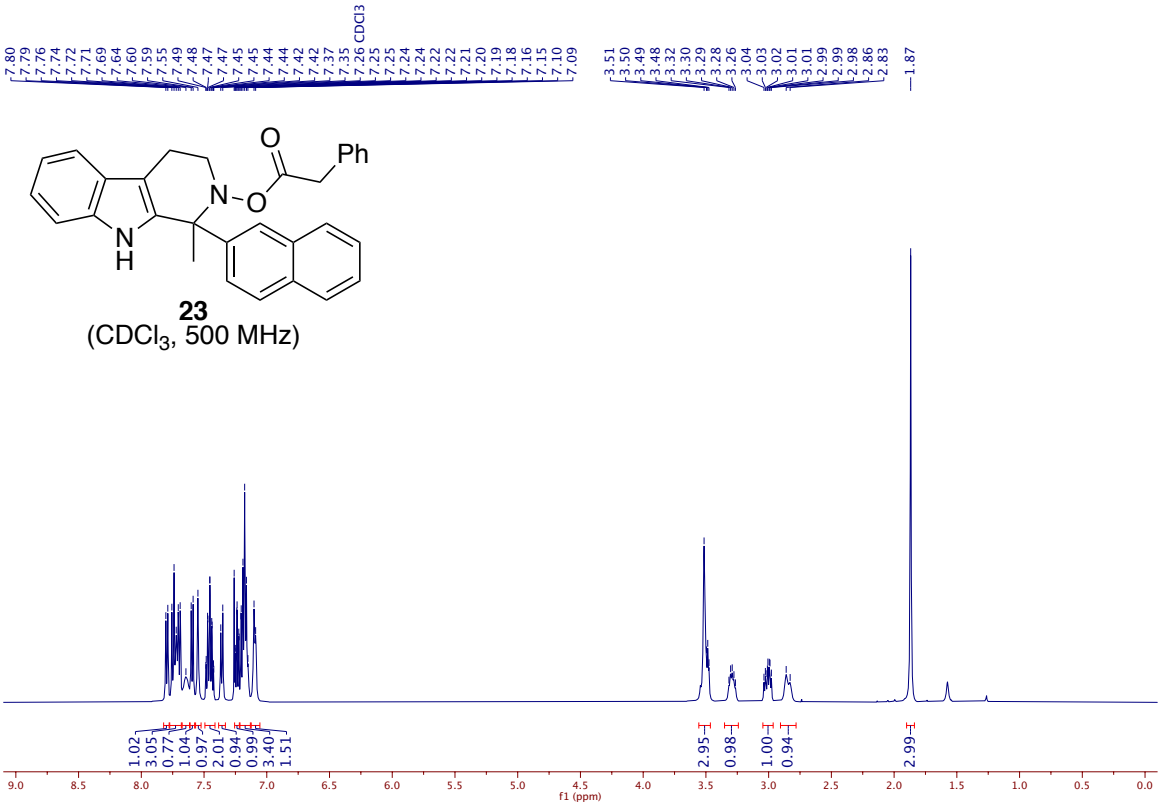

8.03
8.02
7.66
7.58
7.56
7.47
7.45
7.36
7.35
7.26 CDCl3
7.25
7.24
7.24
7.23
7.22
7.20
7.18
7.17
7.17
7.15
7.14
7.14
7.13
3.53
3.51
3.50
3.49
3.48
3.47
3.20
3.19
3.18
3.16
3.15
3.03
3.02
3.02
3.00
2.99
2.98
2.97
2.88
2.87
2.86
2.85
2.84
2.83
1.79
O
Ph
N
O
N
H
NO2
21
(CDCl3, 500 MHz)
1.72
0.95
1.00
1.78
0.99
3.69
2.53
3.00
0.98
1.00
0.97
3.00
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


170.02
147.27
136.39
133.95
133.41
129.14
128.79
128.72
127.37
126.74
123.37
122.66
120.12
118.86
111.28
108.75
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
65.42
48.28
40.30
23.72
18.70
O
Ph
N
O
N
H
NO2
21
(CDCl3, 101 MHz)
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

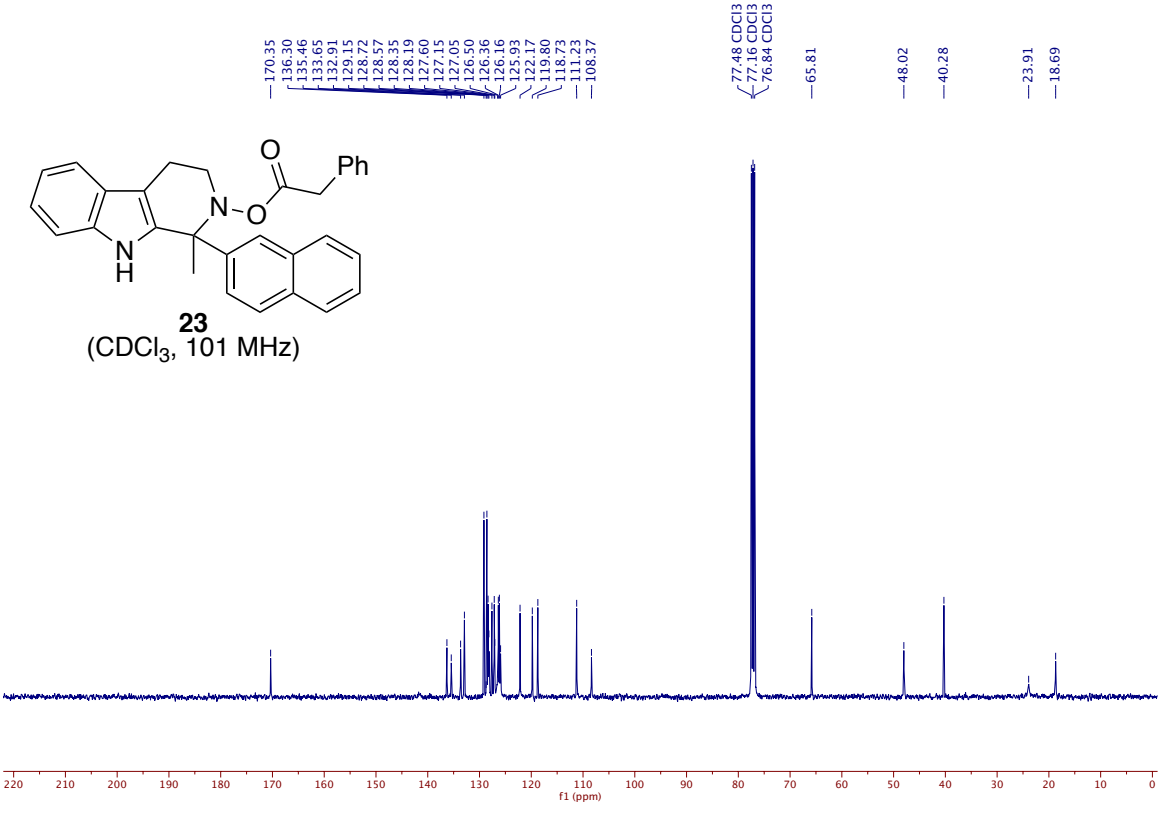

O
Ph
N
O
N
H
NO2
21
(CDCl3, 400 MHz)
HSQC
f2 (ppm)
f1 (ppm)


7.69
7.56
7.55
7.35
7.33
7.26
7.26 CDCl3
7.25
7.23
7.22
7.21
7.20
7.19
7.18
7.18
7.16
7.15
7.15
6.76
6.74
3.77
3.53
3.45
3.44
3.43
3.42
3.25
3.24
3.23
3.22
3.20
3.00
2.99
2.97
2.96
2.94
2.79
2.77
1.77
O
Ph
N
O
N
H
OMe
22
(CDCl3, 500 MHz)
0.91
0.92
1.02
8.07
1.92
3.03
2.00
1.00
0.98
1.00
0.93
3.00
f1 (ppm)

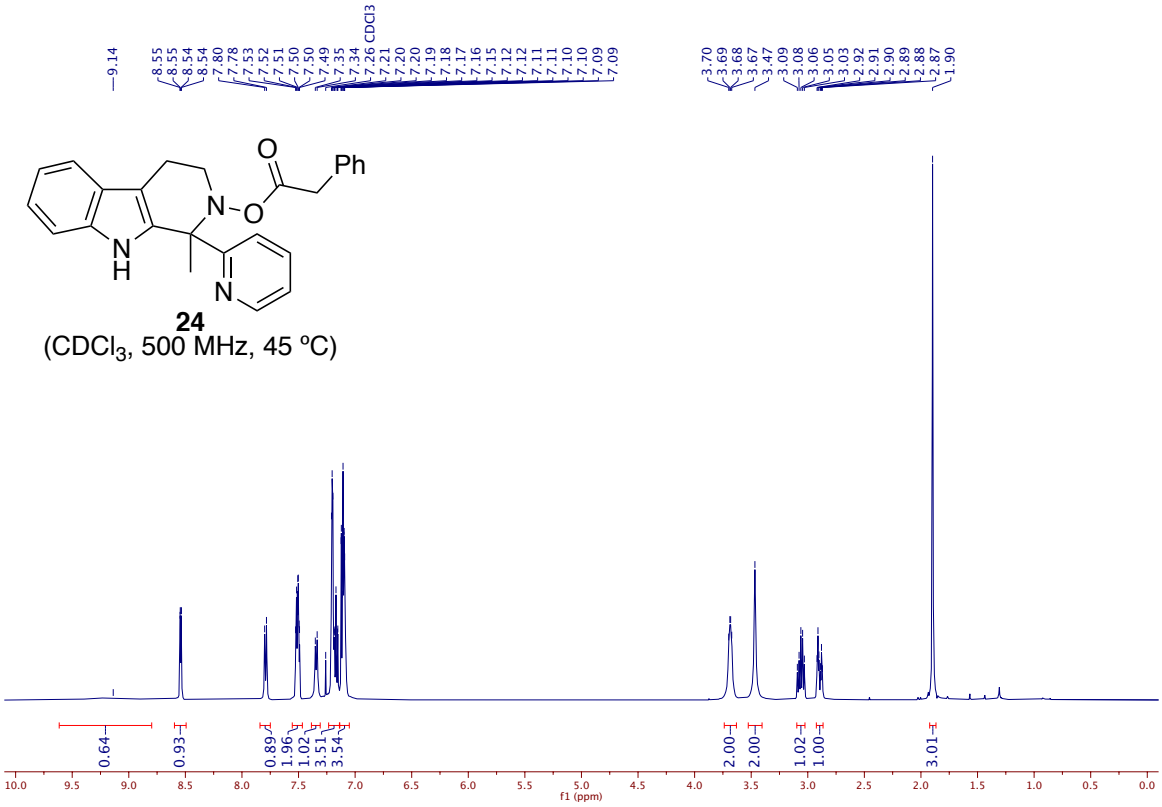

170.40
159.07
136.16
135.62
133.76
129.26
129.08
128.63
127.19
126.97
122.08
119.74
118.64
113.48
111.11
108.23
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
65.17
55.35
47.85
40.31
24.26
18.59
O
Ph
N
O
N
H
OMe
22
(CDCl3, 101 MHz)
f1 (ppm)

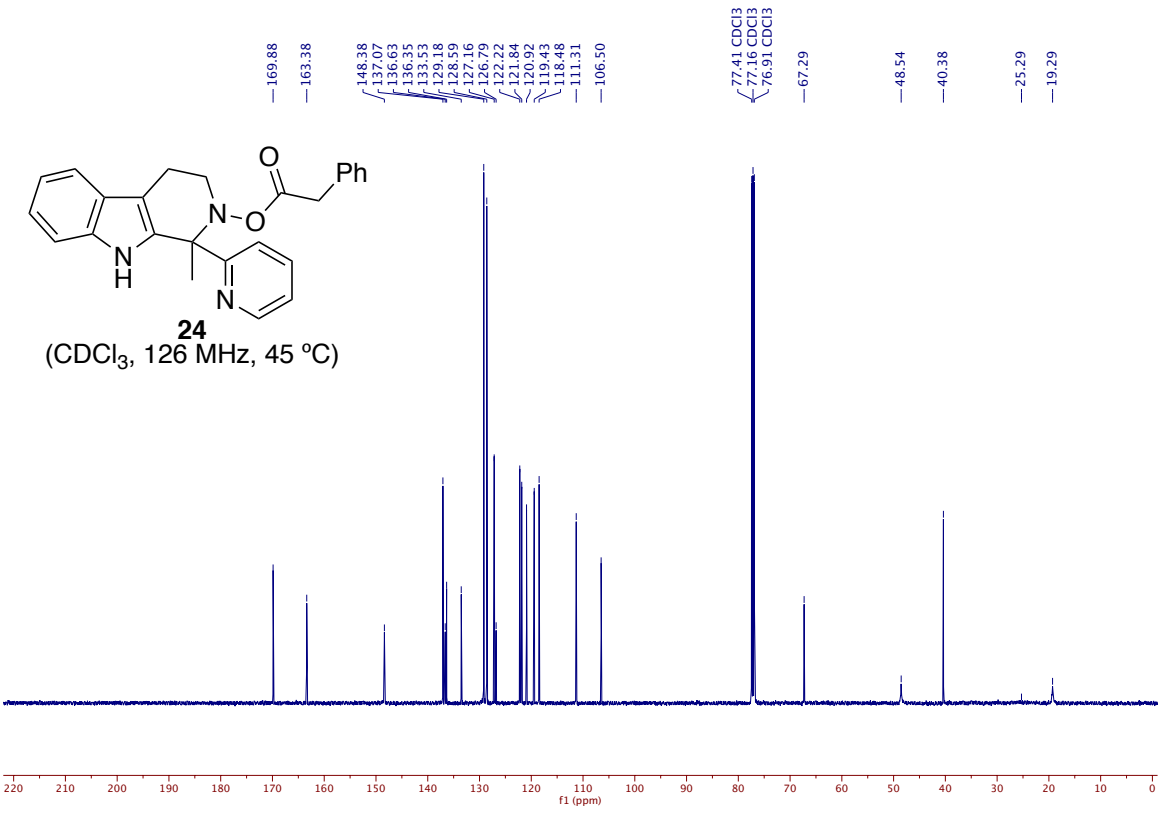


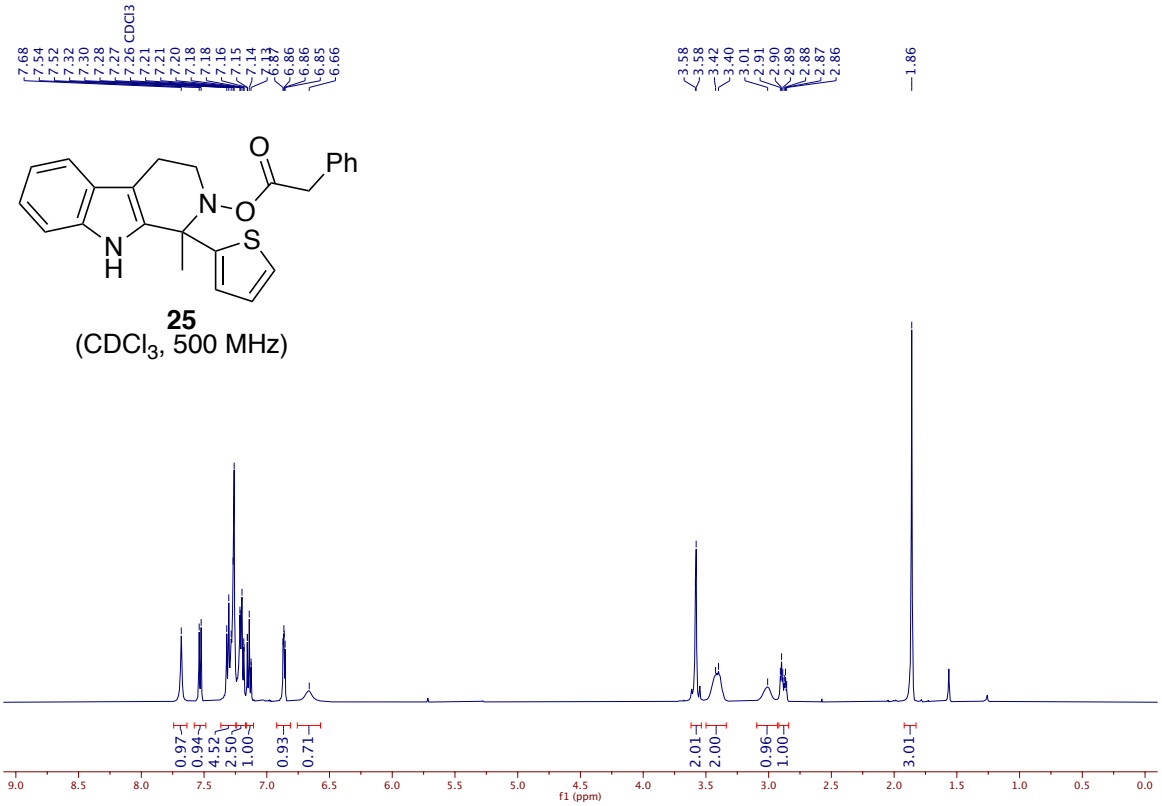

**23**
($CDCl_3$, 500 MHz)



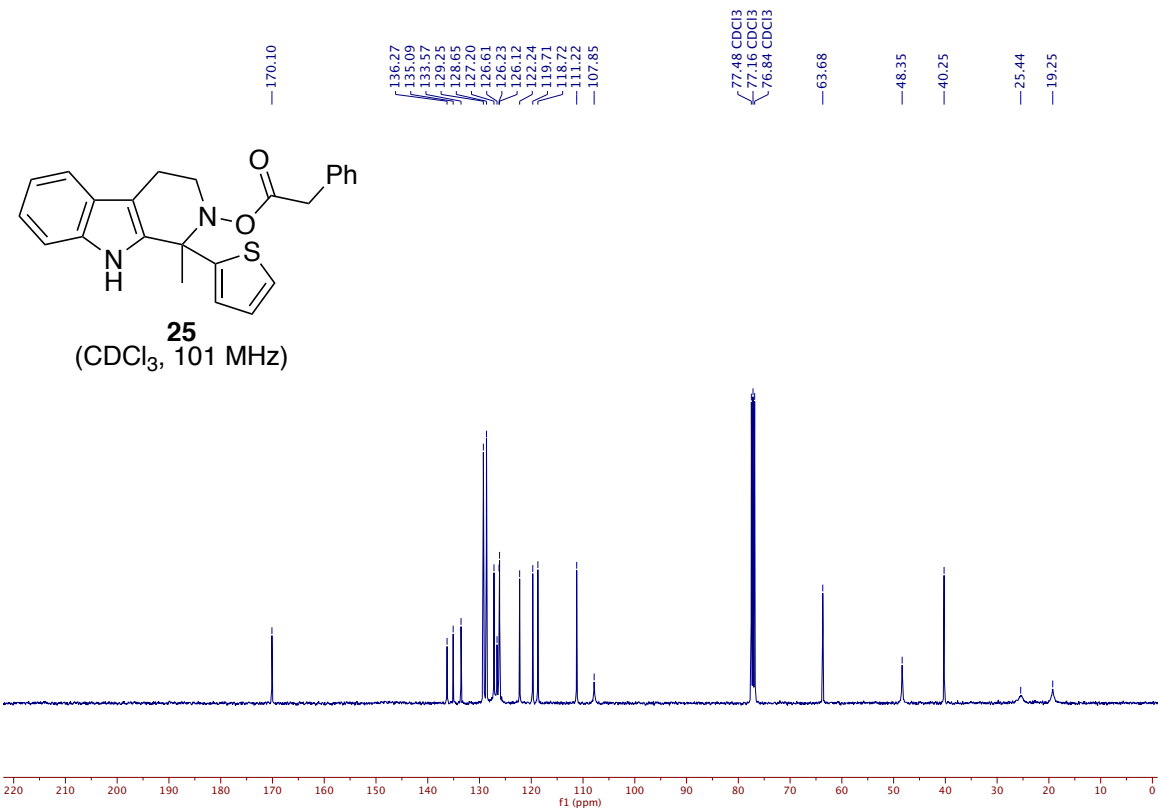

**23**
($CDCl_3$, 101 MHz)


9.14
8.55
8.55
8.54
8.54
7.80
7.78
7.53
7.52
7.51
7.50
7.50
7.49
7.35
7.34
7.26 CDCl3
7.21
7.20
7.20
7.19
7.18
7.17
7.16
7.15
7.12
7.12
7.11
7.11
7.10
7.10
7.09
7.09
3.70
3.69
3.68
3.67
3.47
3.09
3.08
3.06
3.05
3.03
2.92
2.91
2.90
2.89
2.88
2.87
1.90
O
Ph
N
O
N
H
N
24
(CDCl3, 500 MHz, 45 ºC)
0.64
0.93
0.89
1.96
1.02
3.51
3.54
2.00
2.00
1.02
1.00
3.01
f1 (ppm)

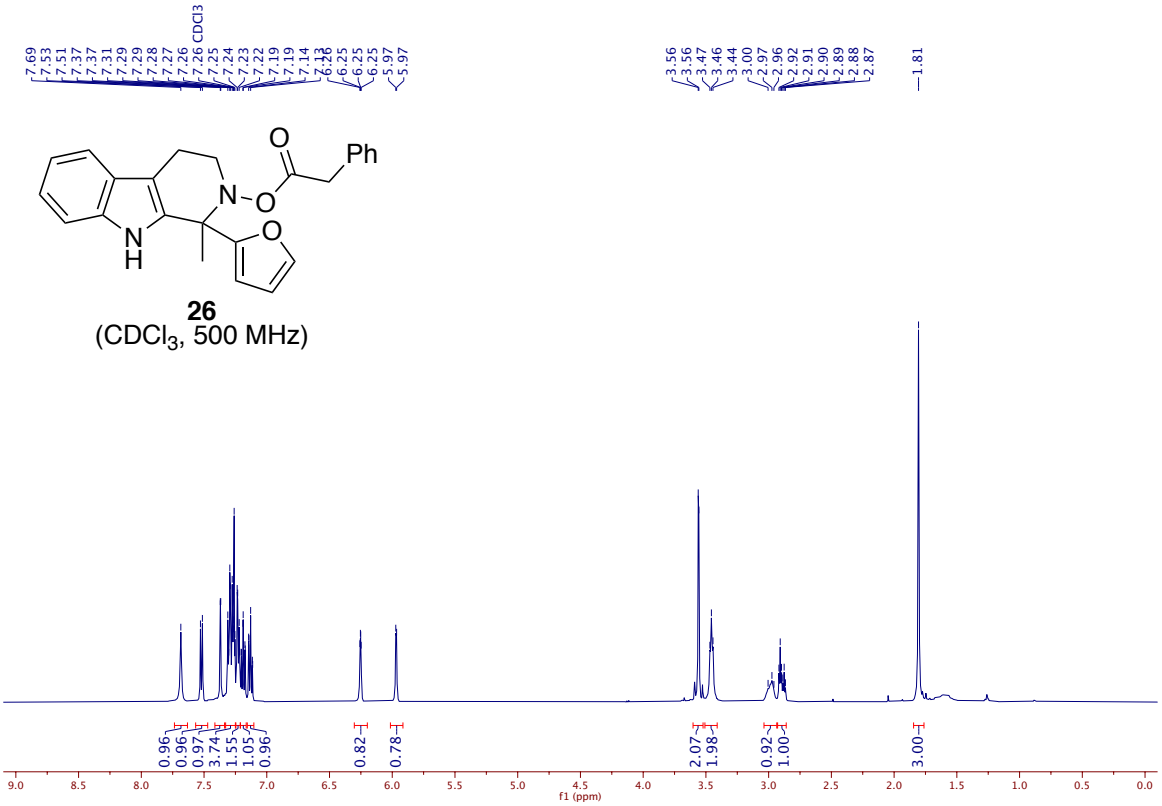

169.88
163.38
148.38
137.07
136.63
136.35
133.53
129.18
128.59
127.16
126.79
122.22
121.84
120.92
119.43
118.48
111.31
106.50
77.41 CDCl3
77.16 CDCl3
76.91 CDCl3
67.29
48.54
40.38
25.29
19.29
O
Ph
N
O
N
H
N
24
(CDCl3, 126 MHz, 45 ºC)
f1 (ppm)



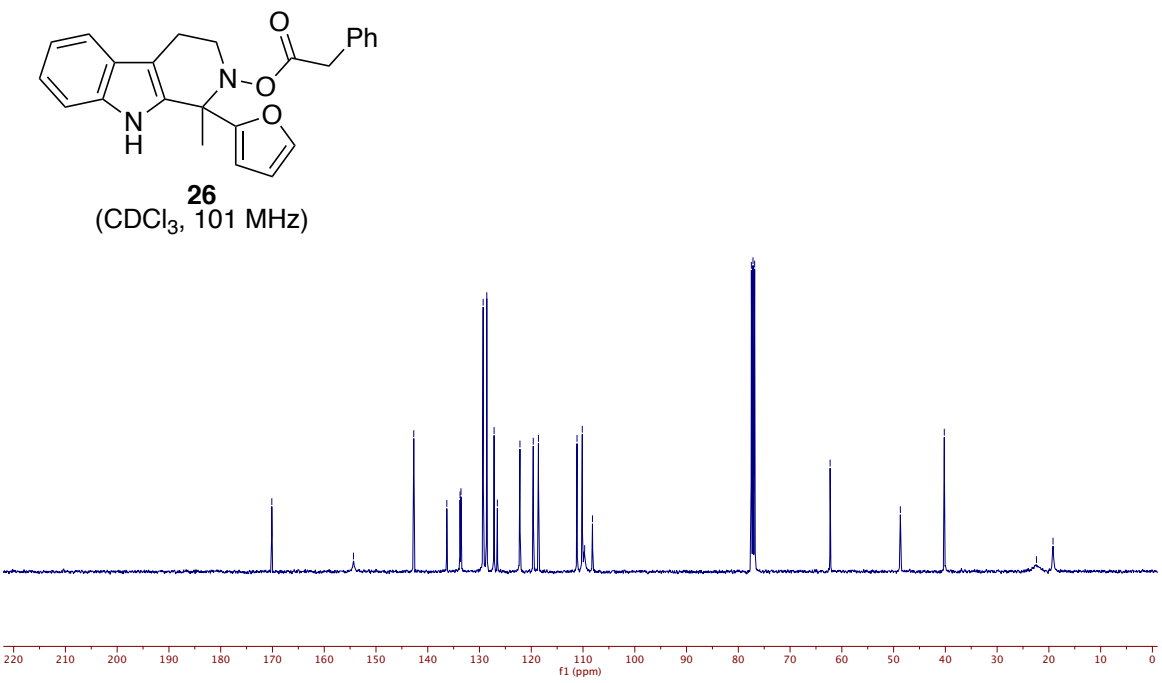

**25**
($CDCl_3$, 500 MHz)



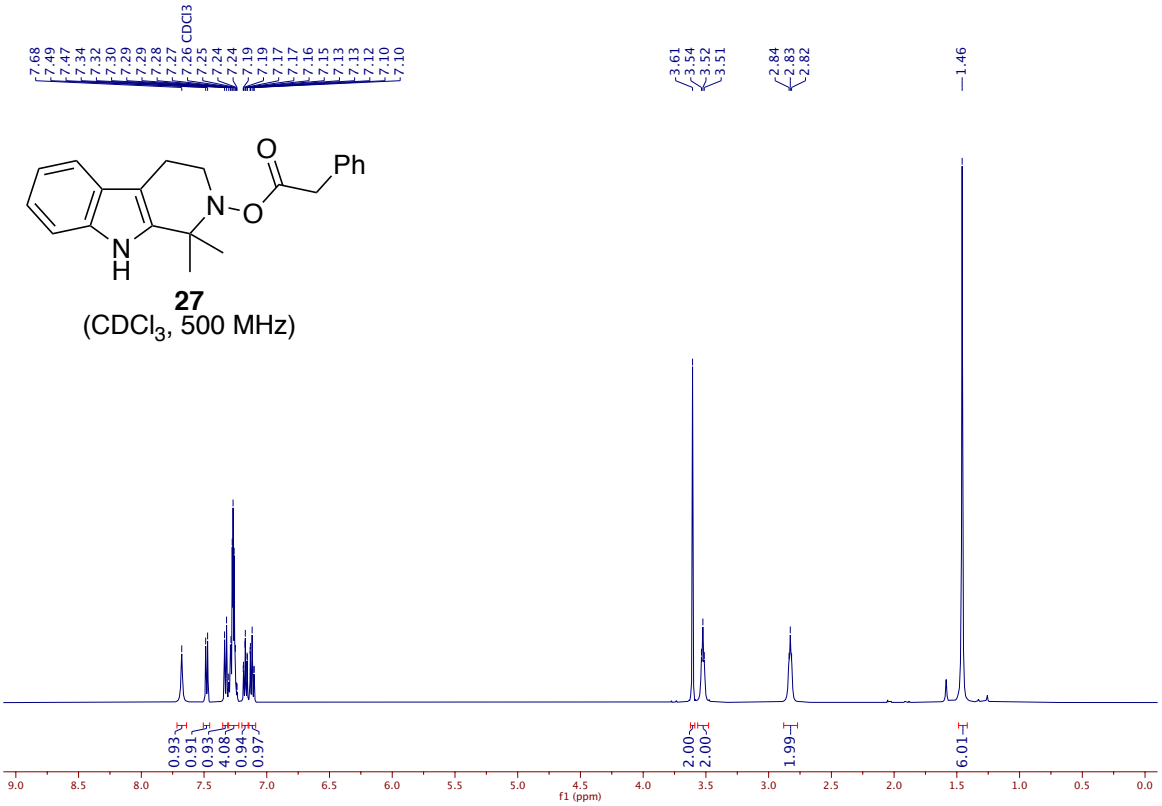

**25**
($CDCl_3$, 101 MHz)



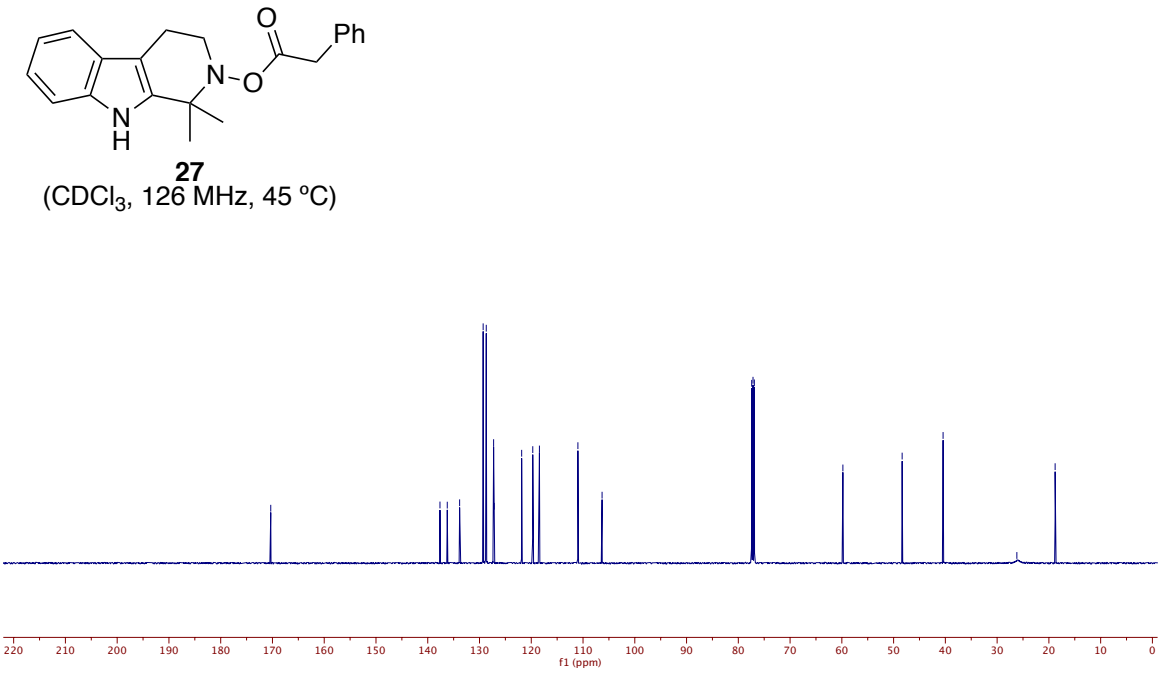

**26**
($CDCl_3$, 500 MHz)



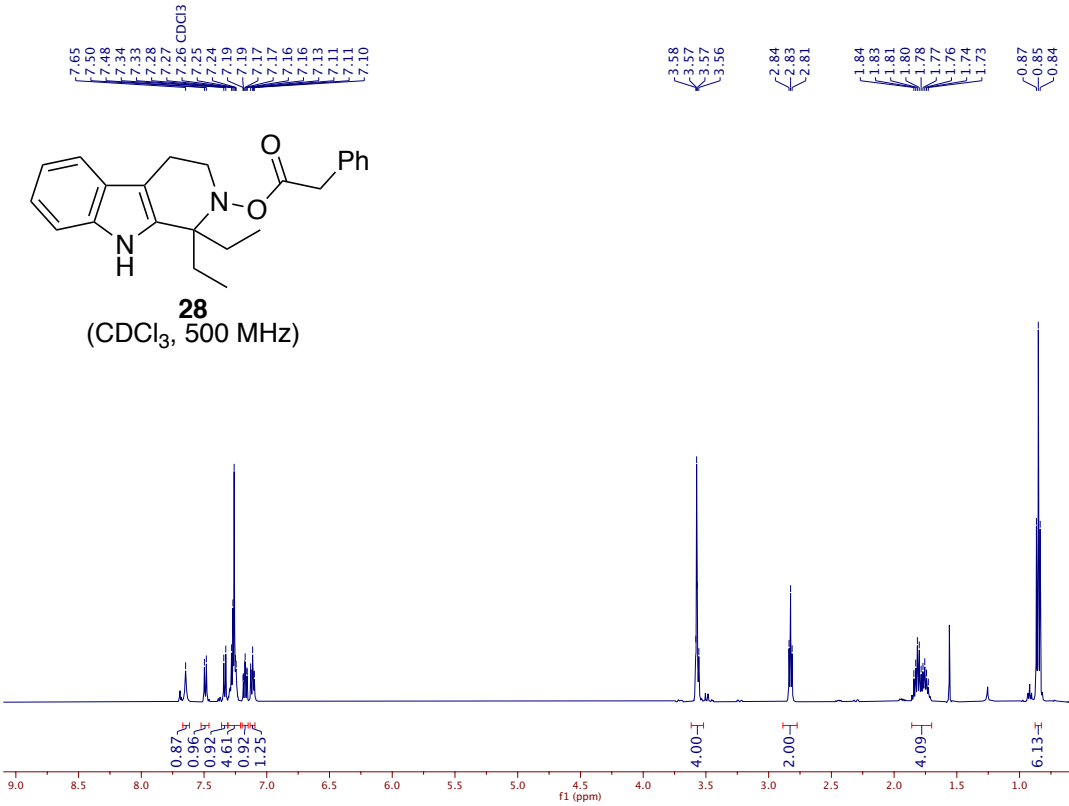

**26**
($CDCl_3$, 101 MHz)



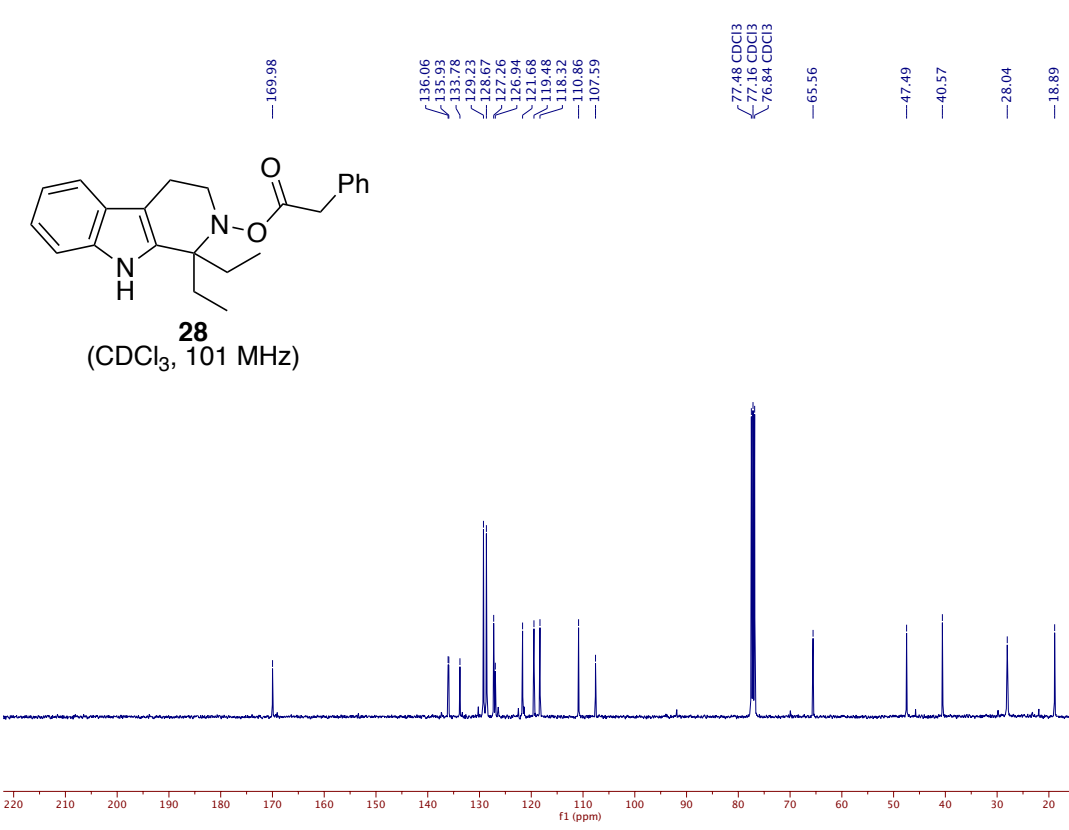

**27**
($CDCl_3$, 500 MHz)



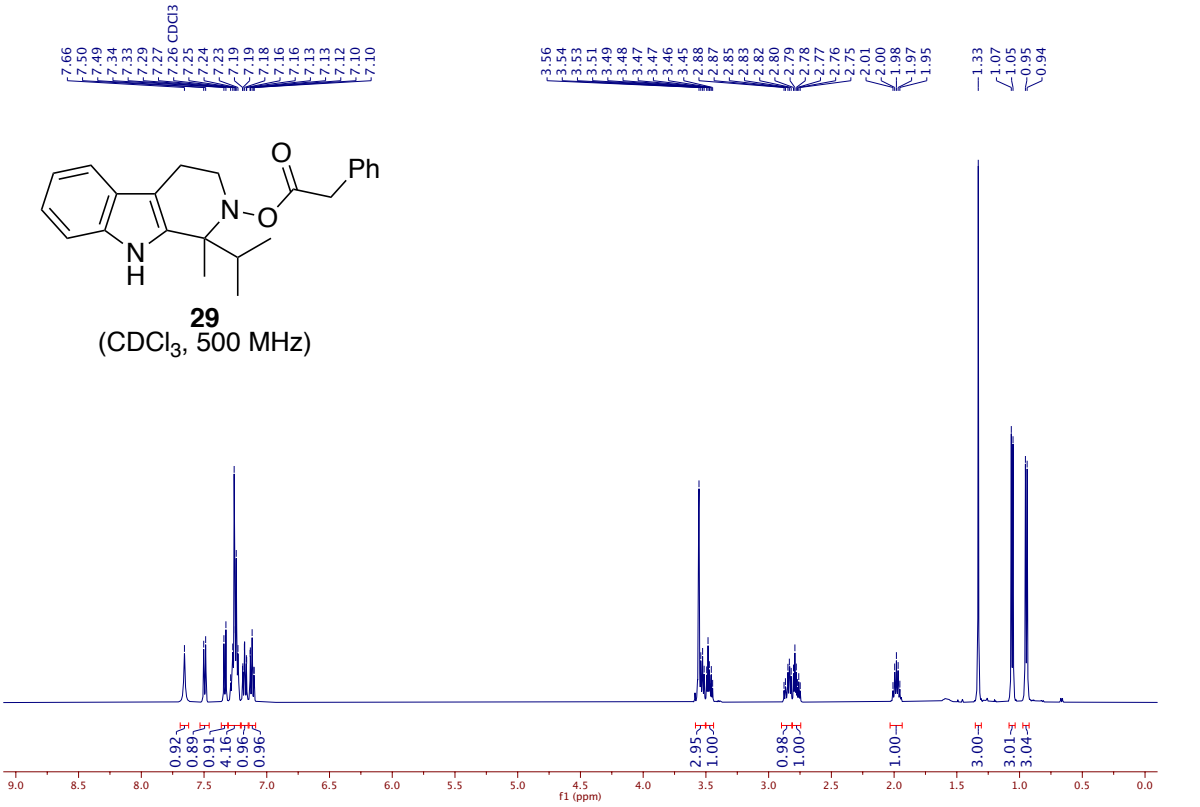

**27**
($CDCl_3$, 126 MHz, 45 °C)



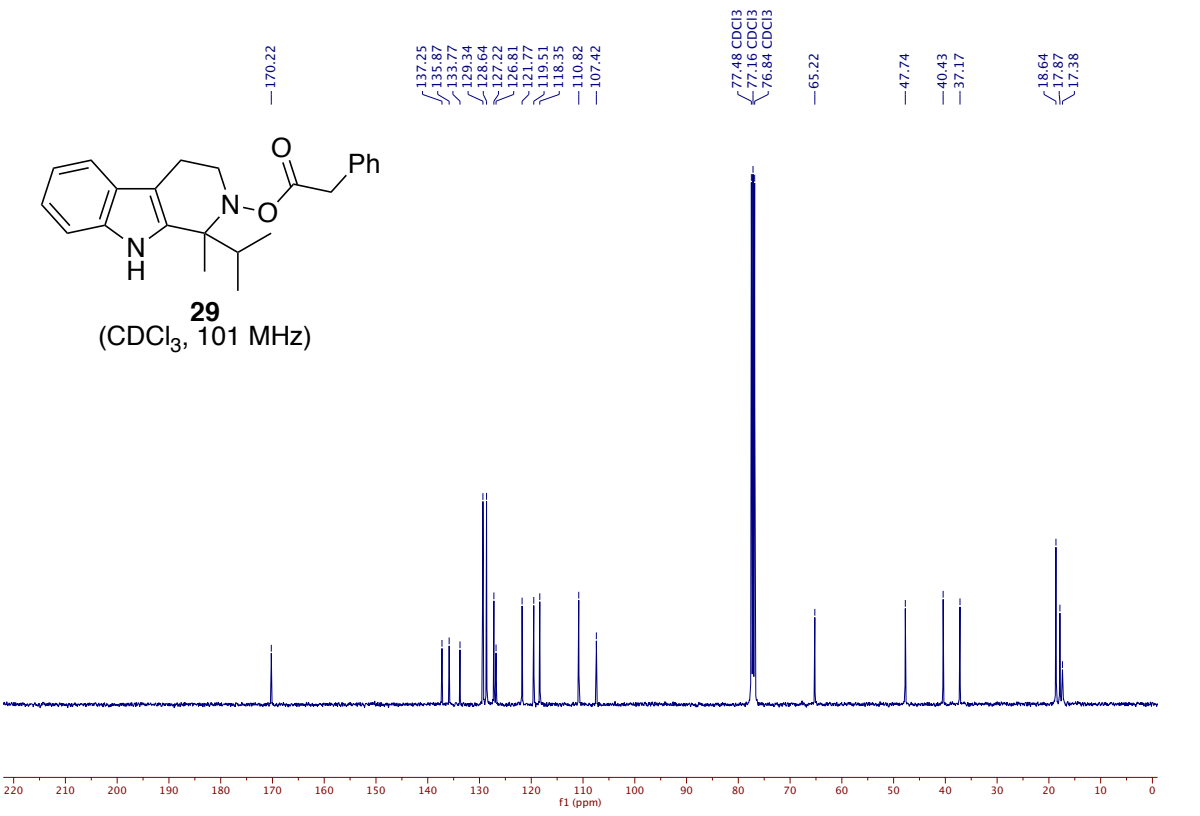

**28**
($CDCl_3$, 500 MHz)



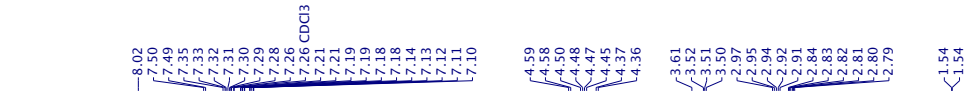

**28**
($CDCl_3$, 101 MHz)

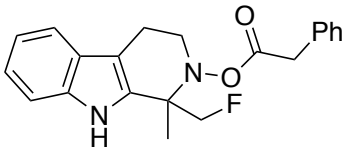



**29**
($CDCl_3$, 500 MHz)

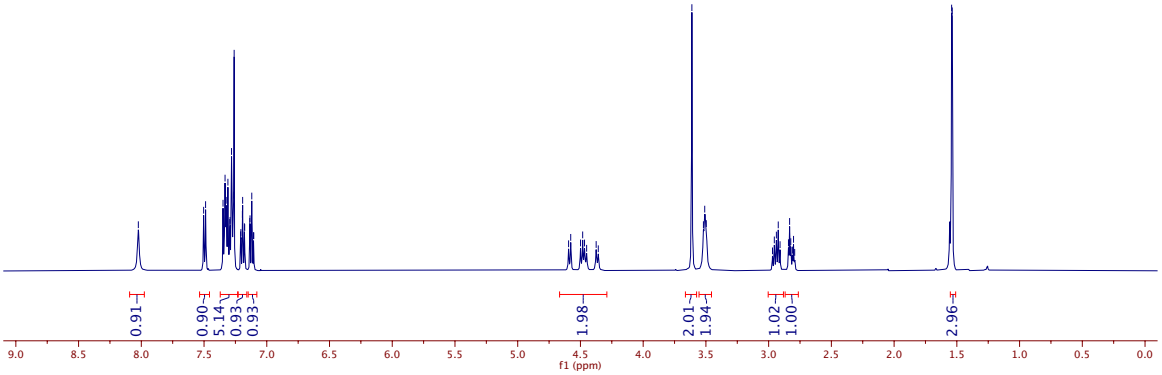



**29**
($CDCl_3$, 101 MHz)

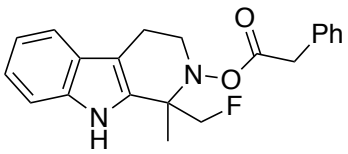


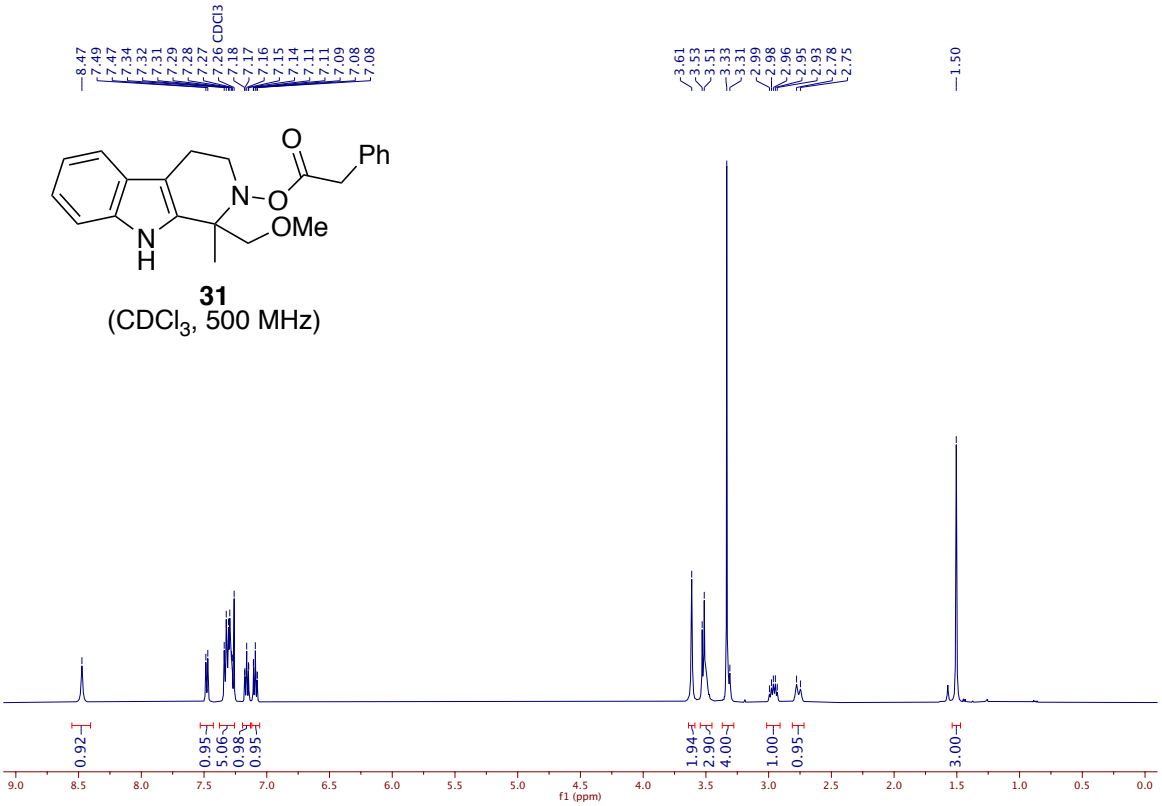

**30**
($CDCl_3$, 500 MHz)



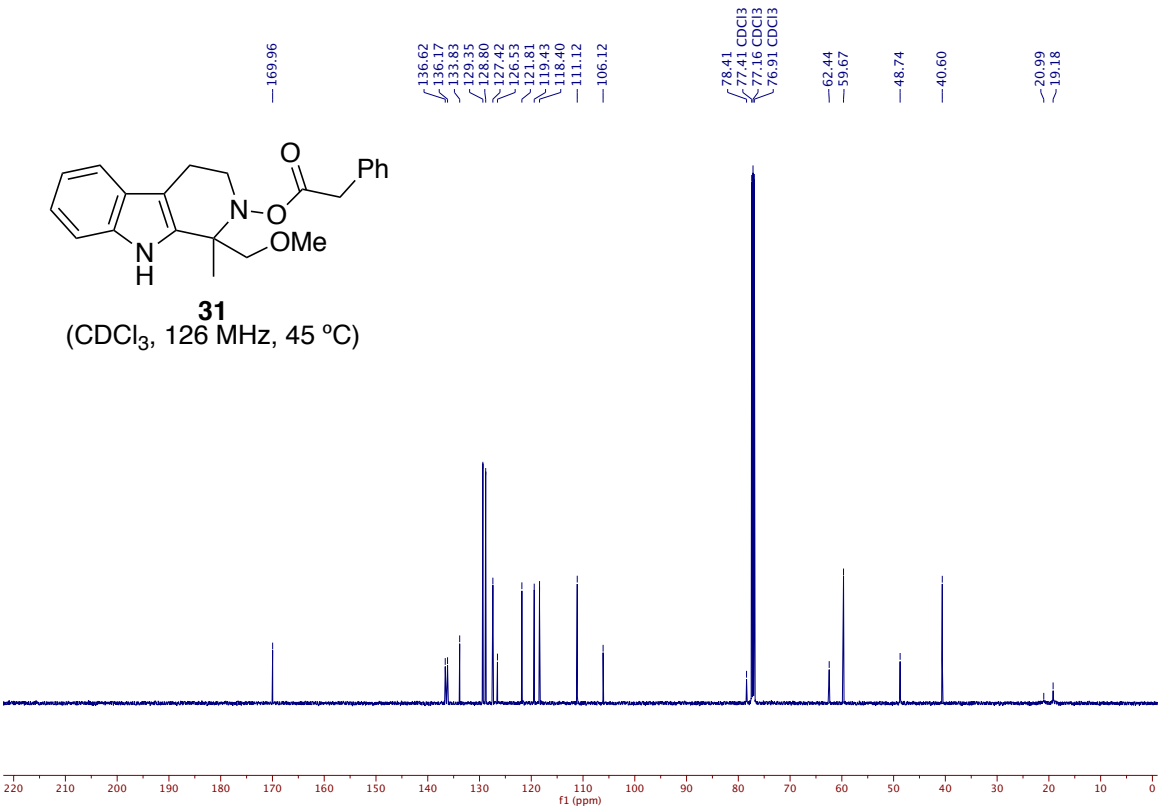




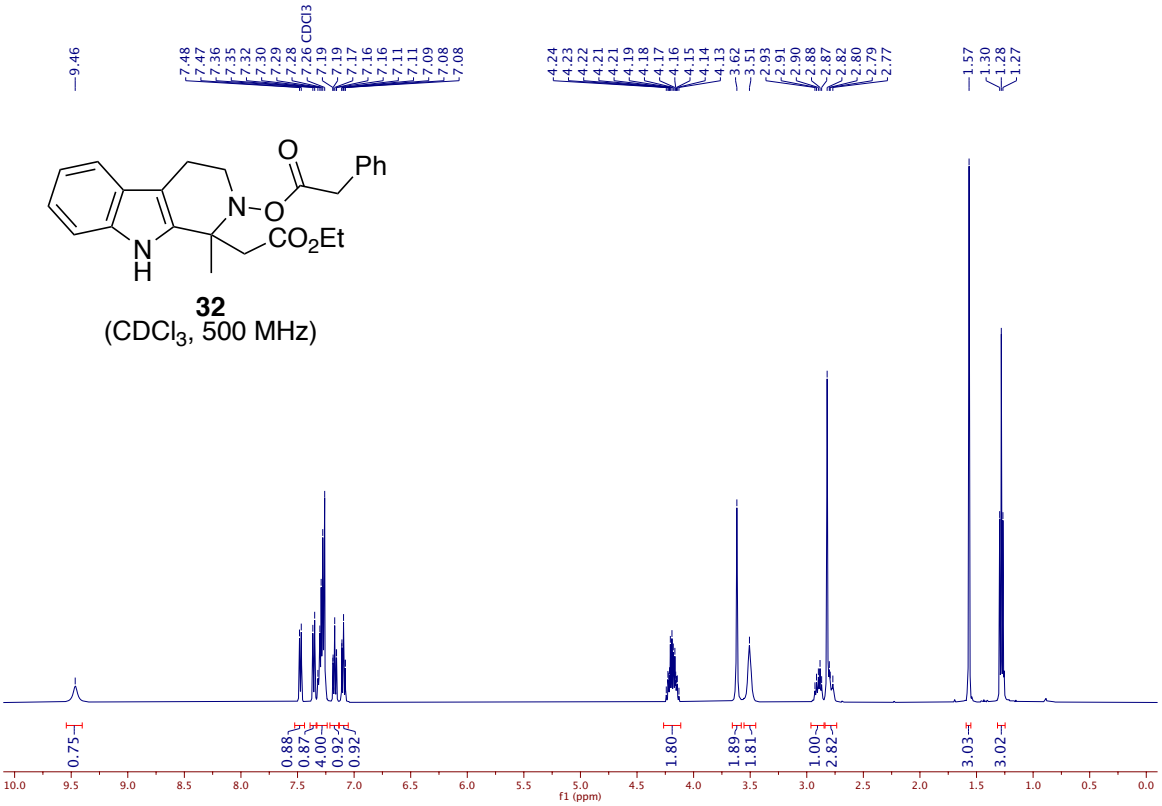

**30**
($CDCl_3$, 126 MHz, 45 °C)



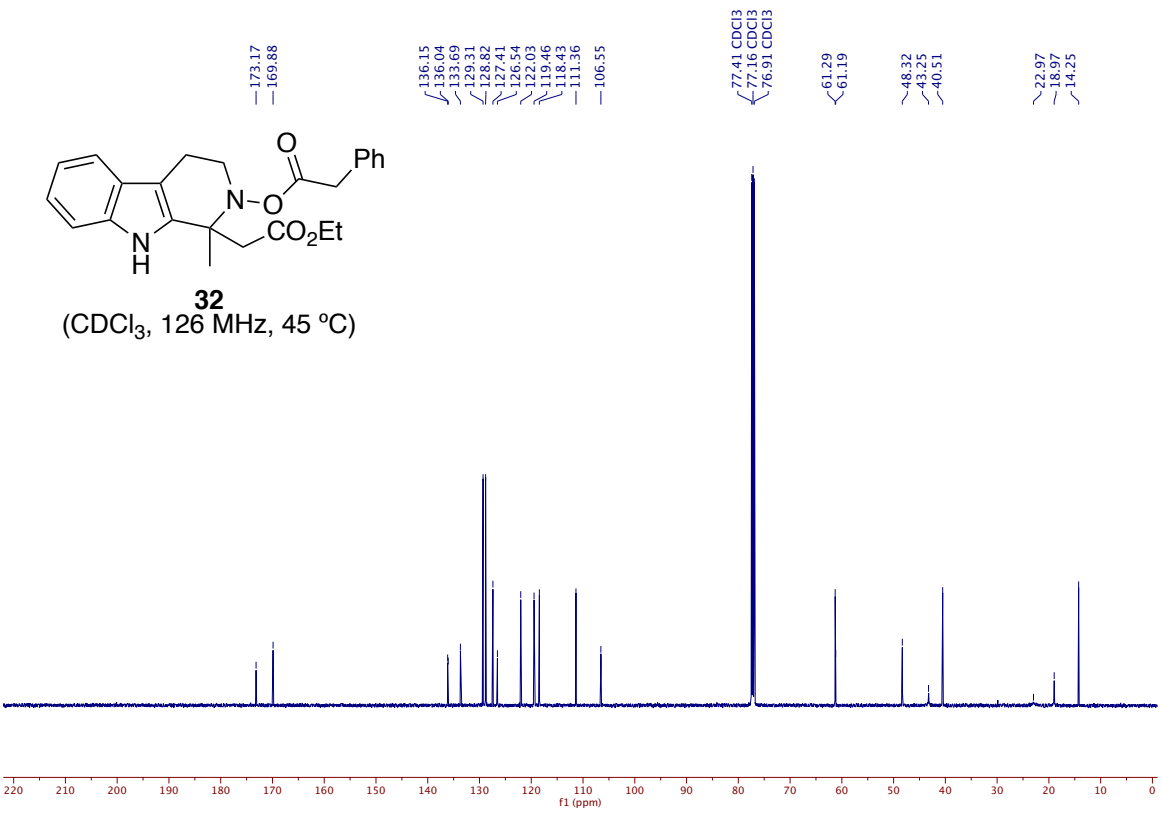

**31**
($CDCl_3$, 500 MHz)



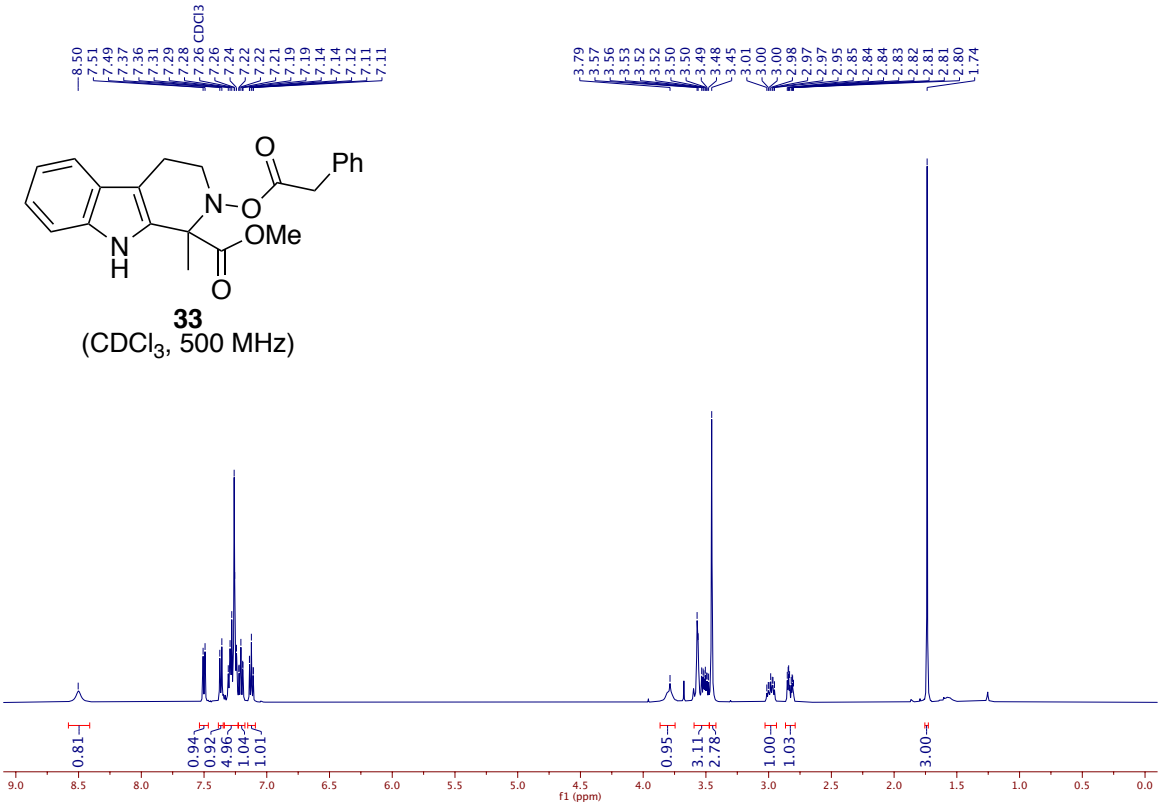

**31**
($CDCl_3$, 126 MHz, 45 °C)



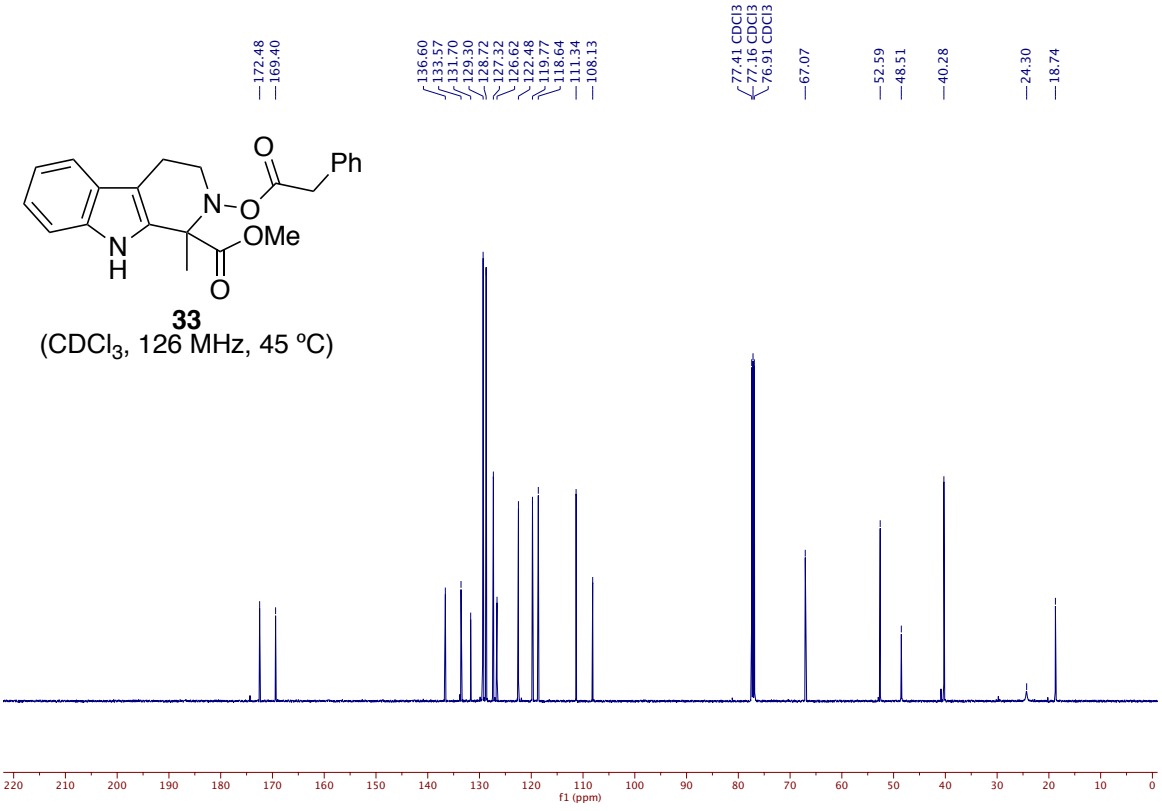

**32**
($CDCl_3$, 500 MHz)



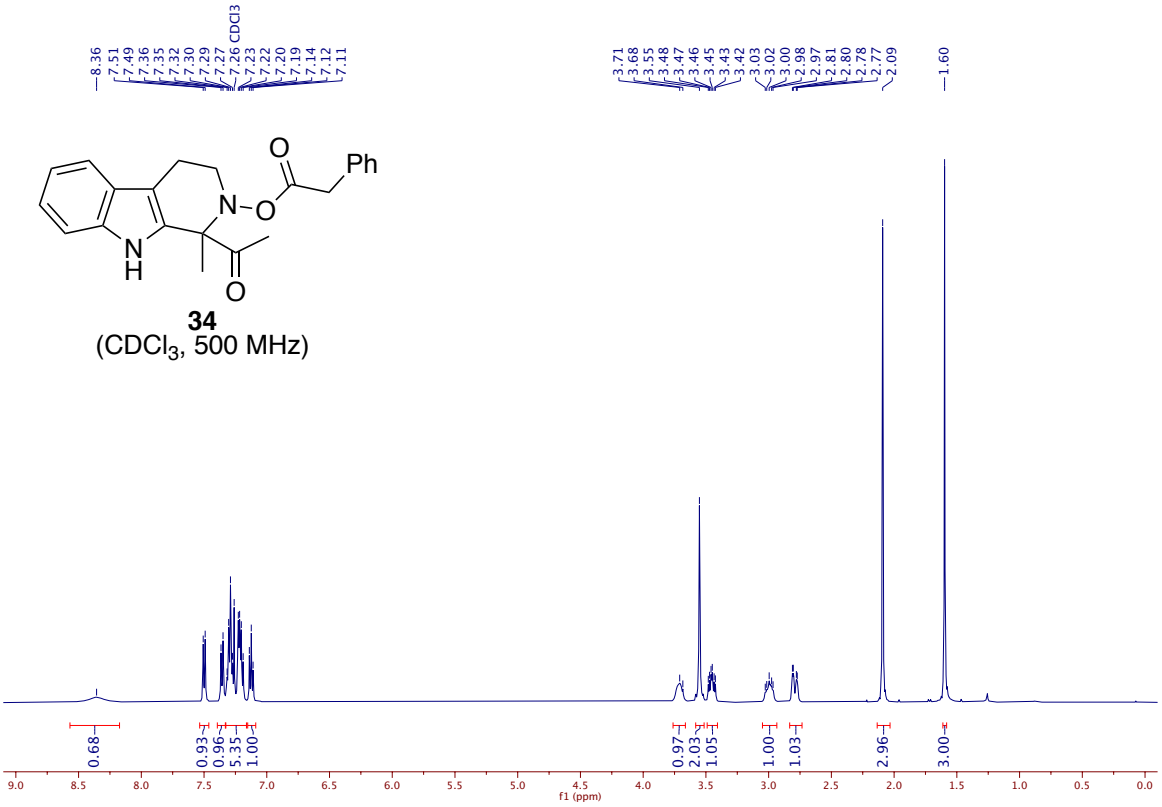

**32**
($CDCl_3$, 126 MHz, 45 °C)



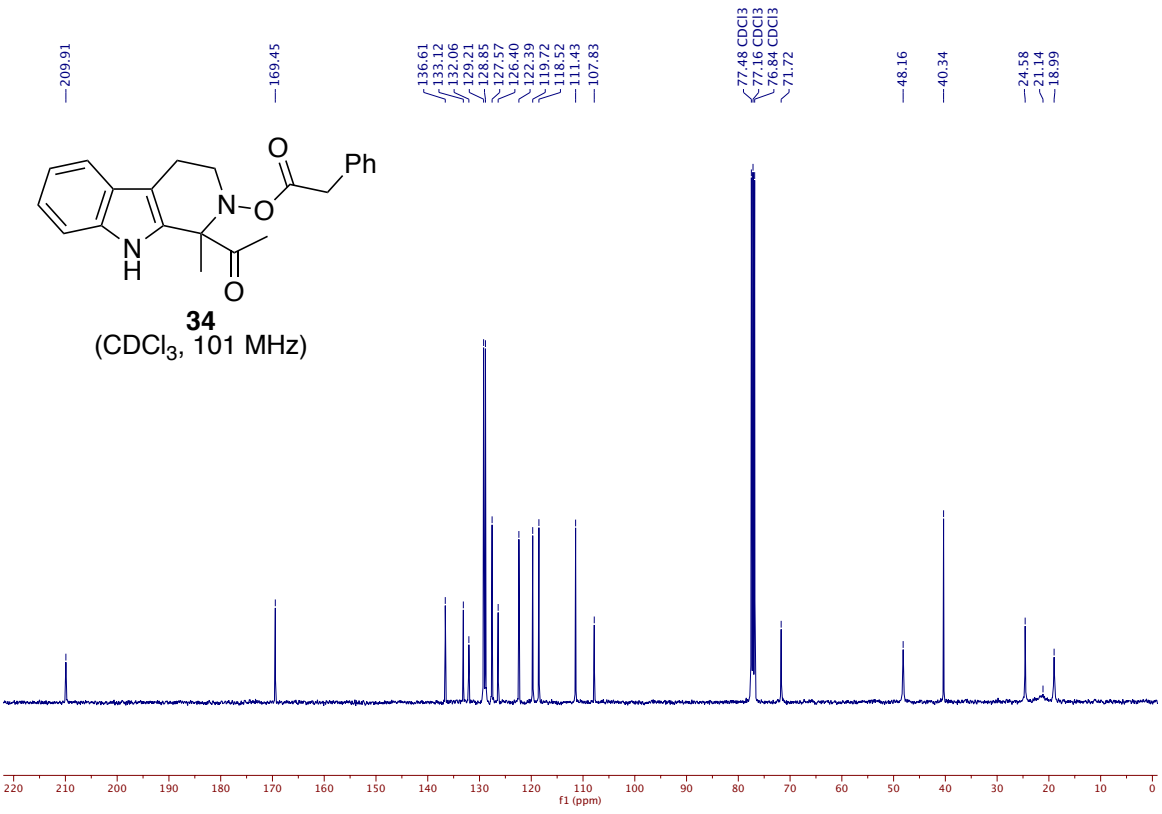

**33**
($CDCl_3$, 500 MHz)



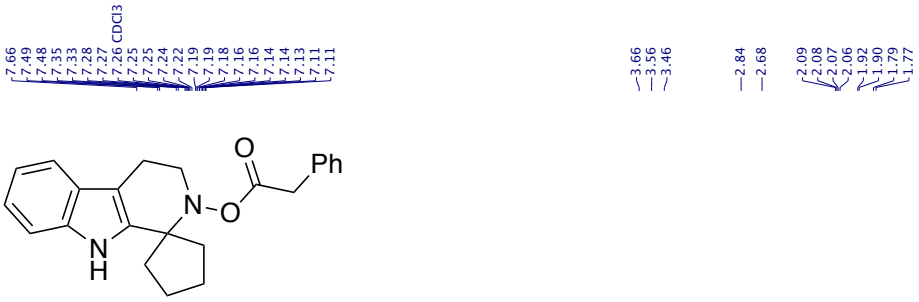

**33**
($CDCl_3$, 126 MHz, 45 °C)



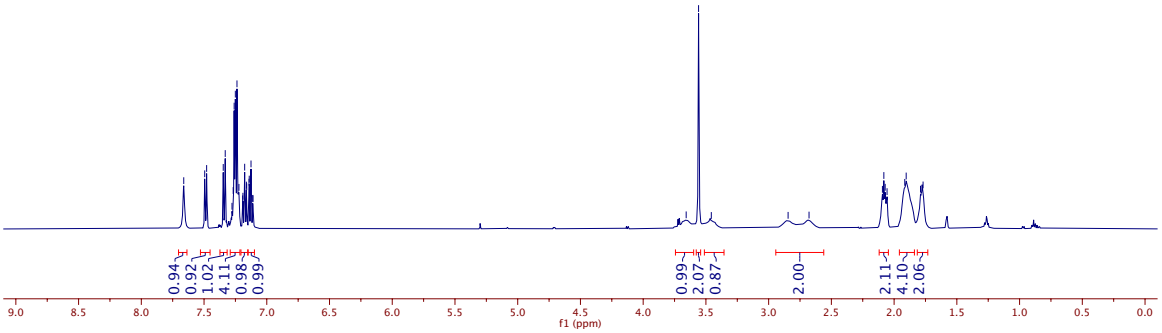

**34**
($CDCl_3$, 500 MHz)

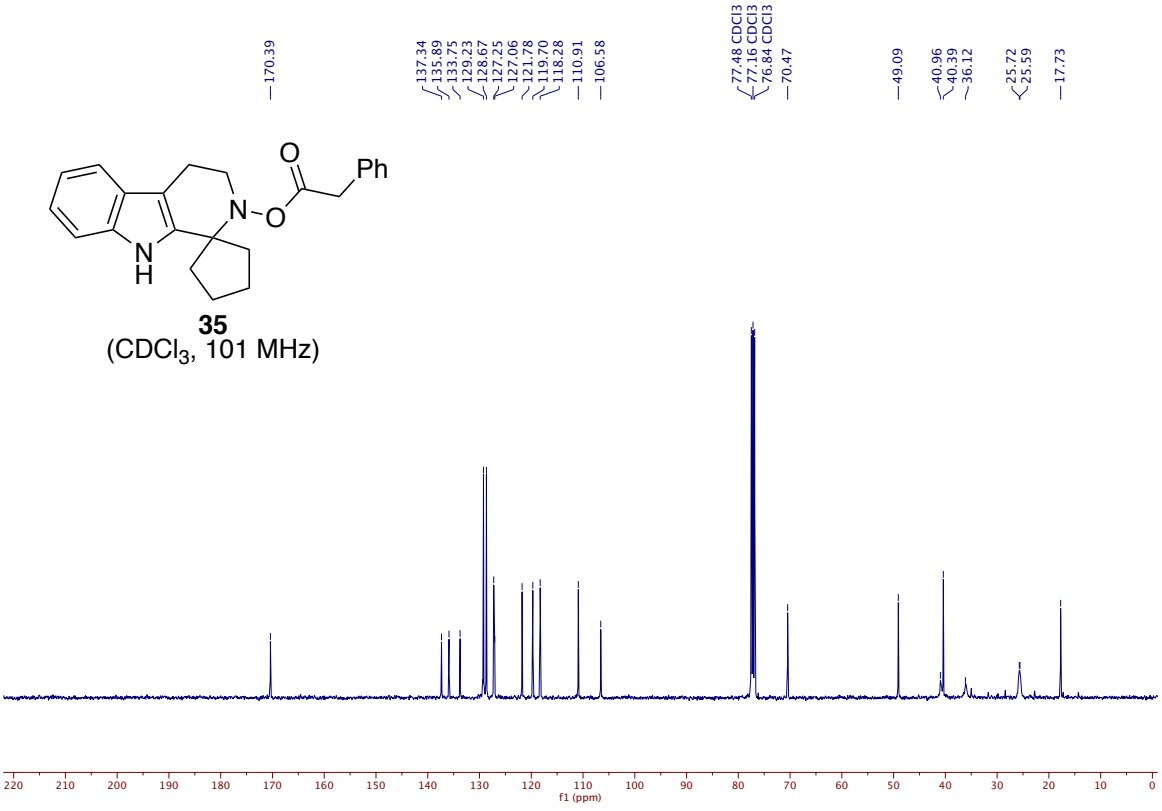



**34**
($CDCl_3$, 101 MHz)

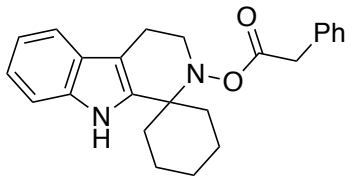



**35**
($CDCl_3$, 500 MHz)

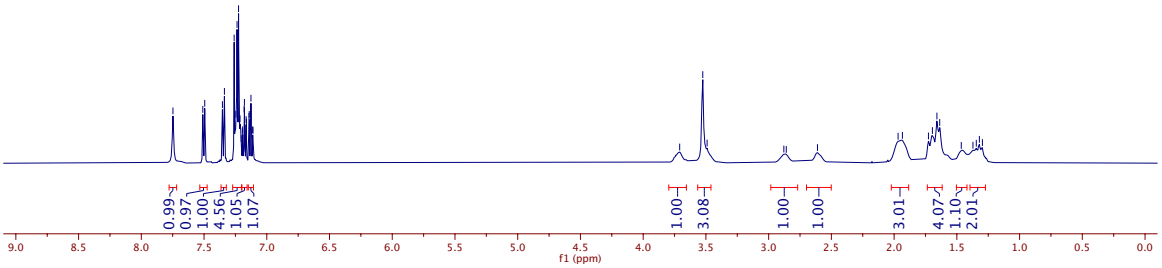


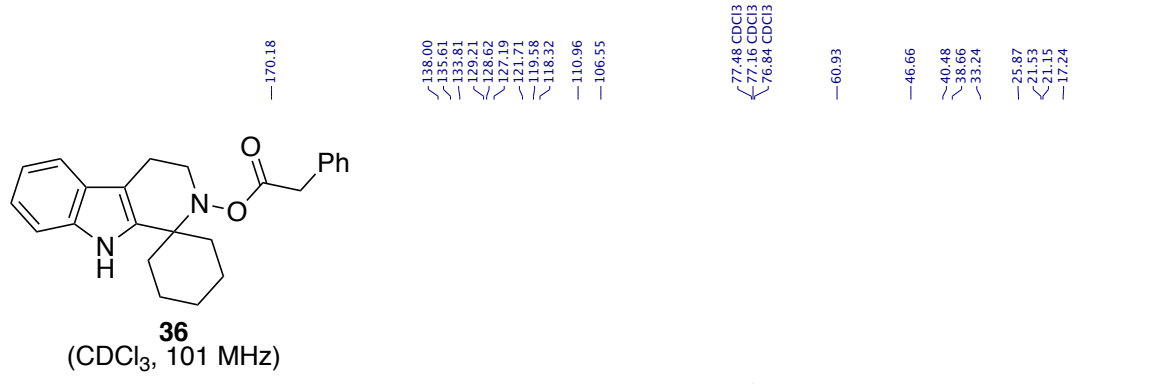




**35**
($CDCl_3$, 101 MHz)


**36**
($CDCl_3$, 500 MHz)

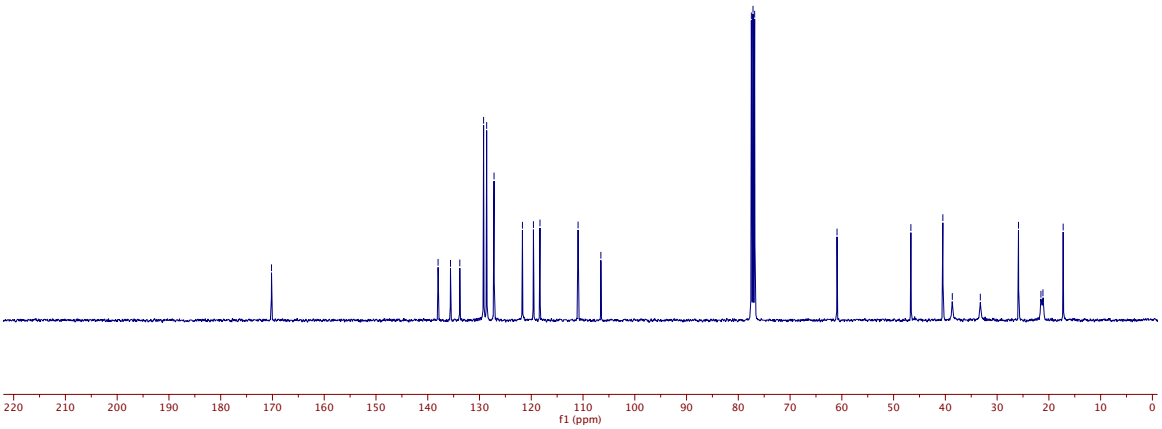


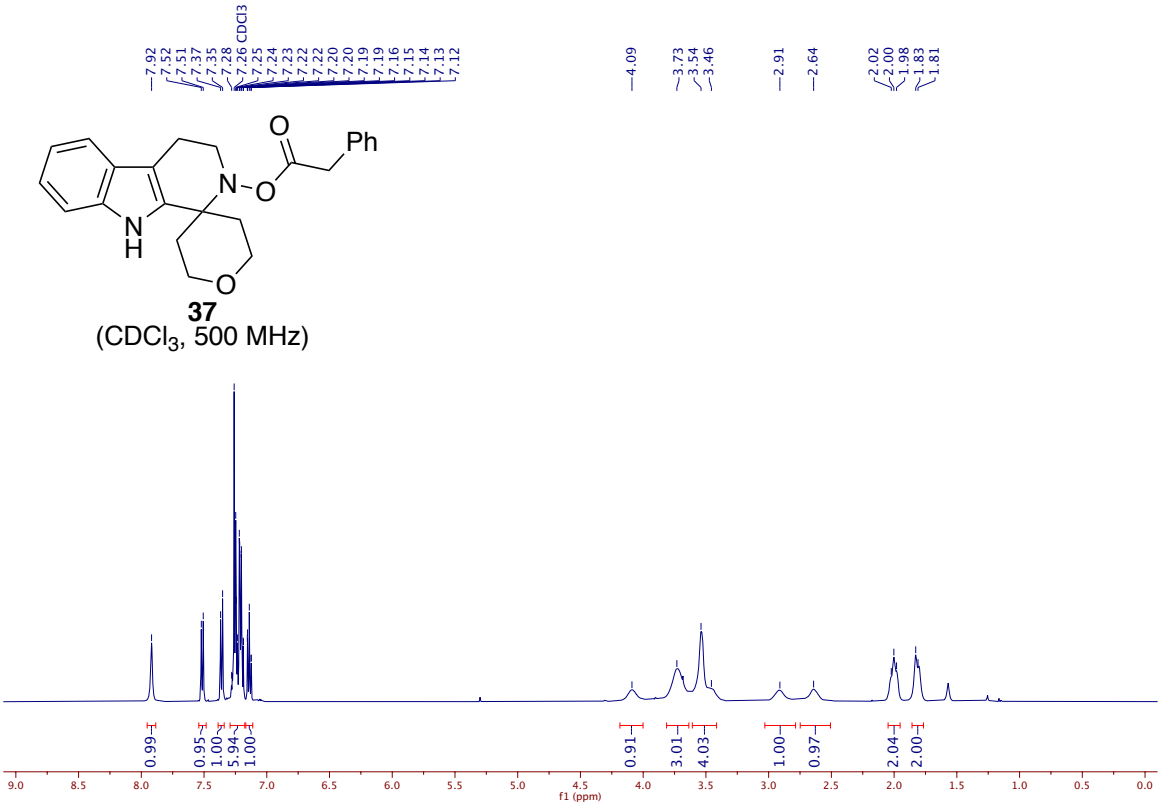







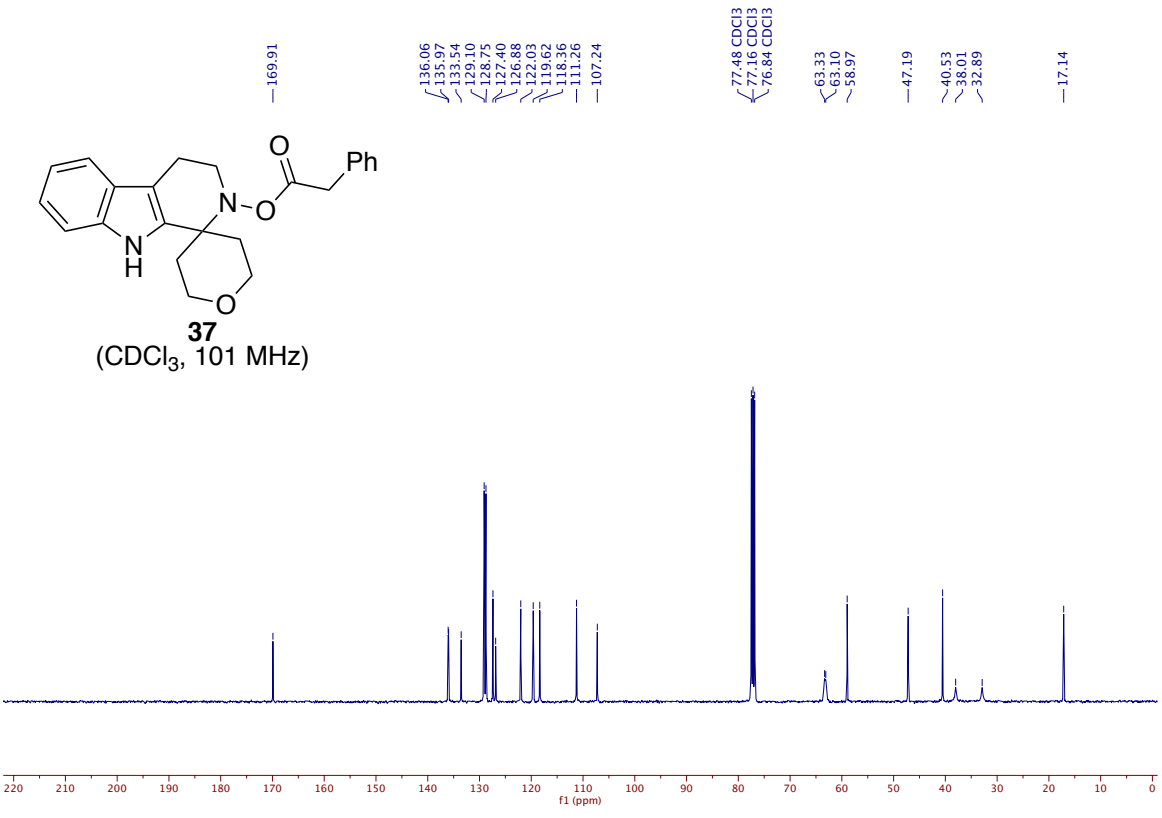
**36**
($CDCl_3$, 101 MHz)





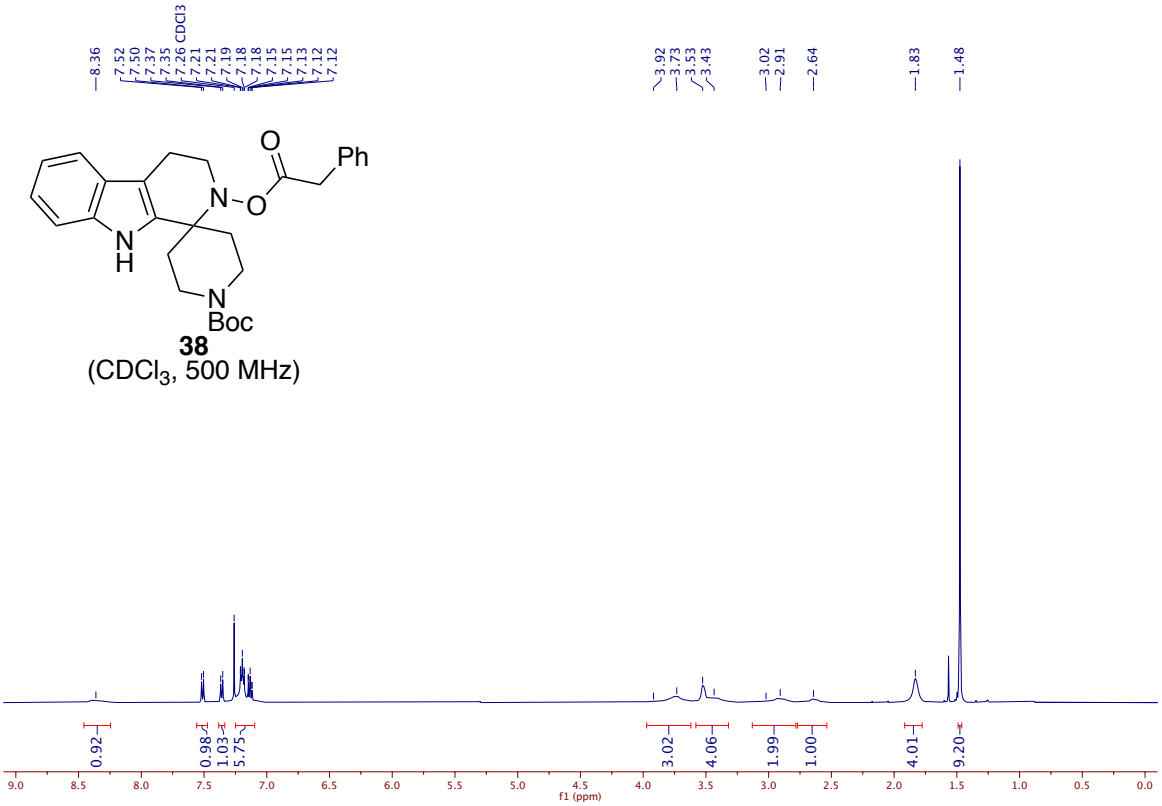

**37**

($CDCl_3$, 500 MHz)



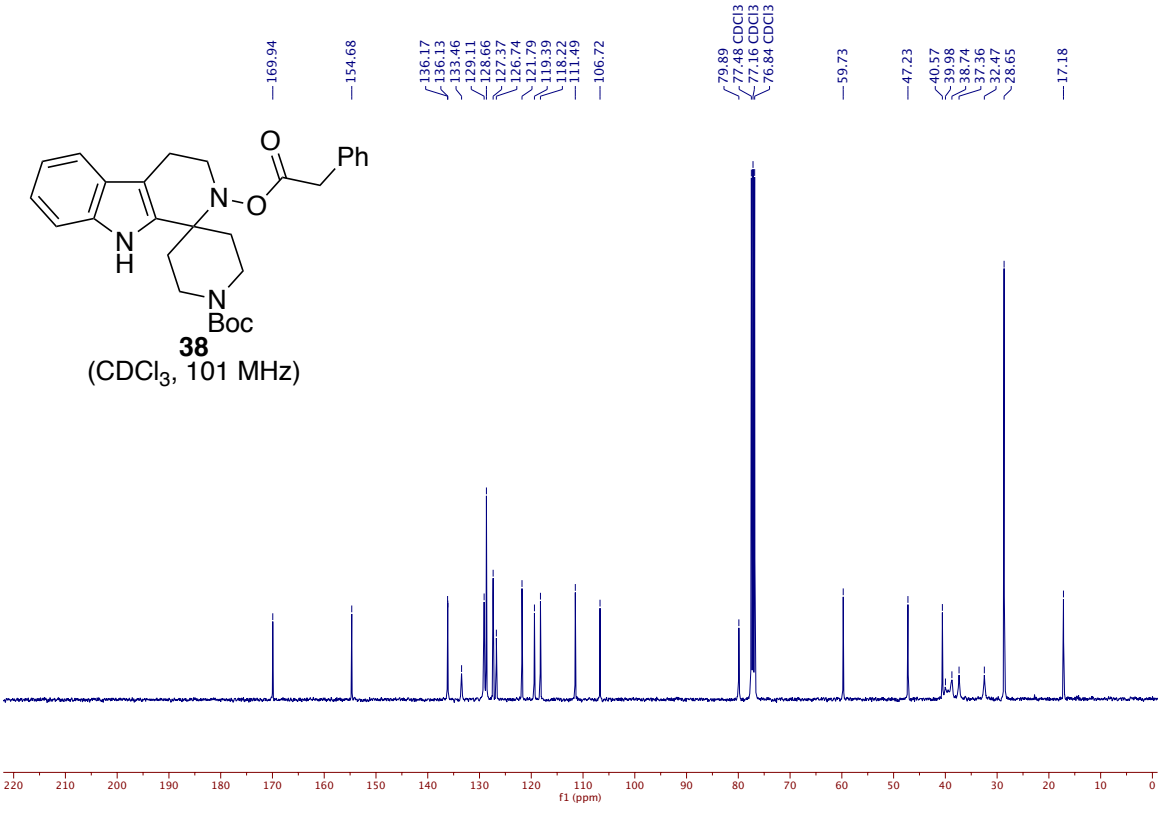

**37**

($CDCl_3$, 101 MHz)



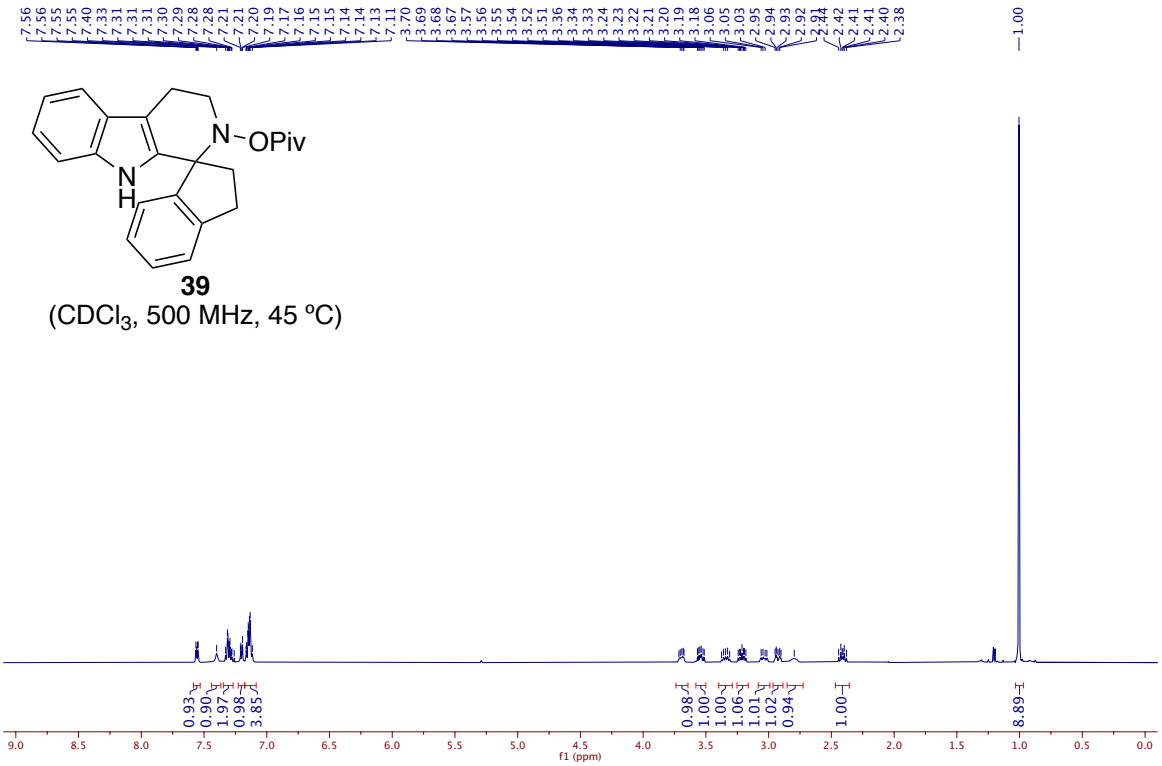

**38**

($CDCl_3$, 500 MHz)



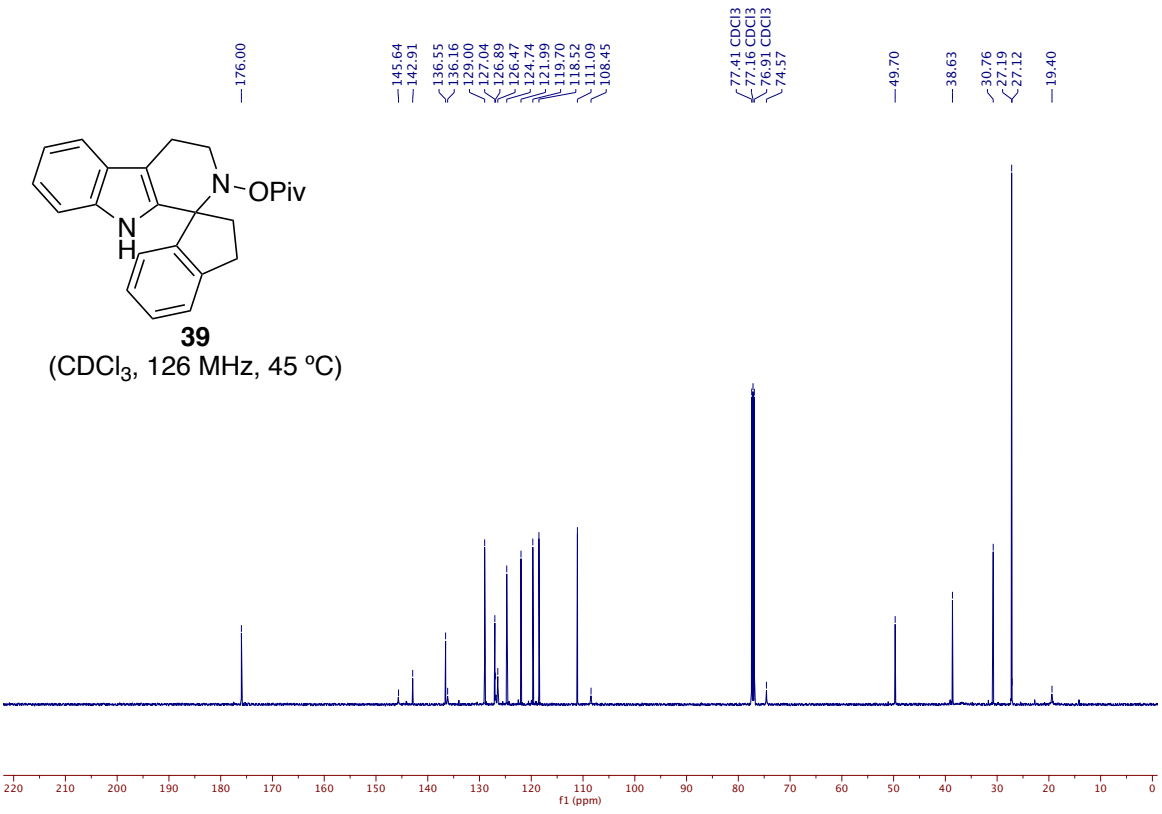

**38**

($CDCl_3$, 101 MHz)



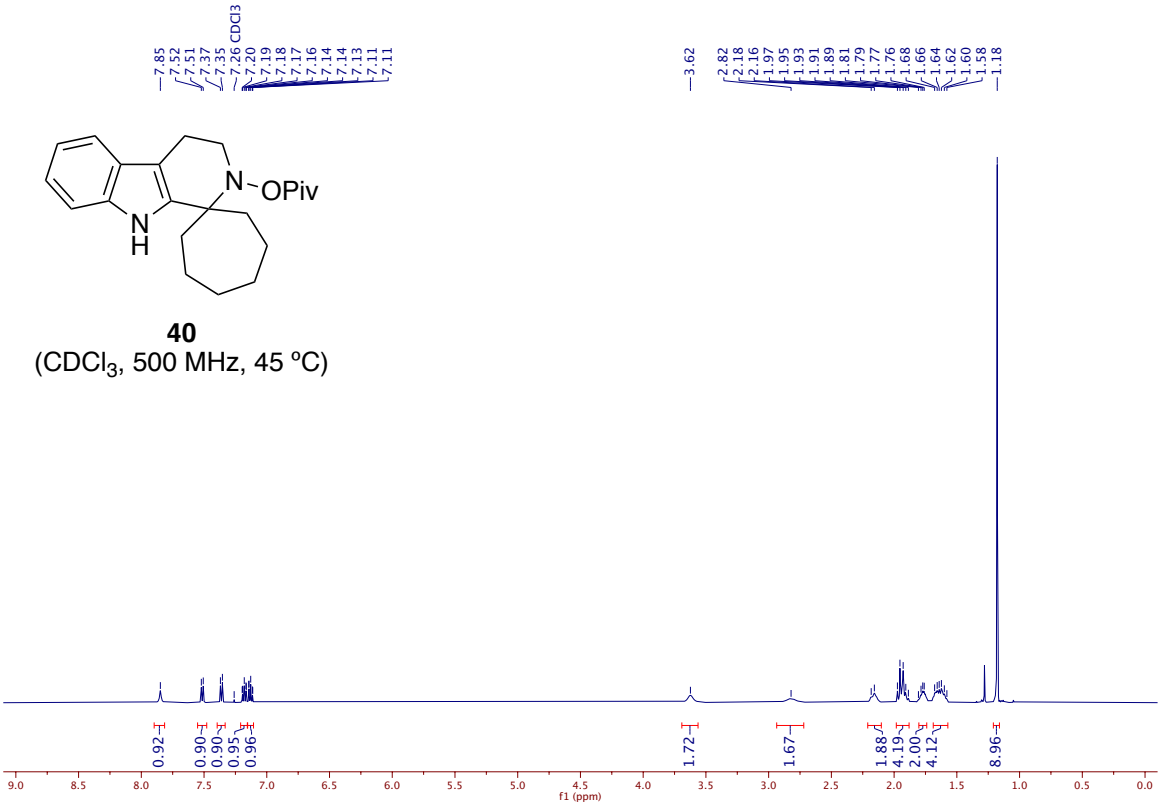

**39**

($CDCl_3$, 500 MHz, 45 °C)

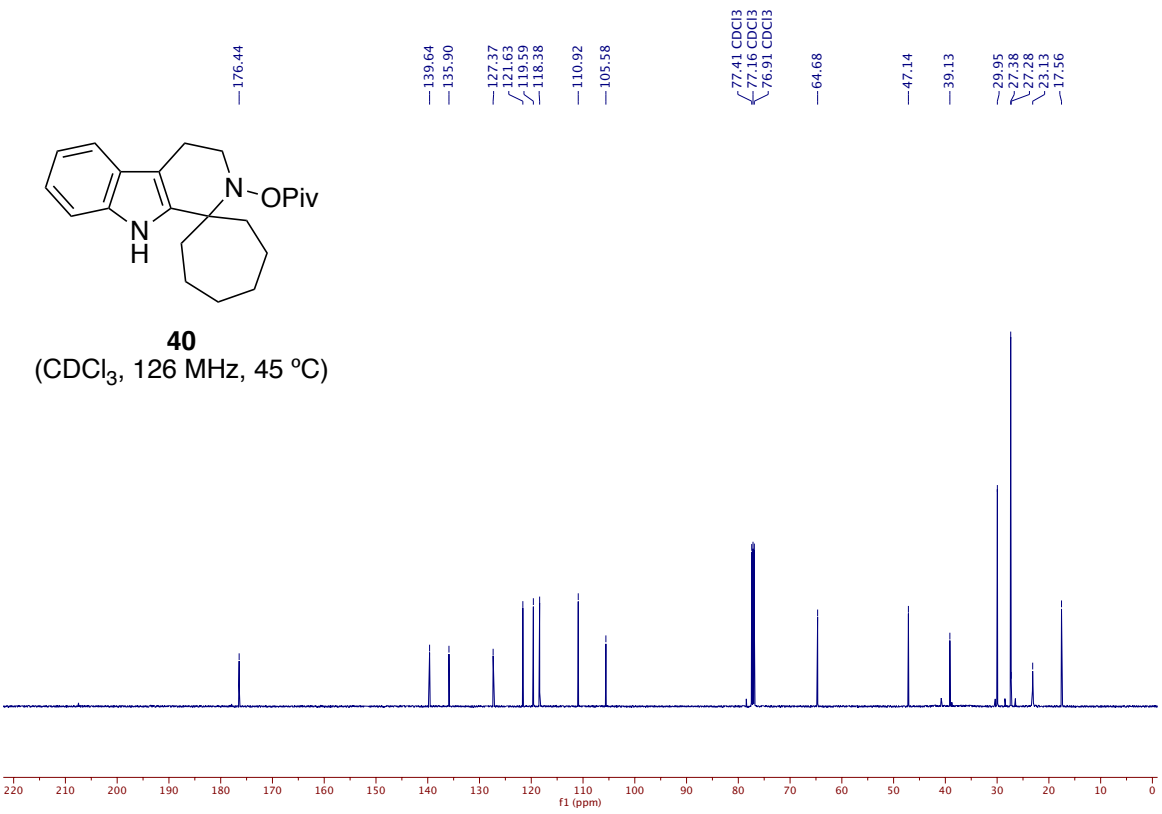



**39**

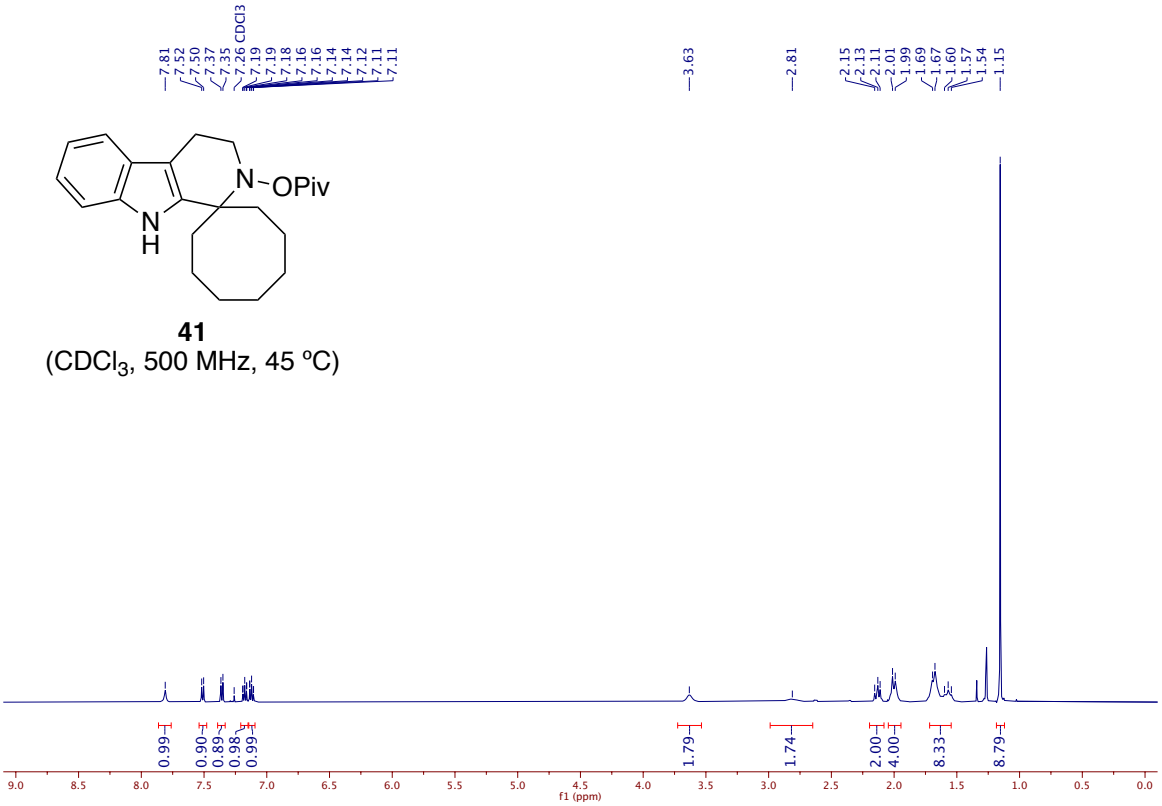
($CDCl_3$, 126 MHz, 45 °C)



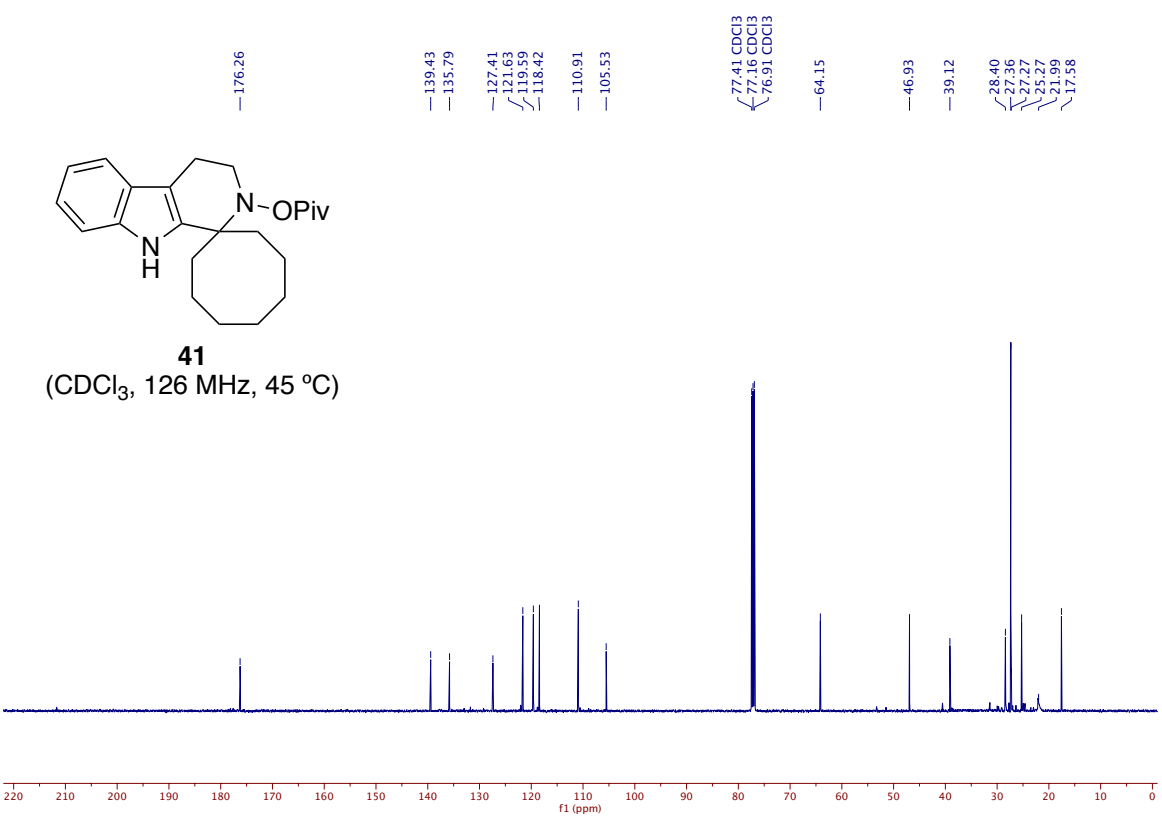

**40**
($CDCl_3$, 500 MHz, 45 °C)



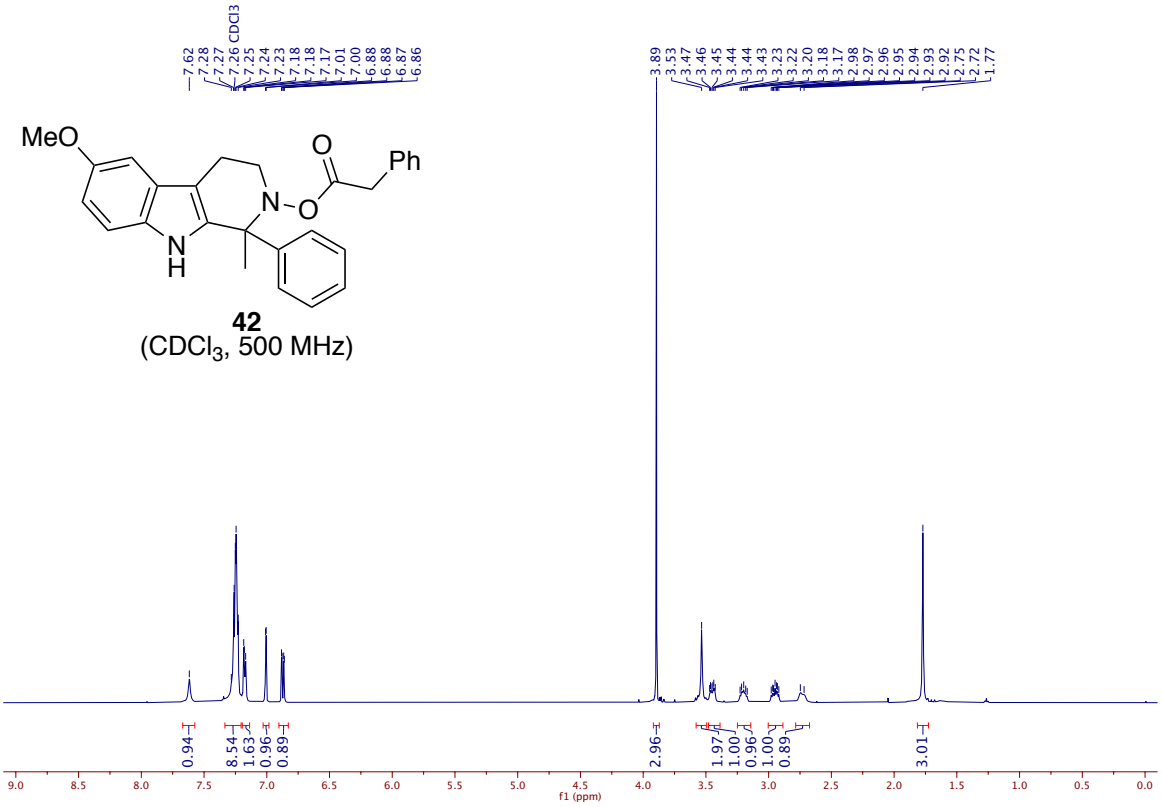

**40**
($CDCl_3$, 126 MHz, 45 °C)



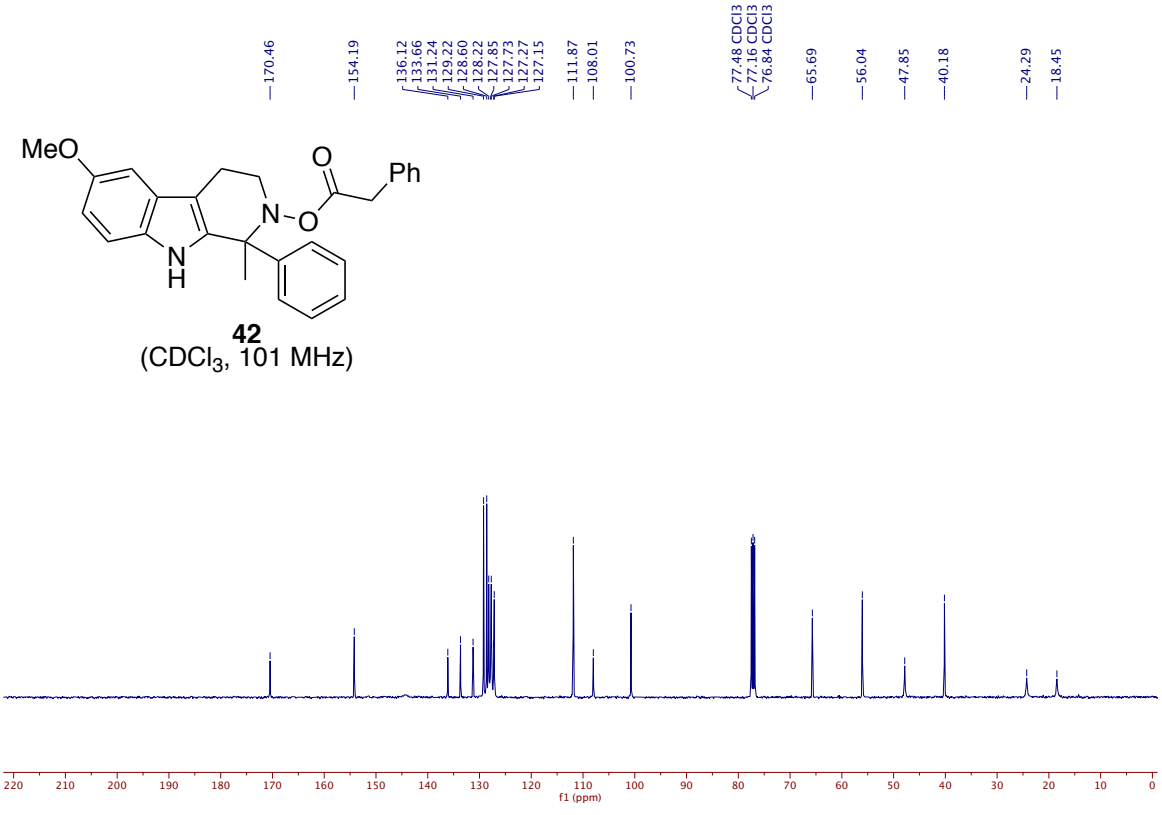

**41**
($CDCl_3$, 500 MHz, 45 ºC)



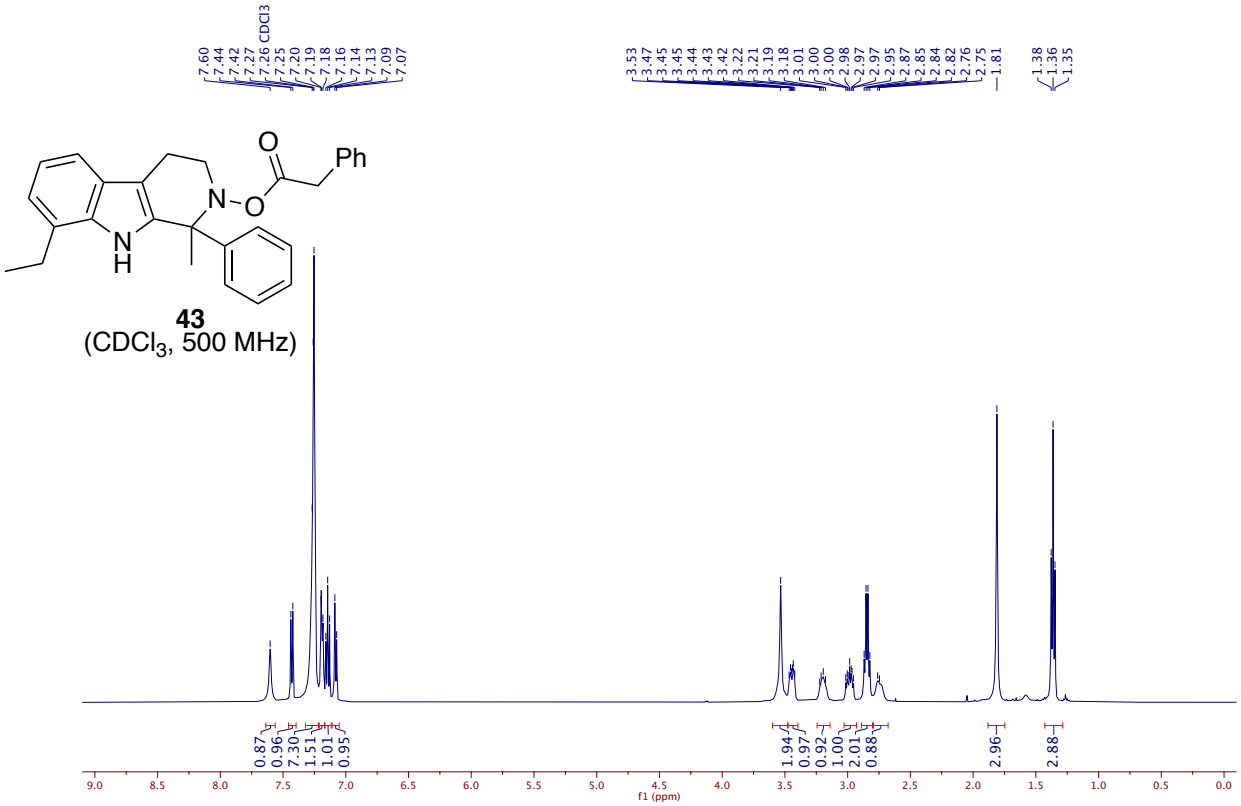

**41**
($CDCl_3$, 126 MHz, 45 ºC)



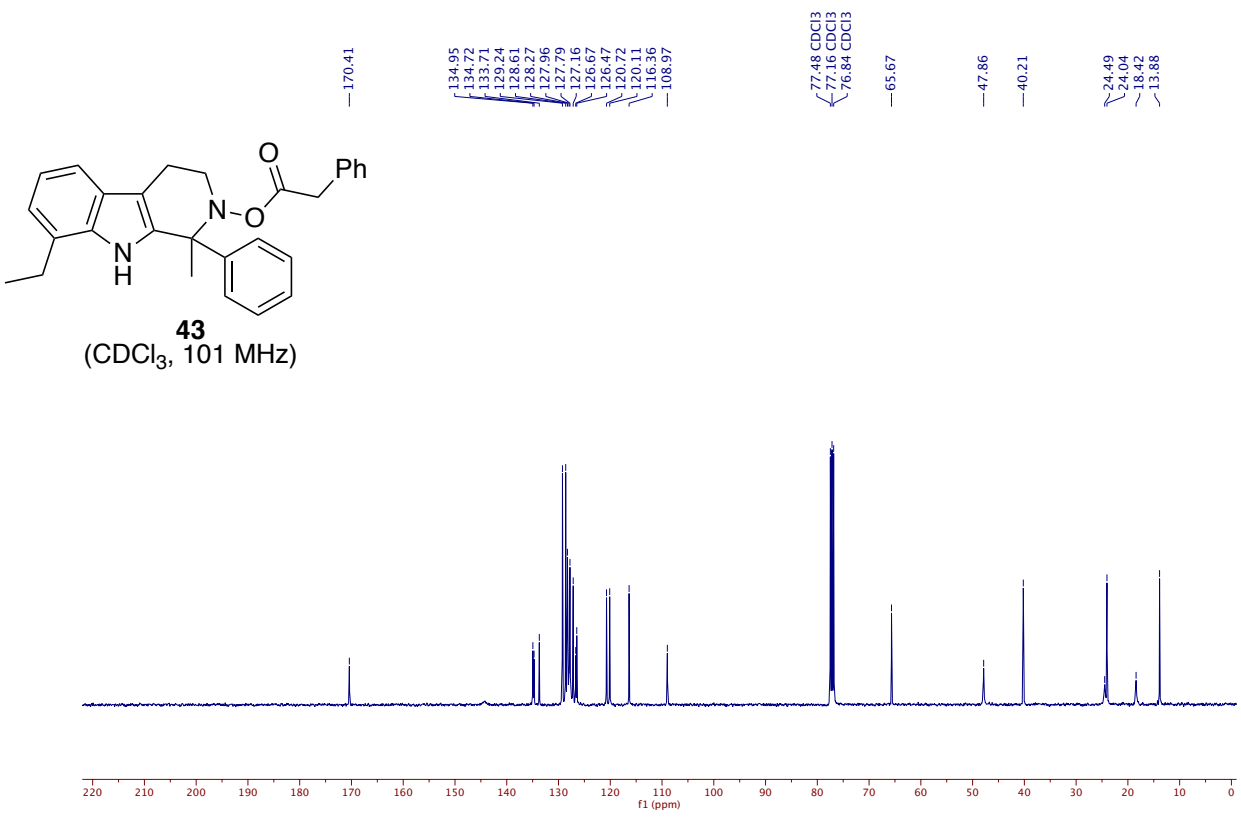

**42**
($CDCl_3$, 500 MHz)



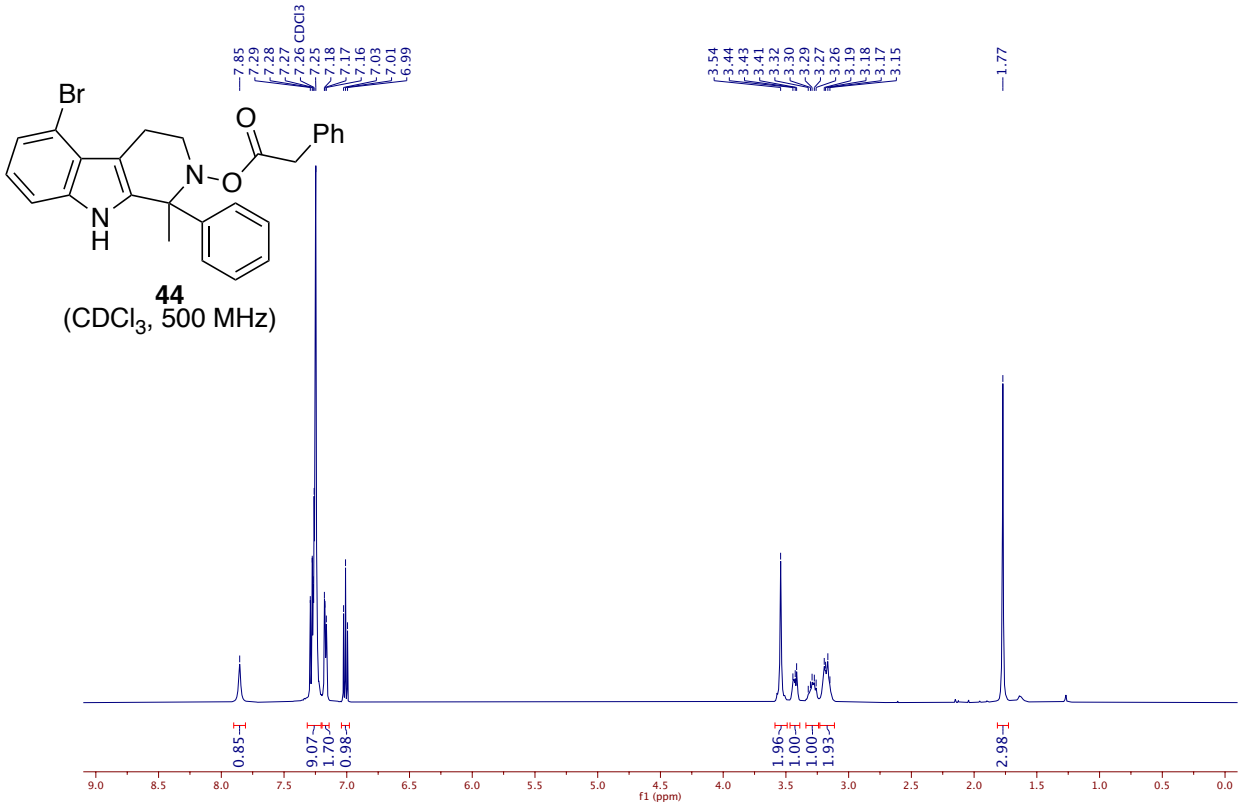

**42**
($CDCl_3$, 101 MHz)



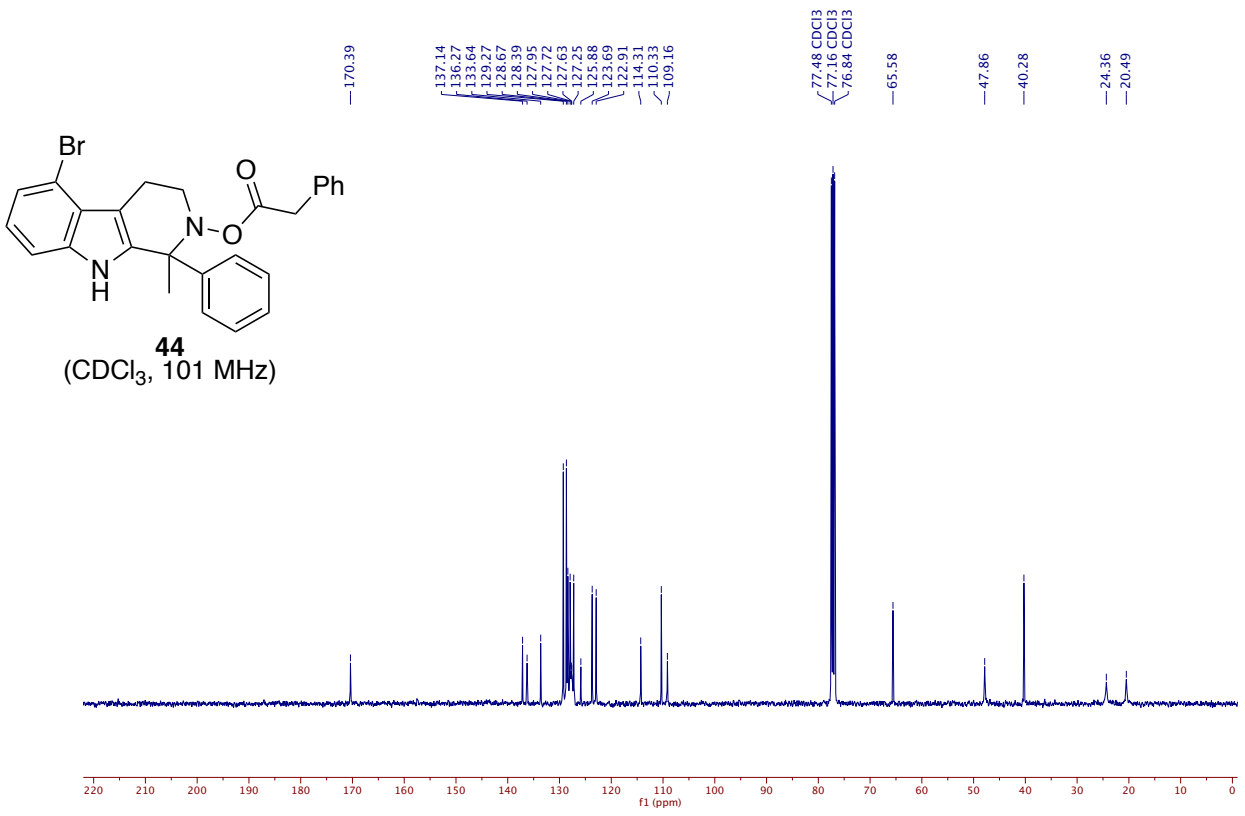

**43**
($CDCl_3$, 500 MHz)



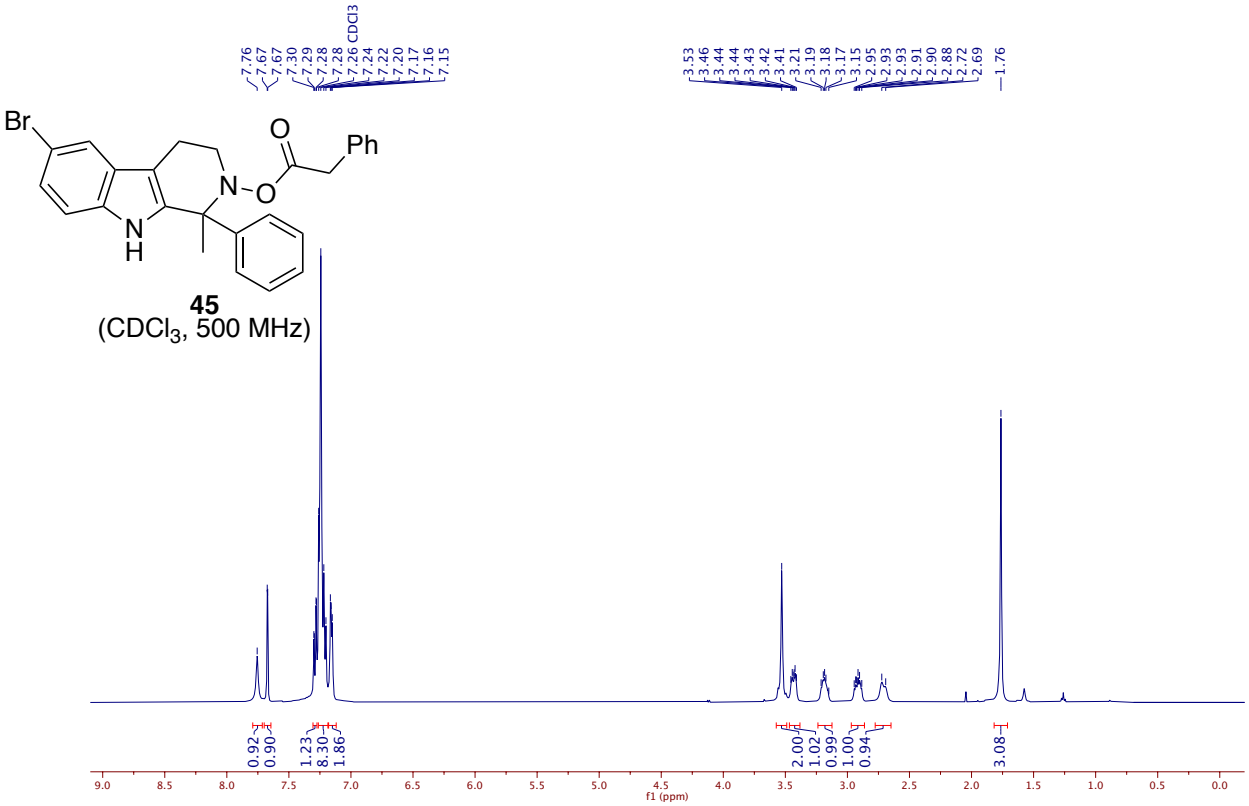

**43**
($CDCl_3$, 101 MHz)



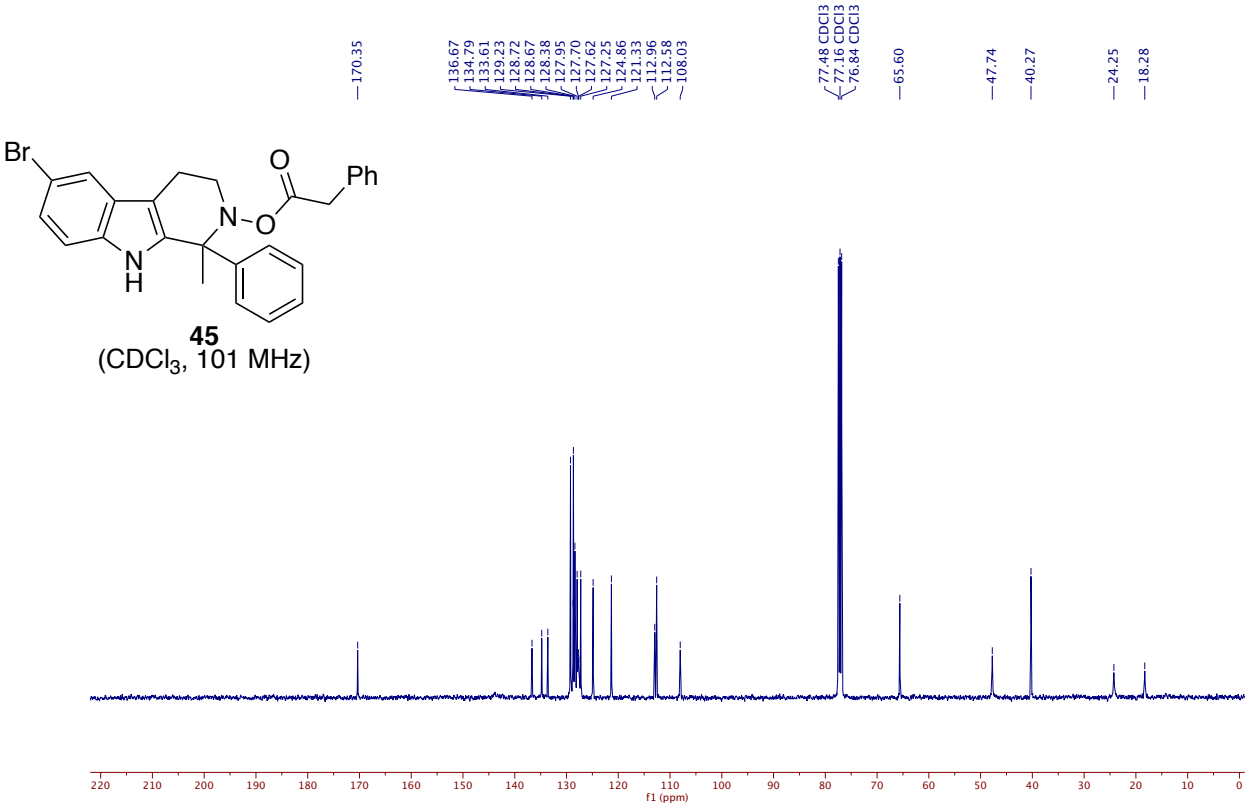

**44**
($CDCl_3$, 500 MHz)



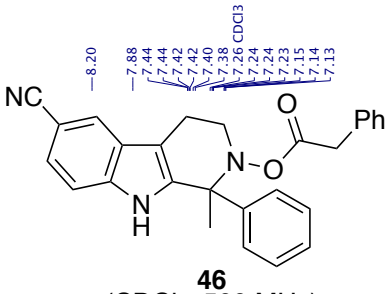

**44**
($CDCl_3$, 101 MHz)




**45**
($CDCl_3$, 500 MHz)



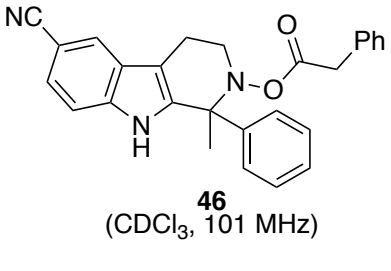

**45**
($CDCl_3$, 101 MHz)




**46**

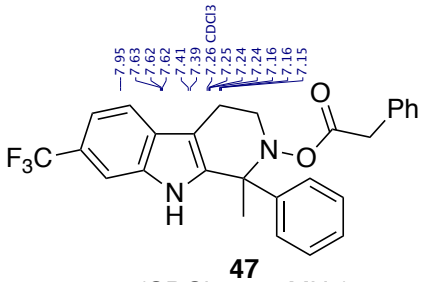
($CDCl_3$, 500 MHz)



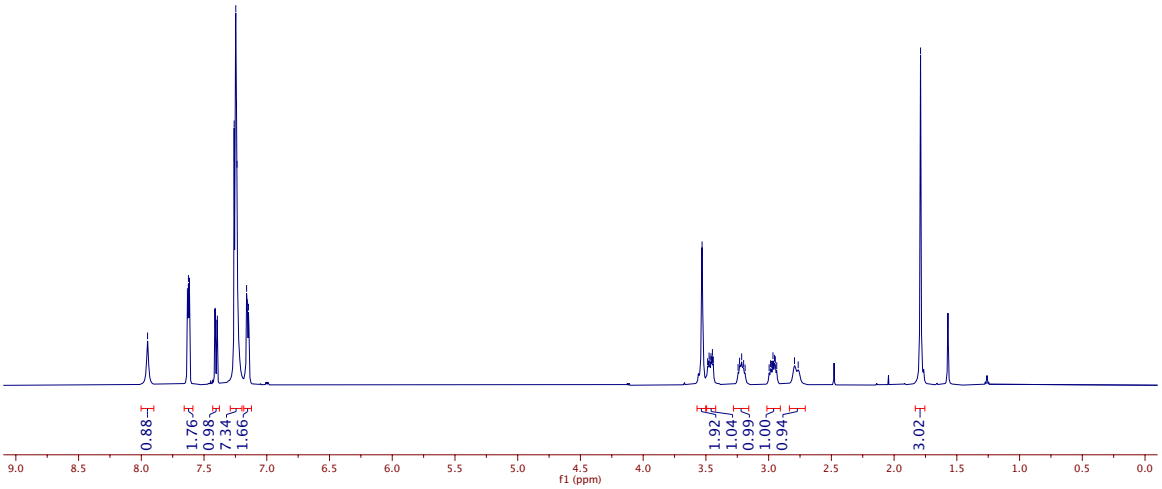



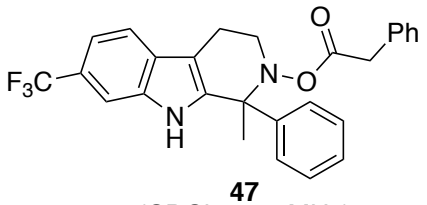

**46**

($CDCl_3$, 101 MHz)

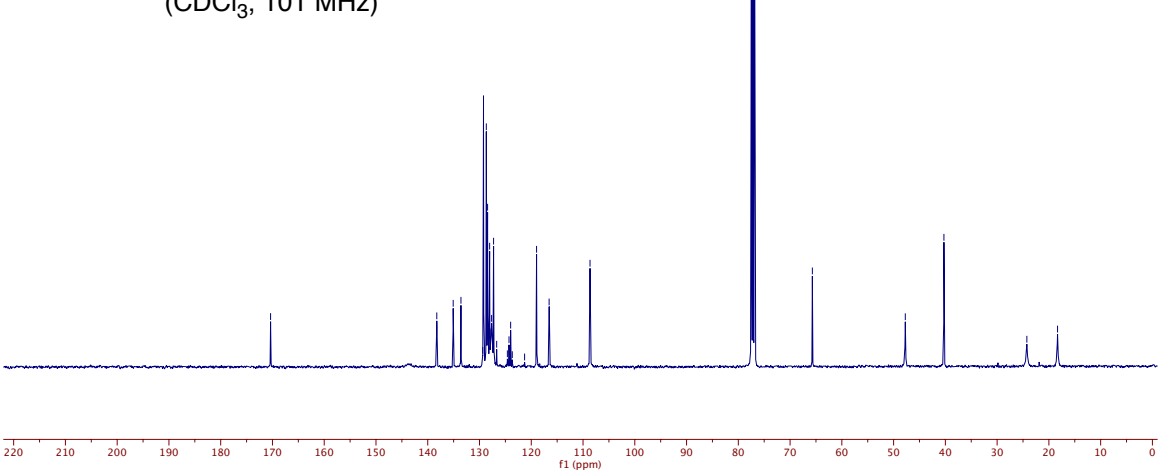


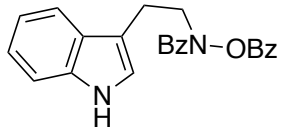
**47**
($CDCl_3$, 500 MHz)



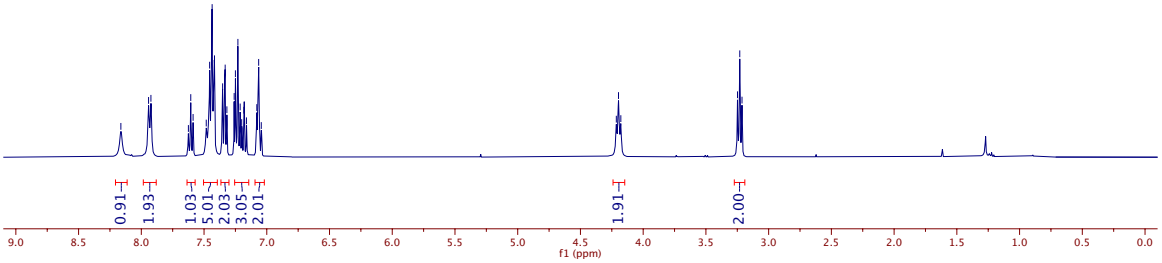


**47**
($CDCl_3$, 101 MHz)

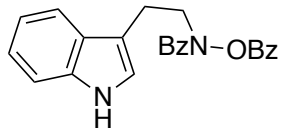


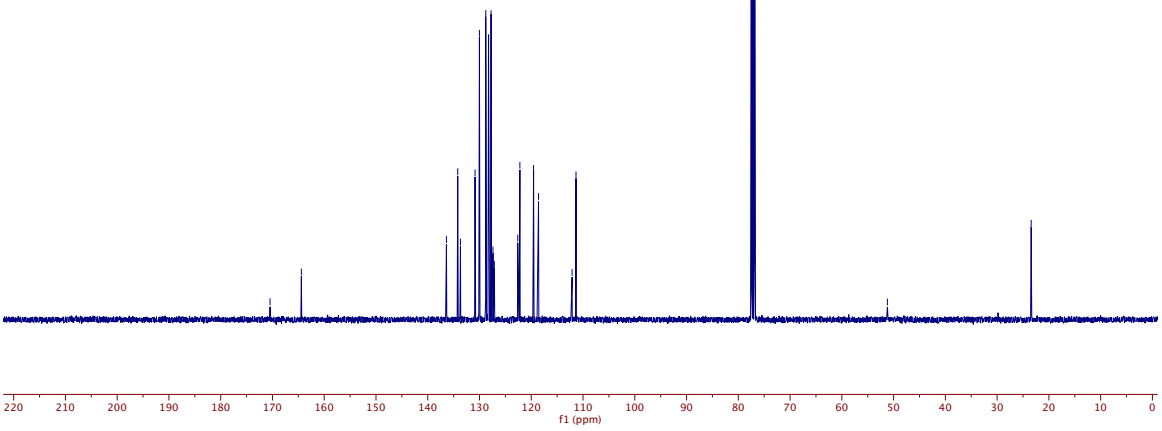

**S49**
($CDCl_3$, 400 MHz)

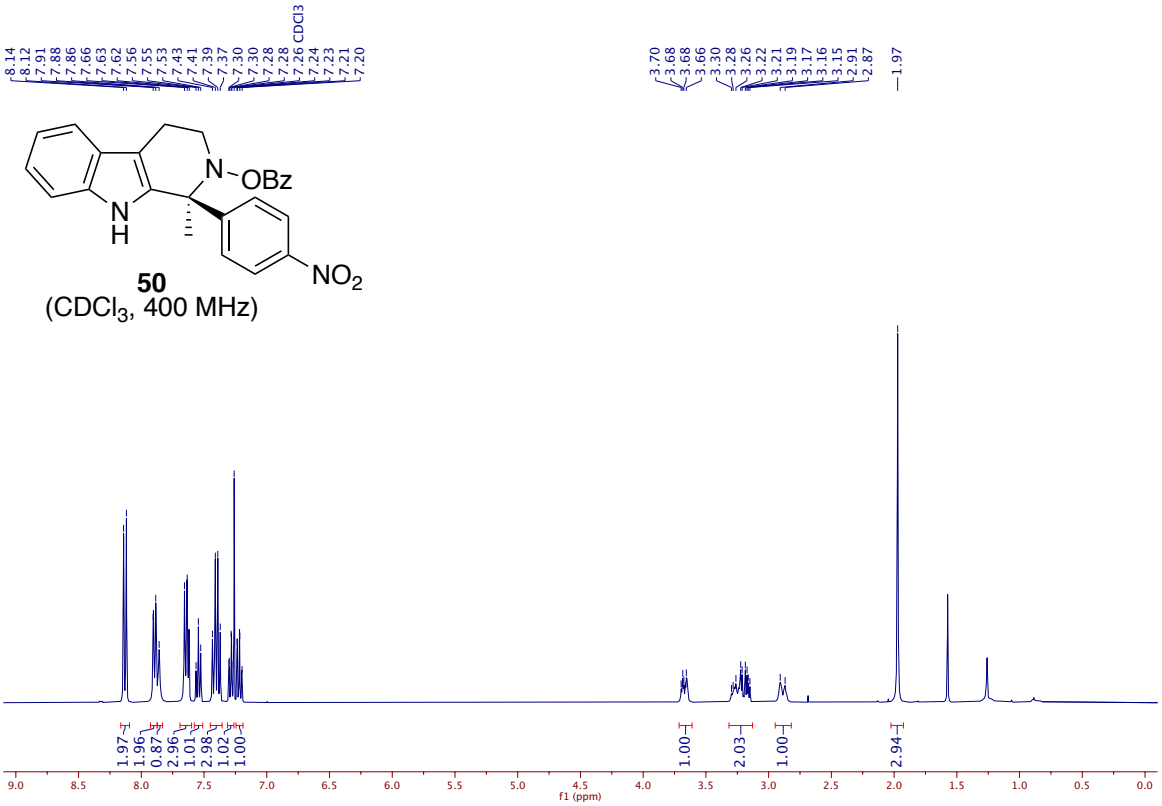


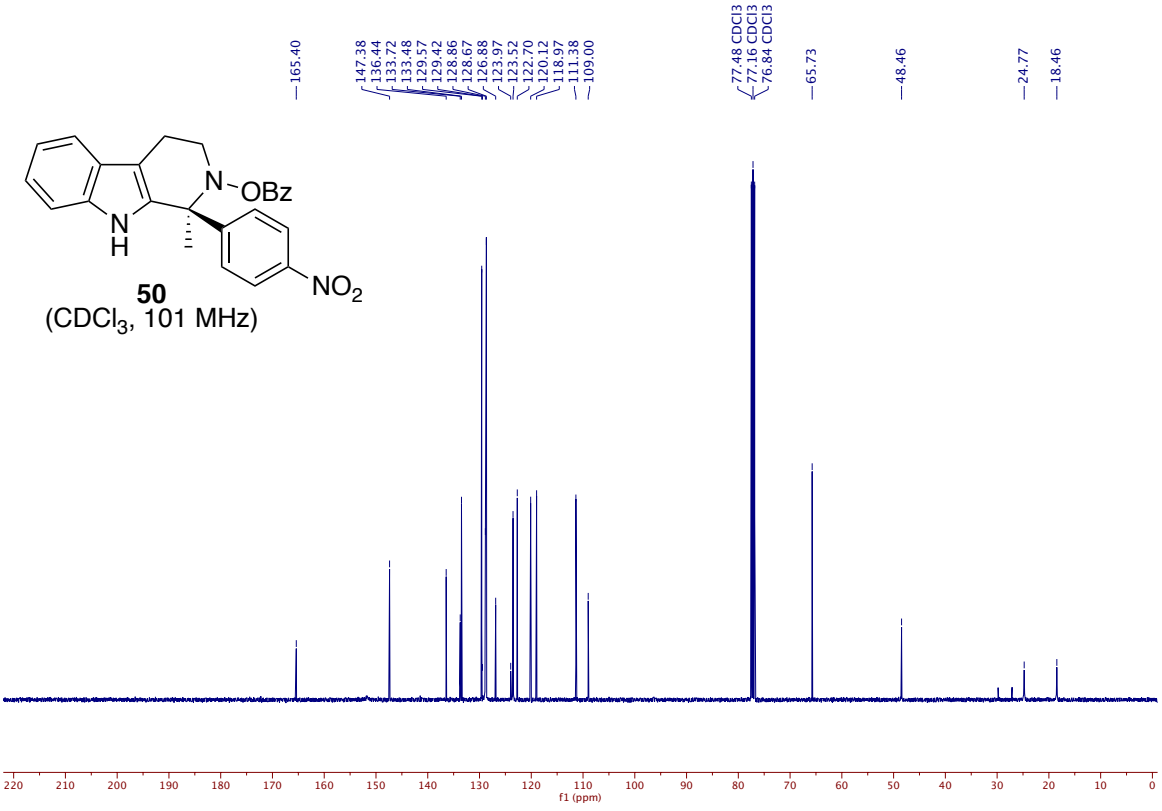


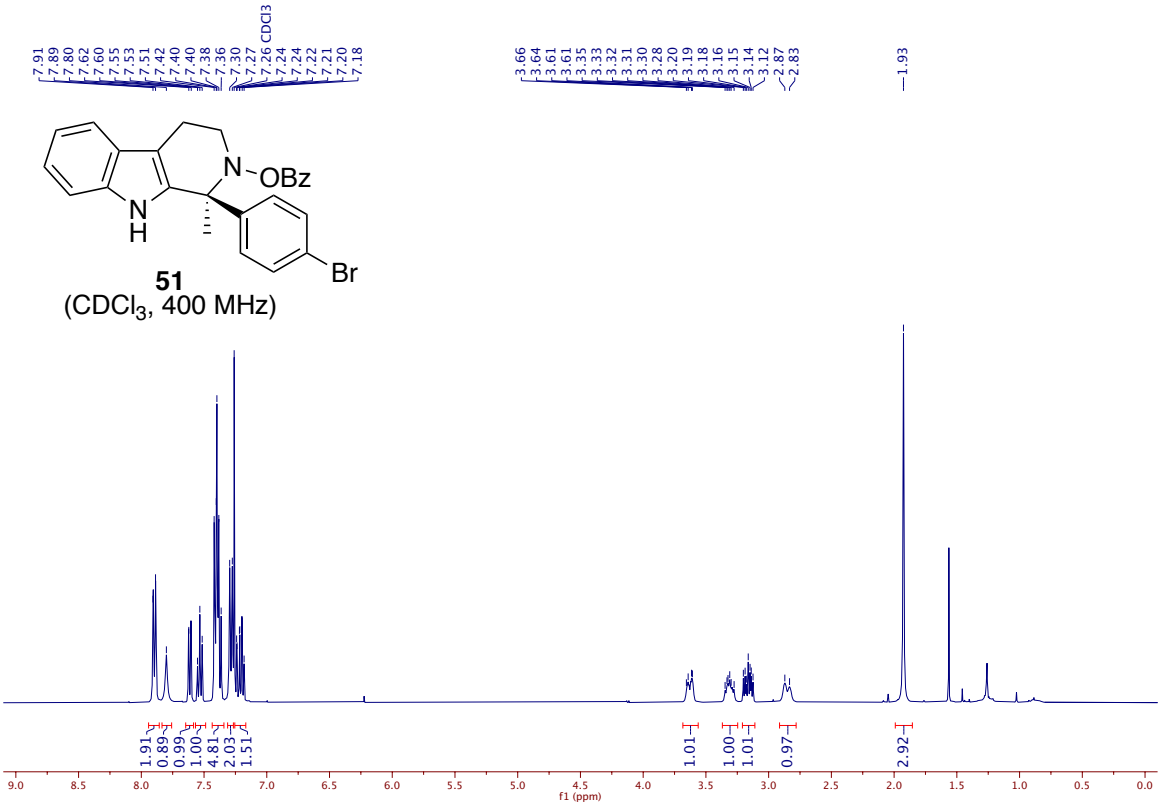



**S49**
($CDCl_3$, 101 MHz)

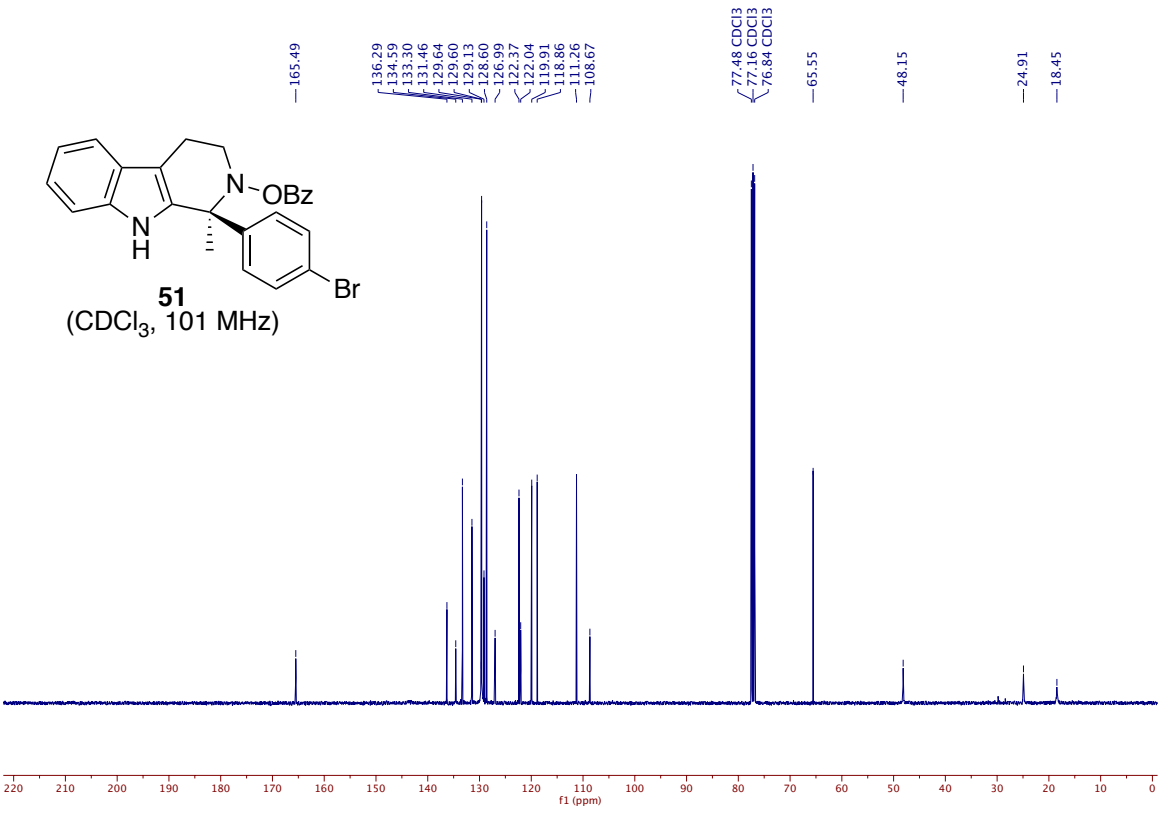



8.14
8.12
7.91
7.88
7.86
7.66
7.63
7.62
7.56
7.55
7.53
7.43
7.41
7.39
7.37
7.30
7.28
7.26 CDCl3
7.24
7.23
7.21
7.20
3.70
3.68
3.68
3.66
3.30
3.28
3.26
3.22
3.21
3.19
3.17
3.16
3.15
2.91
2.87
1.97
N
OBz
N
H
NO2
50
(CDCl3, 400 MHz)
1.97
1.96
0.87
2.96
1.01
2.98
1.02
1.00
1.00
2.03
1.00
2.94
f1 (ppm)

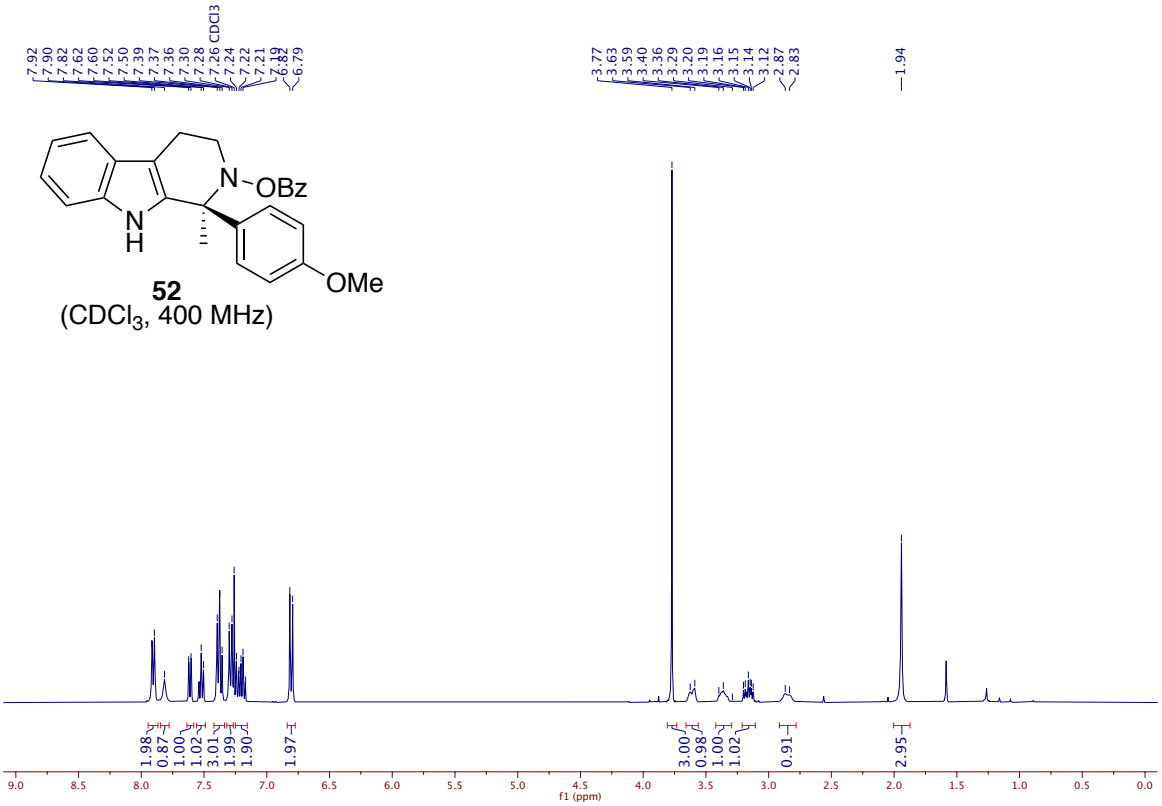

165.40
147.38
136.44
133.72
133.48
129.57
129.42
128.86
128.67
126.88
123.97
123.52
122.70
120.12
118.97
111.38
109.00
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
65.73
48.46
24.77
18.46
N
OBz
N
H
NO2
50
(CDCl3, 101 MHz)
f1 (ppm)

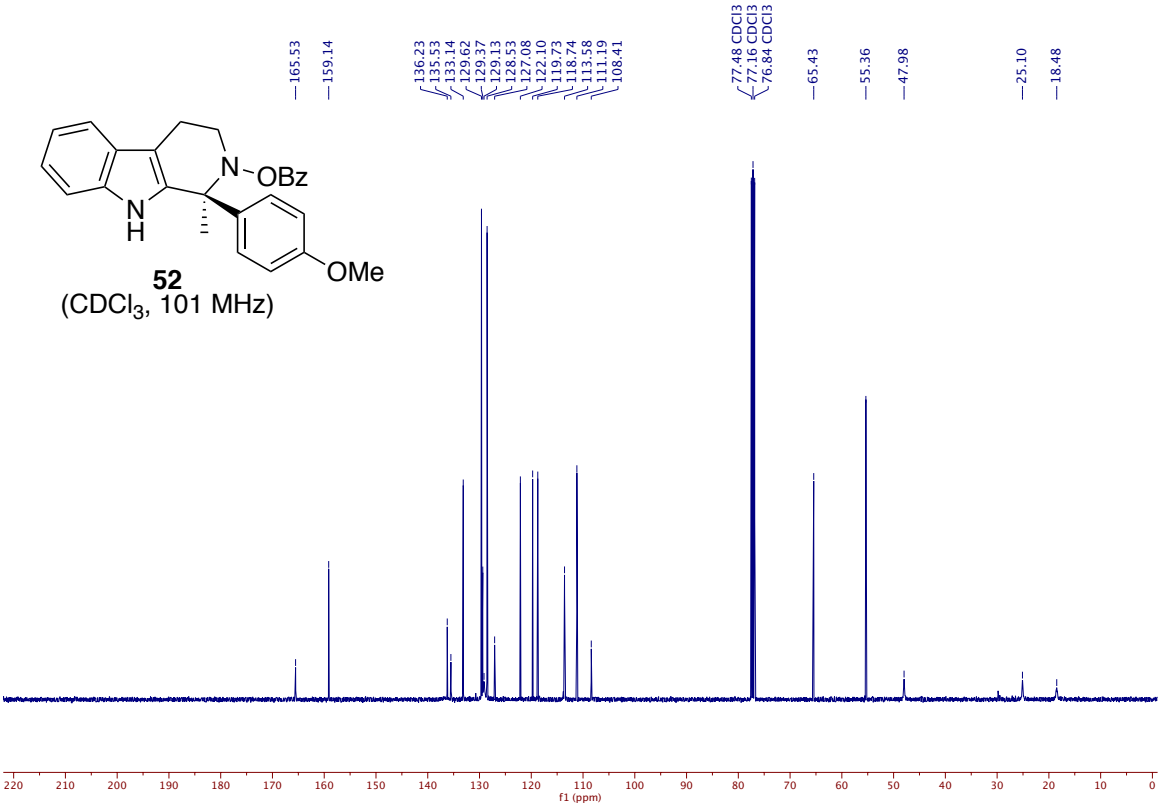


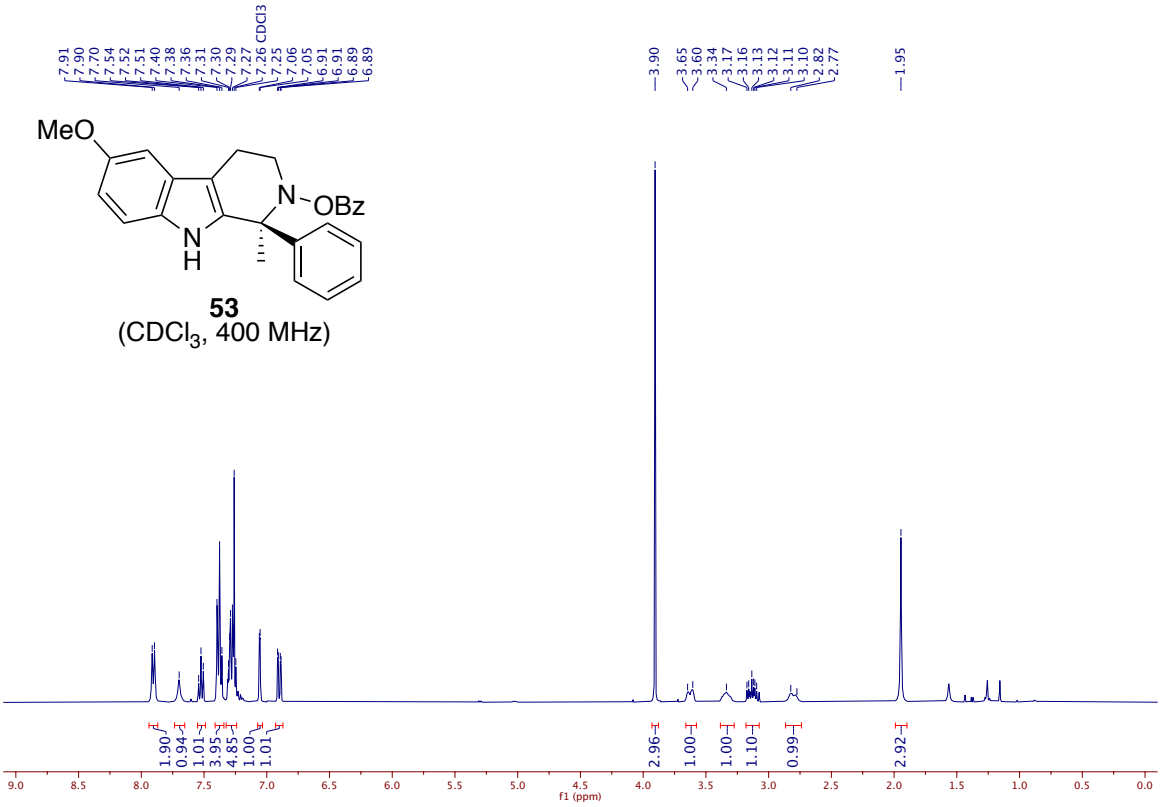

**51**
($CDCl_3$, 400 MHz)



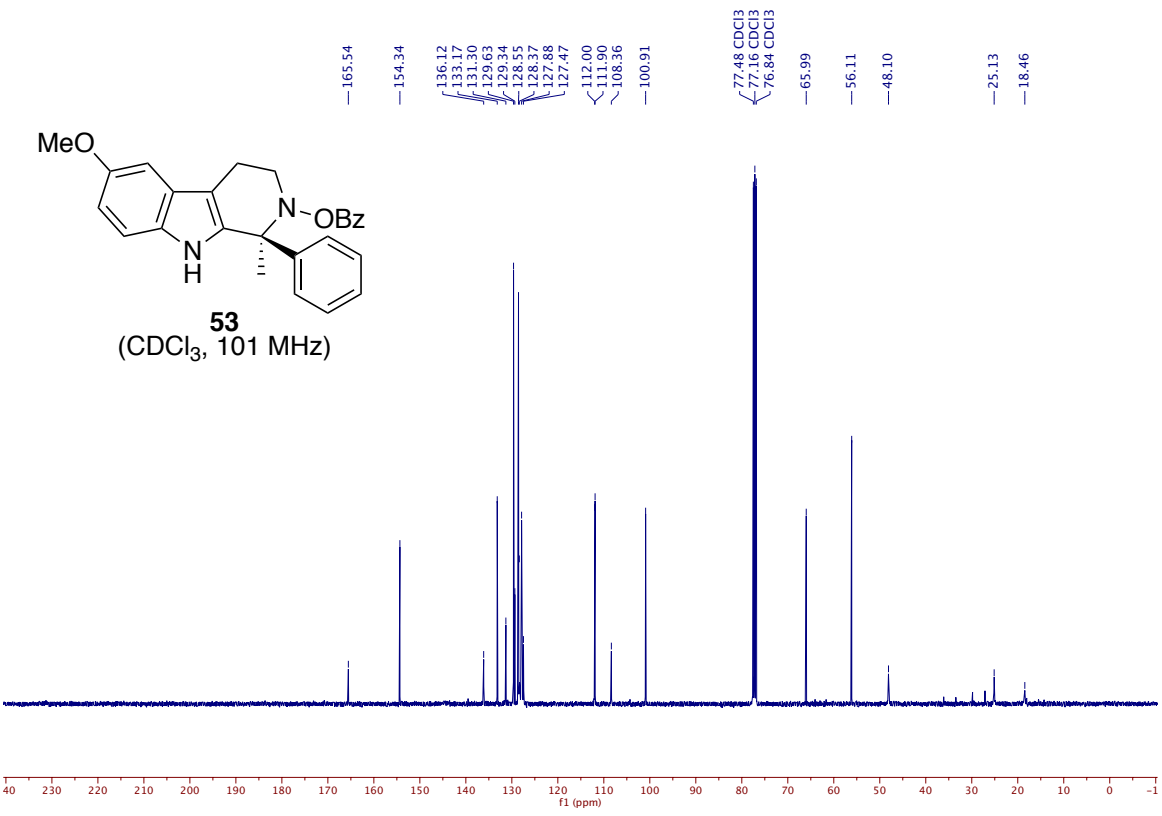

**51**
($CDCl_3$, 101 MHz)


7.92
7.90
7.82
7.62
7.60
7.52
7.50
7.39
7.37
7.36
7.30
7.28
7.26 CDCl3
7.24
7.22
7.21
7.19
6.82
6.79
3.77
3.63
3.59
3.40
3.36
3.29
3.20
3.19
3.16
3.15
3.14
3.12
2.87
2.83
1.94
N
OBz
N
H
OMe
52
(CDCl3, 400 MHz)
1.98
0.87
1.00
1.02
3.01
1.99
1.90
1.97
3.00
0.98
1.00
1.02
0.91
2.95
f1 (ppm)

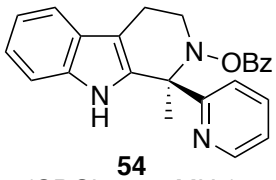

165.53
159.14
136.23
135.53
133.14
129.62
129.37
129.13
128.53
127.08
122.10
119.73
118.74
113.58
111.19
108.41
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
65.43
55.36
47.98
25.10
18.48
N
OBz
N
H
OMe
52
(CDCl3, 101 MHz)
f1 (ppm)



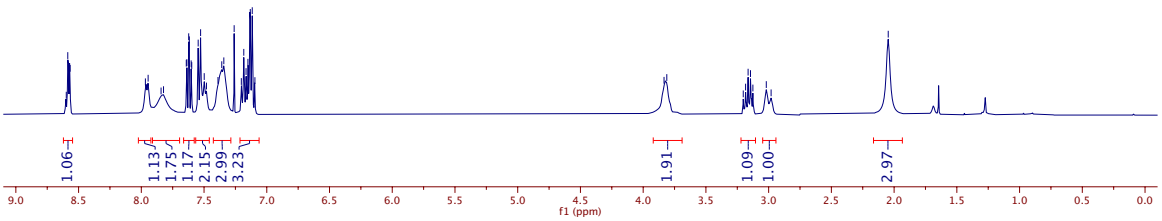

**53**
($CDCl_3$, 400 MHz)

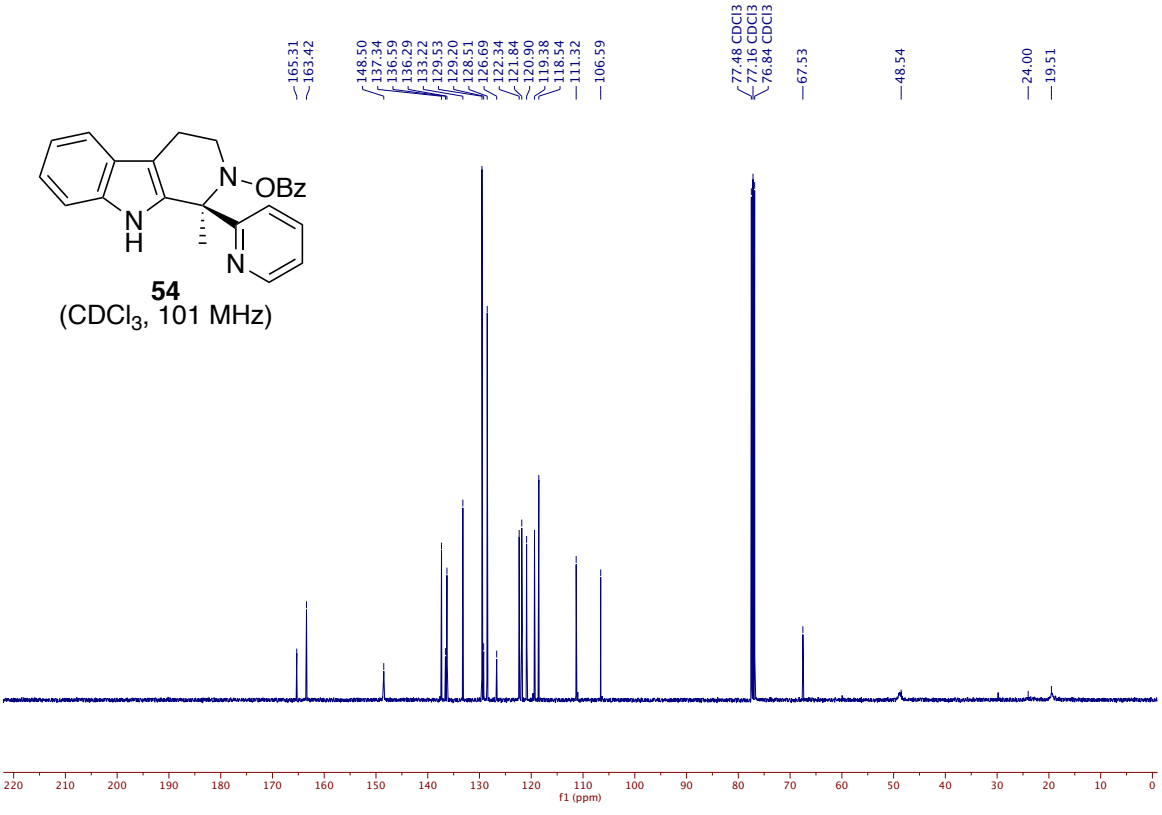



**53**
($CDCl_3$, 101 MHz)


**54**
($CDCl_3$, 400 MHz)

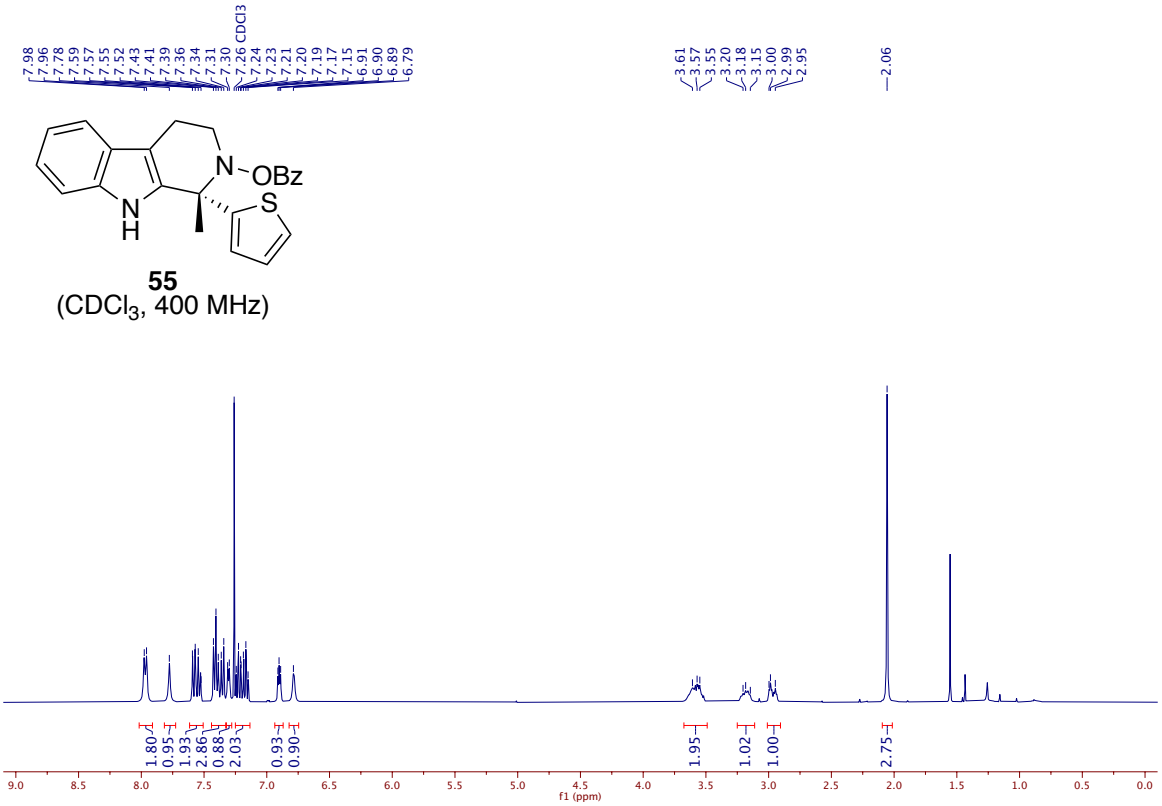


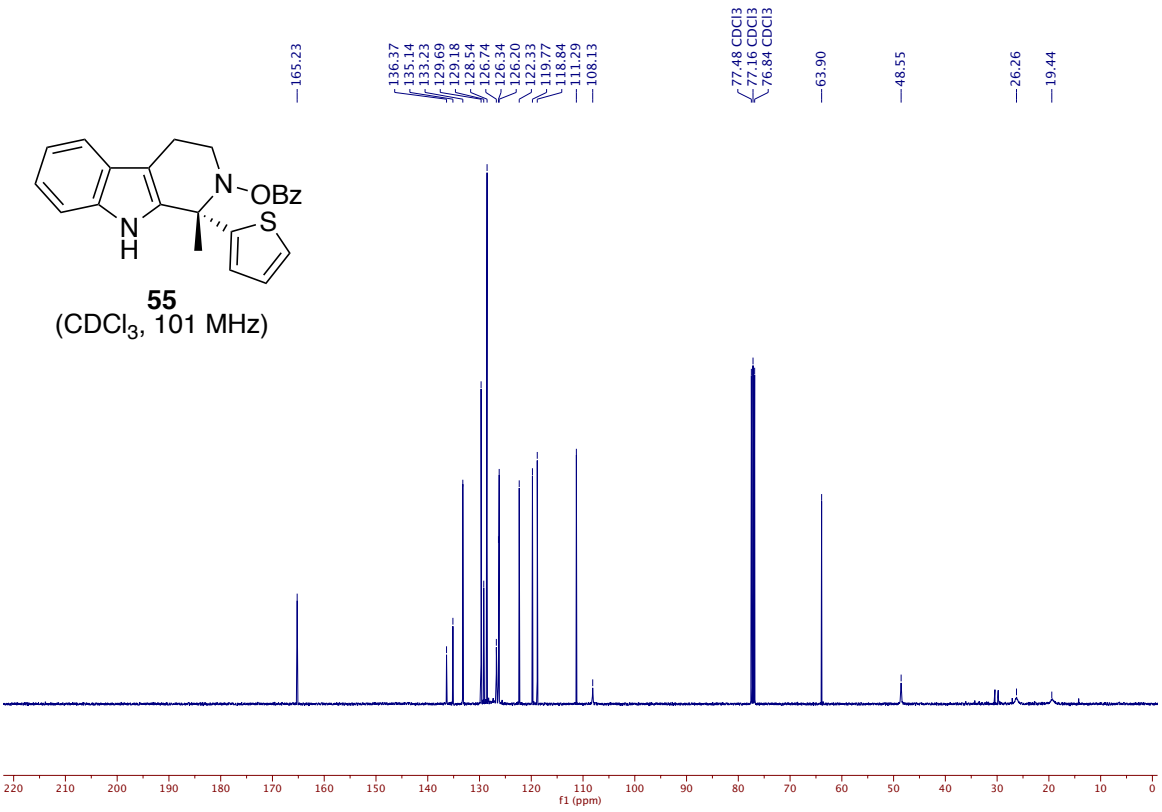




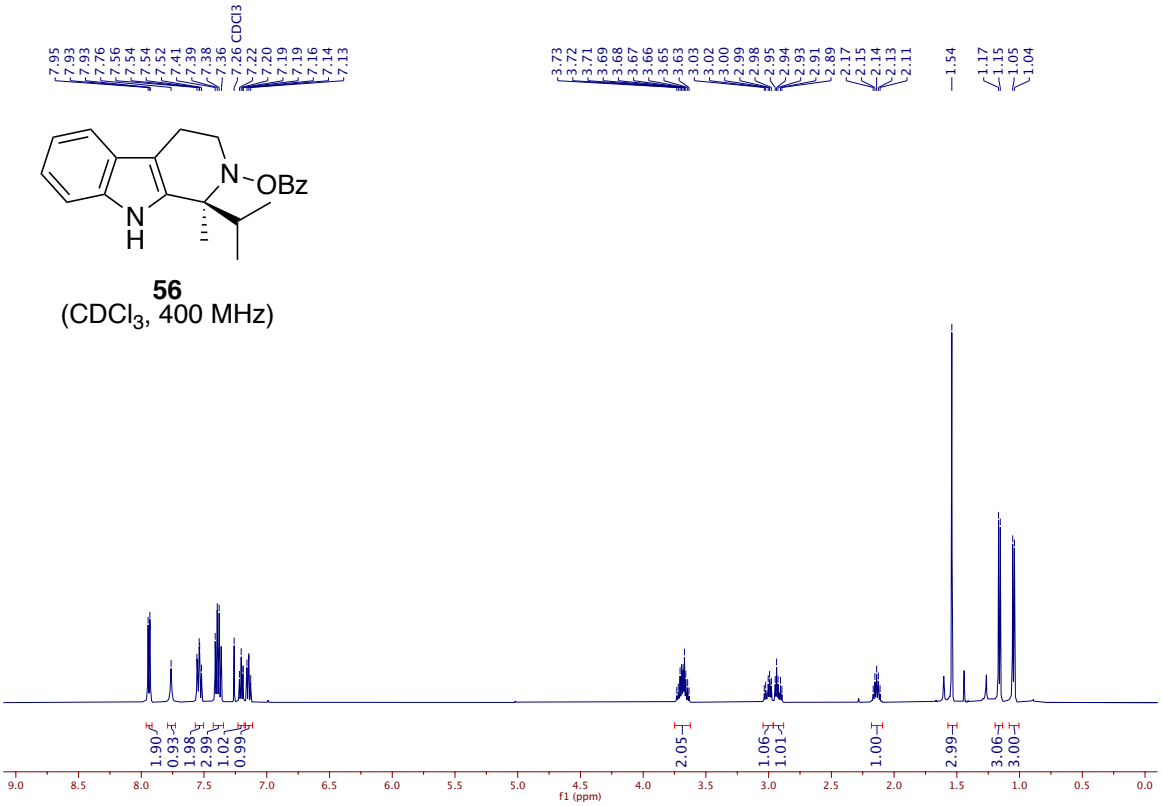
**54**
($CDCl_3$, 101 MHz)



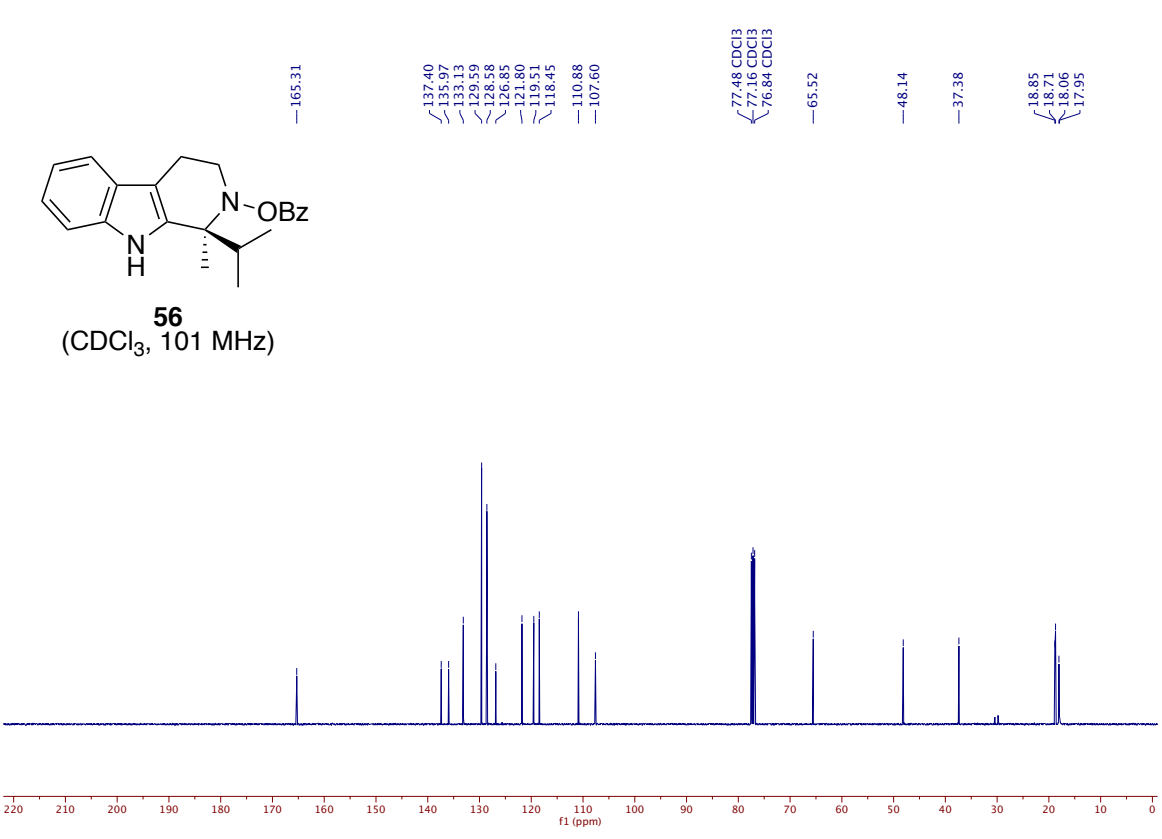

**55**
($CDCl_3$, 400 MHz)



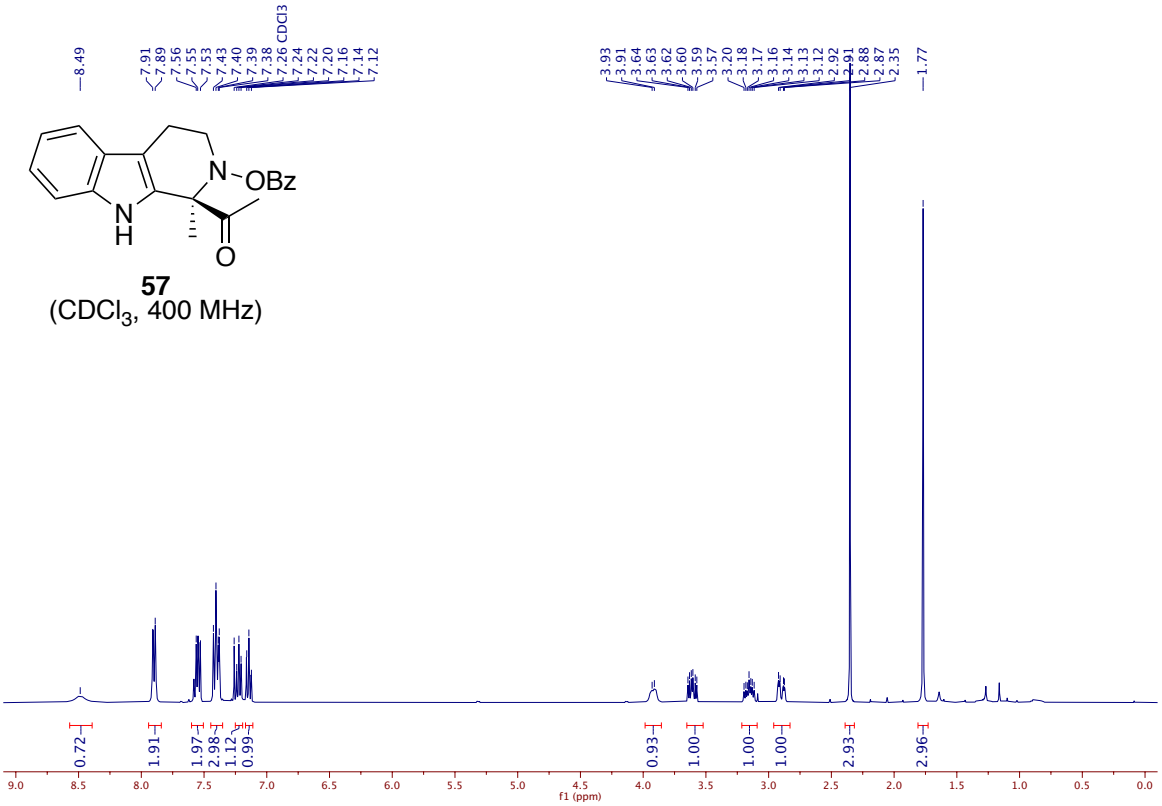

**55**
($CDCl_3$, 101 MHz)



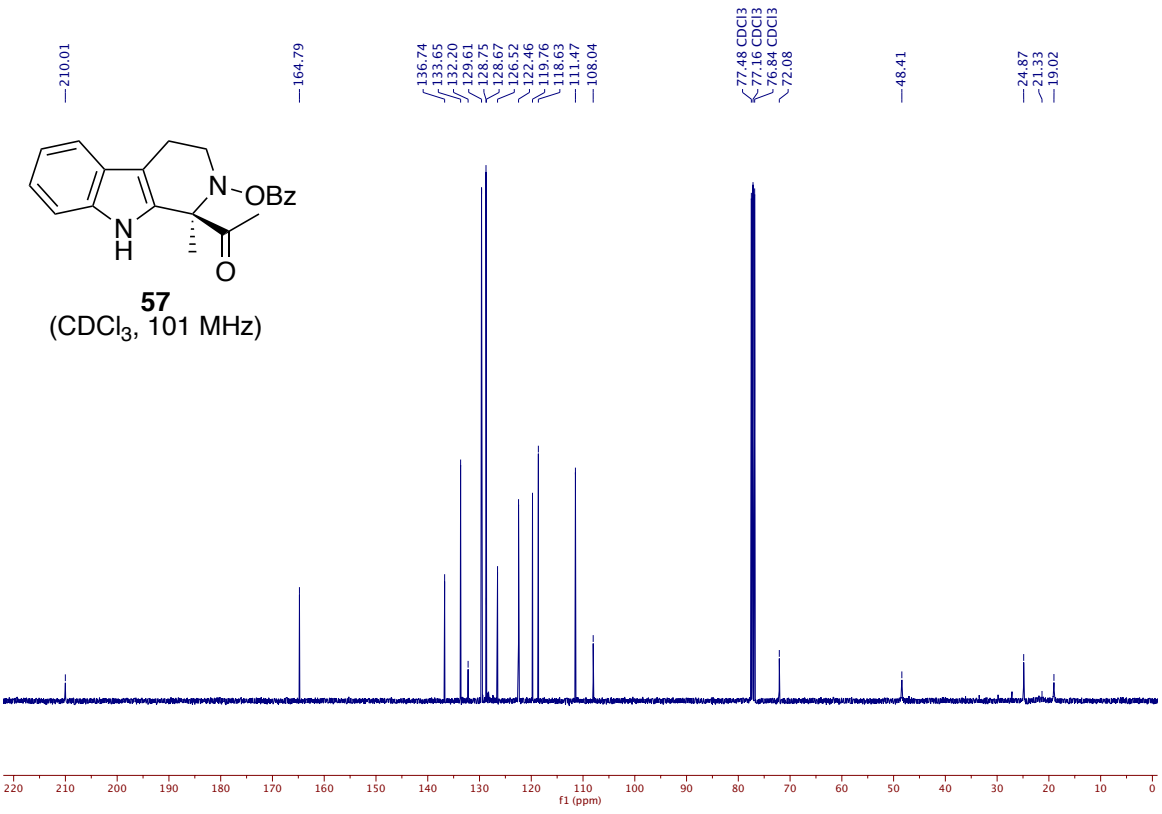

**56**
($CDCl_3$, 400 MHz)



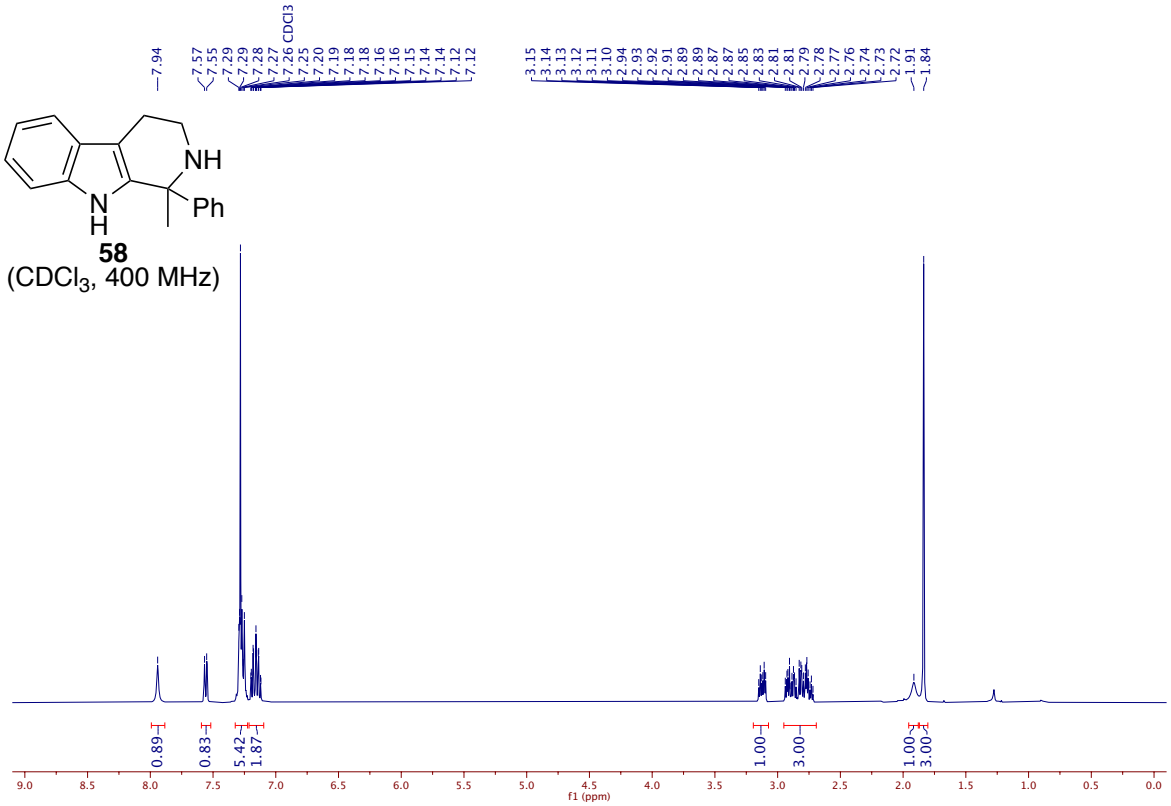

**56**
($CDCl_3$, 101 MHz)




**57**
($CDCl_3$, 400 MHz)

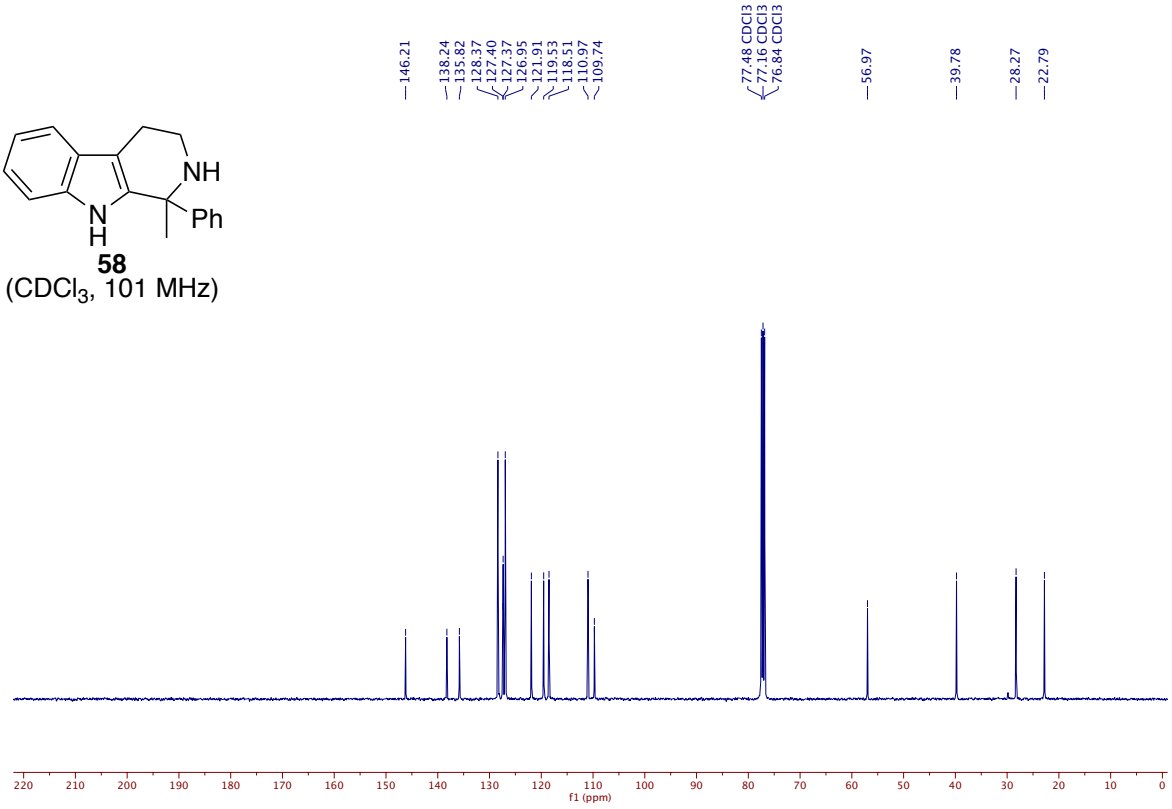



**57**
($CDCl_3$, 101 MHz)



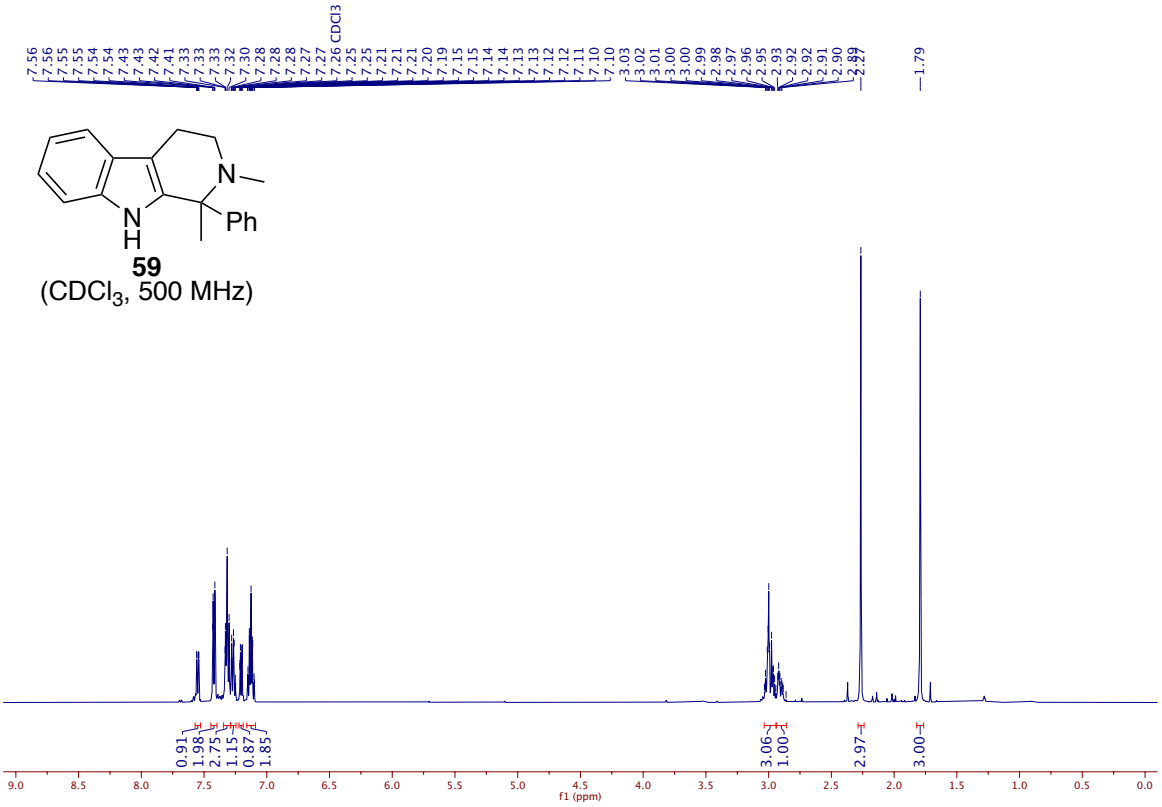

**58**

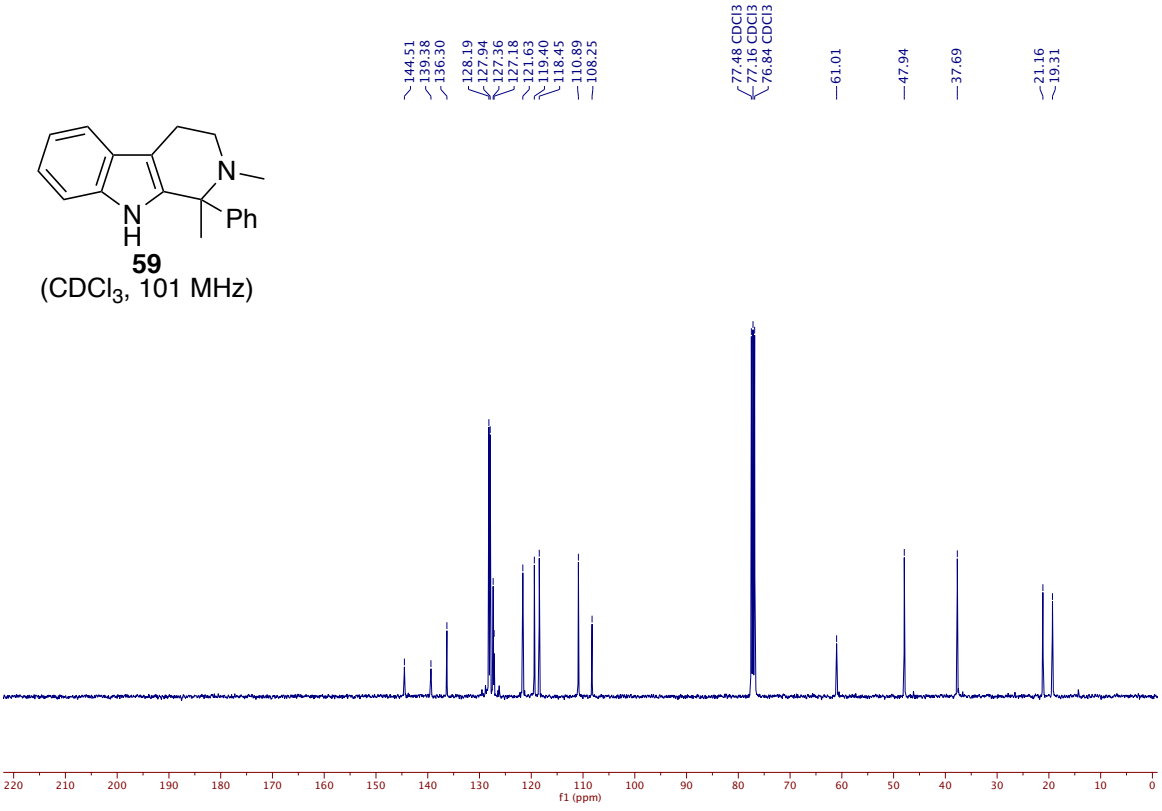
($CDCl_3$, 400 MHz)

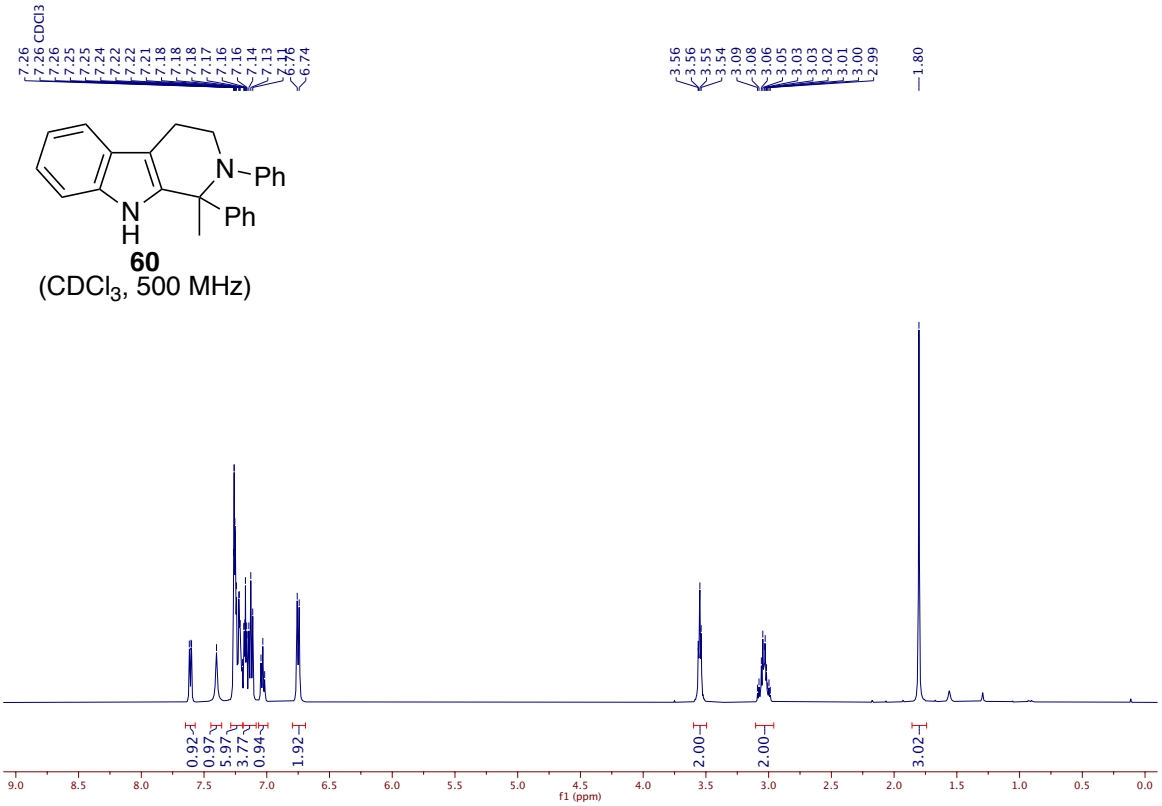



**58**

($CDCl_3$, 101 MHz)

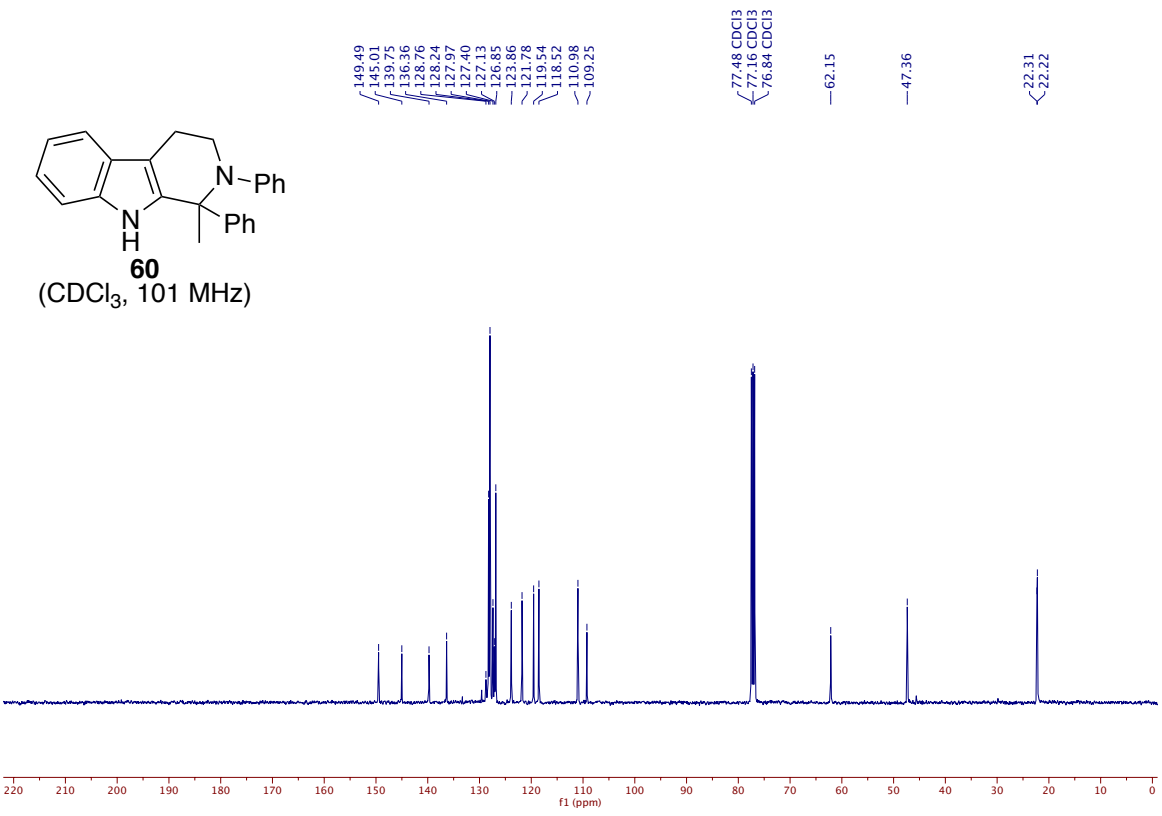

7.56
7.56
7.55
7.55
7.54
7.54
7.43
7.43
7.42
7.41
7.33
7.33
7.33
7.32
7.30
7.28
7.28
7.28
7.27
7.27
7.26 CDCl3
7.25
7.25
7.21
7.21
7.21
7.20
7.19
7.15
7.15
7.14
7.14
7.13
7.13
7.12
7.12
7.11
7.10
7.10
3.03
3.02
3.01
3.00
3.00
2.99
2.98
2.97
2.96
2.95
2.93
2.92
2.92
2.91
2.90
2.89
2.27
1.79
N
H
N
Ph
59
(CDCl3, 500 MHz)
0.91
1.98
2.75
1.15
0.87
1.85
3.06
1.00
2.97
3.00
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


144.51
139.38
136.30
128.19
127.94
127.36
127.18
121.63
119.40
118.45
110.89
108.25
77.48 CDCl3
77.16 CDCl3
76.84 CDCl3
61.01
47.94
37.69
21.16
19.31
N
H
N
Ph
59
(CDCl3, 101 MHz)
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



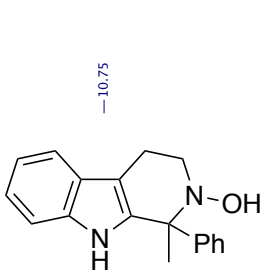

**60**

($CDCl_3$, 500 MHz)



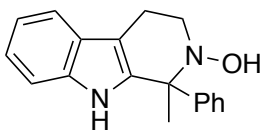

**60**

($CDCl_3$, 101 MHz)

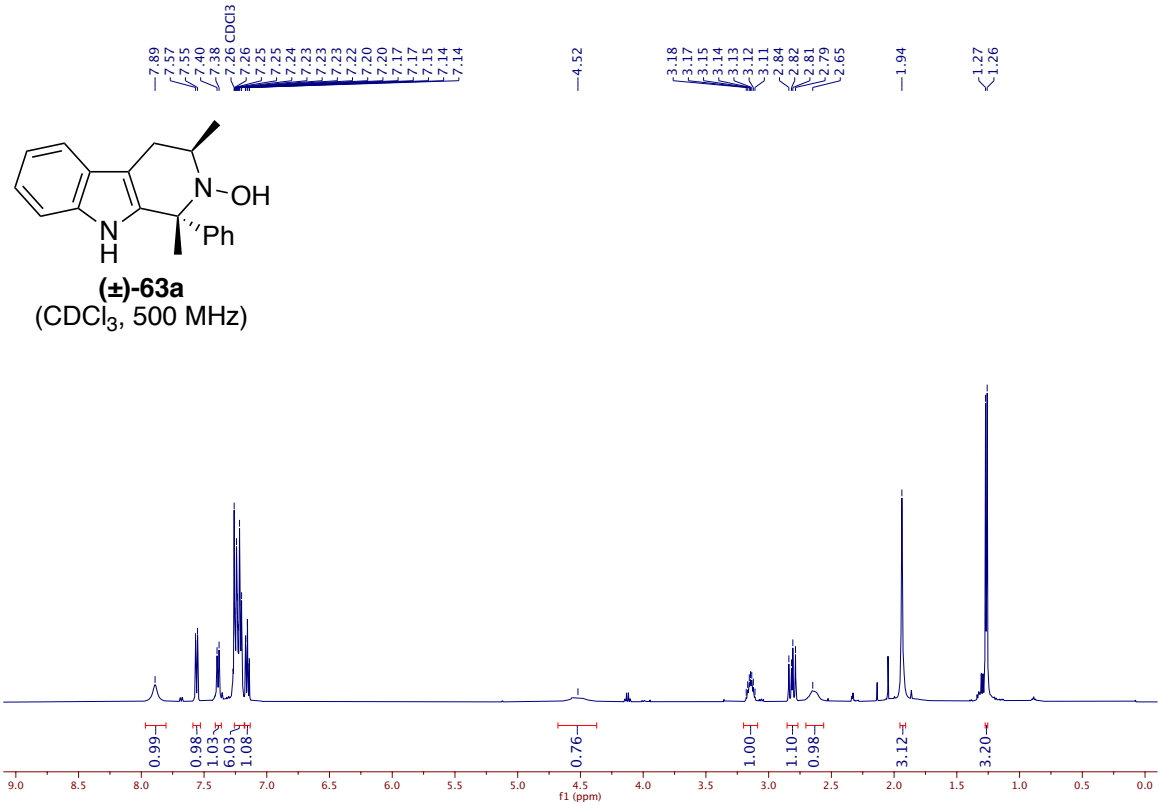


**61**
(DMSO-$d_6$, 500 MHz)

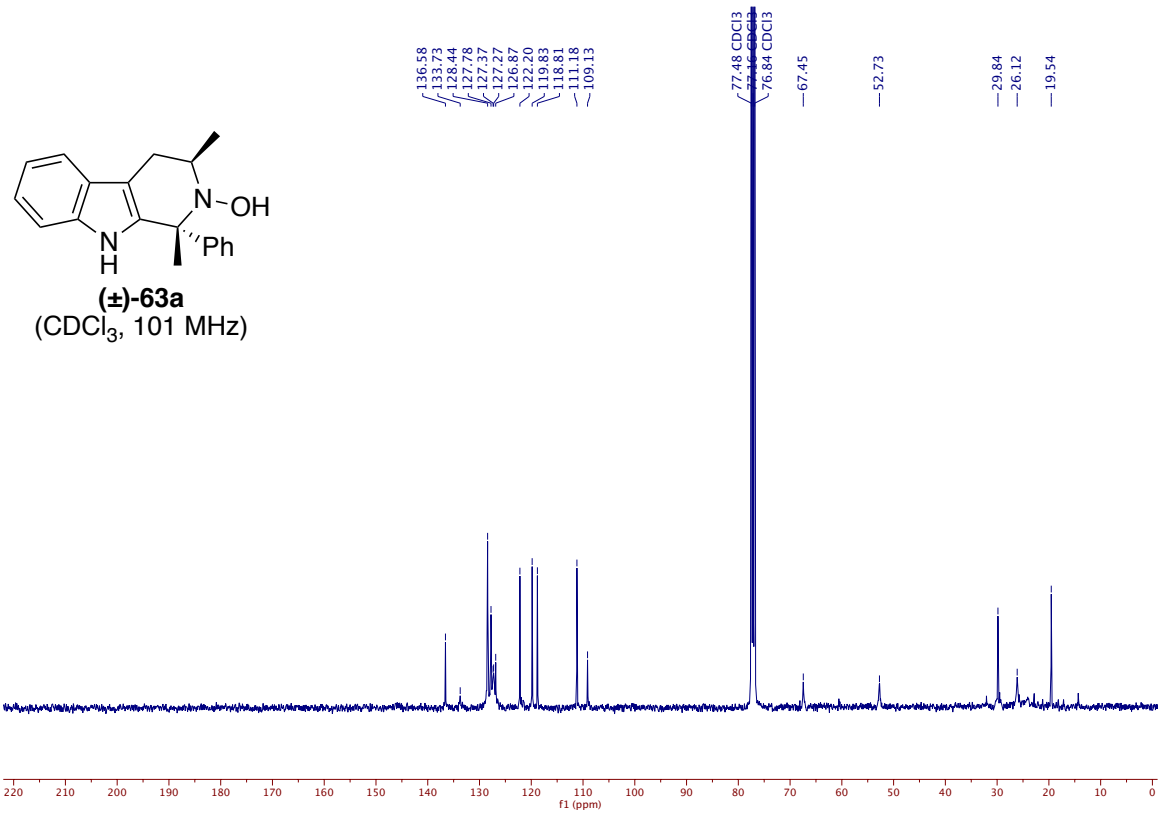




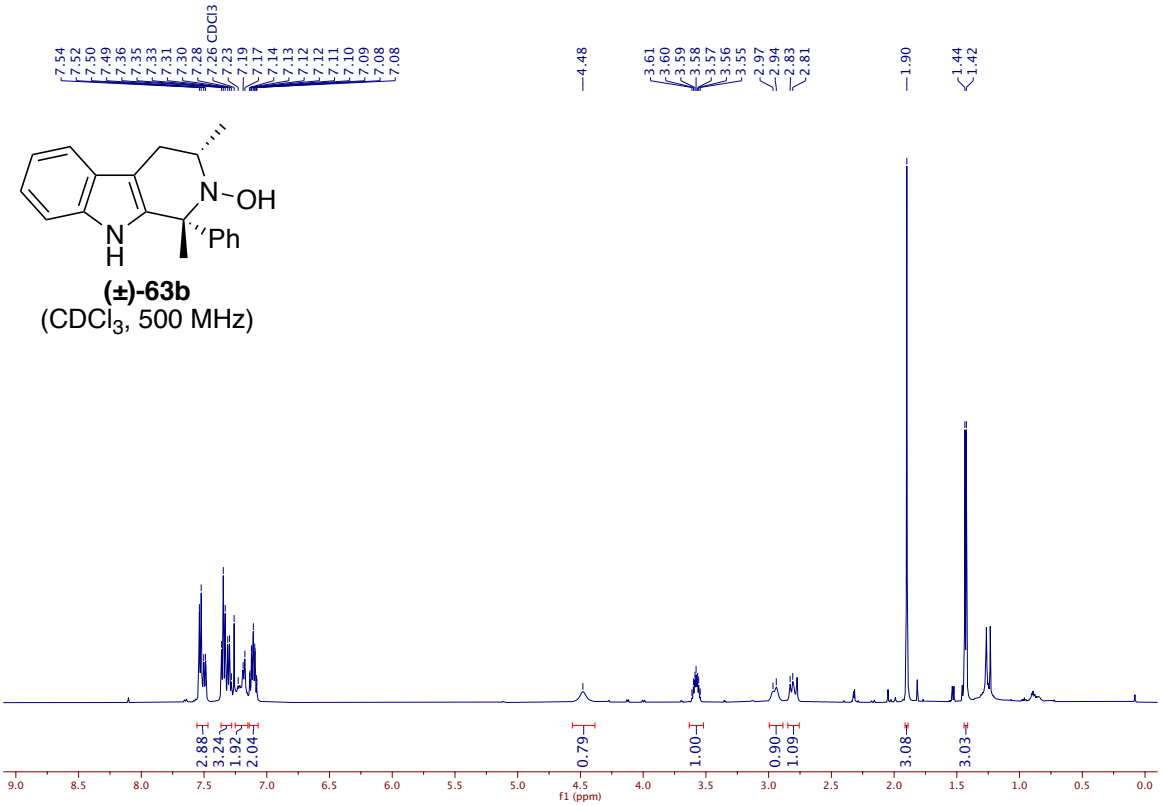
**61**
(DMSO-$d_6$, 101 MHz)



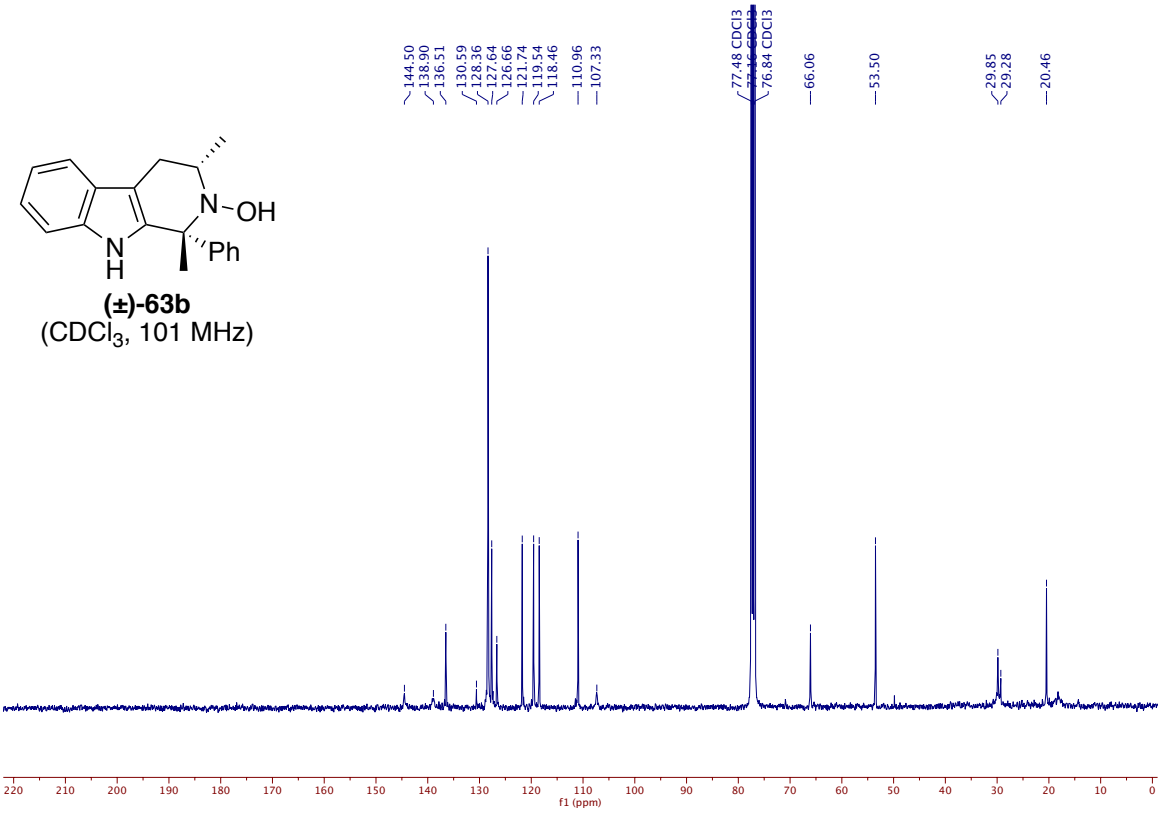

**(±)-63a**
($CDCl_3$, 500 MHz)



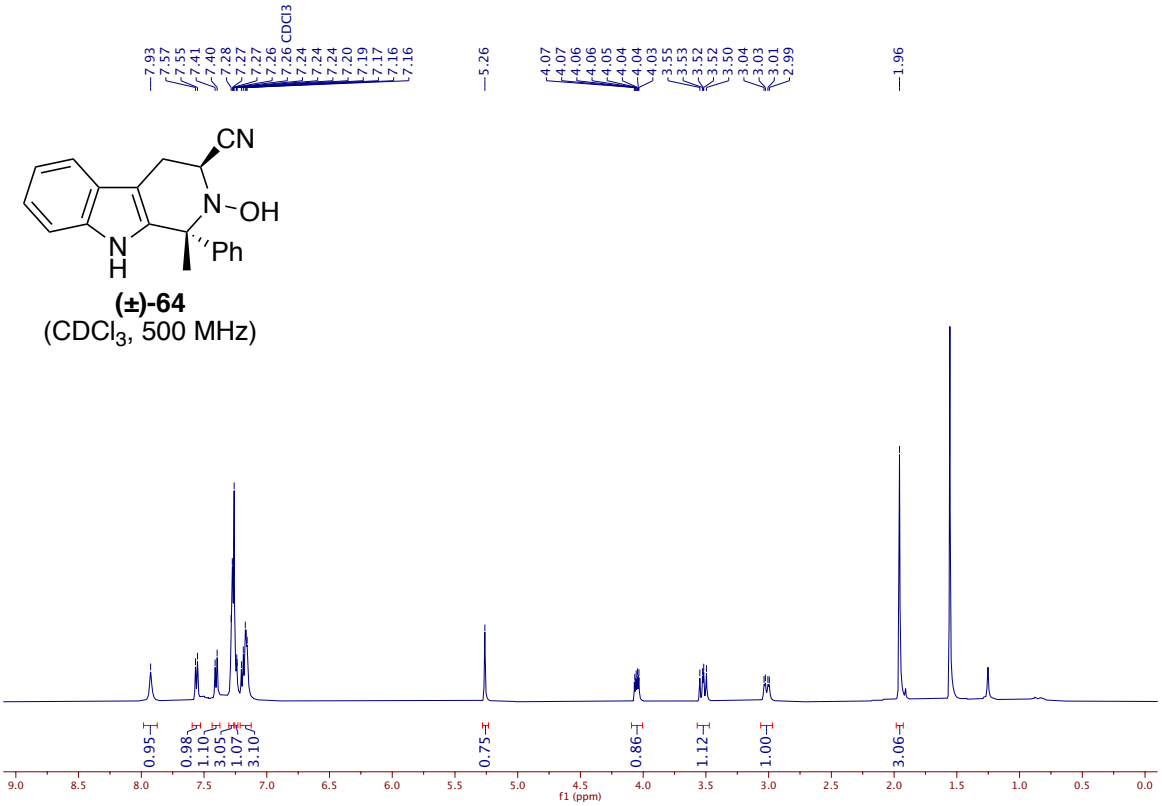

**(±)-63a**
($CDCl_3$, 101 MHz)




**(±)-63b**
($CDCl_3$, 500 MHz)

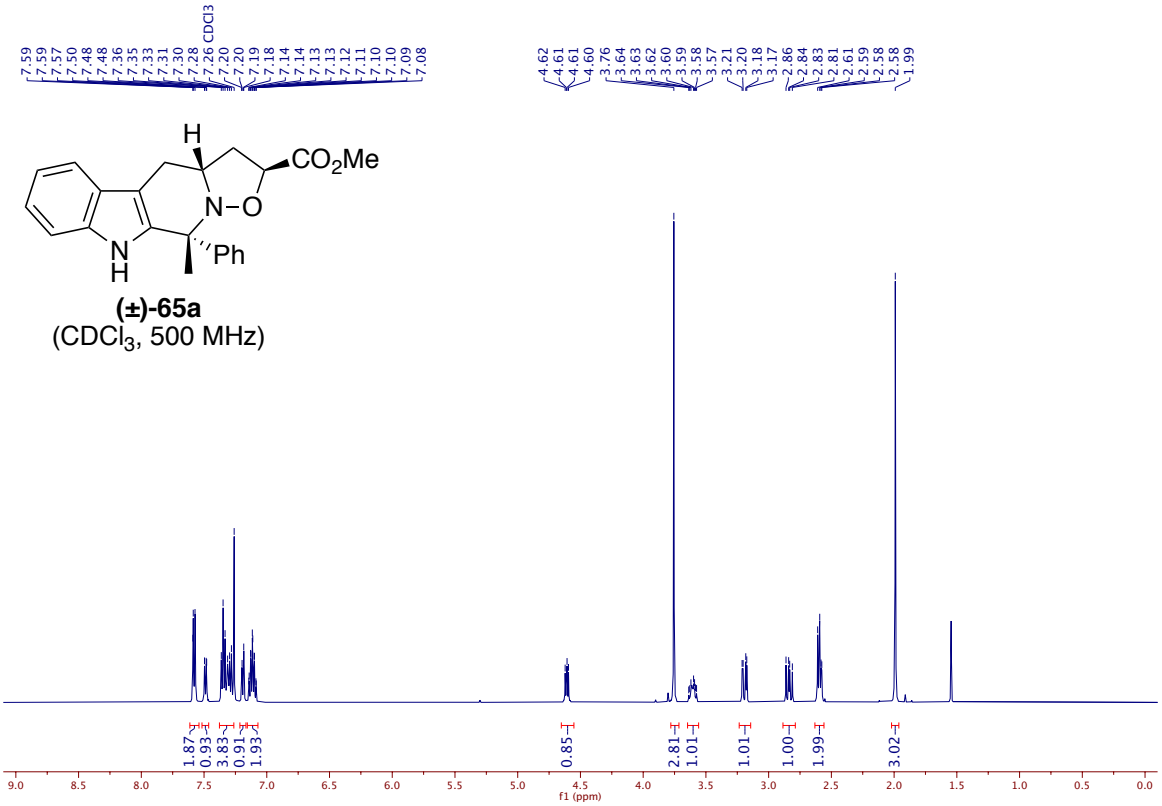



**(±)-63b**
($CDCl_3$, 101 MHz)

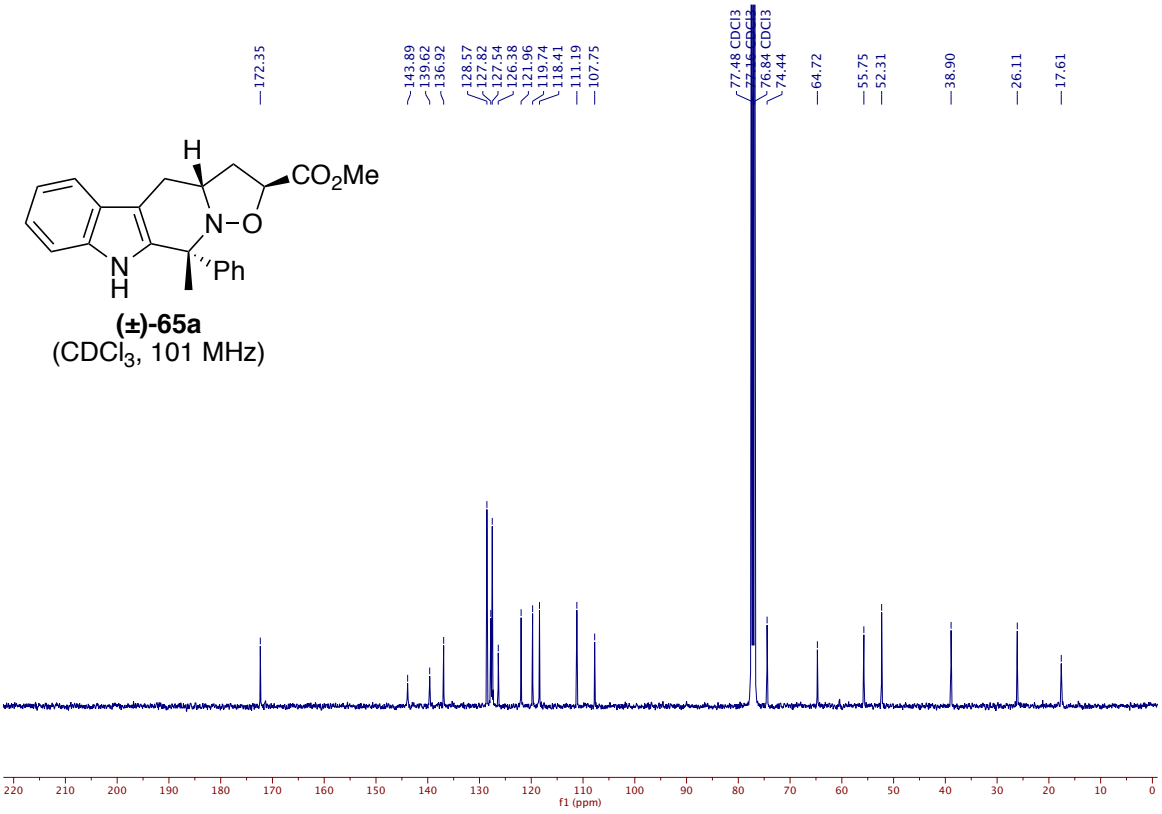



**(±)-64**
($CDCl_3$, 500 MHz)

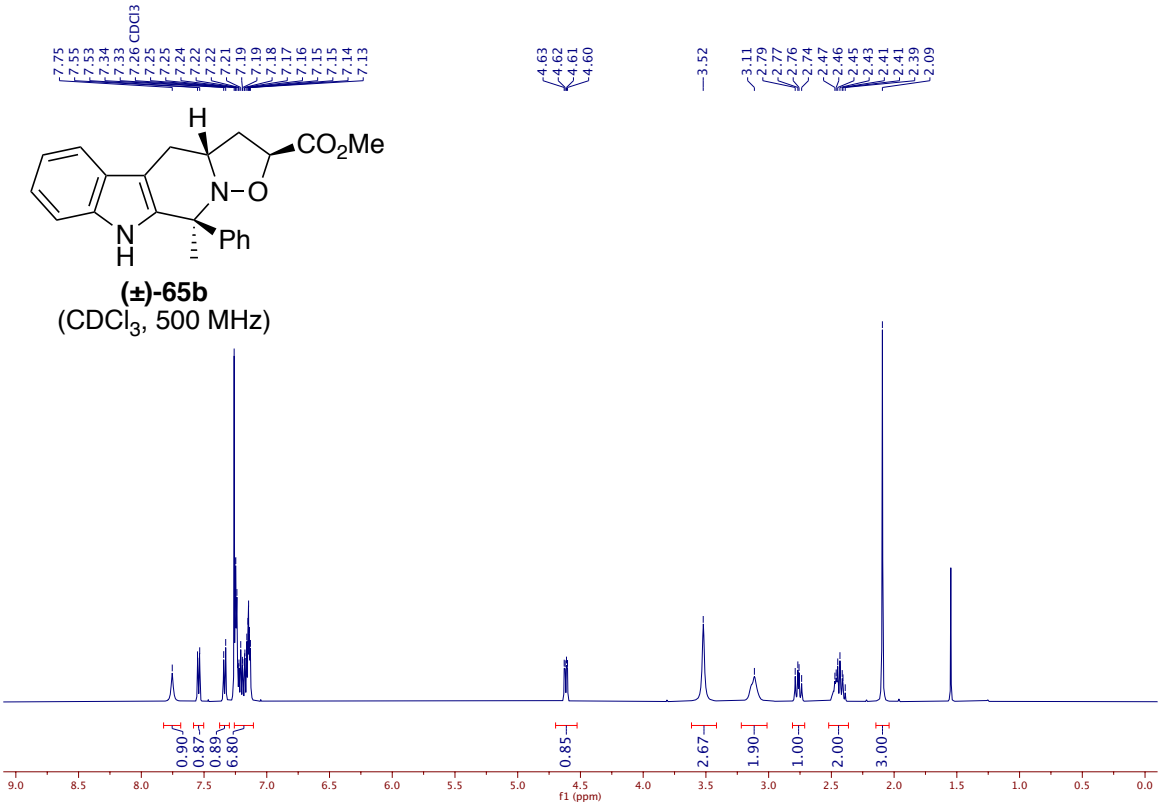
**(±)-64**
($CDCl_3$, 101 MHz)



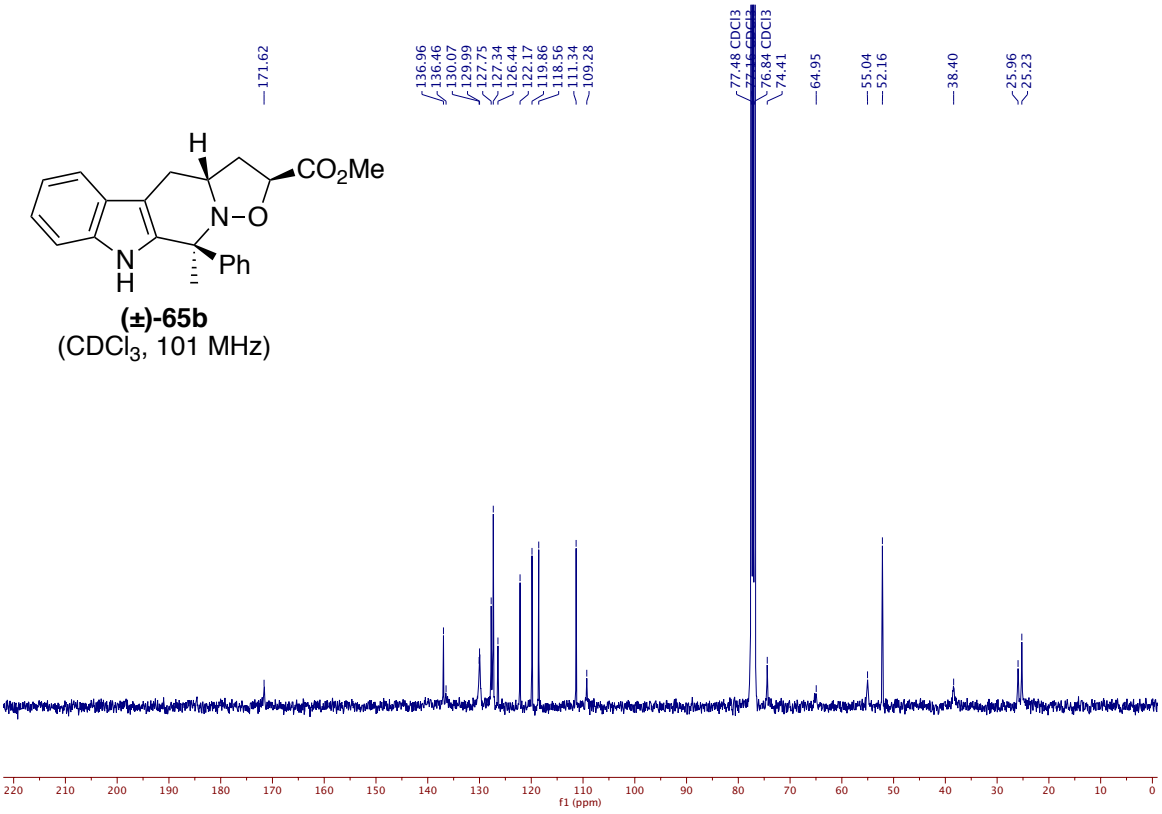

**(±)-65a**
($CDCl_3$, 500 MHz)




**(±)-65a**
($CDCl_3$, 101 MHz)

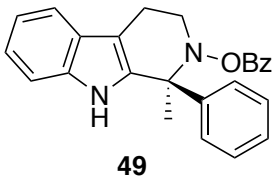



**(±)-65b**
($CDCl_3$, 500 MHz)




**(±)-65b**
($CDCl_3$, 101 MHz)

## M. HPLC Traces

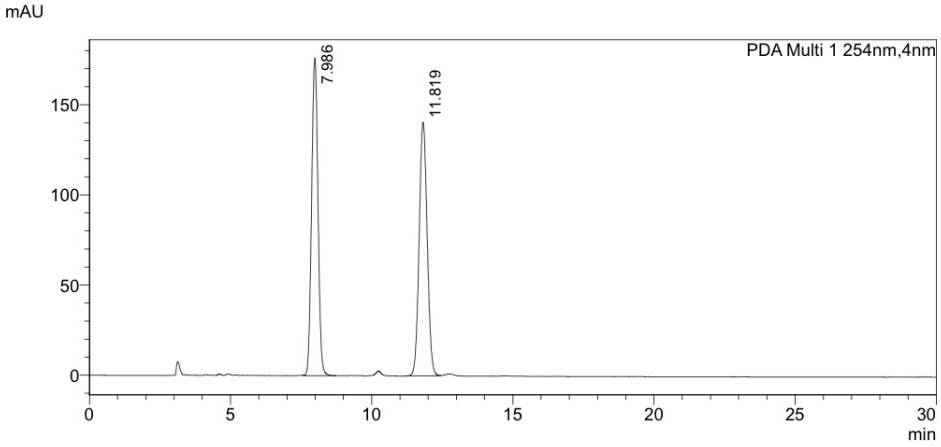



**49**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

### Racemic Sample:

**<Chromatogram>**



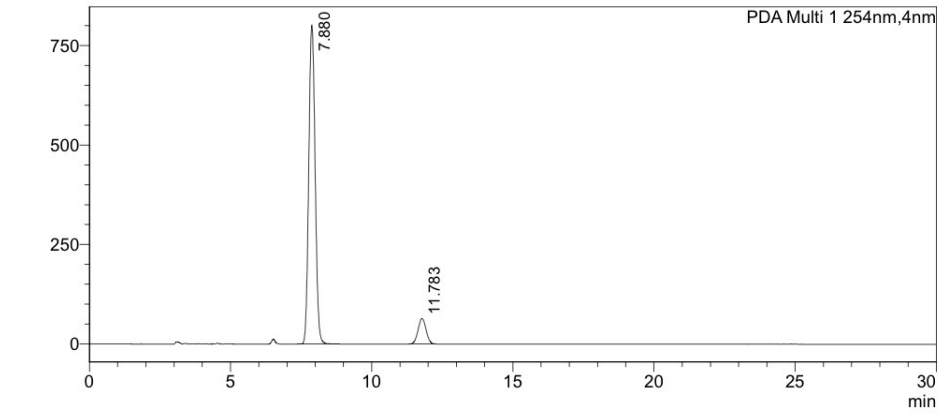

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 7.986 | 176267 | 2749666 | 55.582 | 49.673 |
| 2 | 11.819 | 140861 | 2785819 | 44.418 | 50.327 |
| Total | | 317128 | 5535485 | 100.000 | 100.000 |

### Enantioenriched Sample:

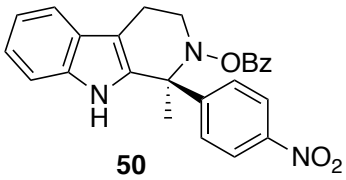
**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 7.880 | 802274 | 12518070 | 92.580 | 90.783 |
| 2 | 11.783 | 64304 | 1270991 | 7.420 | 9.217 |
| Total | | 866578 | 13789061 | 100.000 | 100.000 |

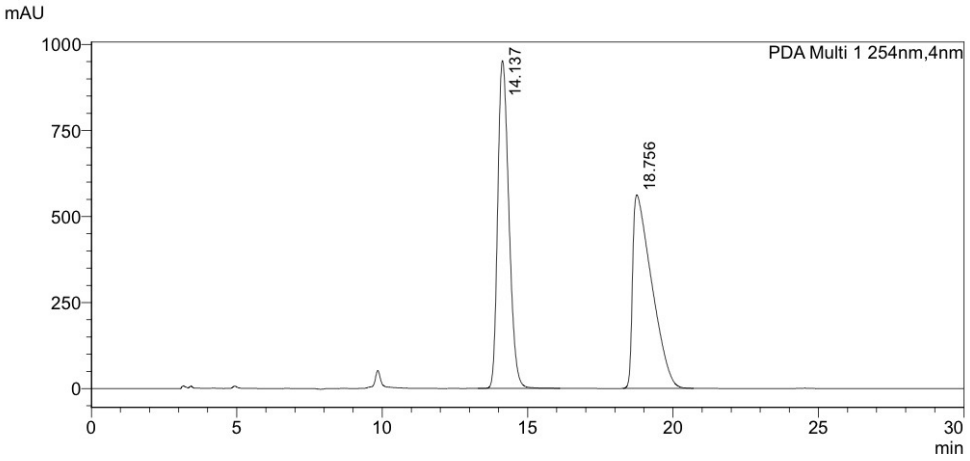



**50**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

## Racemic Sample:

**<Chromatogram>**



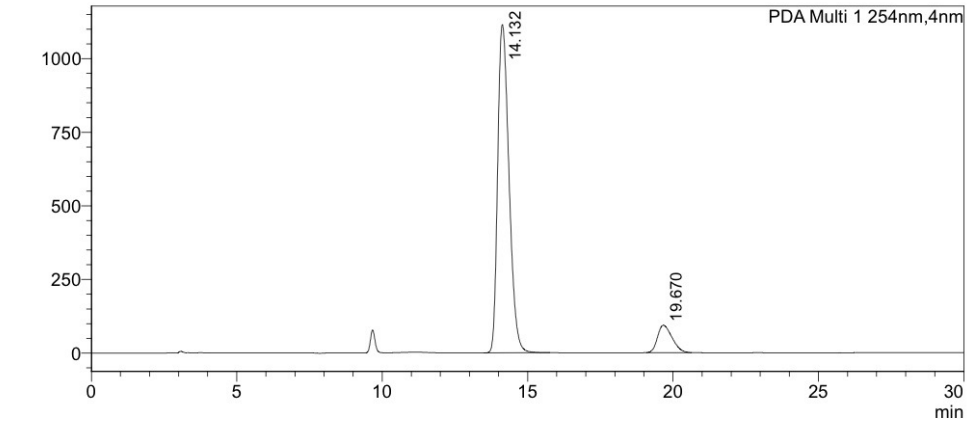

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 14.137 | 952894 | 25421779 | 62.900 | 49.773 |
| 2 | 18.756 | 562034 | 25654098 | 37.100 | 50.227 |
| Total | | 1514928 | 51075878 | 100.000 | 100.000 |

## Enantioenriched Sample:

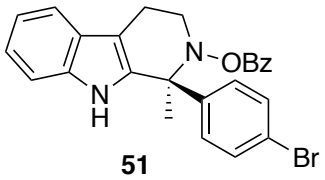
**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 14.132 | 1115363 | 30219406 | 92.306 | 90.376 |
| 2 | 19.670 | 92969 | 3218078 | 7.694 | 9.624 |
| Total | | 1208332 | 33437484 | 100.000 | 100.000 |

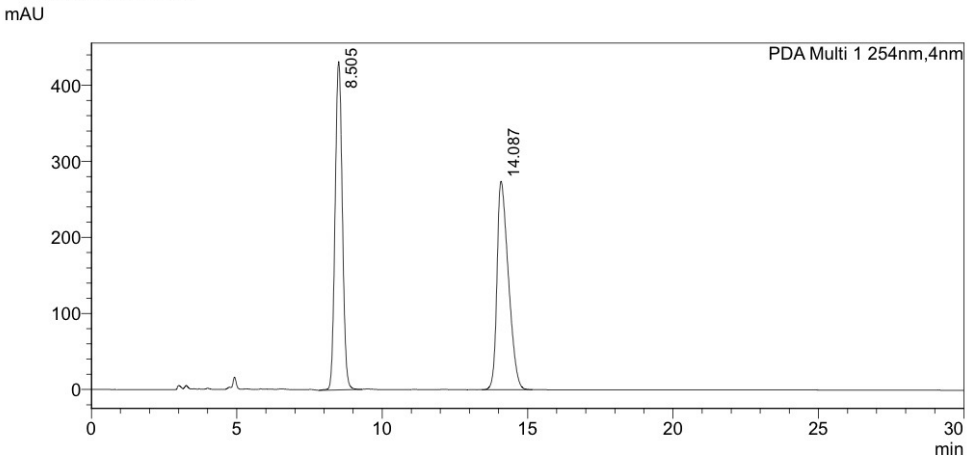



**51**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

## Racemic Sample:

**<Chromatogram>**



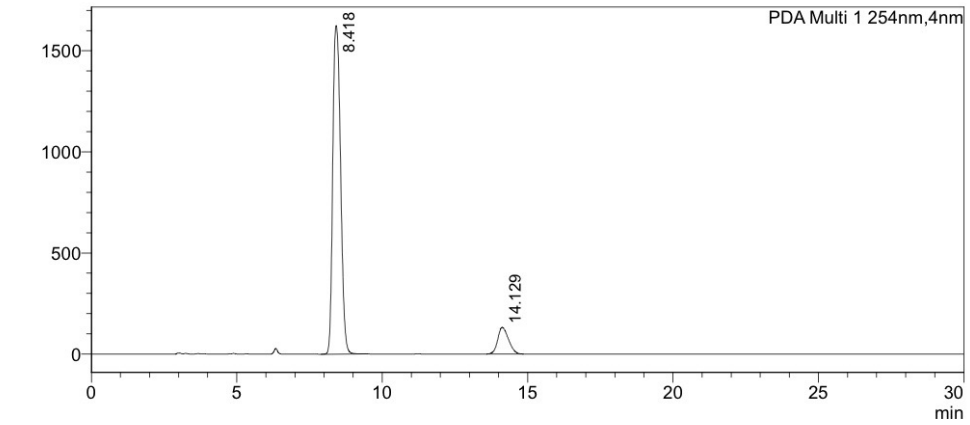

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 8.505 | 431813 | 7476611 | 61.157 | 50.000 |
| 2 | 14.087 | 274260 | 7476740 | 38.843 | 50.000 |
| Total | | 706073 | 14953351 | 100.000 | 100.000 |

## Enantioenriched Sample:

**<Chromatogram>**



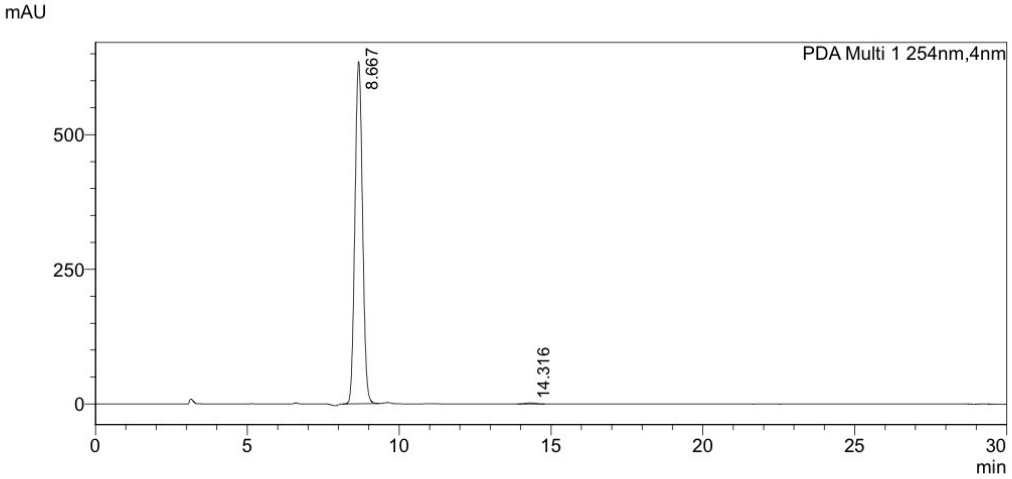

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 8.418 | 1625324 | 30373382 | 92.499 | 89.951 |
| 2 | 14.129 | 131804 | 3393250 | 7.501 | 10.049 |
| Total | | 1757128 | 33766632 | 100.000 | 100.000 |

## Crystallization Sample:

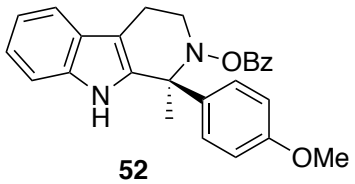
**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 8.667 | 635186 | 10994403 | 99.703 | 99.590 |
| 2 | 14.316 | 1893 | 45287 | 0.297 | 0.410 |
| Total | | 637078 | 11039691 | 100.000 | 100.000 |

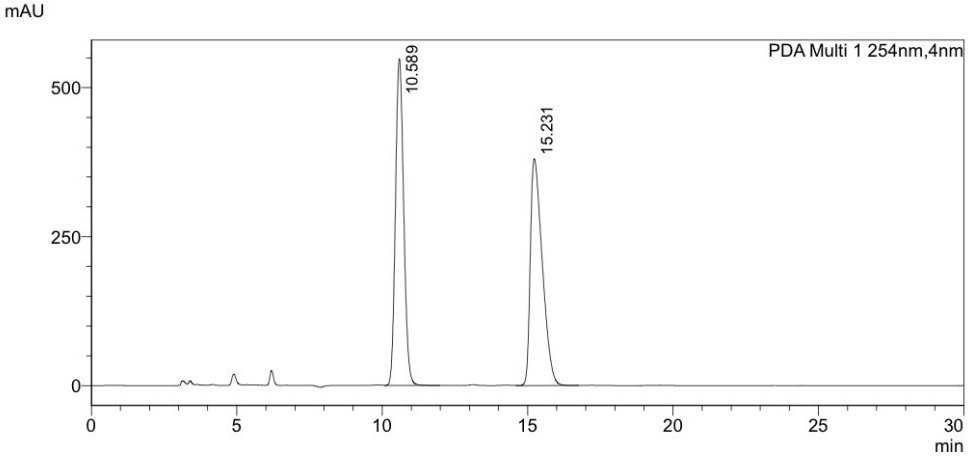



**52**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

## Racemic Sample:

**<Chromatogram>**



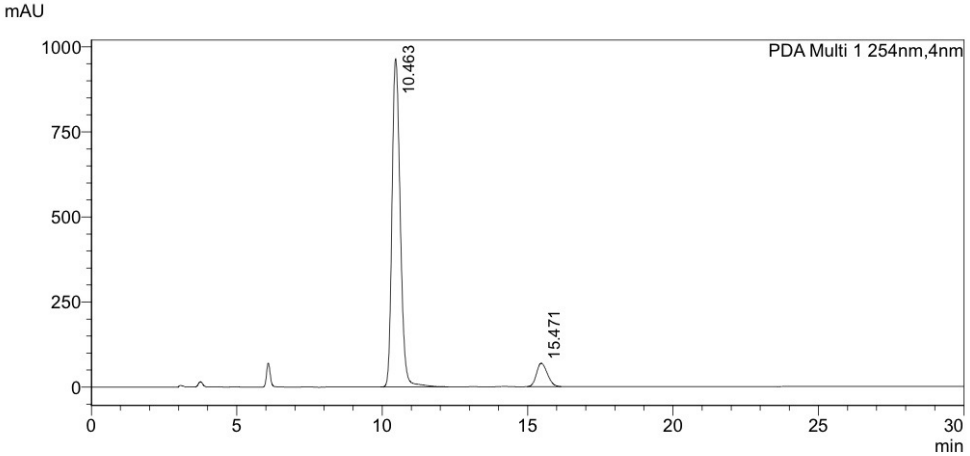

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 10.589 | 548849 | 10821368 | 59.038 | 49.840 |
| 2 | 15.231 | 380801 | 10890847 | 40.962 | 50.160 |
| Total | | 929651 | 21712215 | 100.000 | 100.000 |

## Enantioenriched Sample:

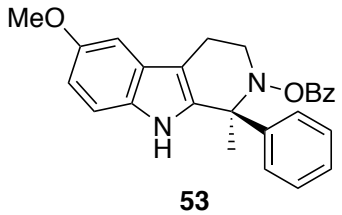
**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 10.463 | 964866 | 19025086 | 93.357 | 91.455 |
| 2 | 15.471 | 68658 | 1777665 | 6.643 | 8.545 |
| Total | | 1033524 | 20802751 | 100.000 | 100.000 |

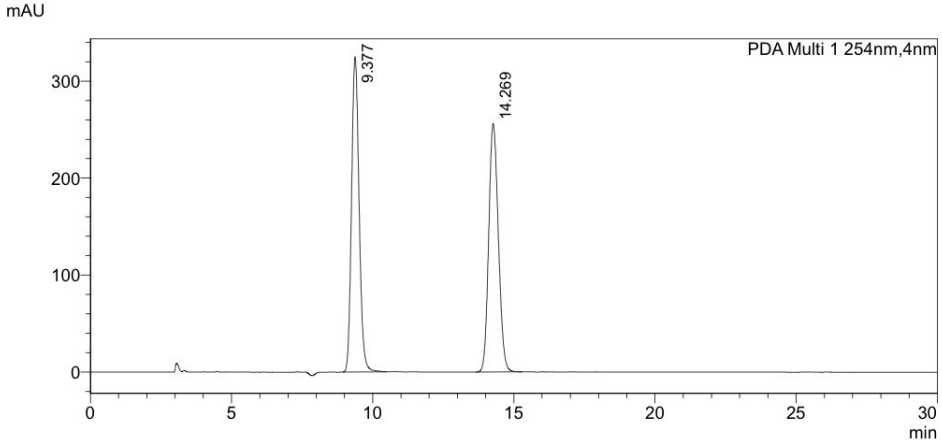



**53**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

## Racemic Sample:

**<Chromatogram>**



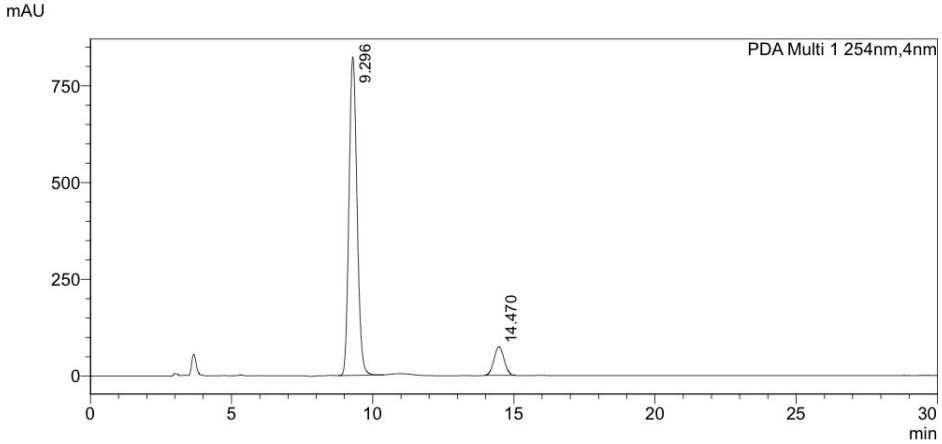

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 9.377 | 325055 | 6031388 | 55.957 | 49.822 |
| 2 | 14.269 | 255845 | 6074544 | 44.043 | 50.178 |
| Total | | 580900 | 12105932 | 100.000 | 100.000 |

## Enantioenriched Sample:

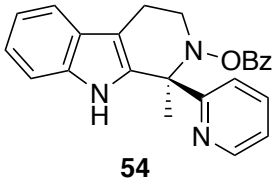
**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 9.296 | 822941 | 16240677 | 91.771 | 89.871 |
| 2 | 14.470 | 73796 | 1830399 | 8.229 | 10.129 |
| Total | | 896737 | 18071077 | 100.000 | 100.000 |

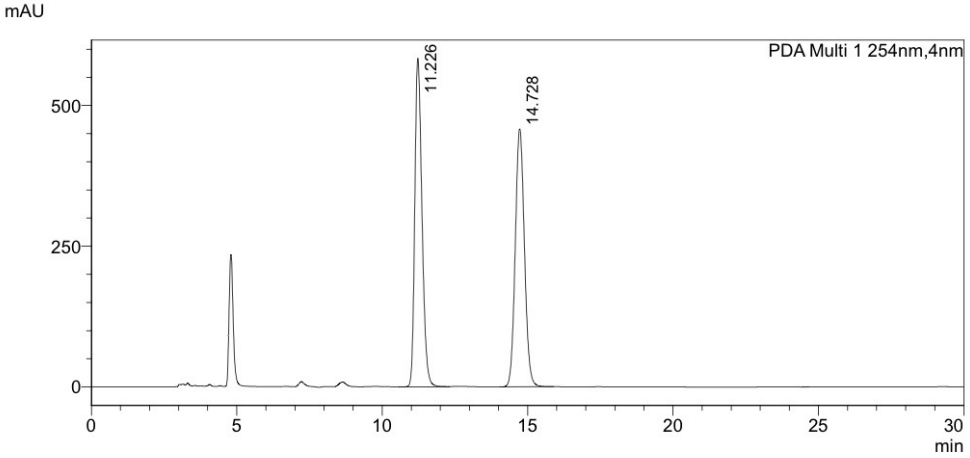



**54**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

## Racemic Sample:

**<Chromatogram>**



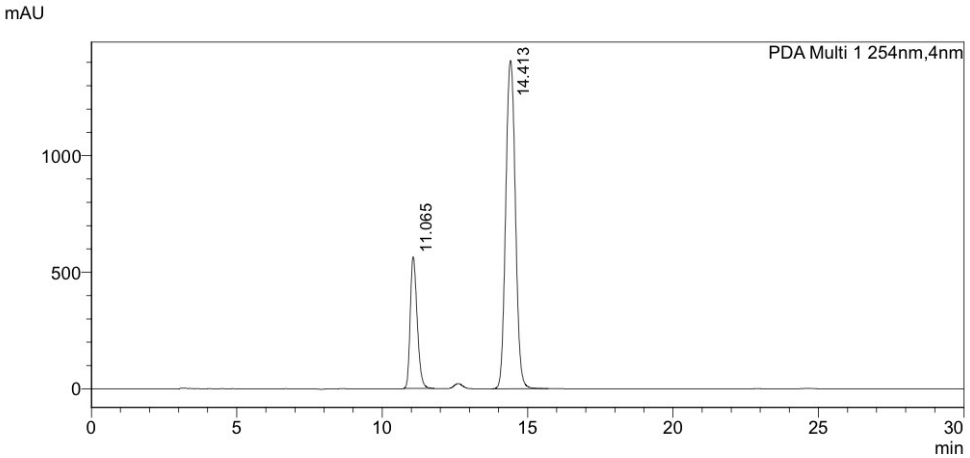

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 11.226 | 583381 | 10071262 | 55.997 | 49.998 |
| 2 | 14.728 | 458435 | 10072209 | 44.003 | 50.002 |
| Total | | 1041816 | 20143471 | 100.000 | 100.000 |

## Enantioenriched Sample:

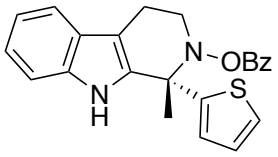
**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 11.065 | 564622 | 9387200 | 28.623 | 22.444 |
| 2 | 14.413 | 1407970 | 32437761 | 71.377 | 77.556 |
| Total | | 1972593 | 41824961 | 100.000 | 100.000 |

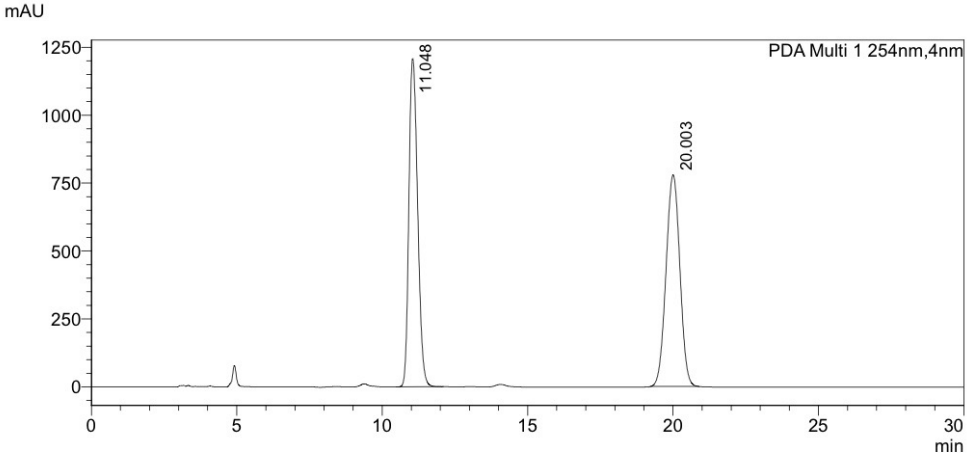



**55**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

## Racemic Sample:

**<Chromatogram>**



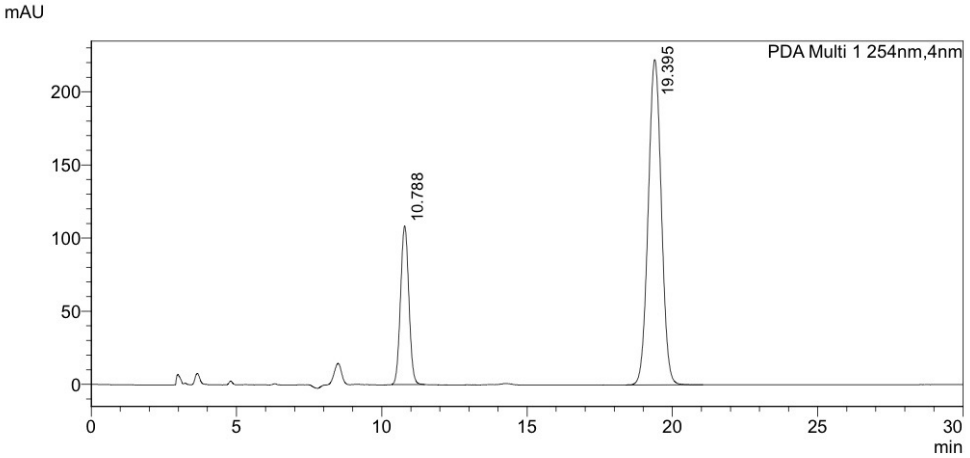

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 11.048 | 1208916 | 25351279 | 60.817 | 49.617 |
| 2 | 20.003 | 778873 | 25742938 | 39.183 | 50.383 |
| Total | | 1987789 | 51094216 | 100.000 | 100.000 |

## Enantioenriched Sample:

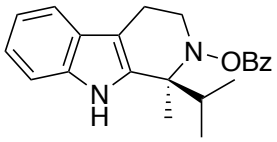
**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 10.788 | 108314 | 2152604 | 32.748 | 23.595 |
| 2 | 19.395 | 222432 | 6970402 | 67.252 | 76.405 |
| Total | | 330746 | 9123006 | 100.000 | 100.000 |

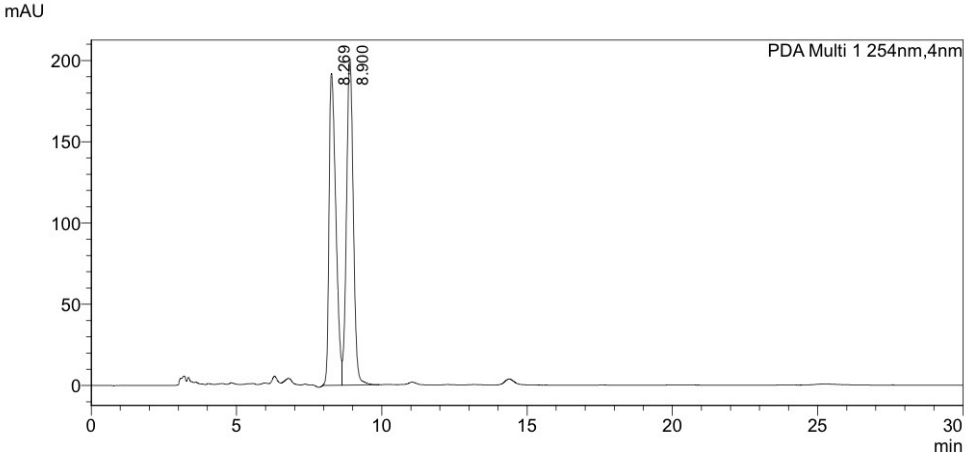



**56**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

## Racemic Sample:

**<Chromatogram>**



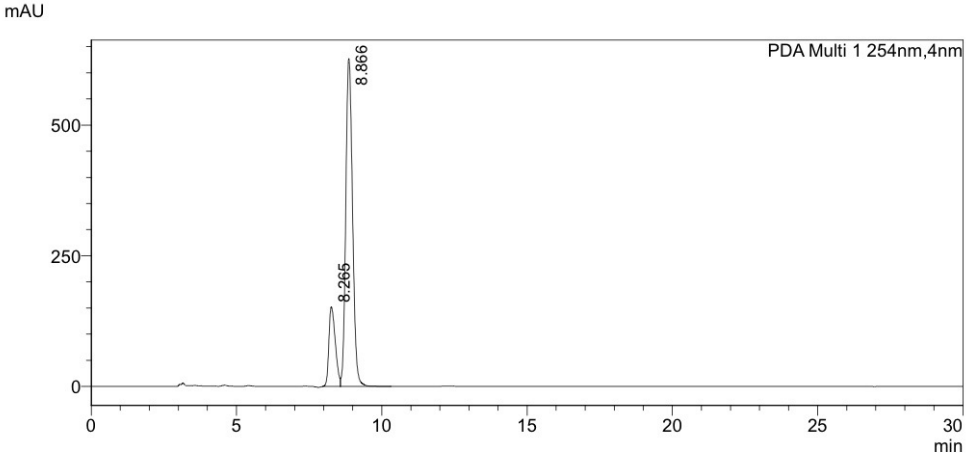

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 8.269 | 192083 | 3130806 | 48.871 | 48.895 |
| 2 | 8.900 | 200956 | 3272371 | 51.129 | 51.105 |
| Total | | 393039 | 6403177 | 100.000 | 100.000 |

## Enantioenriched Sample:

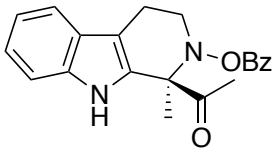
**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 8.265 | 152396 | 2350053 | 19.545 | 18.775 |
| 2 | 8.866 | 627305 | 10166924 | 80.455 | 81.225 |
| Total | | 779701 | 12516977 | 100.000 | 100.000 |

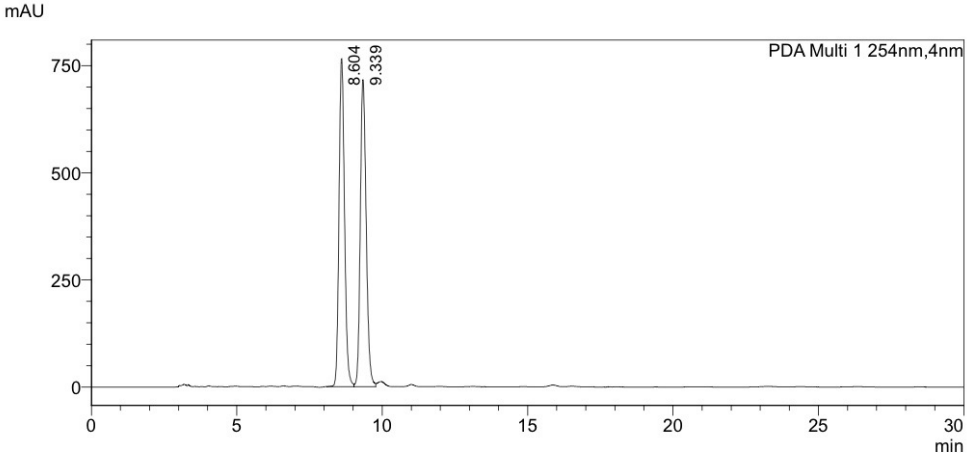



**57**

**Conditions:** HPLC (ChiralPak AD-H, 90:10 hexanes/i-PrOH, 1 mL/min, 254 nm)

## Racemic Sample:

**<Chromatogram>**



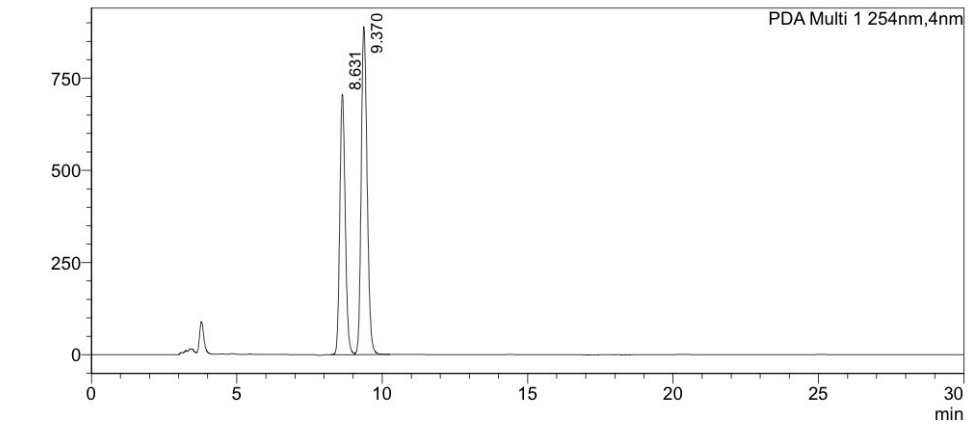

**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 8.604 | 765554 | 10079971 | 51.669 | 49.982 |
| 2 | 9.339 | 716089 | 10087227 | 48.331 | 50.018 |
| Total | | 1481642 | 20167198 | 100.000 | 100.000 |

## Enantioenriched Sample:

**<Chromatogram>**




**<Peak Table>**

PDA Ch1 254nm

| Peak# | Ret. Time | Height | Area | Height% | Area% |
|---|---|---|---|---|---|
| 1 | 8.631 | 705922 | 9185569 | 44.244 | 42.134 |
| 2 | 9.370 | 889606 | 12615307 | 55.756 | 57.866 |
| Total | | 1595528 | 21800876 | 100.000 | 100.000 |

## N. X-Ray Crystallography Data

### Crystal Structure of 20a

**General information**: The diffraction data were measured at 100 K on a Bruker D8 VENTURE diffractometer equipped with a microfocus Mo-target X-ray tube ($\lambda$ = 0.71073 Å) and PHOTON 100 CMOS detector. Data were collected using $\phi$ and $\omega$ scans to survey a hemisphere of reciprocal space. Data reduction and integration were performed with the Bruker APEX3 software package (Bruker AXS, version 2017.3-0, 2018). Data were scaled and corrected for absorption effects using the multi-scan procedure as implemented in SADABS (Bruker AXS, version 2014/5, Krause, Herbst-Irmer, Sheldrick & Stalke, *J. Appl. Cryst.* **2015**, *48*, 3-10). The structure was solved by SHELXT (Version 2014/5: Sheldrick, G. M. *Acta Crystallogr*. **2015**, ***A71***, 3-8) and refined by a full-matrix least-squares procedure using OLEX2 (O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann. J. Appl. Crystallogr. **2009**, *42*, 339-341) (XL refinement program version 2018/3, *Sheldrick, G. M. Acta Crystallogr.* **2015**, *C71*, 3-8). Crystallographic data and details of the data collection and structure refinement are listed in Table S4.

**Specific details for structure refinement**: All atoms were refined with anisotropic thermal parameters. Hydrogen atoms were included in idealized positions for structure factor calculations except atom H2 attached to nitrogen atom N2. This hydrogen atom was located in the difference Fourier map and allowed to be refined without any additional restraints. All structures are drawn with thermal ellipsoids at 50% probability.

**Table S4 Crystal data and structure refinement for 0732_LC.**

| | |
|---|---|
| Identification code | 0732_LC |
| Empirical formula | $C_{25}H_{22}N_2O_2$ |
| Formula weight | 382.44 |
| Temperature/K | 100(2) |
| Crystal system | monoclinic |
| Space group | $P2_1/c$ |
| a/Å | 9.5752(5) |
| b/Å | 12.0481(7) |
| c/Å | 17.8268(10) |
| α/° | 90 |
| β/° | 101.373(2) |
| γ/° | 90 |
| Volume/Å$^3$ | 2016.17(19) |
| Z | 4 |
| $\rho_{calc}$g/cm$^3$ | 1.260 |
| μ/mm$^{-1}$ | 0.080 |
| F(000) | 808.0 |
| Crystal size/mm$^3$ | 0.307 × 0.108 × 0.107 |
| Radiation | MoKα (λ = 0.71073) |
| 2Θ range for data collection/° | 4.662 to 53.01 |
| Index ranges | $-12 \le h \le 12$, $-15 \le k \le 15$, $-22 \le l \le 22$ |
| Reflections collected | 50007 |
| Independent reflections | 4167 [$R_{int}$ = 0.0400, $R_{sigma}$ = 0.0184] |
| Data/restraints/parameters | 4167/0/267 |
| Goodness-of-fit on $F^2$ | 1.023 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0357, $wR_2$ = 0.0812 |
| Final R indexes [all data] | $R_1$ = 0.0481, $wR_2$ = 0.0879 |
| Largest diff. peak/hole / e Å$^{-3}$ | 0.27/-0.18 |

$R_{int} = \Sigma \mid F_o^2 - \langle F_o^2 \rangle \mid / \Sigma \mid F_o^2 \mid$

$R1 = \Sigma \mid \mid F_o \mid - \mid F_c \mid \mid / \Sigma \mid F_o \mid$

$wR2 = [\Sigma [w (F_o^2 - F_c^2)^2] / \Sigma [w (F_o^2)^2]]^{1/2}$

Goodness-of-fit = $[\Sigma [w (F_o^2 - F_c^2)^2] / (n-p)]^{1/2}$

n: number of independent reflections; p: number of refined parameters

**Figure S2.**

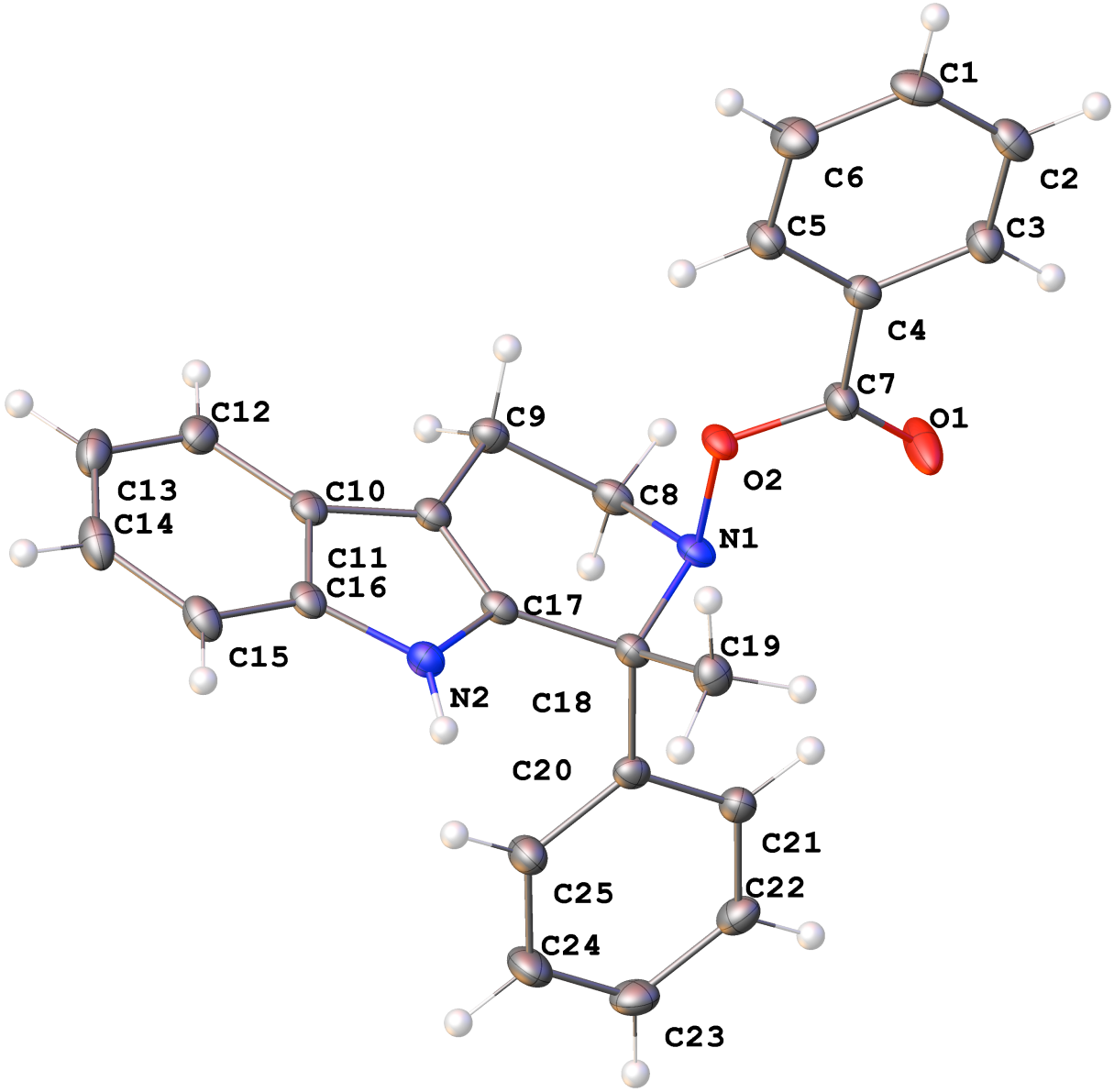

C1
C6
C2
C5
C3
C4
C7
O1
O2
C12
C9
C13
C10
C8
C14
N1
C11
C16
C17
C19
C15
N2
C18
C20
C21
C25
C22
C24
C23

**Figure S3.**

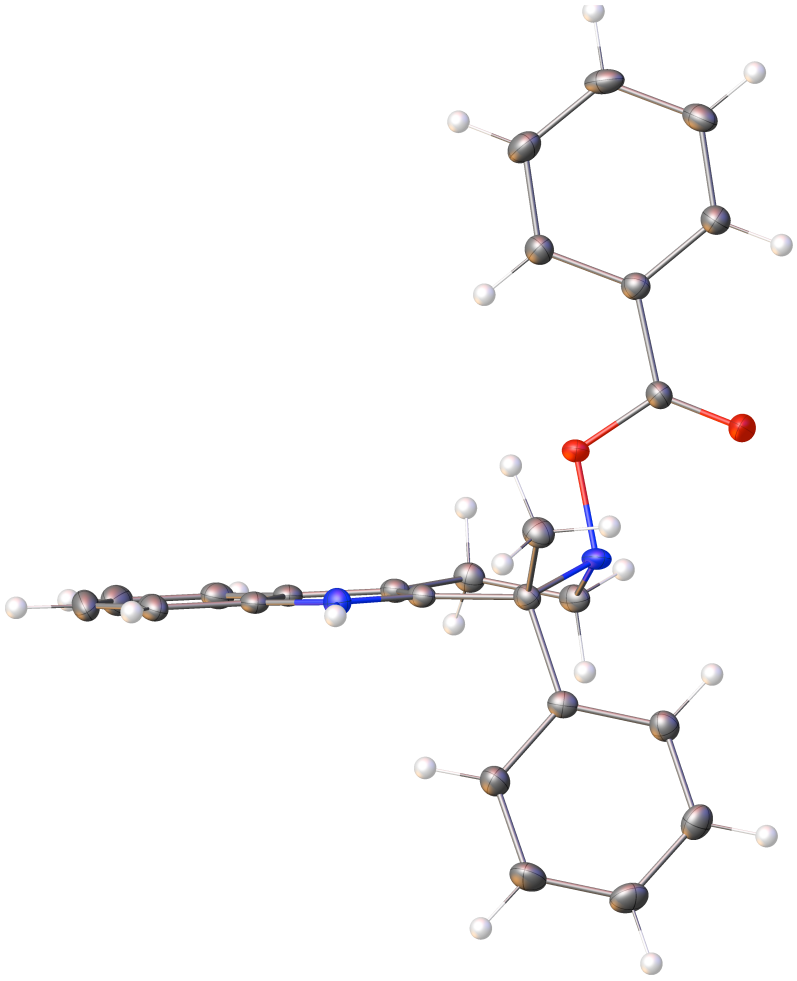


**Figure S4.**

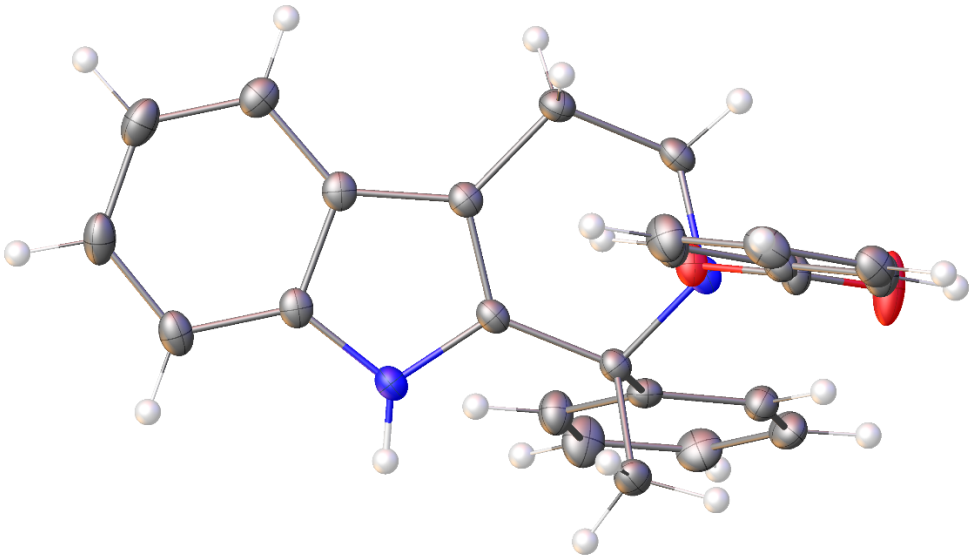


**Figure S5.**

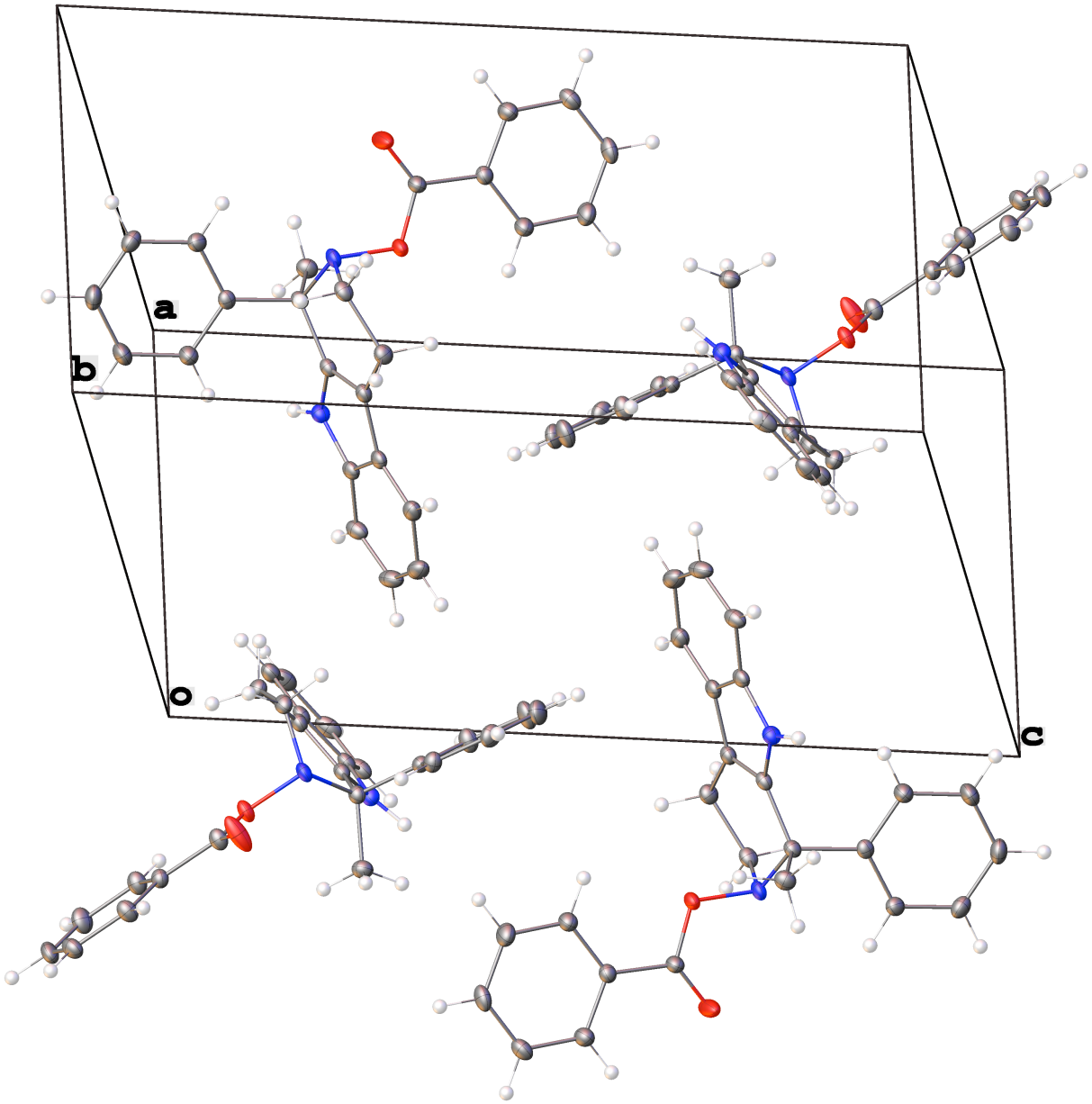


**Table S5 Fractional Atomic Coordinates ($\times 10^4$) and Equivalent Isotropic Displacement Parameters ($Å^2 \times 10^3$) for 0732_LC. $U_{eq}$ is defined as 1/3 of of the trace of the orthogonalised $U_{IJ}$ tensor.**

| Atom | *x* | *y* | *z* | U(eq) |
|---|---|---|---|---|
| O1 | 6999.6(11) | 9878.1(9) | 3763.2(6) | 44.7(3) |
| O2 | 5319.8(9) | 8576.2(7) | 3788.4(4) | 21.14(19) |
| N1 | 4605.3(10) | 9014.0(8) | 3041.3(5) | 19.6(2) |
| N2 | 2857.5(11) | 6247.6(8) | 2543.7(6) | 19.7(2) |
| C1 | 8660.9(15) | 7893.7(11) | 6232.5(7) | 28.2(3) |
| C2 | 9230.2(14) | 8749.2(11) | 5878.8(7) | 26.7(3) |
| C3 | 8516.7(13) | 9131.1(11) | 5176.5(7) | 25.5(3) |
| C4 | 7235.5(13) | 8654.7(10) | 4824.9(7) | 20.0(3) |
| C5 | 6664.0(14) | 7788.5(11) | 5180.9(7) | 24.9(3) |
| C6 | 7388.1(15) | 7409.4(12) | 5883.4(7) | 30.6(3) |
| C7 | 6534.7(13) | 9117.4(10) | 4071.8(7) | 21.8(3) |
| C8 | 3314.0(13) | 9552.4(10) | 3198.6(7) | 21.3(3) |
| C9 | 2336.9(13) | 8814.1(10) | 3563.5(7) | 21.8(3) |
| C10 | 2234.2(12) | 7693.4(10) | 3203.8(6) | 19.2(3) |
| C11 | 1283.0(12) | 6792.8(10) | 3261.5(6) | 20.2(3) |
| C12 | 113.0(13) | 6652.2(11) | 3616.3(7) | 24.6(3) |
| C13 | -566.8(14) | 5638.2(12) | 3559.1(8) | 30.2(3) |
| C14 | -110.9(14) | 4763.9(11) | 3151.5(8) | 30.2(3) |
| C15 | 1018.2(13) | 4879.7(11) | 2782.5(7) | 25.5(3) |
| C16 | 1707.2(12) | 5903.2(10) | 2841.2(7) | 20.3(3) |
| C17 | 3152.9(12) | 7336.2(10) | 2761.2(6) | 17.9(2) |
| C18 | 4301.6(12) | 8025.4(10) | 2526.3(6) | 18.5(3) |
| C19 | 5678.6(13) | 7361.2(11) | 2562.6(7) | 24.0(3) |
| C20 | 3827.8(12) | 8499.1(10) | 1714.9(6) | 18.9(2) |
| C21 | 4516.4(13) | 9414.3(10) | 1481.4(7) | 22.5(3) |
| C22 | 4110.7(14) | 9831.7(11) | 747.6(7) | 26.8(3) |
| C23 | 3033.0(15) | 9332.9(12) | 227.3(7) | 30.8(3) |
| C24 | 2358.0(15) | 8417.2(13) | 451.0(7) | 33.9(3) |
| C25 | 2743.7(14) | 8003.9(11) | 1189.4(7) | 26.5(3) |

**Table S6 Anisotropic Displacement Parameters ($Å^2 \times 10^3$) for 0732_LC. The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+\ldots]$.**

| Atom | $U_{11}$ | $U_{22}$ | $U_{33}$ | $U_{23}$ | $U_{13}$ | $U_{12}$ |
|---|---|---|---|---|---|---|
| O1 | 41.8(6) | 49.2(7) | 34.0(6) | 22.7(5) | -14.7(5) | -27.1(5) |
| O2 | 22.2(4) | 22.5(4) | 15.7(4) | 3.6(3) | -3.5(3) | -4.7(4) |
| N1 | 21.7(5) | 20.0(5) | 14.1(5) | 1.5(4) | -3.6(4) | -0.1(4) |

| | | | | | | |
|---|---|---|---|---|---|---|
| N2 | 22.2(5) | 16.6(5) | 19.6(5) | -1.3(4) | 2.0(4) | -0.2(4) |
| C1 | 35.6(7) | 28.0(7) | 17.5(6) | 1.8(5) | -3.4(5) | 7.0(6) |
| C2 | 23.3(6) | 27.4(7) | 25.7(7) | -2.3(5) | -4.0(5) | 1.0(5) |
| C3 | 23.6(6) | 25.9(7) | 25.2(6) | 3.5(5) | -0.2(5) | -3.7(5) |
| C4 | 22.0(6) | 19.8(6) | 17.5(6) | -0.8(5) | 2.1(5) | -0.4(5) |
| C5 | 27.1(7) | 24.2(7) | 21.7(6) | 0.8(5) | 1.0(5) | -5.5(5) |
| C6 | 39.4(8) | 27.6(7) | 23.6(7) | 6.7(6) | 3.1(6) | -3.4(6) |
| C7 | 22.0(6) | 21.8(6) | 20.1(6) | 0.9(5) | 0.0(5) | -5.3(5) |
| C8 | 25.1(6) | 17.4(6) | 19.7(6) | -3.2(5) | 0.1(5) | 1.2(5) |
| C9 | 23.4(6) | 21.8(6) | 20.0(6) | -3.4(5) | 3.9(5) | 0.8(5) |
| C10 | 19.7(6) | 20.6(6) | 15.6(6) | 0.3(5) | -0.7(4) | 0.4(5) |
| C11 | 19.6(6) | 22.4(6) | 15.9(6) | 3.3(5) | -3.0(4) | -0.1(5) |
| C12 | 19.7(6) | 31.7(7) | 20.7(6) | 3.1(5) | 0.1(5) | 0.8(5) |
| C13 | 19.3(6) | 38.5(8) | 31.3(7) | 9.3(6) | 1.4(5) | -3.5(6) |
| C14 | 22.5(6) | 25.9(7) | 38.0(8) | 7.9(6) | -4.1(6) | -6.1(5) |
| C15 | 23.4(6) | 20.8(6) | 28.0(7) | 2.5(5) | -5.2(5) | -1.4(5) |
| C16 | 19.0(6) | 21.1(6) | 17.7(6) | 3.4(5) | -3.7(4) | -0.2(5) |
| C17 | 19.5(6) | 16.4(6) | 15.7(5) | -0.2(4) | -1.6(4) | 1.3(5) |
| C18 | 19.3(6) | 17.9(6) | 17.3(6) | -1.7(5) | 1.0(5) | -1.0(5) |
| C19 | 20.1(6) | 24.5(7) | 26.8(6) | -0.6(5) | 2.8(5) | 1.9(5) |
| C20 | 18.4(6) | 21.1(6) | 17.3(6) | -1.6(5) | 3.8(4) | 2.7(5) |
| C21 | 22.9(6) | 24.5(7) | 20.2(6) | -2.3(5) | 4.8(5) | -2.7(5) |
| C22 | 32.4(7) | 26.5(7) | 24.1(7) | 2.4(5) | 11.7(5) | -1.5(6) |
| C23 | 36.5(8) | 37.9(8) | 18.0(6) | 4.9(6) | 5.0(5) | 1.5(6) |
| C24 | 33.8(7) | 42.6(9) | 21.0(7) | 0.4(6) | -4.9(6) | -8.4(6) |
| C25 | 28.0(7) | 28.2(7) | 21.8(6) | 1.0(5) | 0.8(5) | -6.8(5) |

**Table S7 Bond Lengths for 0732_LC.**

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| O1 | C7 | 1.1988(15) | C10 | C17 | 1.3621(16) |
| O2 | N1 | 1.4699(12) | C11 | C12 | 1.4011(17) |
| O2 | C7 | 1.3423(14) | C11 | C16 | 1.4125(17) |
| N1 | C8 | 1.4715(16) | C12 | C13 | 1.3785(19) |
| N1 | C18 | 1.4970(15) | C13 | C14 | 1.398(2) |
| N2 | C16 | 1.3774(16) | C14 | C15 | 1.3789(19) |
| N2 | C17 | 1.3811(15) | C15 | C16 | 1.3927(17) |
| C1 | C2 | 1.3757(19) | C17 | C18 | 1.5020(16) |
| C1 | C6 | 1.3835(19) | C18 | C19 | 1.5327(16) |
| C2 | C3 | 1.3816(17) | C18 | C20 | 1.5379(16) |
| C3 | C4 | 1.3871(17) | C20 | C21 | 1.3899(17) |

| | | | | | |
|---|---|---|---|---|---|
| C4 | C5 | 1.3886(17) | C20 | C25 | 1.3884(17) |
| C4 | C7 | 1.4861(16) | C21 | C22 | 1.3838(17) |
| C5 | C6 | 1.3839(18) | C22 | C23 | 1.3816(19) |
| C8 | C9 | 1.5263(17) | C23 | C24 | 1.377(2) |
| C9 | C10 | 1.4897(17) | C24 | C25 | 1.3875(18) |
| C10 | C11 | 1.4333(17) | | | |

**Table S8 Bond Angles for 0732_LC.**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| C7 | O2 | N1 | 112.37(9) | C13 | C12 | C11 | 118.79(12) |
| O2 | N1 | C8 | 104.12(8) | C12 | C13 | C14 | 121.00(12) |
| O2 | N1 | C18 | 105.64(8) | C15 | C14 | C13 | 121.77(12) |
| C8 | N1 | C18 | 113.50(9) | C14 | C15 | C16 | 117.26(13) |
| C16 | N2 | C17 | 108.24(10) | N2 | C16 | C11 | 108.12(10) |
| C2 | C1 | C6 | 120.22(12) | N2 | C16 | C15 | 129.85(12) |
| C1 | C2 | C3 | 119.68(12) | C15 | C16 | C11 | 122.02(12) |
| C2 | C3 | C4 | 120.45(12) | N2 | C17 | C18 | 124.57(10) |
| C3 | C4 | C5 | 119.84(11) | C10 | C17 | N2 | 110.05(11) |
| C3 | C4 | C7 | 117.03(11) | C10 | C17 | C18 | 125.37(11) |
| C5 | C4 | C7 | 123.12(11) | N1 | C18 | C17 | 109.47(9) |
| C6 | C5 | C4 | 119.30(12) | N1 | C18 | C19 | 109.15(9) |
| C1 | C6 | C5 | 120.51(12) | N1 | C18 | C20 | 105.49(9) |
| O1 | C7 | O2 | 124.84(11) | C17 | C18 | C19 | 111.76(10) |
| O1 | C7 | C4 | 123.99(11) | C17 | C18 | C20 | 111.78(9) |
| O2 | C7 | C4 | 111.17(10) | C19 | C18 | C20 | 108.98(9) |
| N1 | C8 | C9 | 115.66(10) | C21 | C20 | C18 | 120.44(10) |
| C10 | C9 | C8 | 109.80(10) | C25 | C20 | C18 | 121.18(11) |
| C11 | C10 | C9 | 130.11(11) | C25 | C20 | C21 | 118.34(11) |
| C17 | C10 | C9 | 122.71(11) | C22 | C21 | C20 | 120.67(12) |
| C17 | C10 | C11 | 107.13(11) | C23 | C22 | C21 | 120.65(12) |
| C12 | C11 | C10 | 134.41(12) | C24 | C23 | C22 | 119.04(12) |
| C12 | C11 | C16 | 119.13(11) | C23 | C24 | C25 | 120.66(12) |
| C16 | C11 | C10 | 106.45(10) | C24 | C25 | C20 | 120.64(12) |

**Table S9 Hydrogen Atom Coordinates (Å×10$^4$) and Isotropic Displacement Parameters (Å$^2$×10$^3$) for 0732_LC.**

| Atom | *x* | *y* | *z* | U(eq) |
|---|---|---|---|---|
| H2 | 3224(17) | 5863(13) | 2194(9) | 38(4) |

| | | | | |
|---|---|---|---|---|
| H1 | 9143.41 | 7634.58 | 6718.1 | 34 |
| H2A | 10109.62 | 9075.67 | 6116.31 | 32 |
| H3 | 8906.19 | 9724.18 | 4932.64 | 31 |
| H5 | 5785.19 | 7459.68 | 4944.77 | 30 |
| H6 | 7008.29 | 6812.02 | 6127.7 | 37 |
| H8A | 2759.99 | 9845.98 | 2711.07 | 26 |
| H8B | 3606.64 | 10193.68 | 3540.8 | 26 |
| H9A | 2719.61 | 8747.24 | 4119.57 | 26 |
| H9B | 1377.46 | 9152.23 | 3492.66 | 26 |
| H12 | -206.01 | 7244.91 | 3891.22 | 30 |
| H13 | -1357.14 | 5532.15 | 3800.41 | 36 |
| H14 | -591.76 | 4071.31 | 3127.98 | 36 |
| H15 | 1313.99 | 4285.65 | 2499.87 | 31 |
| H19A | 6443.37 | 7862.04 | 2484.15 | 36 |
| H19B | 5528.51 | 6791.82 | 2162.19 | 36 |
| H19C | 5944.22 | 7005.1 | 3064.82 | 36 |
| H21 | 5273.26 | 9756.64 | 1829.22 | 27 |
| H22 | 4577.82 | 10467.61 | 600.06 | 32 |
| H23 | 2761.7 | 9617.57 | -277.38 | 37 |
| H24 | 1620.69 | 8064.81 | 96.26 | 41 |
| H25 | 2261.41 | 7375.99 | 1336.77 | 32 |

**Crystal Structure of 24**

**General information**: The diffraction data were measured at 100 K on a Bruker D8 VENTURE diffractometer equipped with a microfocus Mo-target X-ray tube ($\lambda$ = 0.71073 Å) and PHOTON 100 CMOS detector. Data were collected using $\phi$ and $\omega$ scans to survey a hemisphere of reciprocal space. Data reduction and integration were performed with the Bruker APEX3 software package (Bruker AXS, version 2017.3-0, 2018). Data were scaled and corrected for absorption effects using the multi-scan procedure as implemented in SADABS (Bruker AXS, version 2014/5, Krause, Herbst-Irmer, Sheldrick & Stalke, *J. Appl. Cryst.* **2015**, *48*, 3-10). The structure was solved by SHELXT (Version 2014/5: Sheldrick, G. M. *Acta Crystallogr*. **2015**, ***A71***, 3-8) and refined by a full-matrix least-squares procedure using OLEX2 (O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann. J. Appl. Crystallogr. **2009**, *42*, 339-341) (XL refinement program version 2018/3, *Sheldrick, G. M. Acta Crystallogr.* **2015**, *C71*, 3-8). Crystallographic data and details of the data collection and structure refinement are listed in Table S10.

**Specific details for structure refinement**: All atoms were refined with anisotropic thermal parameters. Hydrogen atoms were included in idealized positions for structure factor calculations except an H-atom attached to an indole nitrogen atom. This hydrogen atom was located in the difference Fourier map and allowed to be freely refined with the thermal parameter being constrained to be 1.2 times of the Ueq value of the N atom. All structures are drawn with thermal ellipsoids at 50% probability.

**Table S10 Crystal data and structure refinement for mo_0877_tes.**

| | |
|---|---|
| Identification code | mo_0877_tes |
| Empirical formula | $C_{25}H_{23}N_3O_2$ |
| Formula weight | 397.46 |
| Temperature/K | 100(2) |
| Crystal system | triclinic |
| Space group | P-1 |
| a/Å | 7.7539(3) |
| b/Å | 10.3038(5) |
| c/Å | 13.4620(6) |
| α/° | 107.202(2) |
| β/° | 98.294(2) |
| γ/° | 96.619(2) |
| Volume/Å$^3$ | 1002.39(8) |
| Z | 2 |
| $\rho_{calc}$g/cm$^3$ | 1.317 |
| μ/mm$^{-1}$ | 0.085 |
| F(000) | 420.0 |
| Crystal size/mm$^3$ | 0.41 × 0.28 × 0.14 |
| Radiation | MoKα (λ = 0.71073) |
| 2Θ range for data collection/° | 4.406 to 56.86 |
| Index ranges | $-10 \leq h \leq 10$, $-13 \leq k \leq 13$, $-17 \leq l \leq 18$ |
| Reflections collected | 32154 |
| Independent reflections | 5032 [$R_{int}$ = 0.0383, $R_{sigma}$ = 0.0309] |
| Data/restraints/parameters | 5032/0/275 |
| Goodness-of-fit on $F^2$ | 1.032 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0425, $wR_2$ = 0.0965 |
| Final R indexes [all data] | $R_1$ = 0.0618, $wR_2$ = 0.1050 |
| Largest diff. peak/hole / e Å$^{-3}$ | 0.35/-0.21 |

$R_{int} = \Sigma \mid F_o^2 - \langle F_o^2 \rangle \mid / \Sigma \mid F_o^2 \mid$

$R1 = \Sigma \mid \mid F_o \mid - \mid F_c \mid \mid / \Sigma \mid F_o \mid$

$wR2 = [\Sigma [w (F_o^2 - F_c^2)^2] / \Sigma [w (F_o^2)^2]]^{1/2}$

Goodness-of-fit = $[\Sigma [w (F_o^2 - F_c^2)^2] / (n-p)]^{1/2}$

n: number of independent reflections; p: number of refined parameters

**Figure S6.**

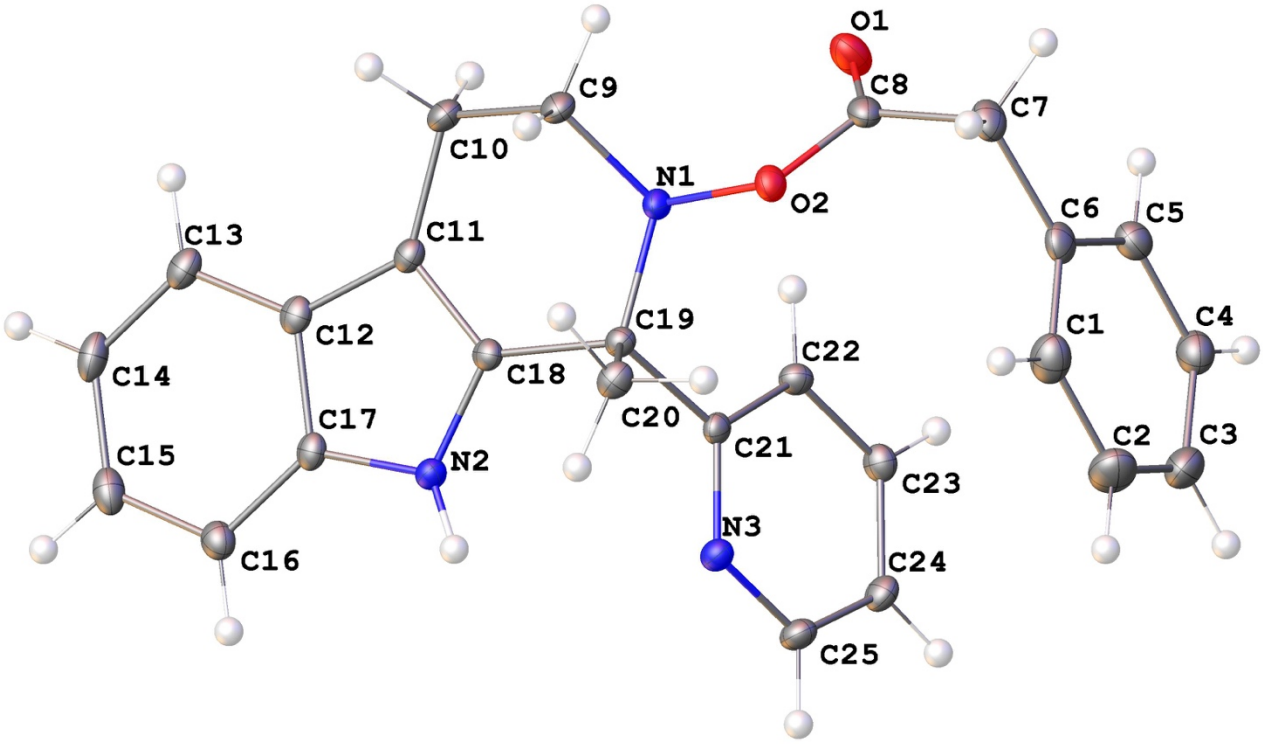



**Figure S7.**

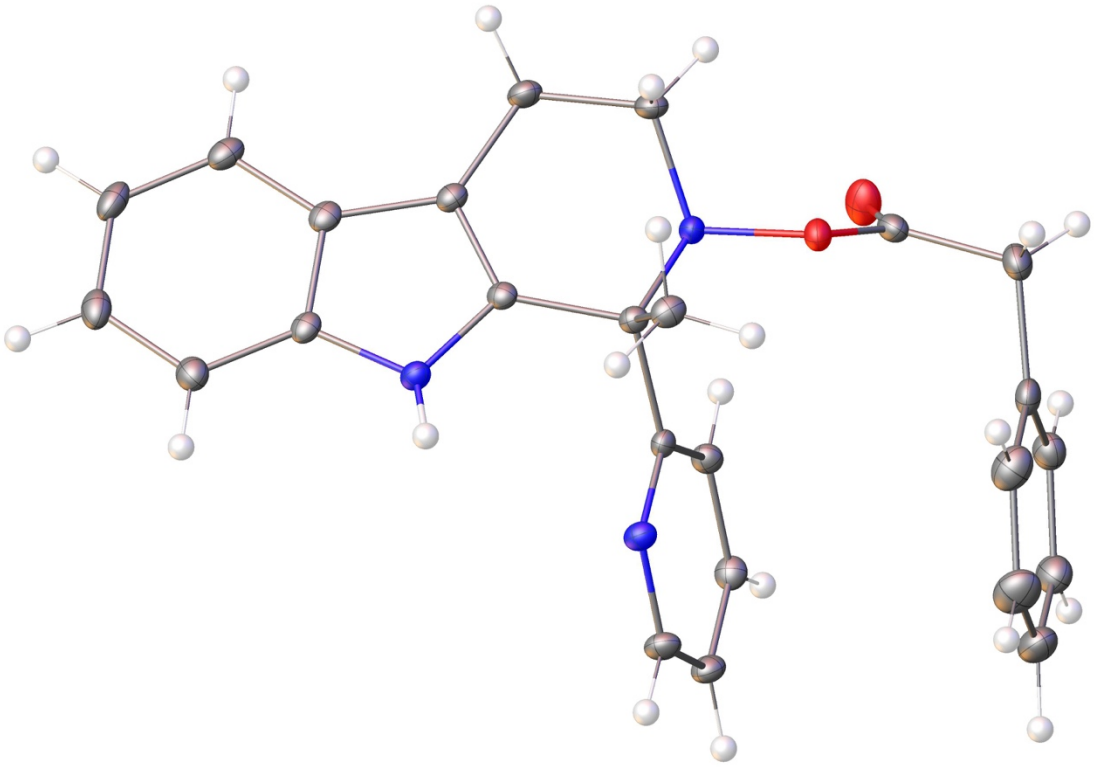


**Figure S8.**

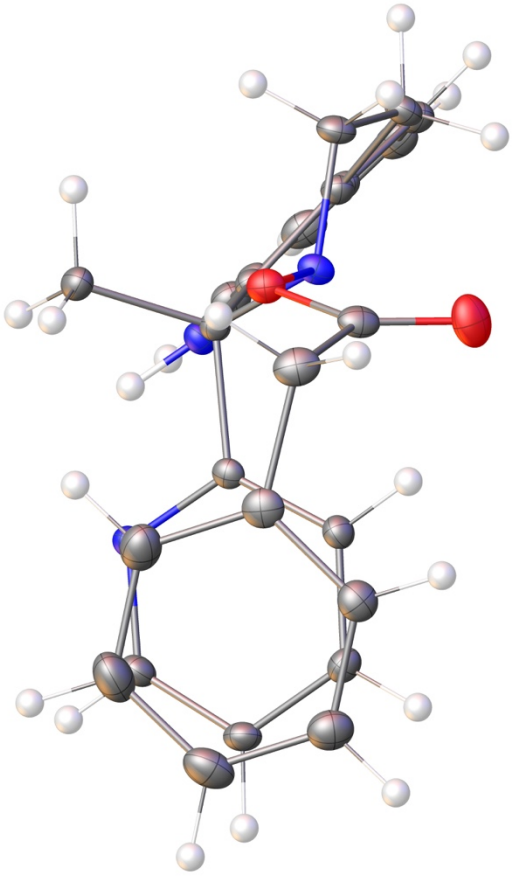


**Figure S9.**

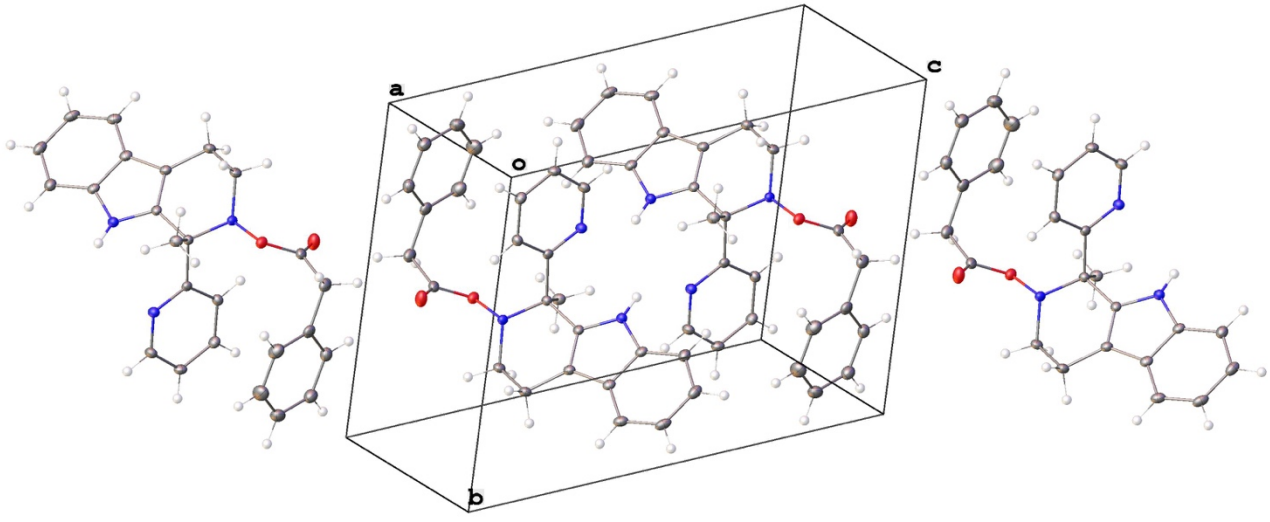


**Table S11 Fractional Atomic Coordinates ($\times 10^4$) and Equivalent Isotropic Displacement Parameters ($Å^2 \times 10^3$) for mo_0877_tes. $U_{eq}$ is defined as 1/3 of of the trace of the orthogonalised $U_{IJ}$ tensor.**

| Atom | *x* | *y* | *z* | U(eq) |
|---|---|---|---|---|
| O1 | 852.0(13) | 4003.5(10) | 8854.2(8) | 29.0(2) |
| O2 | 3530.4(11) | 4503.0(8) | 8440.0(6) | 17.86(19) |
| N1 | 2885.3(13) | 3408.5(10) | 7426.2(8) | 15.5(2) |
| N2 | 3566.4(13) | 2809.6(10) | 4698.6(8) | 15.8(2) |
| N3 | 3409.8(13) | 5829.6(10) | 5940.4(8) | 16.9(2) |
| C1 | 3639.7(19) | 7995.5(15) | 9185.7(12) | 30.3(3) |
| C2 | 3165(2) | 9020.7(15) | 8777.9(13) | 35.2(4) |
| C3 | 1459(2) | 9286.9(14) | 8712.2(12) | 31.0(3) |
| C4 | 225.6(19) | 8538.1(14) | 9063.5(11) | 26.7(3) |
| C5 | 694.6(18) | 7515.8(13) | 9470.8(10) | 23.1(3) |
| C6 | 2408.4(17) | 7232.8(13) | 9534.9(10) | 20.9(3) |
| C7 | 2867.4(18) | 6063.8(13) | 9937.3(10) | 23.6(3) |
| C8 | 2255.6(17) | 4732.0(13) | 9038.4(10) | 19.4(3) |
| C9 | 3464.3(17) | 2140.1(12) | 7550.3(10) | 18.5(3) |
| C10 | 2623.3(17) | 940.2(12) | 6551.9(10) | 19.3(3) |
| C11 | 2855.7(15) | 1364.0(12) | 5603.3(10) | 16.0(2) |
| C12 | 2675.4(15) | 568.6(12) | 4510.0(10) | 17.1(2) |
| C13 | 2106.3(16) | -826.8(12) | 3916.7(10) | 20.7(3) |
| C14 | 2068.3(17) | -1240.1(13) | 2840.1(11) | 23.3(3) |
| C15 | 2625.3(17) | -300.6(13) | 2335.6(10) | 23.6(3) |
| C16 | 3188.4(17) | 1084.1(13) | 2895.6(10) | 20.5(3) |
| C17 | 3168.9(15) | 1502.5(12) | 3974.3(9) | 16.2(2) |
| C18 | 3383.7(15) | 2701.0(12) | 5676.2(9) | 14.5(2) |
| C19 | 3697.5(15) | 3937.9(11) | 6659.2(9) | 14.3(2) |
| C20 | 5688.4(16) | 4527.1(12) | 7017.4(10) | 18.6(3) |
| C21 | 2647.7(15) | 5027.1(11) | 6433.7(9) | 13.7(2) |
| C22 | 984.6(16) | 5141.2(12) | 6693.4(9) | 16.6(2) |
| C23 | 106.5(16) | 6140.5(12) | 6459.6(10) | 18.2(3) |
| C24 | 880.6(16) | 6977.4(12) | 5956.6(10) | 18.8(3) |
| C25 | 2517.3(17) | 6777.2(12) | 5710.2(10) | 19.3(3) |

**Table S12 Anisotropic Displacement Parameters ($Å^2 \times 10^3$) for mo_0877_tes. The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+\ldots]$.**

| Atom | $U_{11}$ | $U_{22}$ | $U_{33}$ | $U_{23}$ | $U_{13}$ | $U_{12}$ |
|---|---|---|---|---|---|---|
| O1 | 32.2(5) | 28.3(5) | 25.0(5) | 4.7(4) | 13.3(4) | -0.9(4) |
| O2 | 20.9(4) | 17.3(4) | 13.9(4) | 2.8(3) | 2.4(3) | 4.6(3) |

| | | | | | | |
|---|---|---|---|---|---|---|
| N1 | 21.2(5) | 12.8(5) | 12.4(5) | 3.3(4) | 3.5(4) | 4.1(4) |
| N2 | 17.7(5) | 13.3(5) | 17.3(5) | 5.2(4) | 5.5(4) | 2.7(4) |
| N3 | 17.5(5) | 15.2(5) | 19.8(5) | 7.0(4) | 5.6(4) | 4.0(4) |
| C1 | 26.2(7) | 26.8(7) | 36.5(8) | 6.0(6) | 9.8(6) | 5.2(6) |
| C2 | 37.0(8) | 27.2(7) | 44.4(9) | 13.6(7) | 16.0(7) | 1.2(6) |
| C3 | 43.9(9) | 20.7(7) | 31.3(8) | 9.4(6) | 11.1(7) | 8.6(6) |
| C4 | 29.8(7) | 26.6(7) | 24.8(7) | 7.2(5) | 7.0(6) | 9.9(6) |
| C5 | 25.9(7) | 23.7(6) | 19.9(6) | 5.9(5) | 6.8(5) | 4.3(5) |
| C6 | 26.0(7) | 18.2(6) | 14.4(6) | -0.6(5) | 2.8(5) | 4.1(5) |
| C7 | 29.1(7) | 25.4(7) | 14.9(6) | 3.7(5) | 2.4(5) | 8.9(5) |
| C8 | 26.2(7) | 20.3(6) | 15.5(6) | 8.5(5) | 6.0(5) | 8.5(5) |
| C9 | 23.3(6) | 16.4(6) | 19.3(6) | 9.1(5) | 4.7(5) | 7.1(5) |
| C10 | 24.0(6) | 14.2(6) | 22.2(6) | 8.3(5) | 6.0(5) | 4.8(5) |
| C11 | 15.7(6) | 13.7(5) | 19.0(6) | 5.1(5) | 3.4(5) | 4.4(4) |
| C12 | 14.0(6) | 16.6(6) | 20.6(6) | 5.0(5) | 2.3(5) | 5.7(4) |
| C13 | 19.1(6) | 15.2(6) | 26.9(7) | 5.7(5) | 2.3(5) | 5.1(5) |
| C14 | 21.7(6) | 15.6(6) | 26.5(7) | -1.4(5) | -0.3(5) | 6.2(5) |
| C15 | 23.7(7) | 24.9(7) | 18.9(6) | 0.6(5) | 2.1(5) | 10.0(5) |
| C16 | 21.4(6) | 21.8(6) | 19.3(6) | 6.0(5) | 4.9(5) | 7.6(5) |
| C17 | 13.9(6) | 15.0(5) | 19.1(6) | 3.4(5) | 2.8(5) | 5.3(4) |
| C18 | 13.9(5) | 15.2(5) | 16.3(6) | 6.0(4) | 4.3(4) | 5.4(4) |
| C19 | 14.8(5) | 13.5(5) | 15.8(6) | 5.5(4) | 3.7(4) | 3.2(4) |
| C20 | 15.2(6) | 17.1(6) | 23.1(6) | 6.4(5) | 2.5(5) | 2.5(5) |
| C21 | 16.0(6) | 11.2(5) | 12.3(5) | 1.8(4) | 1.8(4) | 1.9(4) |
| C22 | 17.0(6) | 16.5(6) | 17.4(6) | 6.7(5) | 4.2(5) | 2.0(5) |
| C23 | 15.0(6) | 20.1(6) | 19.6(6) | 5.3(5) | 4.4(5) | 4.8(5) |
| C24 | 20.4(6) | 15.7(6) | 21.9(6) | 7.3(5) | 3.0(5) | 6.5(5) |
| C25 | 21.7(6) | 16.1(6) | 23.7(6) | 10.3(5) | 6.4(5) | 4.0(5) |

**Table S13 Bond Lengths for mo_0877_tes.**

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| O1 | C8 | 1.1971(16) | C9 | C10 | 1.5293(17) |
| O2 | N1 | 1.4654(12) | C10 | C11 | 1.4939(17) |
| O2 | C8 | 1.3613(15) | C11 | C12 | 1.4347(17) |
| N1 | C9 | 1.4766(15) | C11 | C18 | 1.3614(16) |
| N1 | C19 | 1.4838(15) | C12 | C13 | 1.4046(17) |
| N2 | C17 | 1.3785(15) | C12 | C17 | 1.4135(17) |
| N2 | C18 | 1.3792(15) | C13 | C14 | 1.3793(19) |
| N3 | C21 | 1.3414(15) | C14 | C15 | 1.401(2) |
| N3 | C25 | 1.3420(15) | C15 | C16 | 1.3855(18) |

| | | | | | |
|---|---|---|---|---|---|
| C1 | C2 | 1.388(2) | C16 | C17 | 1.3901(17) |
| C1 | C6 | 1.3874(19) | C18 | C19 | 1.5076(16) |
| C2 | C3 | 1.378(2) | C19 | C20 | 1.5428(16) |
| C3 | C4 | 1.382(2) | C19 | C21 | 1.5347(16) |
| C4 | C5 | 1.3837(19) | C21 | C22 | 1.3927(16) |
| C5 | C6 | 1.3891(19) | C22 | C23 | 1.3835(17) |
| C6 | C7 | 1.5166(18) | C23 | C24 | 1.3805(17) |
| C7 | C8 | 1.5081(17) | C24 | C25 | 1.3801(17) |

**Table S14 Bond Angles for mo_0877_tes.**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| C8 | O2 | N1 | 112.35(9) | C17 | C12 | C11 | 106.67(10) |
| O2 | N1 | C9 | 107.01(8) | C14 | C13 | C12 | 119.16(12) |
| O2 | N1 | C19 | 103.77(8) | C13 | C14 | C15 | 121.19(12) |
| C9 | N1 | C19 | 114.55(9) | C16 | C15 | C14 | 121.17(12) |
| C17 | N2 | C18 | 107.90(10) | C15 | C16 | C17 | 117.37(12) |
| C21 | N3 | C25 | 117.50(10) | N2 | C17 | C12 | 108.10(10) |
| C6 | C1 | C2 | 120.57(14) | N2 | C17 | C16 | 129.30(11) |
| C3 | C2 | C1 | 120.14(14) | C16 | C17 | C12 | 122.60(11) |
| C2 | C3 | C4 | 119.72(14) | N2 | C18 | C19 | 122.50(10) |
| C3 | C4 | C5 | 120.27(13) | C11 | C18 | N2 | 110.71(10) |
| C4 | C5 | C6 | 120.51(13) | C11 | C18 | C19 | 126.78(11) |
| C1 | C6 | C5 | 118.79(12) | N1 | C19 | C18 | 103.81(9) |
| C1 | C6 | C7 | 121.68(12) | N1 | C19 | C20 | 114.74(10) |
| C5 | C6 | C7 | 119.48(12) | N1 | C19 | C21 | 107.39(9) |
| C8 | C7 | C6 | 108.00(10) | C18 | C19 | C20 | 110.45(9) |
| O1 | C8 | O2 | 124.81(11) | C18 | C19 | C21 | 109.18(9) |
| O1 | C8 | C7 | 125.84(12) | C21 | C19 | C20 | 110.93(9) |
| O2 | C8 | C7 | 109.32(11) | N3 | C21 | C19 | 115.69(10) |
| N1 | C9 | C10 | 108.29(10) | N3 | C21 | C22 | 122.28(11) |
| C11 | C10 | C9 | 108.87(10) | C22 | C21 | C19 | 121.99(10) |
| C12 | C11 | C10 | 131.26(11) | C23 | C22 | C21 | 118.91(11) |
| C18 | C11 | C10 | 122.12(11) | C24 | C23 | C22 | 119.34(11) |
| C18 | C11 | C12 | 106.59(11) | C25 | C24 | C23 | 117.94(11) |
| C13 | C12 | C11 | 134.87(12) | N3 | C25 | C24 | 124.00(11) |
| C13 | C12 | C17 | 118.43(11) | | | | |

**Crystal Structure of 51**

**General information**: The diffraction data were measured at 100 K on a Bruker D8 VENTURE diffractometer equipped with a microfocus Mo-target X-ray tube ($\lambda$ = 0.71073 Å) and PHOTON 100 CMOS detector. Data were collected using ω scans to survey a sphere of reciprocal space. Data reduction and integration were performed with the Bruker APEX3 software package (Bruker AXS, version 2017.3-0, 2018). Data were scaled and corrected for absorption effects using the multi-scan procedure as implemented in SADABS (Bruker AXS, version 2014/5, Krause, Herbst-Irmer, Sheldrick & Stalke, *J. Appl. Cryst.* **2015**, *48*, 3-10). The structure was solved by SHELXT (Version 2018/2: Sheldrick, G. M. *Acta Crystallogr*. **2015**, *A71*, 3-8) and refined by a full-matrix least-squares procedure using OLEX2 (O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann. J. Appl. Crystallogr. **2009**, *42*, 339-341) (XL refinement program version 2018/3, Sheldrick, G. M. Acta Crystallogr. **2015**, *C71*, 3-8). Crystallographic data and details of the data collection and structure refinement are listed in Table S15.

**Specific details for structure refinement**: All atoms were refined with anisotropic thermal parameters. All hydrogen atoms were included in idealized positions for structure factor calculations except the hydrogen atom of the NH group. This atom was found in the difference Fourier map and refined without geometric restraints. All structures are drawn with thermal ellipsoids at 50% probability.

**Table S15 Crystal data and structure refinement for 0953_TLC_Snyder_2.**

| | |
|---|---|
| Identification code | 0953_TLC_Snyder_2 |
| Empirical formula | $C_{25}H_{21}BrN_2O_2$ |
| Formula weight | 461.35 |
| Temperature/K | 100(2) |
| Crystal system | orthorhombic |
| Space group | $P2_12_12_1$ |
| a/Å | 9.8948(6) |
| b/Å | 10.3781(6) |
| c/Å | 20.5618(13) |
| α/° | 90 |
| β/° | 90 |
| γ/° | 90 |
| Volume/Å$^3$ | 2111.5(2) |
| Z | 4 |
| $\rho_{calc}$g/cm$^3$ | 1.451 |
| μ/mm$^{-1}$ | 1.971 |
| F(000) | 944.0 |
| Crystal size/mm$^3$ | 0.12 × 0.051 × 0.045 |
| Radiation | MoKα (λ = 0.71073) |
| 2Θ range for data collection/° | 4.396 to 57.446 |
| Index ranges | $-13 \leq h \leq 12$, $-14 \leq k \leq 13$, $-27 \leq l \leq 27$ |
| Reflections collected | 43364 |
| Independent reflections | 5432 [$R_{int}$ = 0.0474, $R_{sigma}$ = 0.0470] |
| Data/restraints/parameters | 5432/0/275 |
| Goodness-of-fit on $F^2$ | 1.056 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0338, $wR_2$ = 0.0616 |
| Final R indexes [all data] | $R_1$ = 0.0468, $wR_2$ = 0.0646 |
| Largest diff. peak/hole / e Å$^{-3}$ | 0.73/-0.36 |
| Flack parameter | 0.012(3) |

$R_{int} = \Sigma \mid F_o^2 - \langle F_o^2 \rangle \mid / \Sigma \mid F_o^2 \mid$

$R1 = \Sigma \mid \mid F_o \mid - \mid F_c \mid \mid / \Sigma \mid F_o \mid$

$wR2 = [\Sigma [w (F_o^2 - F_c^2)^2] / \Sigma [w (F_o^2)^2]]^{1/2}$

Goodness-of-fit = $[\Sigma [w (F_o^2 - F_c^2)^2] / (n-p)]^{1/2}$

n: number of independent reflections; p: number of refined parameters

**Figure S10.**

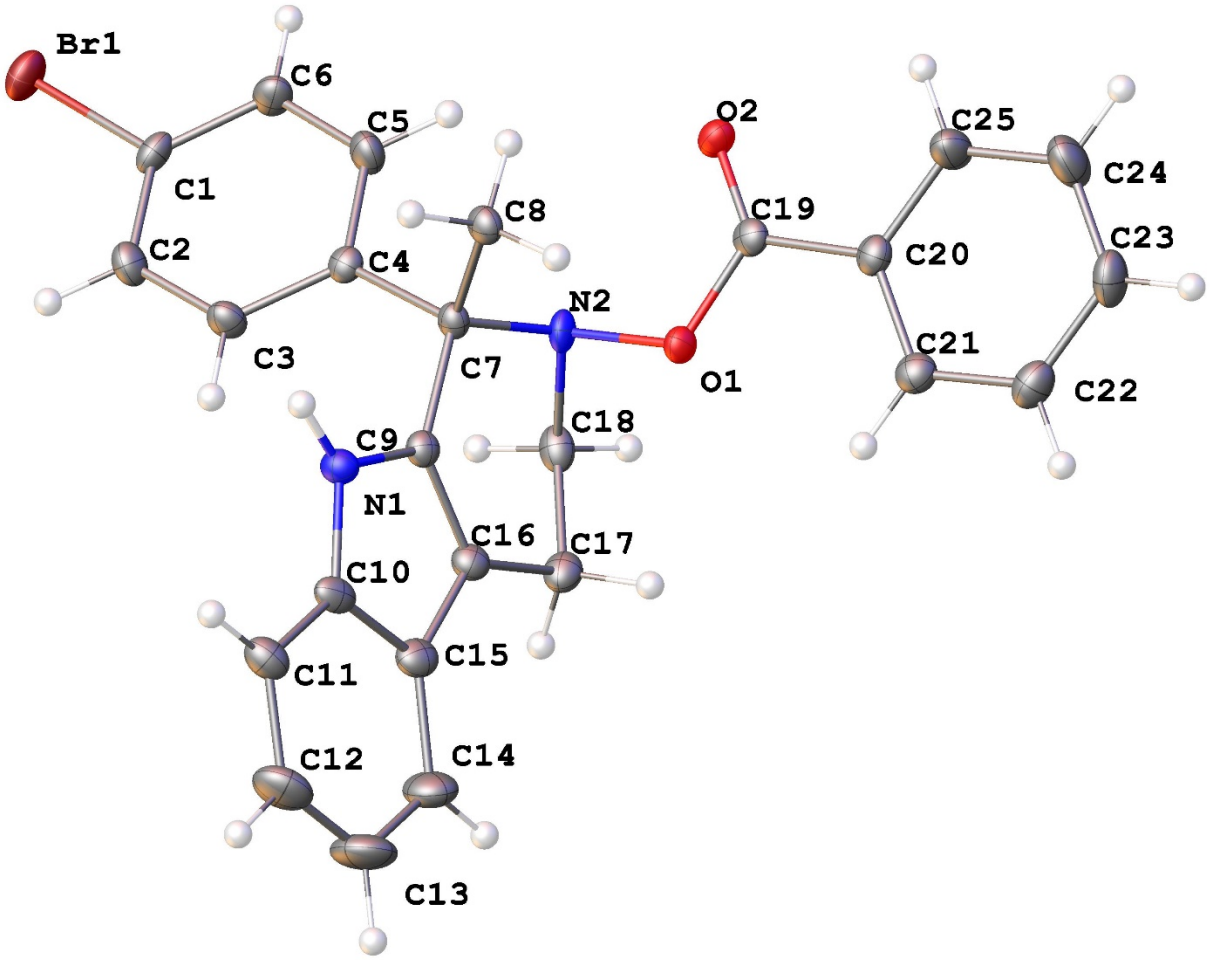

Br1
C6
C5
C1
C2
C4
C8
C3
C7
N2
O2
C19
C25
C24
C20
C23
C21
O1
C22
C18
C9
N1
C16
C17
C10
C15
C11
C12
C14
C13

**Figure S11.**

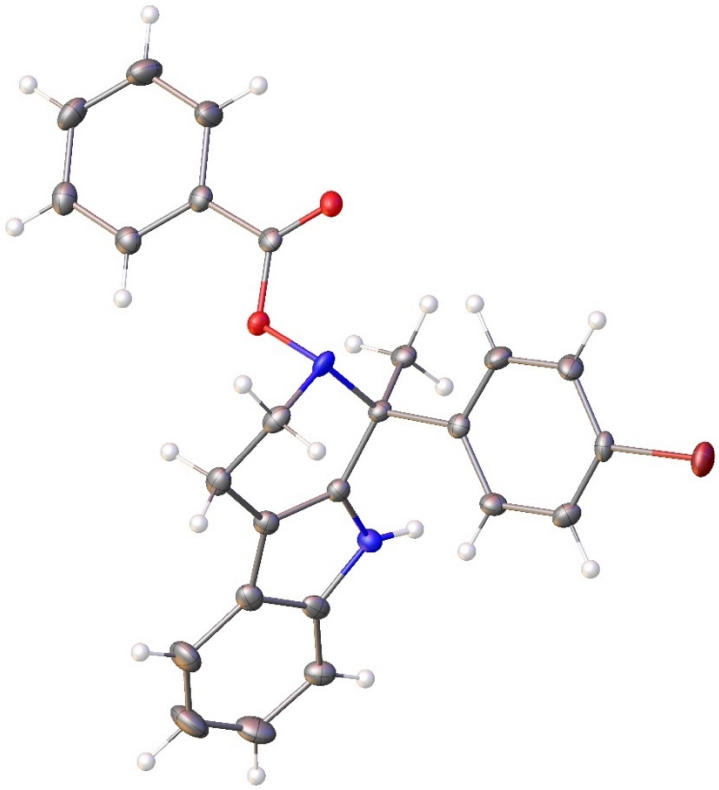


**Figure S12.**

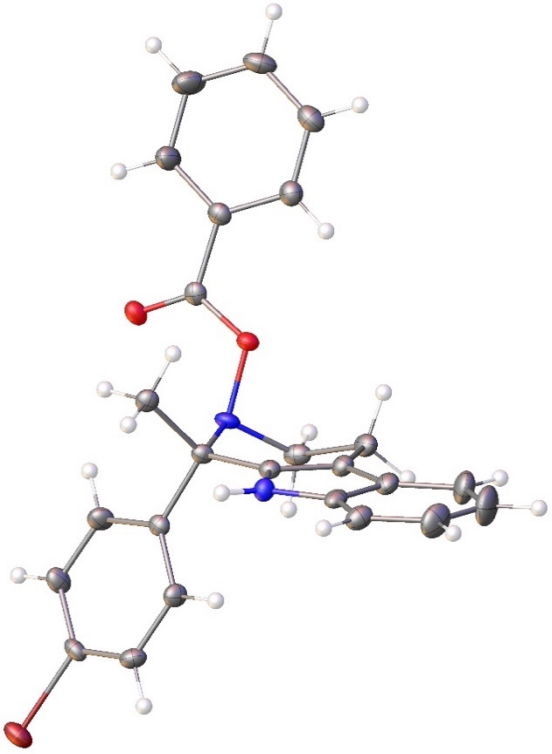


**Figure S13.**

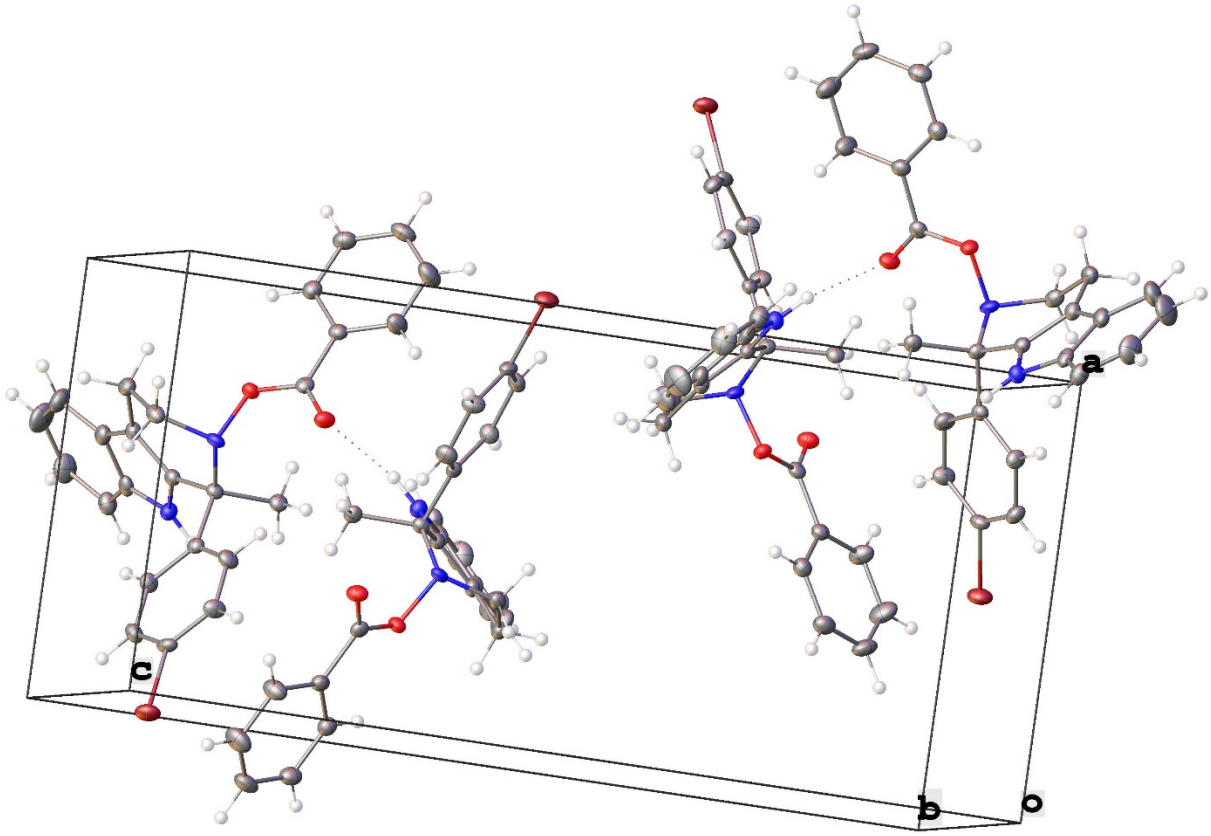


**Table S16 Fractional Atomic Coordinates ($\times 10^4$) and Equivalent Isotropic Displacement Parameters ($Å^2 \times 10^3$) for 0953_TLC_Snyder_2. $U_{eq}$ is defined as 1/3 of of the trace of the orthogonalised $U_{IJ}$ tensor.**

| Atom | *x* | *y* | *z* | U(eq) |
|---|---|---|---|---|
| Br1 | 10135.5(2) | 962.6(3) | 5898.3(2) | 25.65(9) |
| N1 | 5321(2) | 6189(2) | 6408.1(10) | 16.3(5) |
| N2 | 3748(2) | 2879(2) | 6445.2(11) | 16.1(5) |
| O1 | 2509.8(17) | 3232.6(17) | 6796.2(9) | 15.8(4) |
| O2 | 2994.1(19) | 1567.4(16) | 7467.1(9) | 19.3(4) |
| C1 | 8525(3) | 1865(3) | 6112.8(13) | 17.5(6) |
| C2 | 8302(3) | 3080(3) | 5866.3(14) | 19.9(6) |
| C3 | 7099(3) | 3706(3) | 6019.2(13) | 18.5(6) |
| C4 | 6147(3) | 3135(3) | 6417.0(13) | 14.6(6) |
| C5 | 6404(3) | 1909(3) | 6656.8(14) | 21.1(6) |
| C6 | 7585(3) | 1268(3) | 6509.1(14) | 20.8(6) |
| C7 | 4833(3) | 3820(2) | 6620.3(11) | 14.3(5) |
| C8 | 4871(3) | 4029(2) | 7360.6(12) | 17.1(5) |
| C9 | 4605(3) | 5080(2) | 6273.3(12) | 14.6(5) |
| C10 | 4844(3) | 7161(2) | 6009.2(11) | 17.8(5) |
| C11 | 5234(3) | 8443(2) | 5973.3(13) | 21.8(6) |
| C12 | 4554(4) | 9215(3) | 5537.5(15) | 33.6(8) |
| C13 | 3527(4) | 8717(3) | 5148.3(17) | 40.5(9) |
| C14 | 3148(3) | 7443(3) | 5177.3(15) | 30.7(7) |
| C15 | 3812(3) | 6636(3) | 5617.8(13) | 20.0(6) |
| C16 | 3692(3) | 5305(3) | 5794.9(13) | 16.6(6) |
| C17 | 2776(3) | 4269(3) | 5545.8(14) | 19.9(6) |
| C18 | 3353(3) | 2969(3) | 5754.7(13) | 19.4(6) |
| C19 | 2245(3) | 2418(2) | 7293.2(13) | 16.0(6) |
| C20 | 935(3) | 2716(3) | 7610.7(13) | 17.4(6) |
| C21 | 37(3) | 3631(2) | 7366.6(13) | 20.5(6) |
| C22 | -1180(3) | 3837(3) | 7669.9(15) | 24.1(6) |
| C23 | -1520(3) | 3148(3) | 8225.5(16) | 27.6(7) |
| C24 | -631(3) | 2260(3) | 8475.7(16) | 33.1(8) |
| C25 | 598(3) | 2042(3) | 8171.8(15) | 26.0(7) |

**Table S17 Anisotropic Displacement Parameters ($Å^2 \times 10^3$) for 0953_TLC_Snyder_2.** The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+\ldots]$.

| Atom | $U_{11}$ | $U_{22}$ | $U_{33}$ | $U_{23}$ | $U_{13}$ | $U_{12}$ |
|---|---|---|---|---|---|---|
| Br1 | 14.75(13) | 27.10(15) | 35.09(16) | -3.25(13) | 0.49(12) | 4.61(12) |
| N1 | 18.1(11) | 14.9(11) | 15.9(11) | 0.4(9) | -1.4(9) | -0.5(9) |
| N2 | 10.1(11) | 19.2(12) | 18.9(12) | -2.9(10) | 4.4(9) | -1.4(9) |
| O1 | 13.0(9) | 17.2(10) | 17.2(9) | 0.3(8) | 2.8(7) | 2.0(8) |
| O2 | 14.8(10) | 17.4(10) | 25.6(11) | 3.5(8) | -0.7(8) | 1.6(8) |
| C1 | 11.6(12) | 20.1(14) | 20.7(14) | -5.1(12) | -2.2(10) | 3.1(11) |
| C2 | 19.7(13) | 21.2(14) | 18.7(14) | -0.4(13) | 5.4(13) | -2.4(11) |
| C3 | 21.2(13) | 13.7(13) | 20.5(15) | 2.7(11) | 2.0(11) | 0.4(10) |
| C4 | 14.1(13) | 14.6(14) | 15.1(14) | -2.6(12) | -1.6(11) | -1.4(11) |
| C5 | 18.7(14) | 19.2(15) | 25.5(16) | 3.8(13) | 3.9(12) | -3.6(12) |
| C6 | 18.9(14) | 13.2(14) | 30.4(16) | 3.6(12) | 0.1(12) | 1.1(10) |
| C7 | 13.7(12) | 12.3(12) | 17.1(12) | 0.0(9) | 1.5(10) | -1.6(11) |
| C8 | 17.0(12) | 15.3(11) | 18.9(12) | 0.7(11) | 0.1(11) | -3.8(14) |
| C9 | 14.8(13) | 15.5(13) | 13.5(13) | -1.5(11) | 1.5(10) | -0.3(10) |
| C10 | 22.2(13) | 17.6(12) | 13.7(12) | 0.4(10) | 5.9(12) | 5.9(11) |
| C11 | 28.1(14) | 17.8(13) | 19.4(14) | 0.2(11) | 3.4(14) | -1.1(11) |
| C12 | 48(2) | 19.2(15) | 33.6(17) | 8.3(14) | 1.1(15) | 1.7(15) |
| C13 | 51(2) | 33(2) | 38(2) | 16.9(16) | -11.2(18) | 5.7(16) |
| C14 | 34.1(19) | 34.7(19) | 23.4(17) | 8.3(14) | -9.1(14) | 1.1(15) |
| C15 | 22.2(15) | 23.6(16) | 14.1(14) | -0.5(12) | 1.8(12) | 2.8(12) |
| C16 | 18.7(13) | 18.1(13) | 13.1(14) | -0.5(11) | 0.7(11) | 0.1(11) |
| C17 | 18.0(13) | 26.4(17) | 15.4(14) | -1.7(12) | -1.3(11) | -1.1(12) |
| C18 | 18.3(13) | 21.3(15) | 18.5(15) | -5.3(12) | 2.3(11) | -5.6(11) |
| C19 | 15.3(13) | 14.2(14) | 18.7(14) | -1.1(11) | -2.5(11) | -3.5(11) |
| C20 | 14.8(14) | 17.9(14) | 19.7(14) | -2.0(12) | -1.1(11) | -2.1(11) |
| C21 | 19.9(14) | 21.2(13) | 20.4(13) | -0.8(10) | -2.2(13) | -0.7(12) |
| C22 | 18.7(14) | 23.6(16) | 30.2(16) | -3.8(14) | -1.4(12) | 2.8(13) |
| C23 | 17.9(15) | 29.5(17) | 35.4(18) | -4.3(15) | 9.3(13) | -1.5(13) |
| C24 | 30.5(18) | 33.0(18) | 35.7(19) | 9.4(16) | 13.5(15) | 0.4(14) |
| C25 | 22.6(16) | 26.1(16) | 29.4(17) | 9.0(14) | 4.9(13) | 5.4(13) |

**Table S18 Bond Lengths for 0953_TLC_Snyder_2.**

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| Br1 | C1 | 1.900(3) | C9 | C16 | 1.356(4) |
| N1 | C9 | 1.379(3) | C10 | C11 | 1.388(4) |

**Table S18 Bond Lengths for 0953_TLC_Snyder_2.**

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| N1 | C10 | 1.383(3) | C10 | C15 | 1.410(4) |
| N2 | O1 | 1.468(3) | C11 | C12 | 1.377(4) |
| N2 | C7 | 1.496(3) | C12 | C13 | 1.393(5) |
| N2 | C18 | 1.475(4) | C13 | C14 | 1.376(5) |
| O1 | C19 | 1.352(3) | C14 | C15 | 1.397(4) |
| O2 | C19 | 1.207(3) | C15 | C16 | 1.434(4) |
| C1 | C2 | 1.378(4) | C16 | C17 | 1.497(4) |
| C1 | C6 | 1.383(4) | C17 | C18 | 1.526(4) |
| C2 | C3 | 1.391(4) | C19 | C20 | 1.484(4) |
| C3 | C4 | 1.381(4) | C20 | C21 | 1.393(4) |
| C4 | C5 | 1.387(4) | C20 | C25 | 1.390(4) |
| C4 | C7 | 1.540(4) | C21 | C22 | 1.373(4) |
| C5 | C6 | 1.379(4) | C22 | C23 | 1.389(4) |
| C7 | C8 | 1.538(3) | C23 | C24 | 1.374(5) |
| C7 | C9 | 1.506(3) | C24 | C25 | 1.386(4) |

**Table S19 Bond Angles for 0953_TLC_Snyder_2.**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| C9 | N1 | C10 | 108.3(2) | N1 | C10 | C15 | 107.7(2) |
| O1 | N2 | C7 | 108.50(19) | C11 | C10 | C15 | 122.8(2) |
| O1 | N2 | C18 | 103.68(19) | C12 | C11 | C10 | 117.2(3) |
| C18 | N2 | C7 | 112.3(2) | C11 | C12 | C13 | 121.0(3) |
| C19 | O1 | N2 | 112.14(19) | C14 | C13 | C12 | 122.1(3) |
| C2 | C1 | Br1 | 120.0(2) | C13 | C14 | C15 | 118.4(3) |
| C2 | C1 | C6 | 121.3(2) | C10 | C15 | C16 | 106.7(2) |
| C6 | C1 | Br1 | 118.7(2) | C14 | C15 | C10 | 118.7(3) |
| C1 | C2 | C3 | 118.8(3) | C14 | C15 | C16 | 134.7(3) |
| C4 | C3 | C2 | 121.1(3) | C9 | C16 | C15 | 107.1(3) |
| C3 | C4 | C5 | 118.6(3) | C9 | C16 | C17 | 121.9(2) |
| C3 | C4 | C7 | 122.6(2) | C15 | C16 | C17 | 131.0(3) |
| C5 | C4 | C7 | 118.8(2) | C16 | C17 | C18 | 108.2(2) |
| C6 | C5 | C4 | 121.3(3) | N2 | C18 | C17 | 115.2(2) |
| C5 | C6 | C1 | 118.9(3) | O1 | C19 | C20 | 111.8(2) |
| N2 | C7 | C4 | 103.81(18) | O2 | C19 | O1 | 124.2(3) |

**Table S19 Bond Angles for 0953_TLC_Snyder_2.**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| N2 | C7 | C8 | 110.4(2) | O2 | C19 | C20 | 124.0(3) |
| N2 | C7 | C9 | 110.2(2) | C21 | C20 | C19 | 122.7(3) |
| C8 | C7 | C4 | 108.2(2) | C25 | C20 | C19 | 118.0(2) |
| C9 | C7 | C4 | 113.5(2) | C25 | C20 | C21 | 119.3(3) |
| C9 | C7 | C8 | 110.5(2) | C22 | C21 | C20 | 120.1(3) |
| N1 | C9 | C7 | 123.5(2) | C21 | C22 | C23 | 120.4(3) |
| C16 | C9 | N1 | 110.2(2) | C24 | C23 | C22 | 119.9(3) |
| C16 | C9 | C7 | 126.3(2) | C23 | C24 | C25 | 120.2(3) |
| N1 | C10 | C11 | 129.5(3) | C24 | C25 | C20 | 120.2(3) |

**Crystal Structure of ±63a**

**General information**: The diffraction data were measured at 100 K on a Bruker D8 VENTURE diffractometer equipped with a microfocus Mo-target X-ray tube ($\lambda$ = 0.71073 Å) and PHOTON 100 CMOS detector. Data were collected using $\phi$ and $\omega$ scans to survey a hemisphere of reciprocal space. Data reduction and integration were performed with the Bruker APEX3 software package (Bruker AXS, version 2017.3-0, 2018). Data were scaled and corrected for absorption effects using the multi-scan procedure as implemented in SADABS (Bruker AXS, version 2014/5, Krause, Herbst-Irmer, Sheldrick & Stalke, *J. Appl. Cryst.* **2015**, *48*, 3-10). The structure was solved by SHELXT (Version 2014/5: Sheldrick, G. M. *Acta Crystallogr*. **2015**, *A71*, 3-8) and refined by a full-matrix least-squares procedure using OLEX2 (O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann. J. Appl. Crystallogr. **2009**, *42*, 339-341) (XL refinement program version 2018/3, *Sheldrick, G. M. Acta Crystallogr.* **2015**, *C71*, 3-8). Crystallographic data and details of the data collection and structure refinement are listed in Table S20.

**Specific details for structure refinement**: All atoms were refined with anisotropic thermal parameters. Hydrogen atoms were included in idealized positions for structure factor calculations except atom H1O and H1N attached to oxygen and nitrogen atoms, respectively. These hydrogen atom were located in the difference Fourier map. All structures are drawn with thermal ellipsoids at 50% probability.

**Table S20 Crystal data and structure refinement for 0812_T.**

| | |
|---|---|
| Identification code | 0812_T |
| Empirical formula | $C_{19}H_{20}N_2O$ |
| Formula weight | 292.37 |
| Temperature/K | 100(2) |
| Crystal system | triclinic |
| Space group | P-1 |
| a/Å | 8.5841(6) |
| b/Å | 10.1481(7) |
| c/Å | 10.2458(8) |
| α/° | 112.745(2) |
| β/° | 103.325(2) |
| γ/° | 99.118(2) |
| Volume/Å$^3$ | 769.88(10) |
| Z | 2 |
| $\rho_{calc}$g/cm$^3$ | 1.261 |
| μ/mm$^{-1}$ | 0.079 |
| F(000) | 312.0 |
| Crystal size/mm$^3$ | 0.6 × 0.27 × 0.15 |
| Radiation | MoKα (λ = 0.71073) |
| 2Θ range for data collection/° | 4.528 to 57.228 |
| Index ranges | $-11 \leq h \leq 11$, $-13 \leq k \leq 13$, $-13 \leq l \leq 13$ |
| Reflections collected | 28347 |
| Independent reflections | 3937 [$R_{int}$ = 0.0470, $R_{sigma}$ = 0.0339] |
| Data/restraints/parameters | 3937/2/209 |
| Goodness-of-fit on $F^2$ | 1.031 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0453, $wR_2$ = 0.1035 |
| Final R indexes [all data] | $R_1$ = 0.0654, $wR_2$ = 0.1129 |
| Largest diff. peak/hole / e Å$^{-3}$ | 0.39/-0.19 |

$R_{int} = \Sigma \mid F_o^2 - \langle F_o^2 \rangle \mid / \Sigma \mid F_o^2 \mid$

$R1 = \Sigma \mid \mid F_o \mid - \mid F_c \mid \mid / \Sigma \mid F_o \mid$

$wR2 = [\Sigma [w (F_o^2 - F_c^2)^2] / \Sigma [w (F_o^2)^2]]^{1/2}$

Goodness-of-fit = $[\Sigma [w (F_o^2 - F_c^2)^2] / (n-p)]^{1/2}$

n: number of independent reflections; p: number of refined parameters

**Figure S14.**

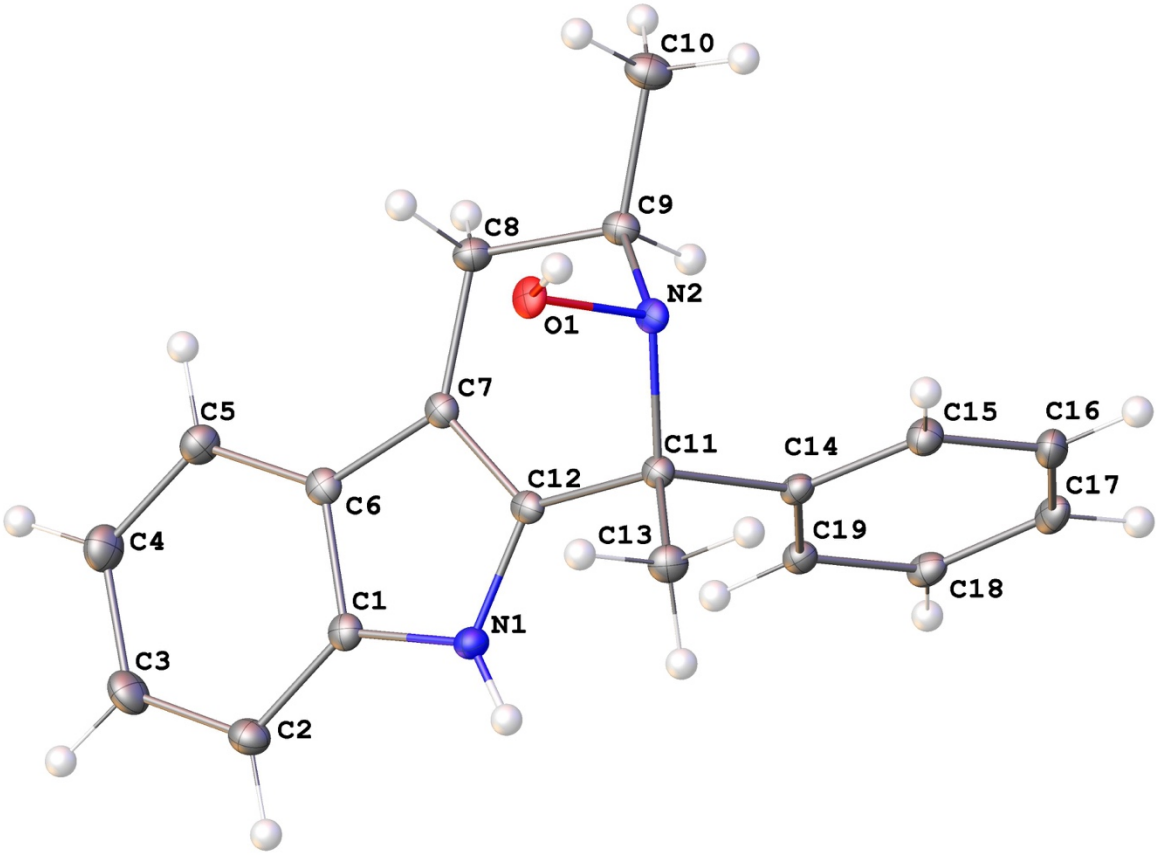



**Figure S15.**

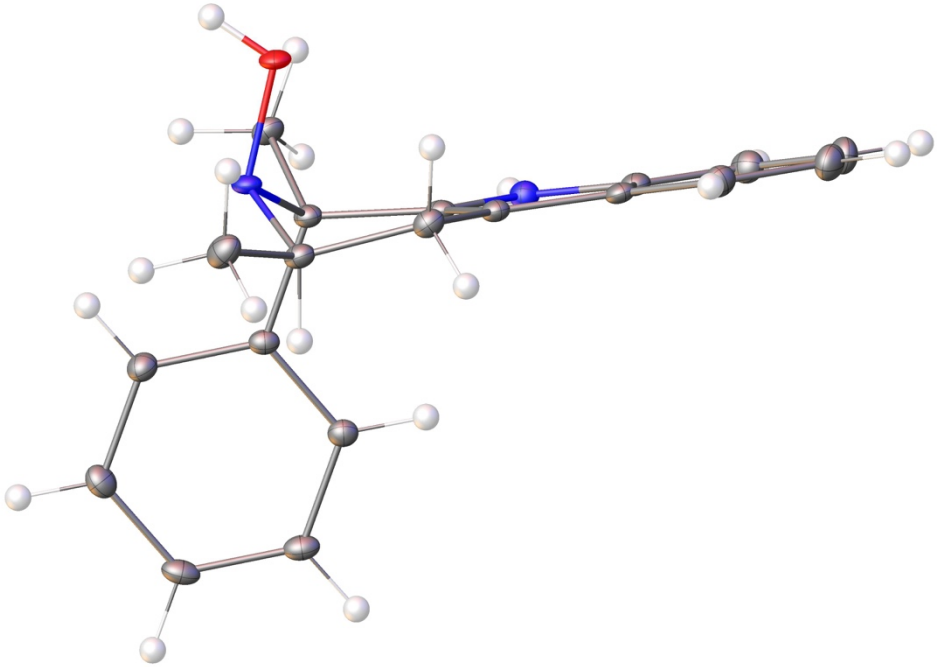


**Figure S16.**

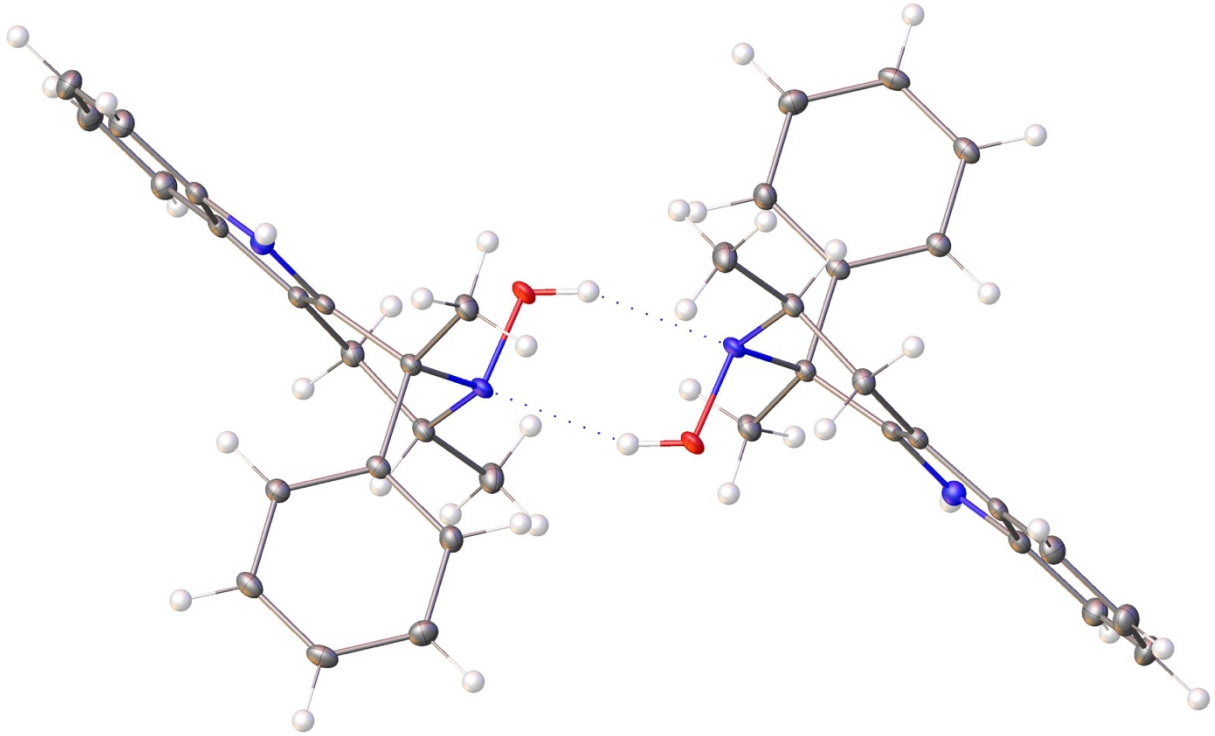


**Figure S17.**

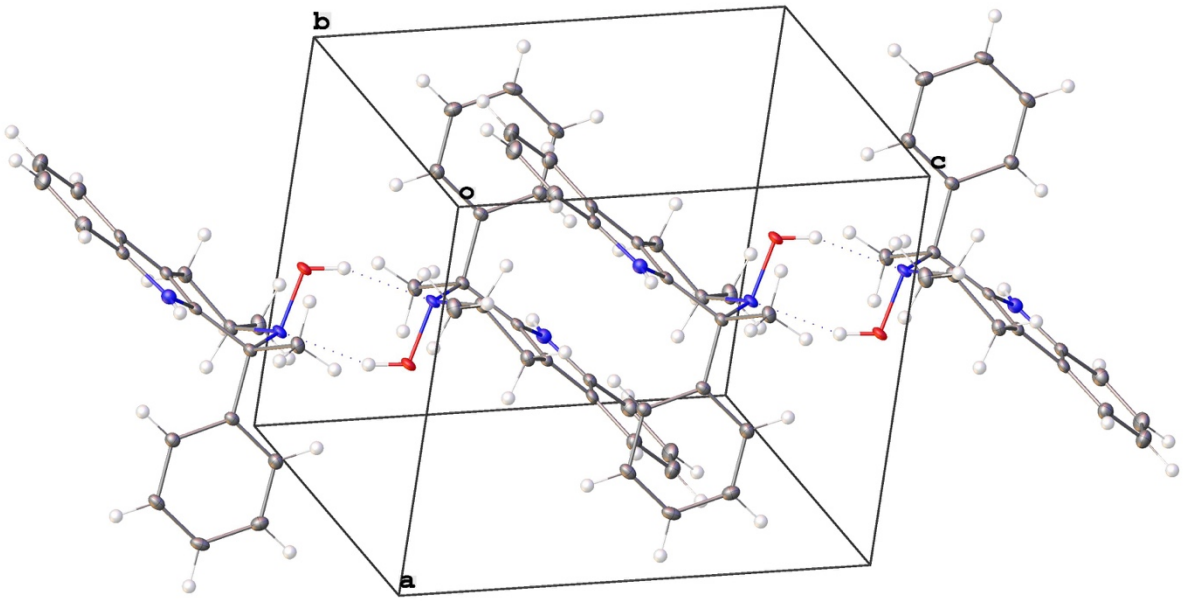


**Table S21 Fractional Atomic Coordinates ($\times 10^4$) and Equivalent Isotropic Displacement Parameters ($Å^2 \times 10^3$) for 0812_T. $U_{eq}$ is defined as 1/3 of of the trace of the orthogonalised $U_{IJ}$ tensor.**

| Atom | *x* | *y* | *z* | U(eq) |
|---|---|---|---|---|
| O1 | 3482.0(11) | 4598.0(10) | 8579.7(11) | 15.7(2) |
| N1 | 2427.0(13) | 1253.5(12) | 4546.7(12) | 14.2(2) |
| N2 | 5023.7(13) | 4481.5(12) | 8218.0(11) | 13.0(2) |
| C1 | 1299.0(16) | 1461.5(14) | 3489.4(14) | 14.2(3) |
| C2 | 41.8(17) | 430.7(15) | 2182.7(15) | 18.9(3) |
| C3 | -937.6(18) | 980.5(16) | 1361.2(15) | 22.4(3) |
| C4 | -674.6(18) | 2510.7(16) | 1811.9(15) | 21.9(3) |
| C5 | 585.3(17) | 3531.7(15) | 3095.3(15) | 18.2(3) |
| C6 | 1599.5(16) | 3007.0(14) | 3952.0(14) | 13.9(3) |
| C7 | 2965.5(15) | 3722.1(14) | 5320.9(13) | 13.2(3) |
| C8 | 3780.6(16) | 5331.1(14) | 6311.9(14) | 15.3(3) |
| C9 | 5321.1(16) | 5524.7(14) | 7536.4(14) | 14.2(3) |
| C10 | 6039.7(18) | 7125.4(15) | 8705.7(15) | 20.0(3) |
| C11 | 4716.8(15) | 2901.8(14) | 7066.2(13) | 12.6(2) |
| C12 | 3417.4(15) | 2638.4(14) | 5655.7(14) | 12.5(2) |
| C13 | 4162.7(17) | 1812.5(14) | 7672.4(14) | 16.4(3) |
| C14 | 6415.5(15) | 2782.5(13) | 6858.4(14) | 12.8(3) |
| C15 | 7819.1(16) | 3253.7(15) | 8106.9(14) | 16.3(3) |
| C16 | 9374.2(16) | 3186.7(15) | 7942.9(15) | 18.0(3) |
| C17 | 9546.6(16) | 2632.5(15) | 6528.8(15) | 17.6(3) |
| C18 | 8159.1(16) | 2135.7(14) | 5282.5(15) | 16.1(3) |
| C19 | 6598.8(16) | 2206.4(14) | 5446.6(14) | 14.1(3) |

**Table S22 Anisotropic Displacement Parameters ($Å^2 \times 10^3$) for 0812_T. The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+\ldots]$.**

| Atom | $U_{11}$ | $U_{22}$ | $U_{33}$ | $U_{23}$ | $U_{13}$ | $U_{12}$ |
|---|---|---|---|---|---|---|
| O1 | 13.2(4) | 22.2(5) | 15.2(5) | 7.7(4) | 10.1(4) | 7.3(4) |
| N1 | 15.2(5) | 12.8(5) | 14.3(5) | 5.1(4) | 5.4(4) | 4.5(4) |
| N2 | 11.4(5) | 15.4(5) | 13.5(5) | 5.2(4) | 8.1(4) | 4.0(4) |
| C1 | 13.8(6) | 17.7(6) | 13.6(6) | 7.0(5) | 7.7(5) | 5.6(5) |
| C2 | 20.2(7) | 16.9(6) | 16.5(6) | 4.5(5) | 6.2(5) | 3.6(5) |
| C3 | 20.5(7) | 24.9(7) | 14.4(6) | 5.1(6) | 1.7(5) | 2.6(6) |
| C4 | 22.9(7) | 27.6(7) | 17.1(7) | 11.8(6) | 5.0(6) | 9.1(6) |
| C5 | 20.6(7) | 19.2(7) | 18.0(6) | 10.2(5) | 7.5(5) | 6.6(5) |
| C6 | 14.3(6) | 17.6(6) | 12.4(6) | 6.7(5) | 8.4(5) | 4.7(5) |
| C7 | 12.5(6) | 15.9(6) | 12.5(6) | 6.0(5) | 6.8(5) | 3.7(5) |

| | | | | | | |
|---|---|---|---|---|---|---|
| C8 | 18.2(6) | 14.2(6) | 14.3(6) | 6.3(5) | 6.9(5) | 4.5(5) |
| C9 | 15.6(6) | 14.3(6) | 13.5(6) | 5.4(5) | 7.5(5) | 3.4(5) |
| C10 | 24.8(7) | 17.1(6) | 15.3(6) | 5.0(5) | 7.3(6) | 2.2(5) |
| C11 | 12.4(6) | 13.7(6) | 12.1(6) | 4.9(5) | 6.1(5) | 3.9(5) |
| C12 | 11.5(6) | 13.7(6) | 12.9(6) | 4.6(5) | 7.5(5) | 3.2(5) |
| C13 | 18.9(6) | 17.4(6) | 15.6(6) | 8.7(5) | 8.1(5) | 4.5(5) |
| C14 | 13.8(6) | 11.9(6) | 15.4(6) | 6.5(5) | 7.3(5) | 4.9(5) |
| C15 | 17.6(6) | 18.0(6) | 14.2(6) | 6.3(5) | 6.7(5) | 6.8(5) |
| C16 | 14.7(6) | 19.0(6) | 20.7(7) | 9.3(5) | 4.0(5) | 6.3(5) |
| C17 | 14.3(6) | 17.5(6) | 26.2(7) | 10.9(6) | 11.5(5) | 7.4(5) |
| C18 | 18.6(6) | 14.9(6) | 19.1(6) | 7.5(5) | 11.7(5) | 6.9(5) |
| C19 | 14.6(6) | 13.5(6) | 15.5(6) | 6.8(5) | 6.2(5) | 4.3(5) |

**Table S23 Bond Lengths for 0812_T.**

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| O1 | N2 | 1.4644(13) | C7 | C12 | 1.3577(18) |
| N1 | C1 | 1.3833(17) | C8 | C9 | 1.5243(18) |
| N1 | C12 | 1.3893(16) | C9 | C10 | 1.5137(18) |
| N2 | C9 | 1.4973(16) | C11 | C12 | 1.5059(17) |
| N2 | C11 | 1.5139(16) | C11 | C13 | 1.5279(17) |
| C1 | C2 | 1.3945(18) | C11 | C14 | 1.5380(17) |
| C1 | C6 | 1.4113(18) | C14 | C15 | 1.3967(18) |
| C2 | C3 | 1.383(2) | C14 | C19 | 1.3925(17) |
| C3 | C4 | 1.401(2) | C15 | C16 | 1.3922(18) |
| C4 | C5 | 1.381(2) | C16 | C17 | 1.3901(19) |
| C5 | C6 | 1.4028(18) | C17 | C18 | 1.3835(19) |
| C6 | C7 | 1.4331(18) | C18 | C19 | 1.3972(17) |
| C7 | C8 | 1.4883(17) | | | |

**Table S24 Bond Angles for 0812_T.**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| C1 | N1 | C12 | 108.46(11) | N2 | C9 | C10 | 111.98(10) |
| O1 | N2 | C9 | 106.12(9) | C10 | C9 | C8 | 111.78(11) |
| O1 | N2 | C11 | 107.41(9) | N2 | C11 | C13 | 109.87(10) |
| C9 | N2 | C11 | 109.43(9) | N2 | C11 | C14 | 105.52(9) |
| N1 | C1 | C2 | 130.51(12) | C12 | C11 | N2 | 108.53(10) |
| N1 | C1 | C6 | 107.53(11) | C12 | C11 | C13 | 111.39(10) |
| C2 | C1 | C6 | 121.96(12) | C12 | C11 | C14 | 113.00(10) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C3 | C2 | C1 | 117.36(13) | C13 | C11 | C14 | 108.35(10) |
| C2 | C3 | C4 | 121.56(13) | N1 | C12 | C11 | 125.12(11) |
| C5 | C4 | C3 | 121.09(13) | C7 | C12 | N1 | 109.71(11) |
| C4 | C5 | C6 | 118.64(13) | C7 | C12 | C11 | 125.05(11) |
| C1 | C6 | C7 | 106.94(11) | C15 | C14 | C11 | 119.81(11) |
| C5 | C6 | C1 | 119.37(12) | C19 | C14 | C11 | 121.67(11) |
| C5 | C6 | C7 | 133.67(12) | C19 | C14 | C15 | 118.52(11) |
| C6 | C7 | C8 | 130.13(12) | C16 | C15 | C14 | 120.63(12) |
| C12 | C7 | C6 | 107.34(11) | C17 | C16 | C15 | 120.31(12) |
| C12 | C7 | C8 | 122.49(11) | C18 | C17 | C16 | 119.56(12) |
| C7 | C8 | C9 | 109.98(10) | C17 | C18 | C19 | 120.15(12) |
| N2 | C9 | C8 | 112.73(10) | C14 | C19 | C18 | 120.80(12) |

**Crystal Structure of ±64**

**General information**: The diffraction data were measured at 100 K on a Bruker D8 VENTURE diffractometer equipped with a microfocus Mo-target X-ray tube ($\lambda$ = 0.71073 Å) and PHOTON 100 CMOS detector. Data were collected using $\phi$ and $\omega$ scans to survey a hemisphere of reciprocal space. Data reduction and integration were performed with the Bruker APEX3 software package (Bruker AXS, version 2017.3-0, 2018). Data were scaled and corrected for absorption effects using the multi-scan procedure as implemented in SADABS (Bruker AXS, version 2014/5, Krause, Herbst-Irmer, Sheldrick & Stalke, *J. Appl. Cryst.* **2015**, *48*, 3-10). The structure was solved by SHELXT (Version 2014/5: Sheldrick, G. M. *Acta Crystallogr*. **2015**, ***A71***, 3-8) and refined by a full-matrix least-squares procedure using OLEX2 (O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann. J. Appl. Crystallogr. **2009**, *42*, 339-341) (XL refinement program version 2018/3, *Sheldrick, G. M. Acta Crystallogr.* **2015**, *C71*, 3-8). Crystallographic data and details of the data collection and structure refinement are listed in Table S25.

**Specific details for structure refinement**: All atoms were refined with anisotropic thermal parameters. Hydrogen atoms were included in idealized positions for structure factor calculations except atom H1O and H3N attached to oxygen and nitrogen atoms, respectively. These hydrogen atom were located in the difference Fourier map. All structures are drawn with thermal ellipsoids at 50% probability.

**Table S25 Crystal data and structure refinement for 0814_t.**

| | |
|---|---|
| Identification code | 0814_t |
| Empirical formula | $C_{19}H_{17}N_3O$ |
| Formula weight | 303.35 |
| Temperature/K | 100(2) |
| Crystal system | monoclinic |
| Space group | $P2_1/c$ |
| a/Å | 8.5899(4) |
| b/Å | 18.3551(8) |
| c/Å | 10.2741(5) |
| α/° | 90 |
| β/° | 102.416(2) |
| γ/° | 90 |
| Volume/Å$^3$ | 1582.02(13) |
| Z | 4 |
| $\rho_{calc}$g/cm$^3$ | 1.274 |
| μ/mm$^{-1}$ | 0.081 |
| F(000) | 640.0 |
| Crystal size/mm$^3$ | 0.426 × 0.202 × 0.106 |
| Radiation | MoKα (λ = 0.71073) |
| 2Θ range for data collection/° | 4.438 to 61.224 |
| Index ranges | $-12 \leq h \leq 12$, $-26 \leq k \leq 25$, $-14 \leq l \leq 14$ |
| Reflections collected | 43653 |
| Independent reflections | 4749 [$R_{int}$ = 0.0455, $R_{sigma}$ = 0.0375] |
| Data/restraints/parameters | 4749/2/217 |
| Goodness-of-fit on $F^2$ | 1.044 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0477, $wR_2$ = 0.1095 |
| Final R indexes [all data] | $R_1$ = 0.0730, $wR_2$ = 0.1192 |
| Largest diff. peak/hole / e Å$^{-3}$ | 0.39/-0.21 |

$R_{int} = \Sigma \mid F_o^2 - \langle F_o^2 \rangle \mid / \Sigma \mid F_o^2 \mid$

$R1 = \Sigma \mid \mid F_o \mid - \mid F_c \mid \mid / \Sigma \mid F_o \mid$

$wR2 = [\Sigma [w (F_o^2 - F_c^2)^2] / \Sigma [w (F_o^2)^2]]^{1/2}$

Goodness-of-fit = $[\Sigma [w (F_o^2 - F_c^2)^2] / (n-p)]^{1/2}$

n: number of independent reflections; p: number of refined parameters

**Figure S18.**

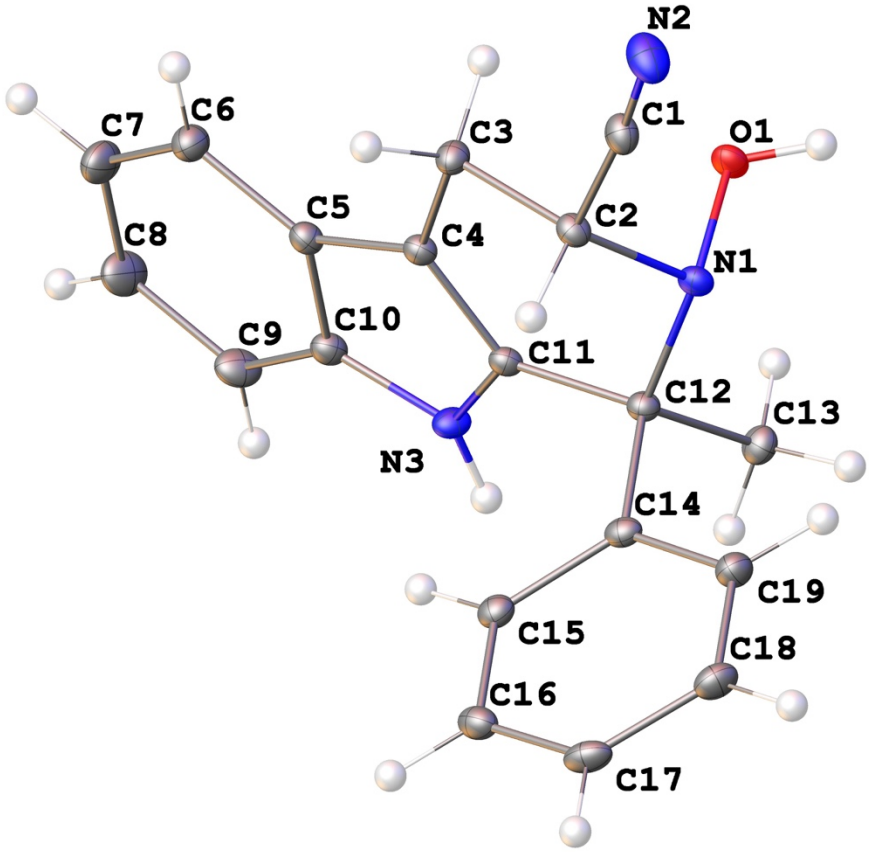



**Figure S19.**

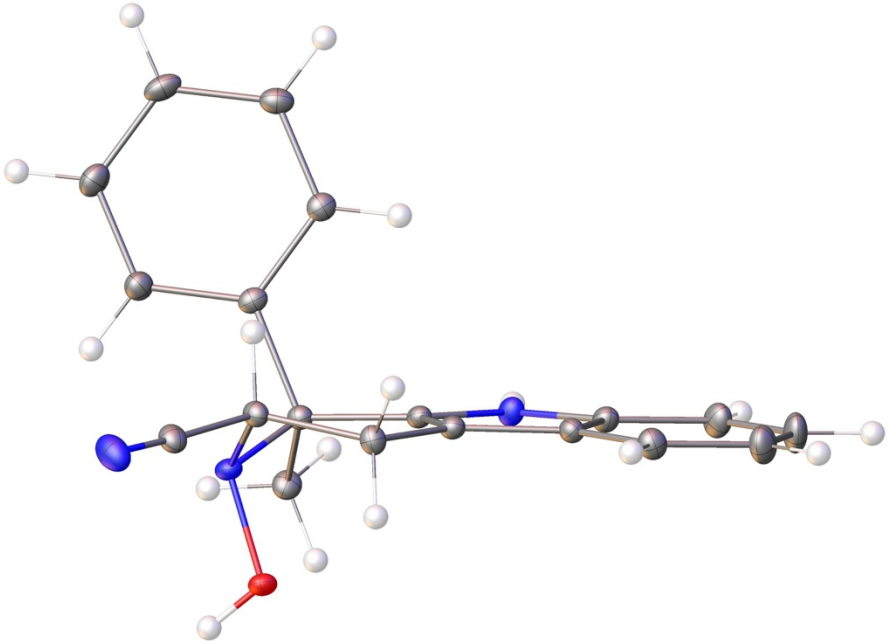


**Figure S20.**

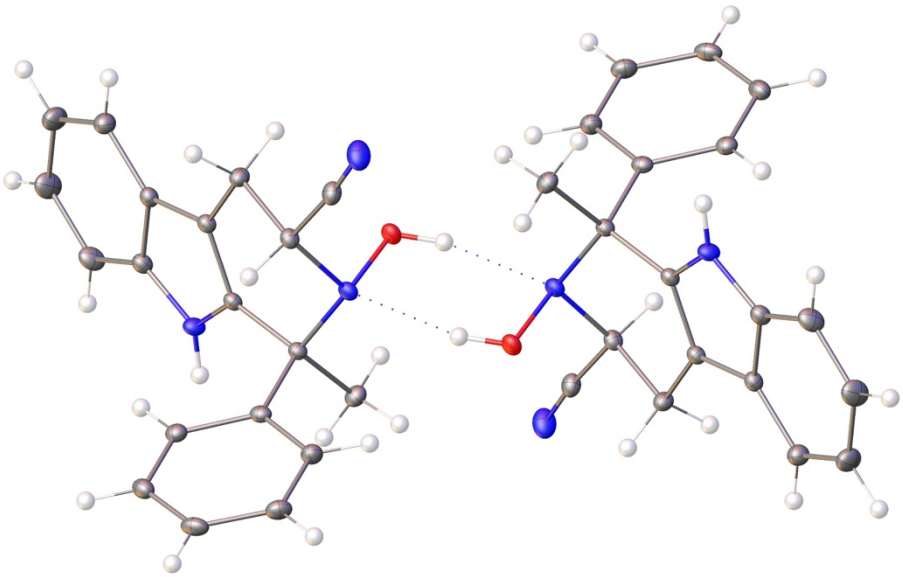


**Figure S21.**

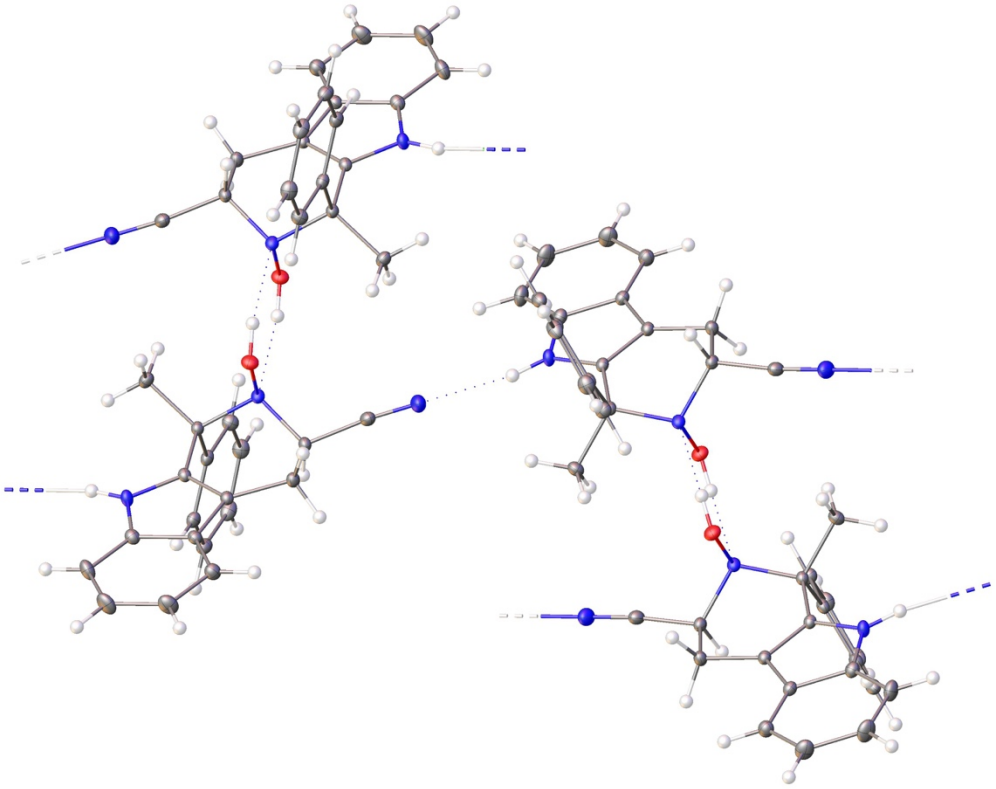


**Figure S22.**

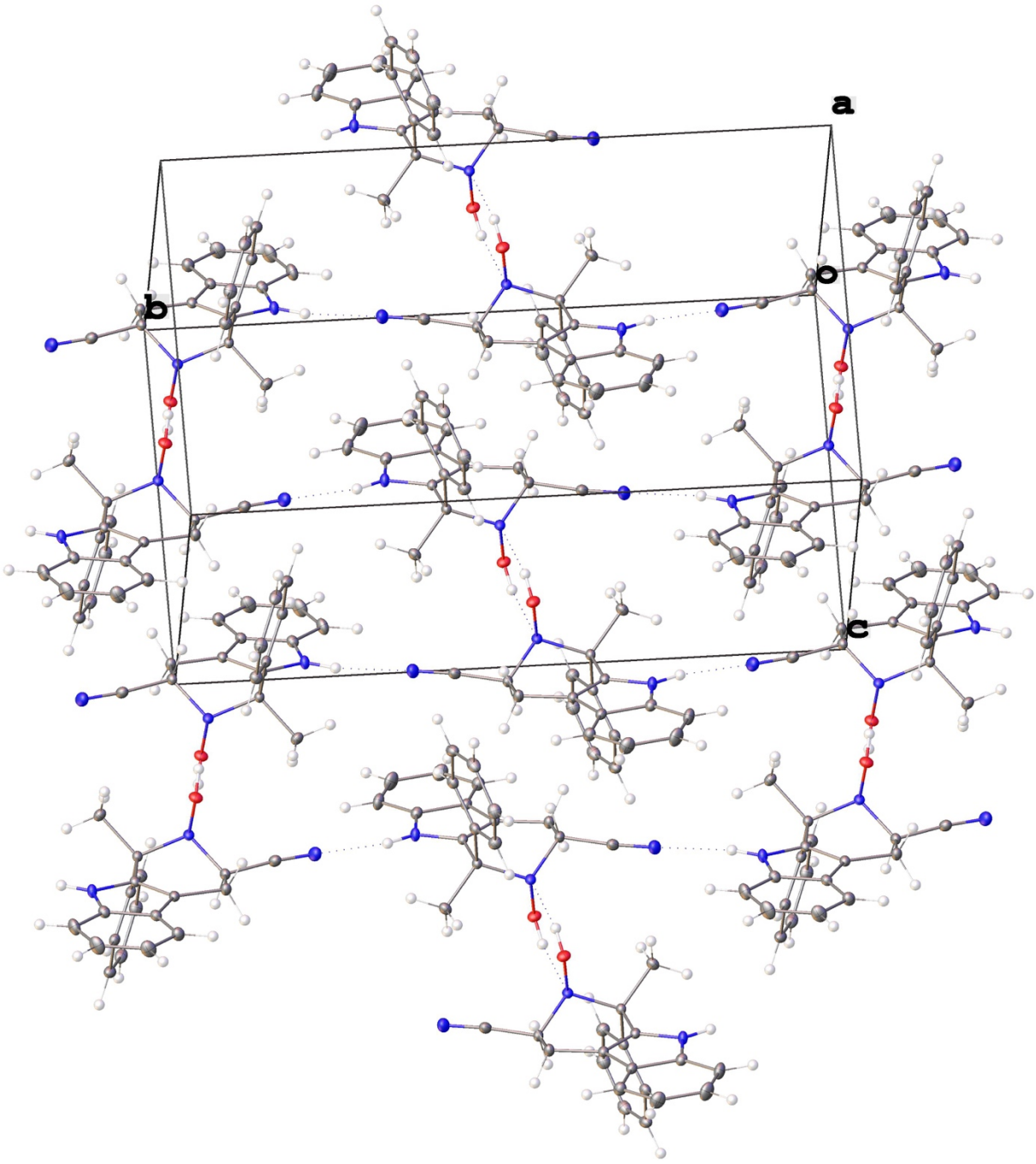


**Table S26 Fractional Atomic Coordinates ($\times 10^4$) and Equivalent Isotropic Displacement Parameters ($Å^2 \times 10^3$) for 0814_t. $U_{eq}$ is defined as 1/3 of of the trace of the orthogonalised $U_{IJ}$ tensor.**

| Atom | *x* | *y* | *z* | U(eq) |
|---|---|---|---|---|
| O1 | 3599.9(9) | 5129.1(5) | 8755.2(8) | 15.57(18) |
| N2 | 5571.5(14) | 3344.1(6) | 7926.7(11) | 24.4(2) |
| N3 | 3569.0(11) | 6790.8(5) | 6266.7(10) | 14.2(2) |
| N1 | 5172.6(11) | 5211.0(5) | 8459.6(9) | 12.5(2) |
| C1 | 5404.5(14) | 3954.9(6) | 7714.2(11) | 16.6(2) |
| C2 | 5174.5(14) | 4722.0(6) | 7306.2(11) | 13.4(2) |
| C3 | 3690.7(14) | 4794.3(6) | 6177.1(11) | 14.5(2) |
| C4 | 3388.3(13) | 5584.7(6) | 5913.6(11) | 12.3(2) |
| C5 | 2264.8(13) | 5933.3(6) | 4868.7(11) | 13.5(2) |
| C6 | 1124.9(14) | 5680.1(7) | 3773.6(12) | 18.0(2) |
| C7 | 198.5(16) | 6182.7(7) | 2960.4(13) | 23.6(3) |
| C8 | 375.2(16) | 6932.2(7) | 3215.3(13) | 25.0(3) |
| C9 | 1478.7(15) | 7197.1(7) | 4293.9(13) | 20.8(3) |
| C10 | 2418.4(13) | 6690.1(6) | 5116.5(11) | 14.8(2) |
| C11 | 4141.9(13) | 6117.2(6) | 6739.3(11) | 11.7(2) |
| C12 | 5350.6(13) | 5991.4(6) | 8018.1(11) | 12.1(2) |
| C13 | 5091.2(14) | 6509.4(6) | 9114.8(12) | 16.3(2) |
| C14 | 7075.7(13) | 6058.0(6) | 7850.9(11) | 13.5(2) |
| C15 | 7435.7(14) | 6342.4(6) | 6693.1(12) | 15.0(2) |
| C16 | 9005.9(14) | 6380.5(6) | 6543.4(12) | 17.3(2) |
| C17 | 10236.3(14) | 6137.9(7) | 7560.0(13) | 19.1(3) |
| C18 | 9894.0(14) | 5872.4(7) | 8725.4(12) | 19.1(3) |
| C19 | 8327.8(14) | 5833.2(7) | 8876.5(12) | 16.9(2) |

**Table S27 Anisotropic Displacement Parameters ($Å^2 \times 10^3$) for 0814_t. The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+\ldots]$.**

| Atom | $U_{11}$ | $U_{22}$ | $U_{33}$ | $U_{23}$ | $U_{13}$ | $U_{12}$ |
|---|---|---|---|---|---|---|
| O1 | 11.7(4) | 19.5(4) | 16.6(4) | 1.9(3) | 5.3(3) | -1.2(3) |
| N2 | 35.8(6) | 16.6(5) | 22.6(6) | 2.3(4) | 10.2(5) | 5.5(5) |
| N3 | 14.1(4) | 9.5(4) | 18.0(5) | 0.4(4) | 1.7(4) | -0.4(4) |
| N1 | 11.2(4) | 12.1(4) | 15.4(5) | 0.0(3) | 5.4(4) | -0.1(3) |
| C1 | 19.8(6) | 16.8(6) | 13.8(5) | 0.1(4) | 4.9(4) | 2.4(5) |
| C2 | 15.3(5) | 10.9(5) | 14.7(5) | 1.4(4) | 4.5(4) | 1.4(4) |
| C3 | 17.0(5) | 11.6(5) | 14.0(5) | -0.5(4) | 1.7(4) | -0.3(4) |
| C4 | 12.1(5) | 11.5(5) | 13.9(5) | 0.6(4) | 4.1(4) | 0.0(4) |
| C5 | 13.4(5) | 13.3(5) | 14.1(5) | 1.9(4) | 3.7(4) | 0.2(4) |

| | | | | | | |
|---|---|---|---|---|---|---|
| C6 | 19.0(6) | 16.9(6) | 17.3(6) | 0.3(4) | 2.1(5) | -1.6(4) |
| C7 | 22.0(6) | 25.3(7) | 19.6(6) | 3.5(5) | -4.0(5) | -2.2(5) |
| C8 | 22.5(6) | 22.7(6) | 25.9(7) | 9.7(5) | -3.8(5) | 2.4(5) |
| C9 | 20.1(6) | 14.3(5) | 27.0(6) | 6.2(5) | 2.4(5) | 1.4(5) |
| C10 | 13.0(5) | 14.5(5) | 16.8(5) | 2.0(4) | 3.4(4) | -0.4(4) |
| C11 | 10.6(5) | 11.0(5) | 14.1(5) | 1.0(4) | 3.8(4) | 0.0(4) |
| C12 | 12.4(5) | 10.6(5) | 13.6(5) | -0.2(4) | 3.4(4) | -0.5(4) |
| C13 | 17.7(6) | 16.2(5) | 14.9(5) | -3.2(4) | 3.5(4) | 1.0(4) |
| C14 | 12.7(5) | 11.4(5) | 16.7(5) | -3.2(4) | 3.7(4) | -1.3(4) |
| C15 | 15.2(5) | 13.5(5) | 16.0(5) | -3.0(4) | 2.9(4) | -1.2(4) |
| C16 | 18.1(6) | 16.4(5) | 19.0(6) | -2.8(4) | 7.8(5) | -3.4(4) |
| C17 | 12.3(5) | 18.4(6) | 27.7(6) | -6.0(5) | 6.5(5) | -3.3(4) |
| C18 | 13.8(5) | 19.2(6) | 22.6(6) | -2.3(5) | -0.1(5) | -1.2(4) |
| C19 | 15.2(5) | 18.1(5) | 16.8(5) | 0.0(4) | 2.1(4) | -1.7(4) |

**Table S28 Bond Lengths for 0814_t.**

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| O1 | N1 | 1.4548(12) | C6 | C7 | 1.3772(17) |
| N2 | C1 | 1.1454(16) | C7 | C8 | 1.4026(19) |
| N3 | C10 | 1.3803(15) | C8 | C9 | 1.3824(18) |
| N3 | C11 | 1.3798(14) | C9 | C10 | 1.3924(16) |
| N1 | C2 | 1.4869(14) | C11 | C12 | 1.5069(15) |
| N1 | C12 | 1.5203(14) | C12 | C13 | 1.5268(15) |
| C1 | C2 | 1.4701(16) | C12 | C14 | 1.5329(15) |
| C2 | C3 | 1.5336(15) | C14 | C15 | 1.3933(16) |
| C3 | C4 | 1.4884(15) | C14 | C19 | 1.3964(16) |
| C4 | C5 | 1.4310(15) | C15 | C16 | 1.3917(16) |
| C4 | C11 | 1.3631(15) | C16 | C17 | 1.3898(18) |
| C5 | C6 | 1.4024(16) | C17 | C18 | 1.3816(18) |
| C5 | C10 | 1.4132(16) | C18 | C19 | 1.3889(17) |

**Table S29 Bond Angles for 0814_t.**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| C11 | N3 | C10 | 108.47(9) | N3 | C10 | C9 | 130.17(11) |
| O1 | N1 | C2 | 105.32(8) | C9 | C10 | C5 | 121.88(11) |
| O1 | N1 | C12 | 108.48(8) | N3 | C11 | C12 | 124.81(10) |
| C2 | N1 | C12 | 108.28(8) | C4 | C11 | N3 | 109.74(10) |
| N2 | C1 | C2 | 174.53(13) | C4 | C11 | C12 | 125.37(10) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| N1 | C2 | C3 | 114.05(9) | N1 | C12 | C13 | 109.06(9) |
| C1 | C2 | N1 | 111.96(9) | N1 | C12 | C14 | 105.67(8) |
| C1 | C2 | C3 | 109.72(9) | C11 | C12 | N1 | 108.05(8) |
| C4 | C3 | C2 | 107.83(9) | C11 | C12 | C13 | 111.44(9) |
| C5 | C4 | C3 | 129.45(10) | C11 | C12 | C14 | 113.05(9) |
| C11 | C4 | C3 | 123.01(10) | C13 | C12 | C14 | 109.33(9) |
| C11 | C4 | C5 | 107.44(10) | C15 | C14 | C12 | 121.52(10) |
| C6 | C5 | C4 | 134.07(11) | C15 | C14 | C19 | 118.59(11) |
| C6 | C5 | C10 | 119.49(10) | C19 | C14 | C12 | 119.88(10) |
| C10 | C5 | C4 | 106.41(10) | C16 | C15 | C14 | 120.76(11) |
| C7 | C6 | C5 | 118.51(11) | C17 | C16 | C15 | 119.95(11) |
| C6 | C7 | C8 | 121.24(12) | C18 | C17 | C16 | 119.68(11) |
| C9 | C8 | C7 | 121.51(12) | C17 | C18 | C19 | 120.45(11) |
| C8 | C9 | C10 | 117.36(12) | C18 | C19 | C14 | 120.52(11) |
| N3 | C10 | C5 | 107.93(10) | | | | |

**Crystal Structure of ±65a**

**General information**: The diffraction data were measured at 100 K on a Bruker D8 VENTURE diffractometer equipped with a microfocus Mo-target X-ray tube ($\lambda$ = 0.71073 Å) and PHOTON 100 CMOS detector. Data were collected using $\phi$ and $\omega$ scans to survey a hemisphere of reciprocal space. Data reduction and integration were performed with the Bruker APEX3 software package (Bruker AXS, version 2017.3-0, 2018). Data were scaled and corrected for absorption effects using the multi-scan procedure as implemented in SADABS (Bruker AXS, version 2014/5, Krause, Herbst-Irmer, Sheldrick & Stalke, *J. Appl. Cryst.* **2015**, *48*, 3-10). The structure was solved by SHELXT (Version 2014/5: Sheldrick, G. M. *Acta Crystallogr*. **2015**, ***A71***, 3-8) and refined by a full-matrix least-squares procedure using OLEX2 (O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann. J. Appl. Crystallogr. **2009**, *42*, 339-341) (XL refinement program version 2018/3, *Sheldrick, G. M. Acta Crystallogr.* **2015**, *C71*, 3-8). Crystallographic data and details of the data collection and structure refinement are listed in Table S30.

**Specific details for structure refinement**: All atoms were refined with anisotropic thermal parameters. Hydrogen atoms were included in idealized positions for structure factor calculations except H-atoms attached to nitrogen atoms. These hydrogen atoms (H1 and H3) were located in the difference Fourier map and allowed to be refined at 0.88 Å within a default 0.02 Å standard deviation with their thermal parameters being constrained to be 1.2 times of the Ueq value of the N atoms. All structures are drawn with thermal ellipsoids at 50% probability.

**Table S30 Crystal data and structure refinement for 0869_tessa_top.**

| | |
|---|---|
| Identification code | 0869_tessa_top |
| Empirical formula | $C_{22}H_{22.3}N_2O_{3.15}$ |
| Formula weight | 365.12 |
| Temperature/K | 100(2) |
| Crystal system | monoclinic |
| Space group | $P2_1/c$ |
| a/Å | 20.9936(14) |
| b/Å | 10.3069(7) |
| c/Å | 17.3090(11) |
| α/° | 90 |
| β/° | 99.457(2) |
| γ/° | 90 |
| Volume/Å$^3$ | 3694.4(4) |
| Z | 8 |
| $\rho_{calc}$g/cm$^3$ | 1.313 |
| μ/mm$^{-1}$ | 0.088 |
| F(000) | 1548.0 |
| Crystal size/mm$^3$ | 0.22 × 0.16 × 0.12 |
| Radiation | MoKα (λ = 0.71073) |
| 2Θ range for data collection/° | 4.414 to 52.836 |
| Index ranges | -26 ≤ h ≤ 26, -12 ≤ k ≤ 12, -21 ≤ l ≤ 20 |
| Reflections collected | 96894 |
| Independent reflections | 7298 [$R_{int}$ = 0.0519, $R_{sigma}$ = 0.0343] |
| Data/restraints/parameters | 7298/2/504 |
| Goodness-of-fit on $F^2$ | 1.053 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0464, $wR_2$ = 0.0956 |
| Final R indexes [all data] | $R_1$ = 0.0758, $wR_2$ = 0.1049 |
| Largest diff. peak/hole / e Å$^{-3}$ | 0.30/-0.37 |

$R_{int} = \Sigma \mid F_o^2 - \langle F_o^2 \rangle \mid / \Sigma \mid F_o^2 \mid$

$R1 = \Sigma \mid \mid F_o \mid - \mid F_c \mid \mid / \Sigma \mid F_o \mid$

$wR2 = [\Sigma [w (F_o^2 - F_c^2)^2] / \Sigma [w (F_o^2)^2]]^{1/2}$

Goodness-of-fit = $[\Sigma [w (F_o^2 - F_c^2)^2] / (n-p)]^{1/2}$

n: number of independent reflections; p: number of refined parameters

**Figure S23.**

Independent unit

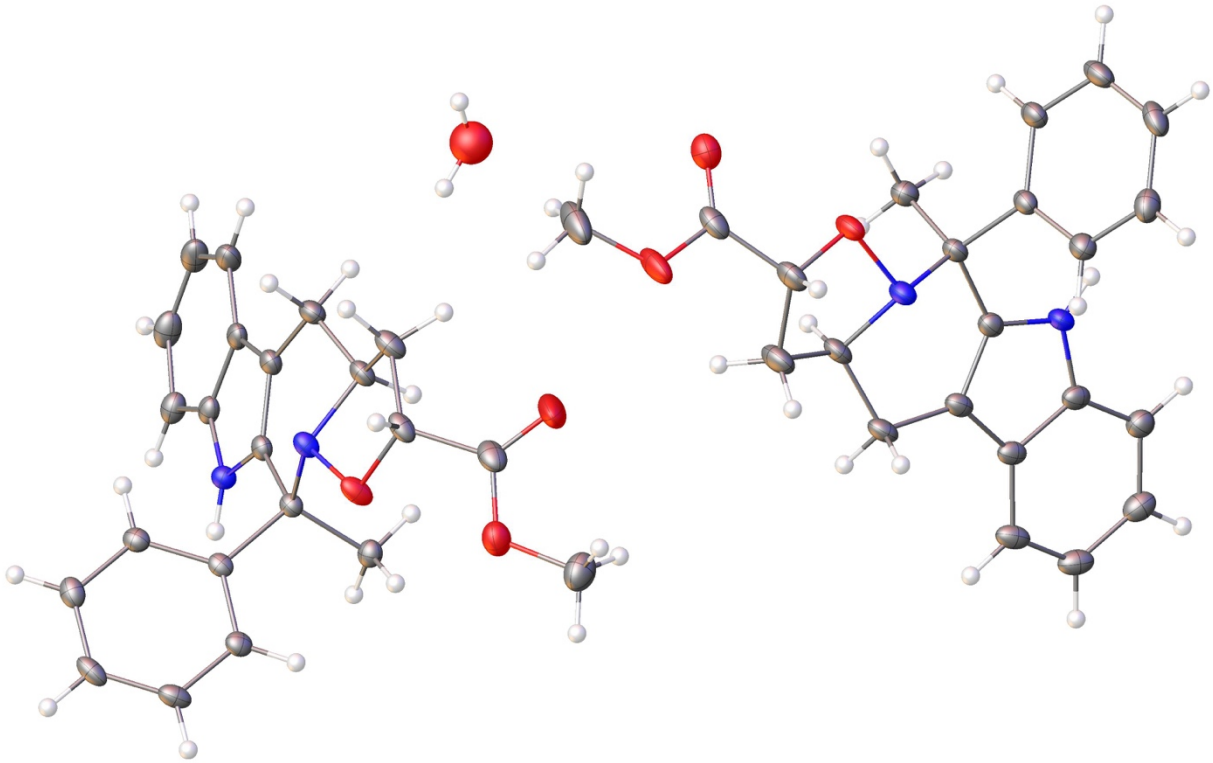


**Figure S24.**

Molecule 1

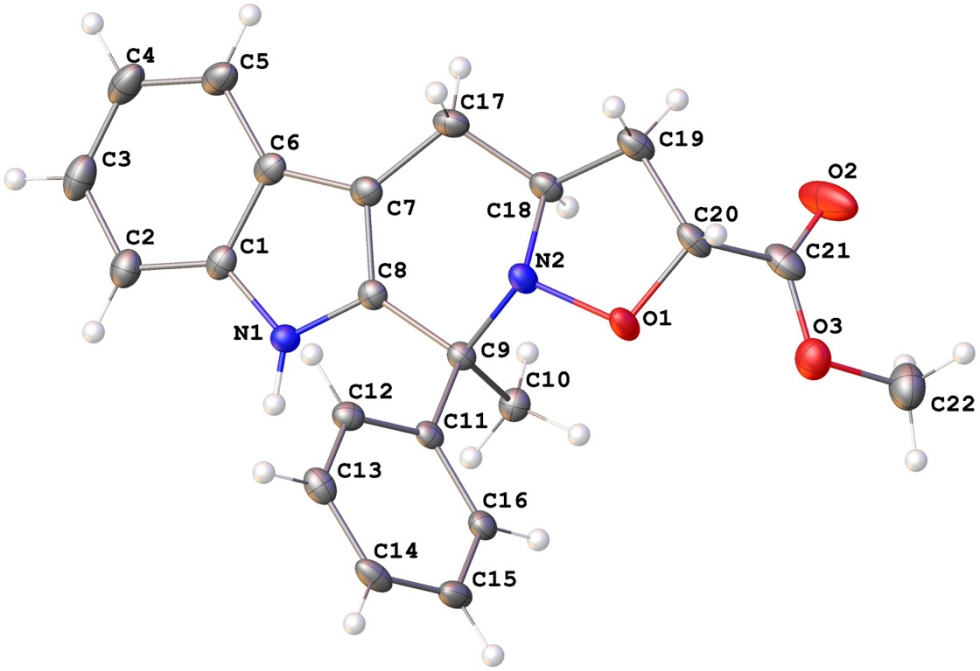



**Figure S25.**

Molecule 2 (different -$CO_2$Me group orientation)

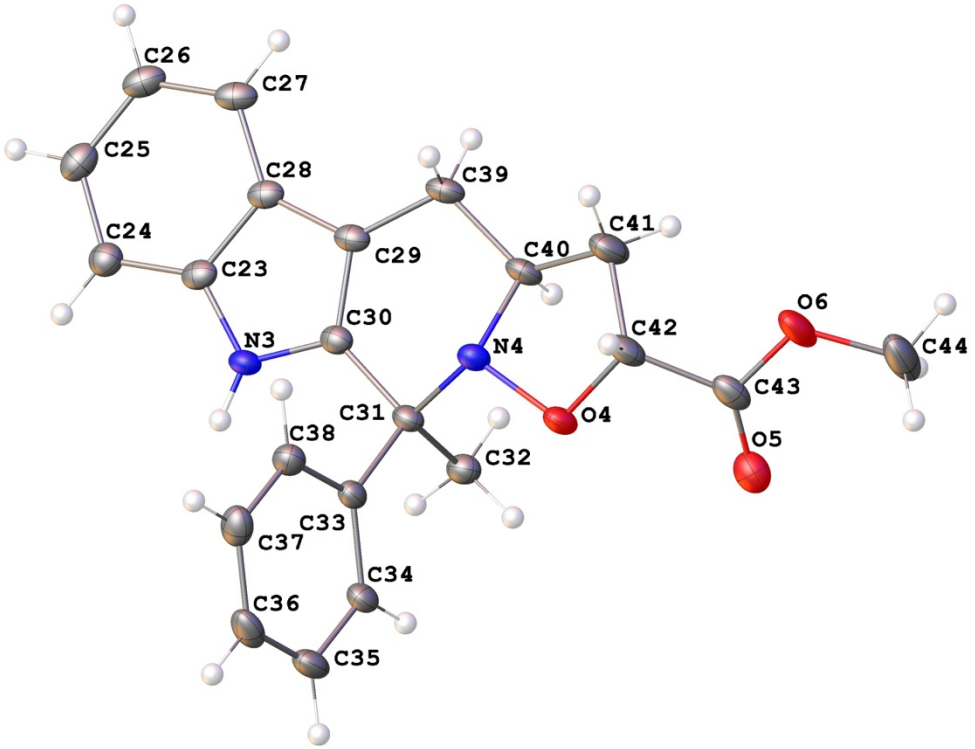


**Figure S26.**

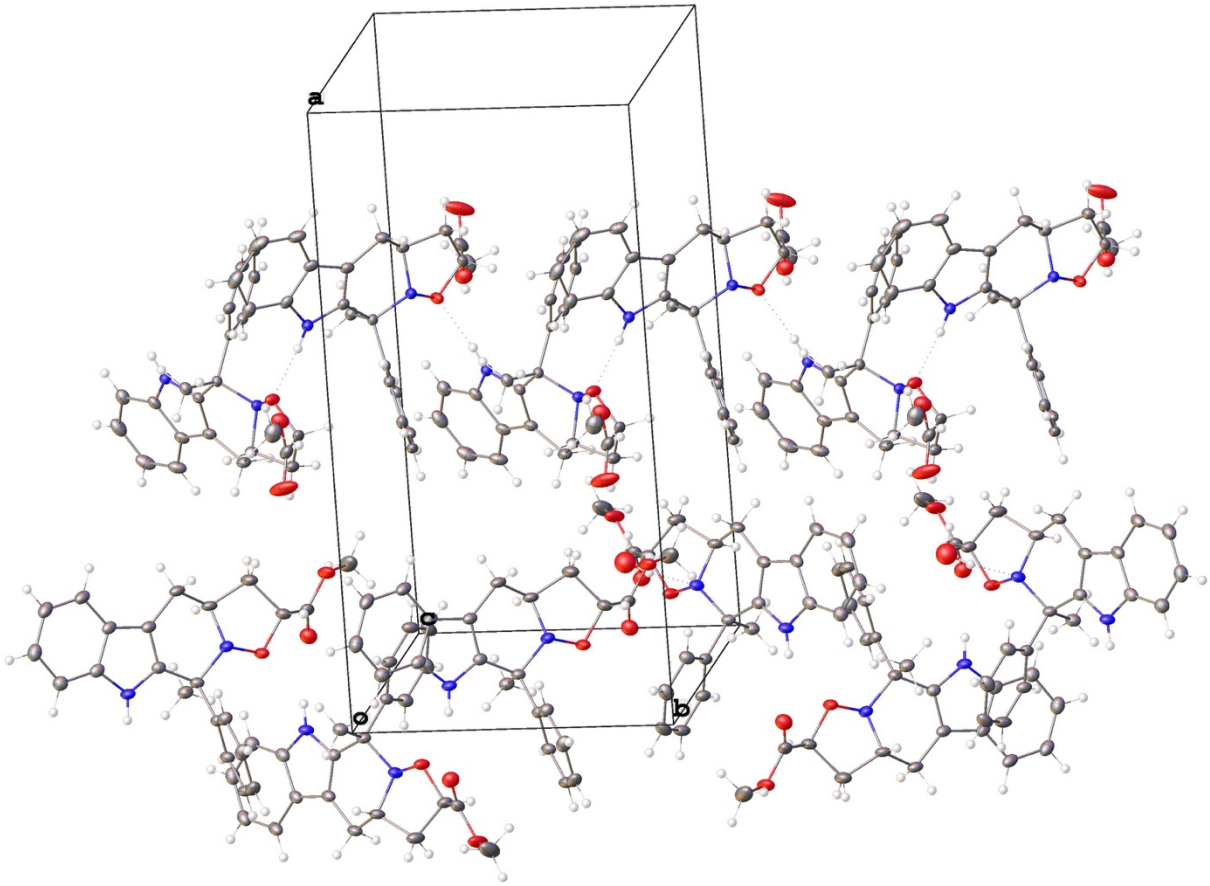


**Table S31 Fractional Atomic Coordinates ($\times 10^4$) and Equivalent Isotropic Displacement Parameters ($Å^2 \times 10^3$) for 0869_tessa_top. $U_{eq}$ is defined as 1/3 of of the trace of the orthogonalised $U_{IJ}$ tensor.**

| Atom | *x* | *y* | *z* | U(eq) |
|---|---|---|---|---|
| O1 | 4337.1(5) | 6722.6(12) | 6738.1(7) | 28.5(3) |
| O2 | 3155.1(7) | 7245(2) | 5146.6(9) | 70.2(6) |
| O3 | 4228.1(6) | 7259.4(14) | 5250.0(7) | 37.3(3) |
| O7 | 1576(3) | 7332(6) | 6696(4) | 63.1(15) |
| N1 | 4440.7(7) | 3045.1(13) | 8518.1(8) | 19.9(3) |
| N2 | 4142.7(6) | 6084.4(13) | 7428.5(8) | 21.6(3) |
| C1 | 3990.4(8) | 2551.1(17) | 8934.5(9) | 22.2(4) |
| C2 | 4021.3(9) | 1469.1(18) | 9420.4(10) | 27.9(4) |
| C3 | 3478.6(10) | 1196(2) | 9753.9(11) | 34.9(5) |
| C4 | 2930.2(9) | 1984(2) | 9623.7(11) | 36.8(5) |
| C5 | 2906.4(8) | 3065(2) | 9154.4(10) | 31.6(4) |
| C6 | 3438.9(8) | 3355.1(17) | 8789.4(9) | 23.6(4) |
| C7 | 3572.5(8) | 4347.7(17) | 8260.4(10) | 23.0(4) |
| C8 | 4180.8(7) | 4119.6(16) | 8108.9(9) | 19.2(4) |
| C9 | 4529.0(7) | 4862.9(15) | 7556.7(9) | 18.6(3) |
| C10 | 4539.4(8) | 4043.3(17) | 6817.2(10) | 23.6(4) |
| C11 | 5209.7(7) | 5261.4(15) | 7948.9(9) | 18.2(3) |
| C12 | 5340.0(8) | 5518.9(16) | 8747.8(10) | 21.9(4) |
| C13 | 5948.9(8) | 5902.0(16) | 9105.5(10) | 25.8(4) |
| C14 | 6437.9(8) | 6053.8(16) | 8665.0(11) | 27.2(4) |
| C15 | 6315.1(8) | 5825.3(17) | 7873.0(11) | 26.5(4) |
| C16 | 5706.3(8) | 5418.8(16) | 7516.3(10) | 22.3(4) |
| C17 | 3159.4(8) | 5431.3(18) | 7881.7(10) | 25.9(4) |
| C18 | 3442.2(8) | 5866.2(17) | 7176.4(10) | 23.6(4) |
| C19 | 3238.5(8) | 7173.5(18) | 6822.1(11) | 29.5(4) |
| C20 | 3798.1(8) | 7528.9(17) | 6407.2(10) | 25.6(4) |
| C21 | 3676.0(9) | 7320.6(18) | 5536.7(11) | 33.4(5) |
| C22 | 4170.8(11) | 7209(2) | 4404.9(11) | 43.7(5) |
| O4 | 831.1(5) | 6653.7(12) | 3115.2(7) | 30.5(3) |
| O5 | 874.9(7) | 7831.6(14) | 4476.7(8) | 39.2(3) |
| O6 | 1885.8(6) | 8534.1(15) | 4470.3(9) | 48.2(4) |
| N3 | 484.1(7) | 2774.4(15) | 1500.5(8) | 24.9(3) |
| N4 | 1039.0(6) | 5696.3(14) | 2580.0(8) | 25.7(3) |
| C23 | 915.0(8) | 1928.5(18) | 1249.7(10) | 25.2(4) |
| C24 | 805.0(9) | 874.3(18) | 744.2(10) | 29.0(4) |
| C25 | 1334.9(9) | 176.9(19) | 598.8(11) | 32.7(4) |
| C26 | 1960.7(9) | 527.6(18) | 947.7(11) | 32.0(4) |
| C27 | 2071.7(8) | 1587.0(18) | 1437.9(11) | 29.3(4) |

| | | | | |
|---|---|---|---|---|
| C28 | 1544.2(8) | 2319.2(17) | 1598.2(10) | 24.1(4) |
| C29 | 1468.4(8) | 3444.9(17) | 2058.7(10) | 24.2(4) |
| C30 | 820.6(8) | 3680.7(17) | 1984.8(10) | 23.3(4) |
| C31 | 500.1(8) | 4748.0(17) | 2379.8(10) | 23.3(4) |
| C32 | 238.8(8) | 4202.5(19) | 3089.3(10) | 28.0(4) |
| C33 | -27.3(8) | 5412.1(17) | 1796.8(10) | 23.1(4) |
| C34 | -646.1(8) | 5616.5(18) | 1957.6(11) | 27.6(4) |
| C35 | -1108.0(9) | 6225(2) | 1412.9(12) | 35.0(5) |
| C36 | -962.9(9) | 6626.9(19) | 704.6(11) | 36.2(5) |
| C37 | -347.8(9) | 6427.7(19) | 538.5(11) | 34.0(5) |
| C38 | 114.6(9) | 5827.9(18) | 1082.1(10) | 29.0(4) |
| C39 | 1961.3(8) | 4296.3(18) | 2539.7(11) | 27.8(4) |
| C40 | 1622.8(8) | 5143.9(18) | 3065.8(11) | 28.6(4) |
| C41 | 1969.0(9) | 6365(2) | 3400.4(13) | 39.3(5) |
| C42 | 1413.6(8) | 7352.3(19) | 3385.2(12) | 32.8(4) |
| C43 | 1346.2(9) | 7919.2(18) | 4168.5(12) | 32.8(5) |
| C44 | 1896.4(11) | 9055(2) | 5246.7(14) | 57.8(7) |

**Table S32 Anisotropic Displacement Parameters ($Å^2×10^3$) for 0869_tessa_top. The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+\ldots]$.**

| Atom | $U_{11}$ | $U_{22}$ | $U_{33}$ | $U_{23}$ | $U_{13}$ | $U_{12}$ |
|---|---|---|---|---|---|---|
| O1 | 19.5(6) | 27.9(7) | 36.5(7) | 14.4(6) | 0.1(5) | 0.6(5) |
| O2 | 36.6(9) | 123.9(17) | 42.9(9) | -27.6(10) | -14.7(7) | 28.2(10) |
| O3 | 35.8(8) | 44.0(8) | 30.4(7) | 2.8(6) | 0.1(6) | -3.4(6) |
| N1 | 18.3(7) | 19.2(7) | 22.2(7) | 0.4(6) | 3.3(6) | -0.4(6) |
| N2 | 18.2(7) | 19.5(7) | 25.8(8) | 3.7(6) | 0.1(6) | -0.6(6) |
| C1 | 24.0(9) | 24.3(9) | 17.7(8) | -3.3(7) | 2.0(7) | -7.7(7) |
| C2 | 34.2(10) | 27.6(10) | 21.9(9) | -0.8(8) | 4.3(8) | -5.6(8) |
| C3 | 45.0(12) | 35.2(11) | 24.9(10) | 1.5(9) | 6.9(8) | -15.5(10) |
| C4 | 31.8(11) | 54.2(13) | 25.2(10) | -0.1(10) | 7.2(8) | -18.1(10) |
| C5 | 20.7(9) | 48.6(12) | 25.1(9) | -1.3(9) | 3.0(7) | -7.0(9) |
| C6 | 20.4(9) | 31.6(10) | 17.9(8) | -4.4(7) | 0.2(7) | -6.2(8) |
| C7 | 18.2(9) | 28.1(9) | 21.3(9) | -2.8(8) | -0.3(7) | -2.4(7) |
| C8 | 18.6(8) | 19.2(8) | 18.7(8) | -2.4(7) | -0.3(6) | -2.7(7) |
| C9 | 18.2(8) | 15.9(8) | 21.0(8) | -0.5(7) | 1.4(6) | -0.6(7) |
| C10 | 25.6(9) | 22.1(9) | 22.6(9) | -1.6(7) | 2.7(7) | -3.3(7) |
| C11 | 18.0(8) | 12.0(8) | 23.8(9) | 1.9(7) | 1.2(7) | 1.3(7) |
| C12 | 20.6(9) | 18.1(8) | 26.9(9) | -0.7(7) | 3.8(7) | 0.8(7) |
| C13 | 28.3(10) | 18.8(9) | 27.7(9) | -1.0(8) | -3.4(7) | 0.0(8) |
| C14 | 17.5(9) | 19.7(9) | 40.9(11) | 3.1(8) | -5.9(8) | -0.6(7) |

| | | | | | | |
|---|---|---|---|---|---|---|
| C15 | 17.5(9) | 24.9(9) | 37.7(11) | 8.2(8) | 5.8(7) | 2.3(7) |
| C16 | 21.0(9) | 20.4(9) | 24.9(9) | 4.7(7) | 2.3(7) | 4.0(7) |
| C17 | 17.0(8) | 30.6(10) | 29.2(9) | -2.9(8) | 1.0(7) | 1.5(8) |
| C18 | 16.4(8) | 24.1(9) | 28.2(9) | -0.4(8) | -2.4(7) | -0.5(7) |
| C19 | 19.8(9) | 26.5(10) | 39.7(11) | 3.3(8) | -2.7(8) | 1.3(8) |
| C20 | 22.0(9) | 17.7(9) | 33.4(10) | 2.0(8) | -6.6(7) | 2.1(7) |
| C21 | 30.6(11) | 27.3(10) | 38.7(11) | -4.6(9) | -5.3(9) | 9.7(8) |
| C22 | 56.0(14) | 42.6(13) | 31.8(11) | 2.3(10) | 4.8(10) | 5.0(11) |
| O4 | 16.5(6) | 34.1(7) | 38.8(7) | -9.6(6) | -1.7(5) | 0.8(5) |
| O5 | 37.7(8) | 41.6(8) | 35.7(8) | -1.1(7) | -1.4(6) | -2.6(7) |
| O6 | 25.9(7) | 48.9(9) | 61.9(10) | -22.7(8) | -15.8(7) | 4.2(7) |
| N3 | 15.0(7) | 32.8(9) | 26.6(8) | -1.5(7) | 2.1(6) | 2.5(7) |
| N4 | 17.5(7) | 28.8(8) | 29.9(8) | -3.0(7) | 0.7(6) | 3.2(6) |
| C23 | 24.5(9) | 30.1(10) | 22.5(9) | 6.8(8) | 8.2(7) | 4.2(8) |
| C24 | 29.4(10) | 32.0(10) | 26.2(9) | 0.9(8) | 6.5(8) | 0.7(8) |
| C25 | 40.8(11) | 28.6(10) | 31.3(10) | 1.1(8) | 13.6(9) | 3.3(9) |
| C26 | 31.7(10) | 29.6(10) | 38.1(11) | 7.1(9) | 15.6(8) | 7.5(9) |
| C27 | 22.2(9) | 30.9(10) | 36.5(10) | 11.0(9) | 10.1(8) | 4.8(8) |
| C28 | 22.0(9) | 27.1(10) | 24.4(9) | 8.3(8) | 7.8(7) | 4.1(8) |
| C29 | 18.3(9) | 28.7(10) | 25.9(9) | 6.8(8) | 4.7(7) | 1.6(7) |
| C30 | 20.0(9) | 27.9(9) | 21.9(9) | 3.7(8) | 3.6(7) | 0.9(8) |
| C31 | 15.6(8) | 28.7(9) | 24.9(9) | 0.0(8) | 1.6(7) | -0.9(7) |
| C32 | 22.4(9) | 33.4(10) | 28.2(10) | 0.4(8) | 3.9(7) | 2.0(8) |
| C33 | 18.6(9) | 24.2(9) | 25.0(9) | -4.4(8) | -0.6(7) | 1.4(7) |
| C34 | 18.5(9) | 32.3(10) | 30.5(10) | -6.0(8) | -0.3(7) | -1.6(8) |
| C35 | 18.2(9) | 40.1(12) | 43.9(12) | -9.5(10) | -3.3(8) | 3.1(8) |
| C36 | 32.4(11) | 34.2(11) | 35.7(11) | -5.1(9) | -13.0(9) | 8.6(9) |
| C37 | 41.0(11) | 33.7(11) | 25.1(10) | -0.9(9) | -1.1(8) | 5.8(9) |
| C38 | 25.2(9) | 32.9(10) | 28.0(10) | -2.5(8) | 1.8(7) | 4.4(8) |
| C39 | 15.5(8) | 33.4(10) | 33.9(10) | 6.2(8) | 2.1(7) | 2.9(8) |
| C40 | 14.7(8) | 35.7(11) | 33.1(10) | 1.8(9) | -2.7(7) | 1.7(8) |
| C41 | 19.4(9) | 44.4(12) | 51.2(13) | -9.7(10) | -3.1(9) | 0.3(9) |
| C42 | 18.3(9) | 34.0(11) | 42.9(11) | -3.5(9) | -4.1(8) | -3.2(8) |
| C43 | 23.9(10) | 28.1(10) | 41.7(11) | 0.7(9) | -9.0(9) | 2.7(8) |
| C44 | 45.9(13) | 52.9(15) | 63.1(15) | -25.5(13) | -25.0(11) | 12.7(12) |

**Table S33 Bond Lengths for 0869_tessa_top.**

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| O1 | N2 | 1.4791(18) | O4 | N4 | 1.4682(19) |
| O1 | C20 | 1.444(2) | O4 | C42 | 1.430(2) |

| | | | | | |
|---|---|---|---|---|---|
| O2 | C21 | 1.190(2) | O5 | C43 | 1.202(2) |
| O3 | C21 | 1.335(2) | O6 | C43 | 1.328(2) |
| O3 | C22 | 1.449(2) | O6 | C44 | 1.444(3) |
| N1 | C1 | 1.377(2) | N3 | C23 | 1.377(2) |
| N1 | C8 | 1.378(2) | N3 | C30 | 1.371(2) |
| N2 | C9 | 1.494(2) | N4 | C31 | 1.492(2) |
| N2 | C18 | 1.481(2) | N4 | C40 | 1.481(2) |
| C1 | C2 | 1.392(2) | C23 | C24 | 1.390(3) |
| C1 | C6 | 1.412(2) | C23 | C28 | 1.417(2) |
| C2 | C3 | 1.388(3) | C24 | C25 | 1.382(3) |
| C3 | C4 | 1.397(3) | C25 | C26 | 1.400(3) |
| C4 | C5 | 1.375(3) | C26 | C27 | 1.379(3) |
| C5 | C6 | 1.404(2) | C27 | C28 | 1.405(2) |
| C6 | C7 | 1.431(2) | C28 | C29 | 1.431(3) |
| C7 | C8 | 1.366(2) | C29 | C30 | 1.367(2) |
| C7 | C17 | 1.497(2) | C29 | C39 | 1.500(2) |
| C8 | C9 | 1.505(2) | C30 | C31 | 1.510(2) |
| C9 | C10 | 1.537(2) | C31 | C32 | 1.532(2) |
| C9 | C11 | 1.534(2) | C31 | C33 | 1.532(2) |
| C11 | C12 | 1.390(2) | C33 | C34 | 1.389(2) |
| C11 | C16 | 1.389(2) | C33 | C38 | 1.387(2) |
| C12 | C13 | 1.383(2) | C34 | C35 | 1.387(3) |
| C13 | C14 | 1.384(3) | C35 | C36 | 1.375(3) |
| C14 | C15 | 1.373(3) | C36 | C37 | 1.384(3) |
| C15 | C16 | 1.390(2) | C37 | C38 | 1.382(3) |
| C17 | C18 | 1.511(2) | C39 | C40 | 1.520(3) |
| C18 | C19 | 1.513(2) | C40 | C41 | 1.520(3) |
| C19 | C20 | 1.519(3) | C41 | C42 | 1.545(3) |
| C20 | C21 | 1.502(3) | C42 | C43 | 1.504(3) |

**Table S34 Bond Angles for 0869_tessa_top.**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| C20 | O1 | N2 | 105.91(12) | C42 | O4 | N4 | 102.58(12) |
| C21 | O3 | C22 | 116.35(15) | C43 | O6 | C44 | 115.17(18) |
| C1 | N1 | C8 | 108.55(14) | C30 | N3 | C23 | 108.97(14) |
| O1 | N2 | C9 | 106.24(12) | O4 | N4 | C31 | 107.10(12) |
| O1 | N2 | C18 | 102.81(11) | O4 | N4 | C40 | 101.77(12) |
| C18 | N2 | C9 | 113.85(13) | C40 | N4 | C31 | 113.89(14) |
| N1 | C1 | C2 | 130.14(16) | N3 | C23 | C24 | 130.05(16) |
| N1 | C1 | C6 | 107.66(14) | N3 | C23 | C28 | 107.48(15) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C2 | C1 | C6 | 122.21(16) | C24 | C23 | C28 | 122.46(16) |
| C3 | C2 | C1 | 117.00(18) | C25 | C24 | C23 | 117.76(17) |
| C2 | C3 | C4 | 121.72(18) | C24 | C25 | C26 | 120.90(18) |
| C5 | C4 | C3 | 121.04(17) | C27 | C26 | C25 | 121.44(17) |
| C4 | C5 | C6 | 118.97(18) | C26 | C27 | C28 | 119.20(17) |
| C1 | C6 | C7 | 106.98(14) | C23 | C28 | C29 | 106.64(15) |
| C5 | C6 | C1 | 119.02(16) | C27 | C28 | C23 | 118.23(17) |
| C5 | C6 | C7 | 134.00(17) | C27 | C28 | C29 | 135.13(17) |
| C6 | C7 | C17 | 130.77(15) | C28 | C29 | C39 | 130.82(15) |
| C8 | C7 | C6 | 106.71(15) | C30 | C29 | C28 | 106.97(15) |
| C8 | C7 | C17 | 122.47(15) | C30 | C29 | C39 | 122.20(16) |
| N1 | C8 | C9 | 122.89(14) | N3 | C30 | C31 | 123.36(14) |
| C7 | C8 | N1 | 110.09(14) | C29 | C30 | N3 | 109.93(15) |
| C7 | C8 | C9 | 126.97(15) | C29 | C30 | C31 | 126.70(16) |
| N2 | C9 | C8 | 102.41(12) | N4 | C31 | C30 | 101.83(13) |
| N2 | C9 | C10 | 114.90(13) | N4 | C31 | C32 | 114.33(14) |
| N2 | C9 | C11 | 106.47(12) | N4 | C31 | C33 | 107.38(14) |
| C8 | C9 | C10 | 108.91(13) | C30 | C31 | C32 | 109.90(15) |
| C8 | C9 | C11 | 111.69(13) | C30 | C31 | C33 | 110.78(14) |
| C11 | C9 | C10 | 112.09(13) | C33 | C31 | C32 | 112.14(13) |
| C12 | C11 | C9 | 120.53(14) | C34 | C33 | C31 | 122.31(16) |
| C16 | C11 | C9 | 121.31(14) | C38 | C33 | C31 | 119.20(15) |
| C16 | C11 | C12 | 118.12(15) | C38 | C33 | C34 | 118.49(16) |
| C13 | C12 | C11 | 121.06(16) | C35 | C34 | C33 | 120.34(18) |
| C12 | C13 | C14 | 120.01(17) | C36 | C35 | C34 | 120.66(17) |
| C15 | C14 | C13 | 119.73(16) | C35 | C36 | C37 | 119.46(17) |
| C14 | C15 | C16 | 120.23(16) | C38 | C37 | C36 | 120.00(18) |
| C11 | C16 | C15 | 120.84(16) | C37 | C38 | C33 | 121.05(17) |
| C7 | C17 | C18 | 107.39(14) | C29 | C39 | C40 | 108.72(14) |
| N2 | C18 | C17 | 108.06(13) | N4 | C40 | C39 | 107.78(14) |
| N2 | C18 | C19 | 100.67(13) | N4 | C40 | C41 | 101.38(14) |
| C17 | C18 | C19 | 118.00(15) | C41 | C40 | C39 | 117.57(15) |
| C18 | C19 | C20 | 102.55(14) | C40 | C41 | C42 | 103.10(14) |
| O1 | C20 | C19 | 106.87(14) | O4 | C42 | C41 | 106.05(15) |
| O1 | C20 | C21 | 108.00(14) | O4 | C42 | C43 | 106.74(15) |
| C21 | C20 | C19 | 114.97(15) | C43 | C42 | C41 | 115.03(16) |
| O2 | C21 | O3 | 123.99(19) | O5 | C43 | O6 | 124.92(19) |
| O2 | C21 | C20 | 124.63(19) | O5 | C43 | C42 | 125.24(17) |
| O3 | C21 | C20 | 111.36(15) | O6 | C43 | C42 | 109.84(17) |

**Crystal Structure of ±65b**

**General information**: The diffraction data were measured at 100 K on a Bruker D8 VENTURE diffractometer equipped with a microfocus Mo-target X-ray tube ($\lambda$ = 0.71073 Å) and PHOTON 100 CMOS detector. Data were collected using $\phi$ and $\omega$ scans to survey a hemisphere of reciprocal space. Data reduction and integration were performed with the Bruker APEX3 software package (Bruker AXS, version 2017.3-0, 2018). The crystal appeared to be a 2-component twin. Unit cell parameters for each component were identified using Cell_Now. Data were scaled and corrected for absorption effects using the multi-scan procedure as implemented in TWINABS (Bruker AXS, version 2012/1, Krause, Herbst-Irmer, Sheldrick & Stalke, *J. Appl. Cryst.* **2015**, *48*, 3-10). The structure was solved by SHELXT (Version 2014/5: Sheldrick, G. M. *Acta Crystallogr*. **2015**, *A71*, 3-8) and refined by a full-matrix least-squares procedure using OLEX2 (O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann. J. Appl. Crystallogr. **2009**, *42*, 339-341) (XL refinement program version 2018/3, *Sheldrick, G. M. Acta Crystallogr.* **2015**, *C71*, 3-8). Crystallographic data and details of the data collection and structure refinement are listed in Table S35.

**Specific details for structure refinement**: The structure was first solved and refined using HKLF 4 file format. The final refinement cycles were carried out with HKLF 5. Refined fractional volume contribution for the second twin component is 0.46. All atoms were refined with anisotropic thermal parameters. Hydrogen atoms were included in idealized positions for structure factor calculations except H-atoms attached to nitrogen atoms. These hydrogen atoms (H1 and H3) were located in the difference Fourier map and allowed to be refined at 0.88 Å within a default 0.02 Å standard deviation with their thermal parameters being constrained to be 1.2 times of the Ueq value of the N atoms. All structures are drawn with thermal ellipsoids at 40% probability.

**Table S35 Crystal data and structure refinement for 0872_tes_btm.**

| | |
|---|---|
| Identification code | 0872_tes_btm |
| Empirical formula | $C_{44.5}H_{45}ClN_4O_6$ |
| Formula weight | 767.29 |
| Temperature/K | 100(2) |
| Crystal system | triclinic |
| Space group | P-1 |
| a/Å | 12.3351(7) |
| b/Å | 13.1435(7) |
| c/Å | 13.7758(7) |
| α/° | 93.491(2) |
| β/° | 101.268(2) |
| γ/° | 116.875(2) |
| Volume/Å$^3$ | 1925.16(18) |
| Z | 2 |
| $\rho_{calc}$g/cm$^3$ | 1.324 |
| μ/mm$^{-1}$ | 0.155 |
| F(000) | 810.0 |
| Crystal size/mm$^3$ | 0.32 × 0.19 × 0.14 |
| Radiation | MoKα (λ = 0.71073) |
| 2Θ range for data collection/° | 4.256 to 52.882 |
| Index ranges | -15 ≤ h ≤ 14, -16 ≤ k ≤ 16, 0 ≤ l ≤ 17 |
| Reflections collected | 7910 |
| Independent reflections | 7910 [$R_{int}$ = 0.0610, $R_{sigma}$ = 0.0562] |
| Data/restraints/parameters | 7910/3/522 |
| Goodness-of-fit on $F^2$ | 1.090 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0559, $wR_2$ = 0.1025 |
| Final R indexes [all data] | $R_1$ = 0.0856, $wR_2$ = 0.1125 |
| Largest diff. peak/hole / e Å$^{-3}$ | 0.36/-0.59 |

$R_{int} = \Sigma \mid F_o^2 - \langle F_o^2 \rangle \mid / \Sigma \mid F_o^2 \mid$

$R1 = \Sigma \mid \mid F_o \mid - \mid F_c \mid \mid / \Sigma \mid F_o \mid$

$wR2 = [\Sigma [w (F_o^2 - F_c^2)^2] / \Sigma [w (F_o^2)^2]]^{1/2}$

Goodness-of-fit = $[\Sigma [w (F_o^2 - F_c^2)^2] / (n-p)]^{1/2}$

n: number of independent reflections; p: number of refined parameters

**Figure S27.**

Independent unit

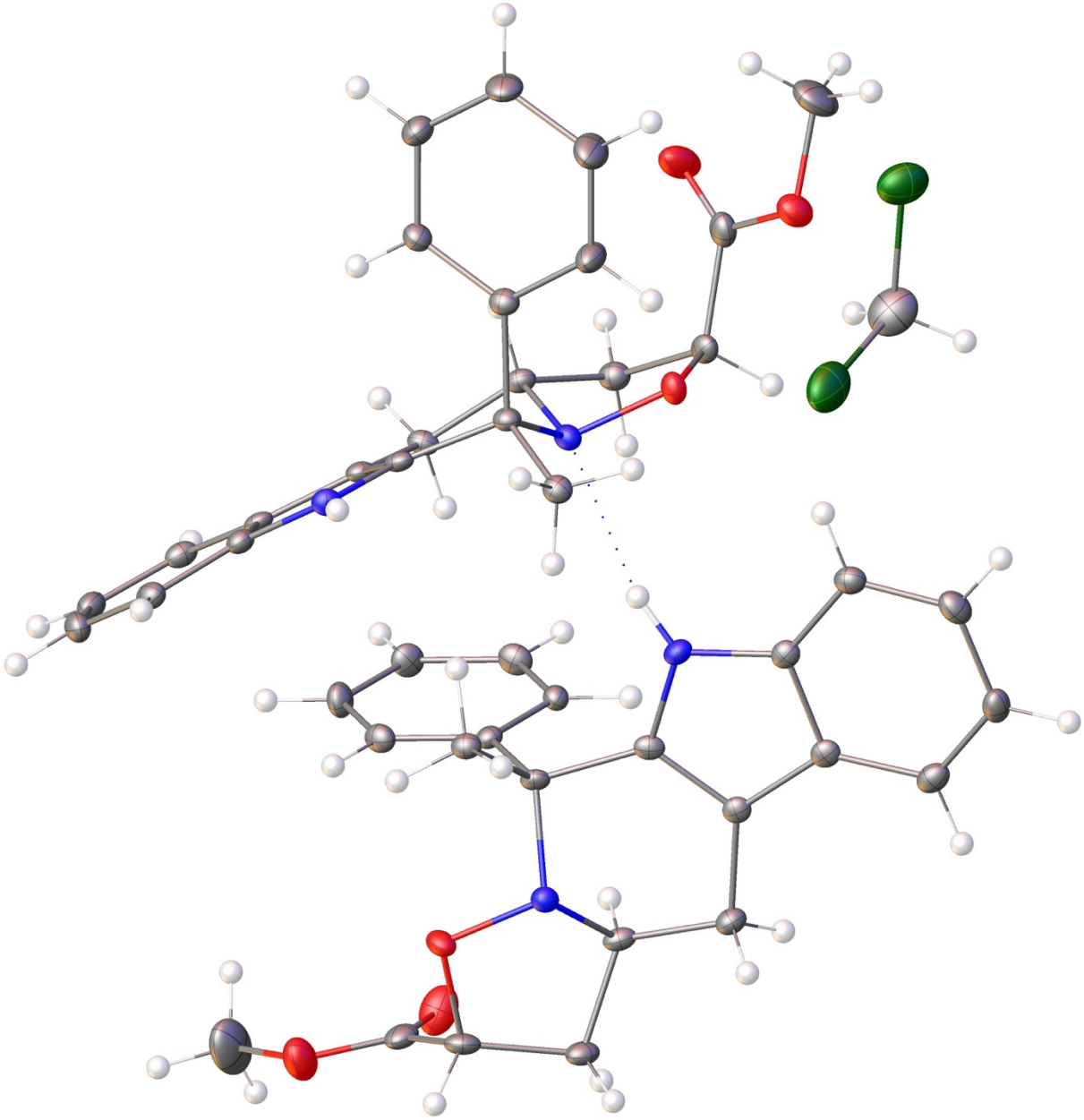


**Figure S28.**

Molecule 1

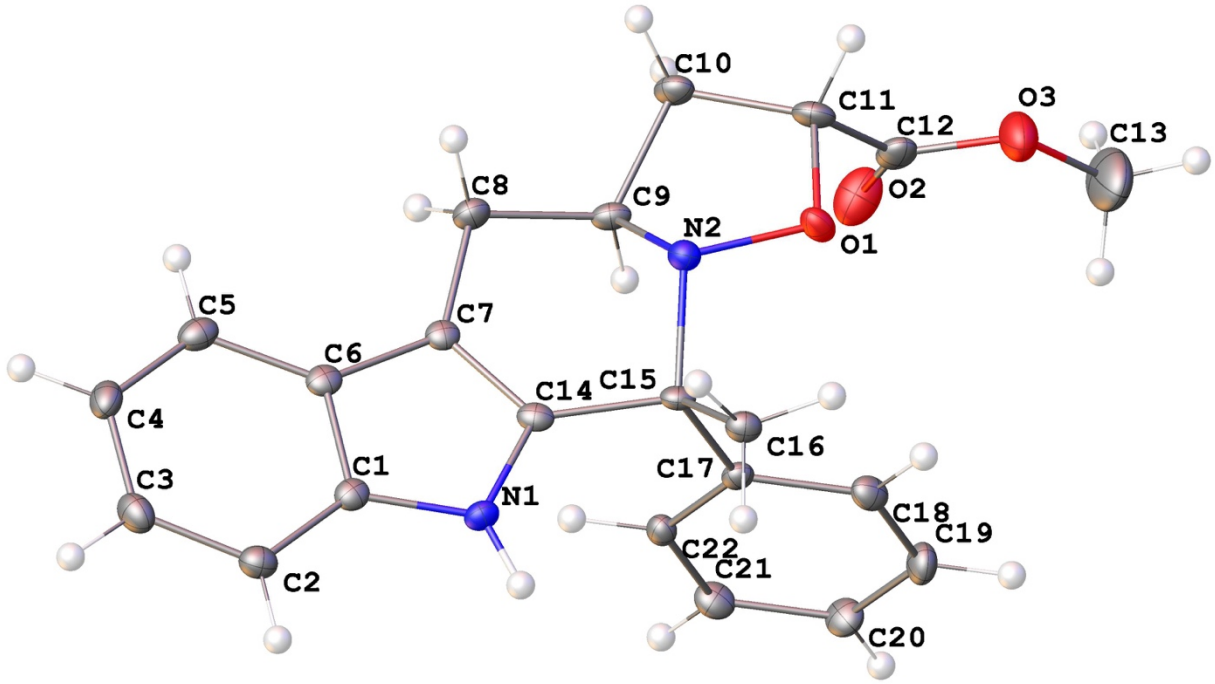



**Figure S29.**

Molecule 2

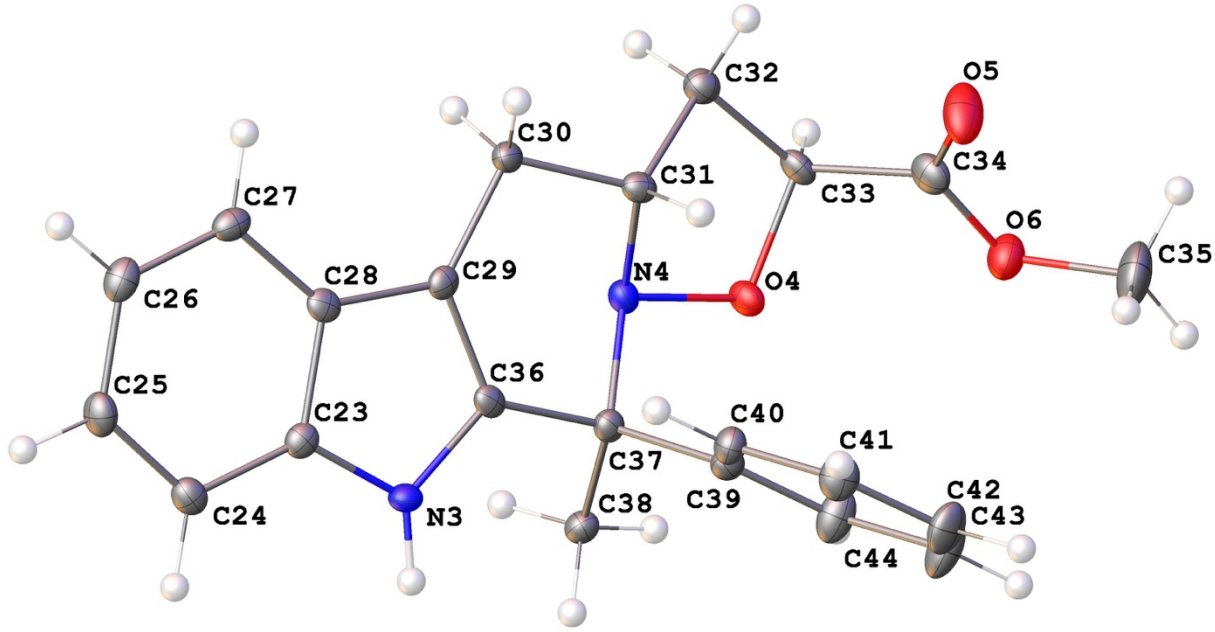


**Figure S30.**

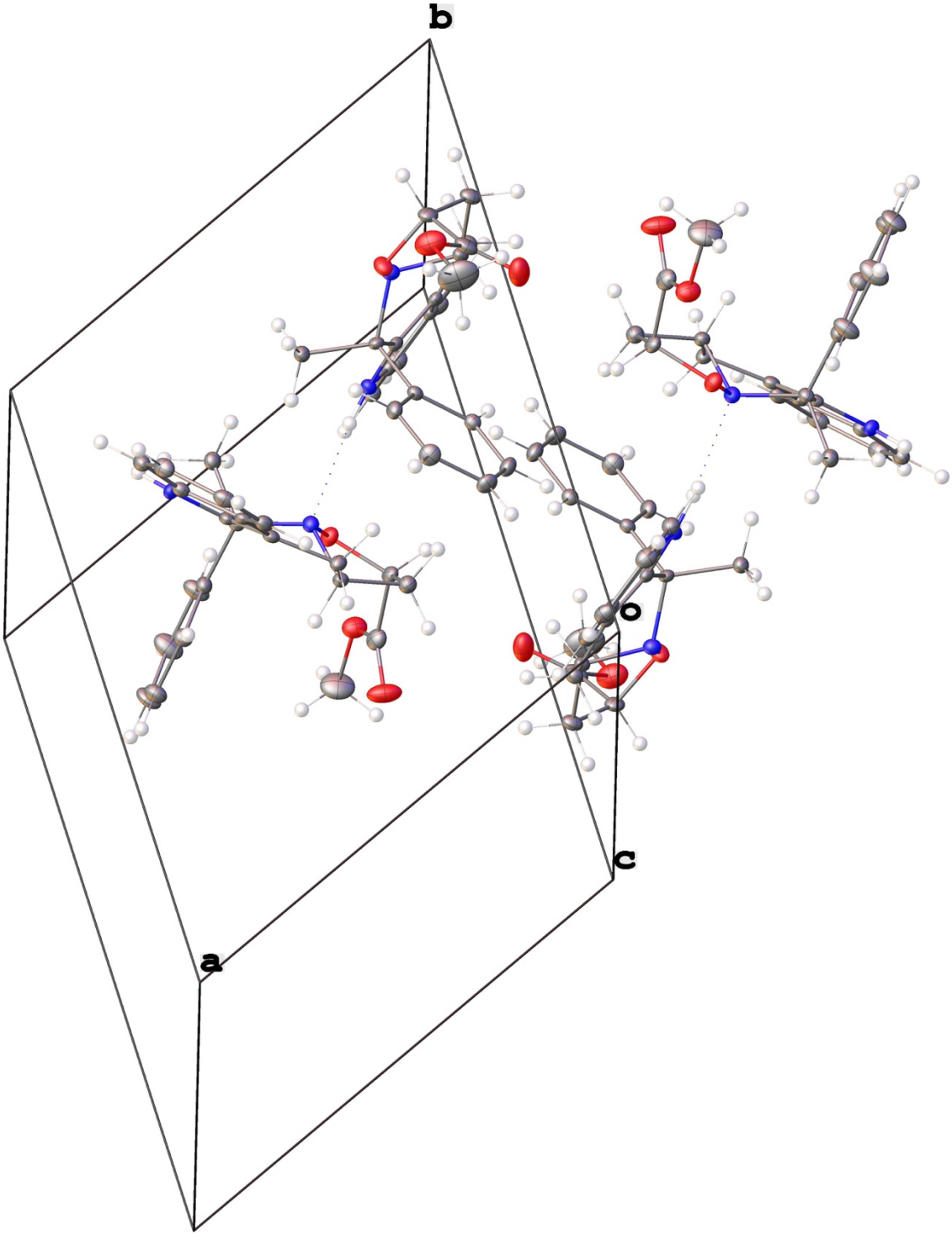


**Table S36 Fractional Atomic Coordinates ($\times 10^4$) and Equivalent Isotropic Displacement Parameters ($Å^2 \times 10^3$) for 0872_tes_btm. $U_{eq}$ is defined as 1/3 of of the trace of the orthogonalised $U_{IJ}$ tensor.**

| Atom | *x* | *y* | *z* | U(eq) |
|---|---|---|---|---|
| O1 | 1826.9(16) | 8330.2(15) | 2569.9(12) | 19.9(4) |
| O2 | -455.0(19) | 6246.1(18) | 1060.8(16) | 36.8(5) |
| O3 | 1138(2) | 7424.9(19) | 454.0(16) | 38.3(6) |
| N1 | 2257(2) | 8030.0(18) | 6110.3(16) | 15.7(5) |
| N2 | 1564(2) | 8483.7(18) | 3551.4(15) | 16.6(5) |
| C1 | 1660(2) | 8270(2) | 6768.9(19) | 15.8(5) |
| C2 | 1960(2) | 8460(2) | 7812.4(19) | 19.5(6) |
| C3 | 1235(3) | 8768(2) | 8280(2) | 23.3(6) |
| C4 | 211(3) | 8867(2) | 7725(2) | 21.8(6) |
| C5 | -104(3) | 8656(2) | 6693(2) | 20.3(6) |
| C6 | 624(2) | 8354(2) | 6191.8(19) | 15.7(5) |
| C7 | 630(2) | 8149(2) | 5162.2(18) | 14.3(5) |
| C8 | -183(2) | 8223(2) | 4236.9(19) | 18.3(6) |
| C9 | 178(2) | 7865(2) | 3338.8(18) | 16.4(5) |
| C10 | -200(3) | 8215(2) | 2348.7(19) | 20.1(6) |
| C11 | 794(3) | 8270(2) | 1818.5(19) | 20.5(6) |
| C12 | 387(3) | 7185(3) | 1070(2) | 23.9(6) |
| C13 | 924(4) | 6447(3) | -251(3) | 59.6(11) |
| C14 | 1642(2) | 7986(2) | 5144.8(18) | 14.6(5) |
| C15 | 2151(2) | 7923(2) | 4245.3(18) | 14.2(5) |
| C16 | 3572(2) | 8693(2) | 4507.9(19) | 16.6(5) |
| C17 | 1790(2) | 6679(2) | 3795.2(18) | 14.1(5) |
| C18 | 2392(2) | 6463(2) | 3113.9(19) | 19.1(6) |
| C19 | 2059(3) | 5342(2) | 2718(2) | 22.8(6) |
| C20 | 1115(3) | 4411(2) | 2985(2) | 21.6(6) |
| C21 | 514(3) | 4616(2) | 3653(2) | 20.8(6) |
| C22 | 843(2) | 5736(2) | 4052.4(18) | 15.1(5) |
| O4 | 3622.3(16) | 7030.0(15) | 7834.4(13) | 18.9(4) |
| O5 | 3400(2) | 4595.2(19) | 8649.1(15) | 38.3(6) |
| O6 | 3420.7(19) | 6090.3(17) | 9530.0(14) | 27.5(5) |
| N3 | 6639(2) | 8748.5(18) | 5824.8(16) | 16.0(5) |
| N4 | 4047.2(19) | 7103.7(18) | 6898.3(15) | 16.1(5) |
| C23 | 6605(2) | 8349(2) | 4862.2(18) | 16.2(5) |
| C24 | 7292(2) | 8928(2) | 4199.8(19) | 18.8(6) |
| C25 | 7046(3) | 8310(2) | 3271(2) | 21.8(6) |
| C26 | 6142(3) | 7138(2) | 2995(2) | 21.1(6) |
| C27 | 5439(2) | 6574(2) | 3641.6(19) | 18.2(6) |
| C28 | 5657(2) | 7184(2) | 4595.5(18) | 15.2(5) |

| | | | | |
|---|---|---|---|---|
| C29 | 5100(2) | 6903(2) | 5424.2(18) | 14.8(5) |
| C30 | 3982(2) | 5827(2) | 5516.9(18) | 16.8(6) |
| C31 | 3868(2) | 5926(2) | 6589.6(19) | 16.2(6) |
| C32 | 2604(2) | 5184(2) | 6790(2) | 19.9(6) |
| C33 | 2717(2) | 5832(2) | 7785.4(19) | 18.0(6) |
| C34 | 3216(3) | 5413(2) | 8687(2) | 23.0(6) |
| C35 | 3948(4) | 5795(3) | 10442(2) | 45.2(9) |
| C36 | 5713(2) | 7872(2) | 6151.7(18) | 14.8(5) |
| C37 | 5400(2) | 8016(2) | 7138.0(18) | 15.4(5) |
| C38 | 5439(2) | 9186(2) | 7350.9(19) | 17.8(6) |
| C39 | 6239(2) | 7839(2) | 8022.2(19) | 17.5(6) |
| C40 | 6972(2) | 7328(2) | 7869.8(19) | 18.9(6) |
| C41 | 7698(3) | 7152(2) | 8678(2) | 24.5(6) |
| C42 | 7700(3) | 7478(3) | 9641(2) | 29.3(7) |
| C43 | 6989(3) | 8003(3) | 9808(2) | 34.8(8) |
| C44 | 6259(3) | 8177(3) | 9001(2) | 27.5(7) |
| Cl1 | 5000 | 10000 | 10000 | 52.0(4) |
| Cl2 | 5009.5(18) | 8656.0(15) | 11478.5(13) | 46.3(4) |
| C45 | 4131(6) | 8781(5) | 10417(4) | 45.9(18) |

**Table S37 Anisotropic Displacement Parameters ($Å^2×10^3$) for 0872_tes_btm. The Anisotropic displacement factor exponent takes the form: $-2π^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+…]$.**

| Atom | $U_{11}$ | $U_{22}$ | $U_{33}$ | $U_{23}$ | $U_{13}$ | $U_{12}$ |
|---|---|---|---|---|---|---|
| O1 | 18.5(10) | 26.9(10) | 14.3(9) | 6.9(8) | 3.5(8) | 10.7(8) |
| O2 | 26.5(12) | 29.4(12) | 46.1(14) | -8.0(10) | 6.9(10) | 8.7(10) |
| O3 | 55.8(15) | 39.7(13) | 33.9(12) | 10.8(10) | 24.3(11) | 29.1(12) |
| N1 | 13.5(11) | 15.5(11) | 18.3(12) | 2.5(9) | 2.1(9) | 7.9(9) |
| N2 | 18.8(12) | 17.3(11) | 15.6(11) | 4.0(9) | 4.4(9) | 9.9(9) |
| C1 | 14.6(13) | 10.8(12) | 20.0(14) | 2.6(10) | 4.2(11) | 4.3(11) |
| C2 | 19.2(14) | 18.1(14) | 20.6(14) | 5.6(11) | 3.9(11) | 8.4(11) |
| C3 | 30.9(16) | 20.8(15) | 17.5(14) | 3.1(11) | 7.4(12) | 11.0(13) |
| C4 | 27.5(15) | 18.2(14) | 25.5(15) | 5.2(11) | 13.2(13) | 12.9(12) |
| C5 | 17.9(14) | 15.4(13) | 28.0(16) | 4.9(11) | 5.1(12) | 8.2(11) |
| C6 | 15.1(13) | 8.8(12) | 20.6(13) | 2.9(10) | 4.1(11) | 3.5(10) |
| C7 | 14.2(13) | 8.4(12) | 17.8(13) | 2.3(10) | 3.3(10) | 3.4(10) |
| C8 | 16.6(14) | 18.5(13) | 20.6(14) | 3.0(11) | 2.4(11) | 9.9(11) |
| C9 | 14.8(13) | 13.1(13) | 18.9(13) | 2.0(10) | -1.4(10) | 6.9(11) |
| C10 | 23.1(15) | 23.0(14) | 15.9(13) | 2.3(11) | -1.0(11) | 14.6(12) |
| C11 | 23.2(15) | 20.2(14) | 17.8(14) | 6.8(11) | -0.5(11) | 11.9(12) |
| C12 | 24.3(15) | 33.1(17) | 19.9(14) | 4.3(12) | 0.0(12) | 20.5(14) |

| | | | | | | |
|---|---|---|---|---|---|---|
| C13 | 97(3) | 57(2) | 50(2) | 6.9(19) | 38(2) | 50(2) |
| C14 | 14.9(13) | 8.8(12) | 16.0(13) | 1.6(10) | 0.4(10) | 3.4(10) |
| C15 | 15.4(13) | 11.1(12) | 15.8(12) | 4.6(10) | 1.8(10) | 6.6(10) |
| C16 | 14.9(13) | 15.5(13) | 17.2(13) | 2.9(10) | 1.5(11) | 6.4(11) |
| C17 | 13.4(13) | 15.6(13) | 14.0(13) | 2.4(10) | 1.3(10) | 8.3(11) |
| C18 | 15.5(14) | 18.6(13) | 21.0(14) | 6.7(11) | 5.2(11) | 5.6(11) |
| C19 | 27.2(16) | 24.9(15) | 19.6(14) | 1.1(12) | 10.3(12) | 13.8(13) |
| C20 | 27.1(16) | 14.8(13) | 22.2(15) | -0.8(11) | 5.9(12) | 9.8(12) |
| C21 | 20.0(15) | 14.4(13) | 22.4(14) | 4.0(11) | 4.4(12) | 3.8(11) |
| C22 | 15.3(13) | 17.4(13) | 13.0(13) | 2.7(10) | 3.4(10) | 8.2(11) |
| O4 | 20.0(10) | 17.4(9) | 20.3(10) | 4.6(8) | 10.2(8) | 7.5(8) |
| O5 | 67.8(17) | 39.0(13) | 27.8(12) | 12.4(10) | 16.3(11) | 39.3(13) |
| O6 | 36.3(12) | 28.7(11) | 19.7(10) | 4.4(9) | 6.7(9) | 17.5(10) |
| N3 | 16.0(12) | 11.7(11) | 17.2(12) | 1.3(9) | 1.8(9) | 5.2(9) |
| N4 | 15.4(11) | 16.9(11) | 15.8(11) | 5.2(9) | 4.5(9) | 7.1(9) |
| C23 | 16.2(14) | 18.4(13) | 16.7(13) | 2.7(11) | 2.3(11) | 11.1(11) |
| C24 | 15.5(14) | 20.5(13) | 22.0(14) | 6.7(11) | 5.2(11) | 9.4(11) |
| C25 | 21.6(15) | 29.1(16) | 20.3(14) | 8.8(12) | 10.0(12) | 14.3(13) |
| C26 | 24.5(15) | 28.4(15) | 17.3(14) | 3.0(11) | 4.7(12) | 18.7(13) |
| C27 | 18.0(14) | 16.9(13) | 19.1(14) | -0.3(11) | -0.5(11) | 10.2(11) |
| C28 | 14.6(13) | 15.0(13) | 19.3(14) | 5.4(11) | 2.4(11) | 10.3(11) |
| C29 | 15.5(13) | 16.2(13) | 14.3(13) | 3.4(10) | 0.6(10) | 10.1(11) |
| C30 | 17.7(14) | 14.5(13) | 15.2(13) | 3.9(10) | 1.6(11) | 6.0(11) |
| C31 | 14.9(14) | 13.6(13) | 19.3(14) | 3.7(10) | 1.8(11) | 6.9(11) |
| C32 | 18.8(14) | 18.6(14) | 21.2(14) | 4.5(11) | 3.9(11) | 8.3(12) |
| C33 | 15.7(13) | 16.3(13) | 23.6(14) | 8.5(11) | 9.3(11) | 6.6(11) |
| C34 | 23.0(15) | 23.4(15) | 25.4(15) | 7.4(12) | 13.4(12) | 10.1(13) |
| C35 | 65(3) | 60(2) | 19.6(16) | 13.2(16) | 10.4(16) | 37(2) |
| C36 | 12.6(13) | 15.2(13) | 17.6(13) | 6.2(11) | 1.6(10) | 8.0(11) |
| C37 | 14.1(13) | 16.9(13) | 15.0(13) | 4.1(10) | 1.8(10) | 7.6(11) |
| C38 | 16.7(14) | 17.6(13) | 16.4(13) | 1.7(11) | 2.2(11) | 6.8(11) |
| C39 | 15.0(13) | 17.2(13) | 17.3(14) | 3.1(11) | 1.7(11) | 6.1(11) |
| C40 | 20.3(14) | 21.8(14) | 15.2(13) | 3.5(11) | 4.1(11) | 10.4(12) |
| C41 | 23.9(15) | 31.1(16) | 24.6(15) | 6.2(13) | 5.7(12) | 18.1(13) |
| C42 | 27.3(16) | 44.3(19) | 19.6(15) | 6.2(13) | -1.2(13) | 22.5(15) |
| C43 | 38.8(19) | 56(2) | 16.4(15) | 2.3(14) | 3.7(13) | 30.3(17) |
| C44 | 29.2(16) | 43.9(18) | 19.5(15) | 4.2(13) | 4.6(12) | 26.4(15) |
| Cl1 | 59.6(9) | 67.6(9) | 36.9(7) | -10.1(6) | 5.9(6) | 41.7(7) |
| Cl2 | 56.9(11) | 39.5(10) | 46.3(10) | 0.8(8) | 3.3(8) | 30.6(9) |
| C45 | 35(4) | 38(4) | 54(5) | -1(3) | 2(3) | 13(3) |

**Table S38 Bond Lengths for 0872_tes_btm.**

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| O1 | N2 | 1.474(3) | O5 | C34 | 1.196(3) |
| O1 | C11 | 1.443(3) | O6 | C34 | 1.326(3) |
| O2 | C12 | 1.199(3) | O6 | C35 | 1.456(3) |
| O3 | C12 | 1.324(3) | N3 | C23 | 1.382(3) |
| O3 | C13 | 1.451(4) | N3 | C36 | 1.381(3) |
| N1 | C1 | 1.379(3) | N4 | C31 | 1.483(3) |
| N1 | C14 | 1.380(3) | N4 | C37 | 1.503(3) |
| N2 | C9 | 1.479(3) | C23 | C24 | 1.391(4) |
| N2 | C15 | 1.509(3) | C23 | C28 | 1.411(4) |
| C1 | C2 | 1.389(4) | C24 | C25 | 1.374(4) |
| C1 | C6 | 1.421(4) | C25 | C26 | 1.404(4) |
| C2 | C3 | 1.378(4) | C26 | C27 | 1.377(4) |
| C3 | C4 | 1.408(4) | C27 | C28 | 1.407(4) |
| C4 | C5 | 1.373(4) | C28 | C29 | 1.429(4) |
| C5 | C6 | 1.404(4) | C29 | C30 | 1.499(3) |
| C6 | C7 | 1.430(4) | C29 | C36 | 1.370(3) |
| C7 | C8 | 1.498(3) | C30 | C31 | 1.515(3) |
| C7 | C14 | 1.363(3) | C31 | C32 | 1.512(4) |
| C8 | C9 | 1.511(4) | C32 | C33 | 1.516(4) |
| C9 | C10 | 1.520(3) | C33 | C34 | 1.522(4) |
| C10 | C11 | 1.523(4) | C36 | C37 | 1.507(4) |
| C11 | C12 | 1.523(4) | C37 | C38 | 1.525(3) |
| C14 | C15 | 1.508(4) | C37 | C39 | 1.539(3) |
| C15 | C16 | 1.527(3) | C39 | C40 | 1.385(4) |
| C15 | C17 | 1.539(3) | C39 | C44 | 1.385(4) |
| C17 | C18 | 1.394(4) | C40 | C41 | 1.388(4) |
| C17 | C22 | 1.390(4) | C41 | C42 | 1.368(4) |
| C18 | C19 | 1.380(4) | C42 | C43 | 1.380(4) |
| C19 | C20 | 1.387(4) | C43 | C44 | 1.387(4) |
| C20 | C21 | 1.374(4) | Cl1 | C45 | 1.687(5) |
| C21 | C22 | 1.383(4) | Cl1 | C45[1] | 1.687(5) |
| O4 | N4 | 1.477(3) | Cl2 | C45 | 1.706(5) |
| O4 | C33 | 1.449(3) | | | |

[1]1-X,2-Y,2-Z

**Table S39 Bond Angles for 0872_tes_btm.**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| C11 | O1 | N2 | 106.59(17) | C34 | O6 | C35 | 114.8(2) |

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|---|---|---|---|---|---|---|---|
| C12 | O3 | C13 | 115.7(3) | C36 | N3 | C23 | 108.6(2) |
| C1 | N1 | C14 | 108.6(2) | O4 | N4 | C31 | 103.96(17) |
| O1 | N2 | C9 | 104.21(18) | O4 | N4 | C37 | 108.02(17) |
| O1 | N2 | C15 | 107.07(17) | C31 | N4 | C37 | 112.77(19) |
| C9 | N2 | C15 | 111.75(19) | N3 | C23 | C24 | 130.0(2) |
| N1 | C1 | C2 | 130.4(2) | N3 | C23 | C28 | 107.7(2) |
| N1 | C1 | C6 | 107.7(2) | C24 | C23 | C28 | 122.3(2) |
| C2 | C1 | C6 | 121.9(2) | C25 | C24 | C23 | 117.4(2) |
| C3 | C2 | C1 | 117.7(2) | C24 | C25 | C26 | 121.7(2) |
| C2 | C3 | C4 | 121.5(2) | C27 | C26 | C25 | 120.8(2) |
| C5 | C4 | C3 | 121.0(3) | C26 | C27 | C28 | 119.0(2) |
| C4 | C5 | C6 | 119.1(2) | C23 | C28 | C29 | 107.0(2) |
| C1 | C6 | C7 | 106.4(2) | C27 | C28 | C23 | 118.8(2) |
| C5 | C6 | C1 | 118.9(2) | C27 | C28 | C29 | 134.3(2) |
| C5 | C6 | C7 | 134.6(2) | C28 | C29 | C30 | 129.9(2) |
| C6 | C7 | C8 | 129.5(2) | C36 | C29 | C28 | 107.1(2) |
| C14 | C7 | C6 | 107.4(2) | C36 | C29 | C30 | 122.8(2) |
| C14 | C7 | C8 | 122.7(2) | C29 | C30 | C31 | 108.4(2) |
| C7 | C8 | C9 | 107.8(2) | N4 | C31 | C30 | 107.9(2) |
| N2 | C9 | C8 | 107.5(2) | N4 | C31 | C32 | 101.1(2) |
| N2 | C9 | C10 | 101.9(2) | C32 | C31 | C30 | 118.0(2) |
| C8 | C9 | C10 | 117.9(2) | C31 | C32 | C33 | 101.8(2) |
| C9 | C10 | C11 | 102.6(2) | O4 | C33 | C32 | 106.50(19) |
| O1 | C11 | C10 | 107.4(2) | O4 | C33 | C34 | 107.2(2) |
| O1 | C11 | C12 | 103.9(2) | C32 | C33 | C34 | 113.0(2) |
| C12 | C11 | C10 | 114.4(2) | O5 | C34 | O6 | 124.5(3) |
| O2 | C12 | O3 | 124.9(3) | O5 | C34 | C33 | 125.3(3) |
| O2 | C12 | C11 | 125.3(3) | O6 | C34 | C33 | 110.1(2) |
| O3 | C12 | C11 | 109.7(2) | N3 | C36 | C37 | 123.9(2) |
| N1 | C14 | C15 | 123.0(2) | C29 | C36 | N3 | 109.6(2) |
| C7 | C14 | N1 | 109.9(2) | C29 | C36 | C37 | 126.4(2) |
| C7 | C14 | C15 | 126.6(2) | N4 | C37 | C36 | 100.79(19) |
| N2 | C15 | C16 | 107.72(19) | N4 | C37 | C38 | 107.4(2) |
| N2 | C15 | C17 | 113.22(19) | N4 | C37 | C39 | 113.4(2) |
| C14 | C15 | N2 | 100.80(19) | C36 | C37 | C38 | 110.7(2) |
| C14 | C15 | C16 | 110.5(2) | C36 | C37 | C39 | 112.9(2) |
| C14 | C15 | C17 | 113.2(2) | C38 | C37 | C39 | 111.1(2) |
| C16 | C15 | C17 | 111.0(2) | C40 | C39 | C37 | 121.7(2) |
| C18 | C17 | C15 | 121.2(2) | C40 | C39 | C44 | 118.3(2) |
| C22 | C17 | C15 | 120.7(2) | C44 | C39 | C37 | 120.0(2) |
| C22 | C17 | C18 | 118.1(2) | C39 | C40 | C41 | 120.7(2) |
| C19 | C18 | C17 | 120.5(2) | C42 | C41 | C40 | 120.4(3) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C18 | C19 | C20 | 120.7(2) | C41 | C42 | C43 | 119.7(3) |
| C21 | C20 | C19 | 119.2(2) | C42 | C43 | C44 | 120.0(3) |
| C20 | C21 | C22 | 120.4(2) | C39 | C44 | C43 | 120.9(3) |
| C21 | C22 | C17 | 121.0(2) | C45 | Cl1 | C45[1] | 180.0(3) |
| C33 | O4 | N4 | 107.03(17) | Cl1 | C45 | Cl2 | 109.9(4) |

[1]1-X,2-Y,2-Z