Electronic Supplementary Material (ESI) for Chemical Communications.
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Supporting Information

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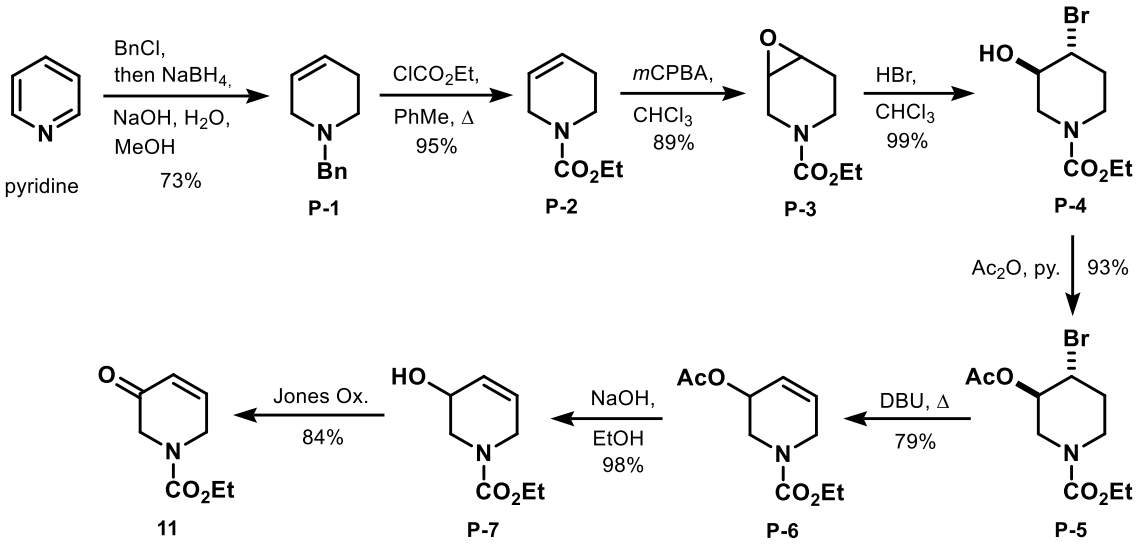
General information

All moisture and oxygen sensitive reactions were performed in flame-dried glassware under a slight nitrogen overpressure. All reactions were stirred magnetically. Sensitive solutions, solvents or reagents were transferred *via* cannula or syringe. Reactions were monitored by thin-layer chromatography (TLC) or NMR of the crude mixture. Evaporations were conducted under reduced pressure at temperatures less than 40°C, unless otherwise noted. Further dryings of the residues were accomplished using a high vacuum pump.All solvents were purchased as the highest available grade from Sigma-Aldrich, Acros-Organics or Fisher-Chemicals. Solvents for Pd-catalyzed coupling reactions were used after sparging the solvent with nitrogen for 30 min under ultrasonification. Ethyl acetate, hexane and dichloromethane for column chromatography were distilled and used without further purification. All other reagents were used as received from Sigma-Aldrich, Acros-Organics, TCI or Fisher-Chemicals unless otherwise noted. Thin-layer chromatographies (TLC) were carried out on pre-coated Merk silica gel 60 F254 to monitor all reactions. The detection was first performed using UV (254 nm) as a visualizing agent followed by immersion in an aqueous solution of phosphomolybdic acid (20 g), ceric(IV)sulfate (2 g) and 22 mL of sulfuric acid. Treatment with a heat-gun eventually revealed the state of the reaction. Preparative column chromatography was performed with silica gel 60 from Merk (0.040-0.063 µm, 240-400 mesh) or with neutral aluminum oxide from Merk (activated, Brockmann Grade II). Photo reactions were performed with two UV-Lamps (OSRAM, PURITEC® HNS L 18W 2G11). These lamps were arranged in an opposite fashion to each other approx. 10 cm away from the centered reaction flask (quartz vessel).

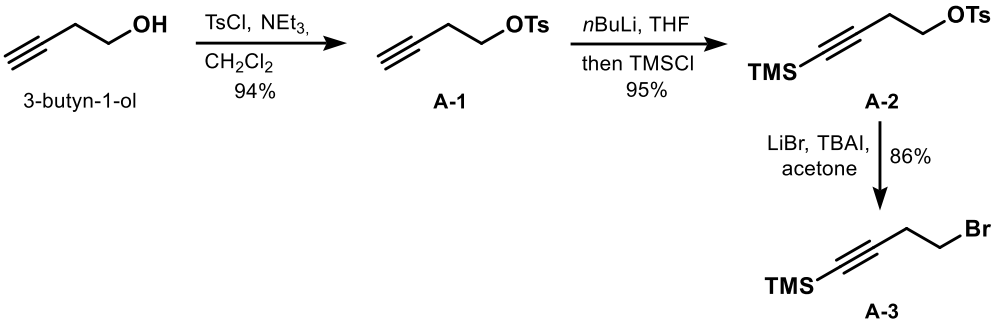
All NMR spectra were measured on a Bruker DPX 200, AV400 or DRX600. Chemical shifts are given in ppm and referenced to the solvent residual peaks ($CDCl_3$ ^1H, δ= 7.26 ppm, ^{13}C, δ= 77.00 ppm; methanol-d_4 ^1H, δ= 3.31 ppm, ^{13}C, δ= 49.00 ppm). Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constant *J*, integration. Infrared spectra were recorded as thin films of pure products on an ATR-unit on a Bruker Vector 22 or Shimadzu IRAffinity 1S. High-resolution mass spectra were measured on Waters QTOF-Premier (Waters Aquity Ultra Performance, electron spray ionization).

Graphical Overview

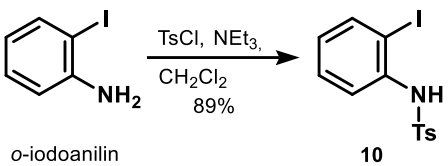
Synthetic sequence for the preparation of dihydropyridon **11**



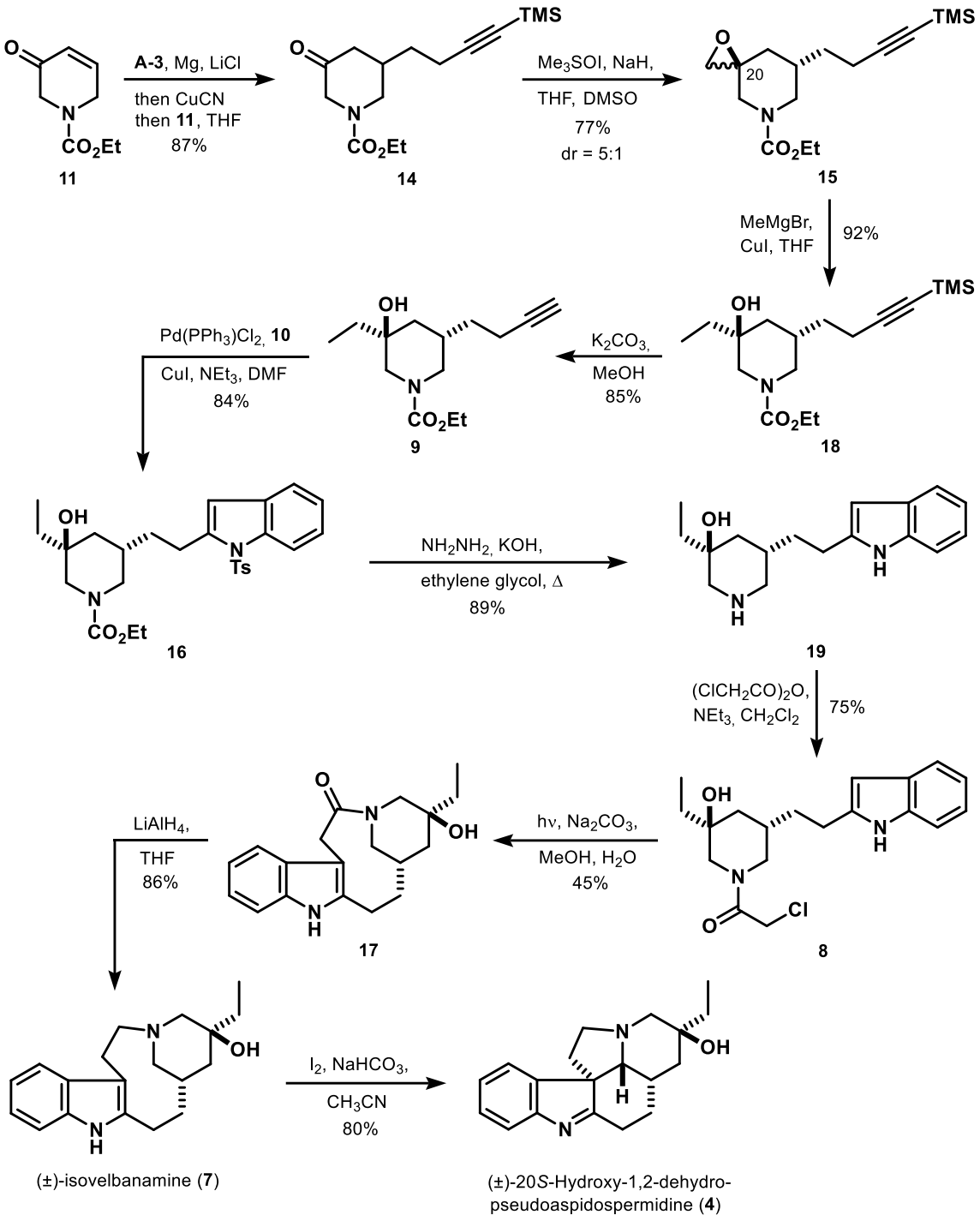
Synthetic sequence for the preparation of alkyne **A-3**



Synthetic sequence for the preparation of aniline **10**



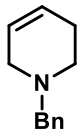
Synthetic sequence for the preparation of (20*S*)-Hydroxy-1,2-dehydro-pseudoaspidospermidine (**4**)



Procedures

Synthetic sequence for the preparation of dihydropyridon 11

1-Benzyl-1,2,3,6-tetrahydropyridine **P-1**



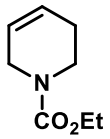
P-1

Benzyl chloride (36 mL, 1.03 eq., 320 mmol) was added to pyridine (25 mL, 310 mmol) and was crystallized for two days at r.t.. The resulting solid was heated to 140 °C for 1 h to complete the salt formation. Afterwards, the mixture was cooled to r.t. and solved in a 1:1 mixture of EtOH/H_2O (150 mL). The resulting solution was added dropwise to a stirred mixture of NaOH (25 g, 2.02 eq., 625 mmol) and $NaBH_4$ (14 g, 1.2 eq., 370 mmol) in EtOH/H_2O (1:1) (150 mL) at r.t.. After stirring for 12 h, the mixture was treated with water. The aqueous layer was extracted with diethyl ether (3x), the combined organic phases were washed with brine, dried over $MgSO_4$ and concentrated under reduced pressure. Vacuum distillation (0.2 mbar, 68-74 °C) of the residue afforded product **P-1** (39 g, 73%) as clear colorless oil. The analytical data matches the data in literature.[1]

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.37 (m, 4H), 7.29 (m, 1H), 5.79 (m, 1H), 5.69 (m, 1H), 3.62 (s, 2H), 3.01 (m, 2H), 2.59 (m, 1H), 2.55 (d, *J* = 5.6 Hz, 1H), 2.20 (m, 2H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 138.4, 129.2, 128.2, 127.0, 125.5, 125.2, 63.0, 52.8, 49.7, 26.2; ppm.
IR: 3030, 2911, 2798, 2750, 1659, 1492, 1454, 1361, 1133, 1036 cm^{-1}
HRMS: m/z calculated for $C_{12}H_{15}N_1H^+$: 174.1283; found: 174.1283;

[1] H. Oedinger, N. Joop, Liebigs Ann. Chem. **1972**, *764*, 21-27

Ethyl 3,6-dihydropyridine-1(2*H*)-carboxylate **P-2**



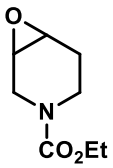
P-2

To a solution of **P-1** (39 g, 226 mmol) in toluene (110 mL) was added ethyl chloroformate (23.7 mL, 1.1 eq., 249 mmol) at r.t.. After stirring for 2.5 h under reflux, the resulting solution was cooled to r.t. and treated with a sat. $NaHCO_3$. The mixture was extracted with ethyl acetate (3x), the organic layer was washed with brine and dried over $MgSO_4$. The solvent was removed under reduced pressure and the residue was purified by column chromatography (hexane/EtOAc, 10:1) to give **P-2** (33 g, 95%) as clear colorless liquid. The analytical data matches the data in literature.[2]

^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.82 (m, 1H), 5.64 (m, 1H), 4.14 (q, *J* = 7.1 Hz, 2H), 3.92 (qi, *J* = 2.8 Hz, 2H), 3.53 (t, *J* = 5.7 Hz, 2H), 2.13 (m, 2H), 1.26 (t, *J* = 7.1 Hz, 3H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 155.8, 125.3, 124.3, 61.2, 43.4, 40.3, 25.0, 14.7; ppm.
IR: 2931, 2842, 1697, 1429, 1281, 1237, 1109, 1038, 769, 656 cm^{-1}
HRMS: m/z calculated for $C_8H_{13}O_2N_1H^+$: 156.1025; found: 156.1024;

[2] T. Imanishi, H. Shin, M. Hanaoka, T. Momose, I. Imanishi, *Chem. Pharm. Bull.* **1982**, *30*, 3617-3623.

Ethyl 7-oxa-3-azabicyclo[4.1.0]heptane-3-carboxylate **P-3**



P-3

To a solution of **P-2** (33 g, 215 mmol) in $CHCl_3$ (540 mL) was added *m*CPBA (56 g, 1.5 eq., 323 mmol) in small portions. The reaction mixture was stirred for 18 h at r.t.. The suspension was neutralized with sat. $NaHCO_3$ and quenched with aq. $Na_2S_2O_3$, the aqueous layer was extracted with CH_2Cl_2 (3x), the combined organic phases were washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation and the residue was purified by vacuum distillation (0.2 mbar, 95-100 °C) to yield **P-3** (32.7 g, 89%) as clear colorless oil. The analytical data matches the data in literature.

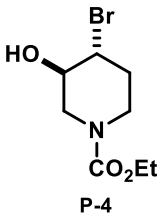
^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.12 (q, *J* = 7.1 Hz, 2H), 3.90 (m, 1H), 3.73 (m, 1H), 3.48 (m, 1H), 3.30 (m, 1H), 3.17 (m, 2H), 2.07 (m, 1H), 1.90 (m, 1H), 1.25 (t, *J* = 7.1 Hz, 3H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 155.7, 61.4, 50.6, 50.2, 42.3, 37.2, 24.3, 14.6; ppm.

IR: 3524, 2984, 1692, 1429, 1243, 1216, 1106, 1038, 798, 768 cm^{-1}

HRMS: m/z calculated for $C_8H_{13}O_3N_1Na^+$: 194.0793; found: 194.0788;

Ethyl 4-bromo-3-hydroxypiperidine-1-carboxylate **P-4**

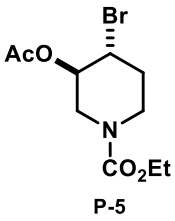


P-4

To a solution of **P-3** (32.7 g, 191 mmol) in $CHCl_3$ (320 mL) was added conc. HBr (48 wt%, 166 mL) at -50 °C over a period of 30 min. The resulting mixture was stirred vigorously for 3 h at the same temperature. Then water was added, the organic layer was extracted with CH_2Cl_2 (3x), neutralized with sat. $NaHCO_3$, washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation to yield the crude product **P-4** (48 g, quant.) as clear slightly red liquid, which was used in the next step without further purification. The analytical data matches the data in literature.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.25 (ddd, *J* = 13.5, 4.4, 1.8 Hz, 1H), 4.14 (q, *J* = 7.1 Hz, 2H), 3.98 (ddd, *J* = 10.2, 8.2, 4.4 Hz, 1H), 3.94 (m, 1H), 3.72 (m, 1H), 3.01 (m, 1H), 2.94 (dd, *J* = 13.1, 8.5 Hz, 1H), 2.49 (bs, 1H), 2.32 (dq, *J* = 13.7, 3.2 Hz, 1H), 1.97 (m, 1H), 1.26 (t, *J* = 7.1 Hz, 3H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 155.6, 71.3, 61.8, 55.6, 48.2, 43.1, 33.6, 14.6; ppm.
IR: 3416, 2932, 1671, 1436, 1470, 1240, 1189, 968, 910, 767 cm^{-1}
HRMS: m/z calculated for $C_8H_{14}O_3N_1Br_1Na^+$: 274.0055; found: 274.0053;

Ethyl 3-acetoxy-4-bromopiperidine-1-carboxylate **P-5**



P-5

To a solution of **P-4** (48 g, 191 mmol) in pyridine (95 mL) was added acetic anhydride (52.4 mL, 2.9 eq., 554 mmol). After stirring for 18 h at r.t., the resulting solution was cooled to 0 °C and neutralized with 1 M $NaHSO_4$. The aqueous layer was extracted with diethyl ether (3x), the etheral phase was washed with $NaHCO_3$ and brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation to provide the crude product **P-5** (52 g, 93%) as clear brownish oil, which was used in the next step without further purification. The analytical data matches the data in literature.

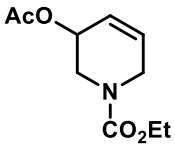
^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.91 (m, 1H), 4.15 (m, 1H), 4.14 (q, *J* = 7.1 Hz, 2H), 3.90 (dd, *J* = 14.1, 3.3 Hz, 1H), 3.55 (ddd, *J* = 13.6, 8.0, 3.6 Hz, 1H), 3.53 (dd, *J* = 14.0, 6.0 Hz, 1H), 3.50 (m, 1H), 2.31 (m, 1H), 2.08 (s, 3H), 1.94 (m, 1H), 1.25 (t, *J* = 7.1 Hz, 3H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.6, 155.6, 70.7, 61.7, 48.2, 44.3, 41.0, 31.6, 20.8, 14.6; ppm.

IR: 2983, 1743, 1698, 1471, 1429, 1219, 1193, 1046, 1026, 768 cm^{-1}

HRMS: m/z calculated for $C_{10}H_{16}O_4N_1Br_1H^+$: 294.0341; found: 294.0338;

Ethyl 3-acetoxy-3,6-dihydropyridine-1(2*H*)-carboxylate **P-6**



P-6

DBU (50 mL, 1.9 eq., 337 mmol) was added to compound **P-5** (52 g, 177 mmol) and stirred for 2 h at 90 °C. The resulting mixture was cooled to r.t., diluted with toluene and filtered to separate the precipitate. The solution was treated with sat. NH_4Cl, the aqueous phase was extracted with diethyl ether (3x), the combined organic phases were washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation. The residue was purified by column chromatography (hexane/EtOAc, 3:1) to give **P-6** (29.8 g, 79%) as clear slightly yellow liquid. The analytical data matches the data in literature.

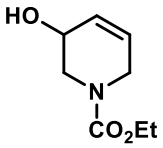
^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.92 (m, 1H), 5.87 (m, 1H), 5.20 (m, 1H), 4.16 (m, 3H), 3.82 (m, 2H), 3.53 (dd, *J* = 13.9, 3.9 Hz, 1H), 2.05 (s, 3H), 1.27 (t, *J* = 7.1 Hz, 3H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.5, 155.7, 130.1, 123.8, 65.5, 61.6, 44.5, 43.1, 21.1, 14.7; ppm.

IR: 2983, 1733, 1699, 1430, 1372, 1228, 1125, 1040, 1016, 769 cm^{-1}

HRMS: m/z calculated for $C_{10}H_{15}O_4N_1Na^+$: 236.0899; found: 236.0897;

Ethyl 3-hydroxy-3,6-dihydropyridine-1(2*H*)-carboxylate **P-7**



P-7

To a solution of **P-6** (29.8 g, 140 mmol) in EtOH (90 mL) was added a solution of NaOH in EtOH (0.2 M, 120 mL) over a period of 30 min at 0 °C. After stirring for 1 h at the same temperature, the resulting solution was quenched with sat. NH_4Cl, the mixture was extracted with diethyl ether (3x), the combined organic layers were washed with brine and dried over $MgSO_4$. The solvent was removed under reduced pressure to give the crude product **P-7** (24.5 g, 98%) as colorless liquid, which was used in the next step without further purification. The analytical data matches the data in literature.

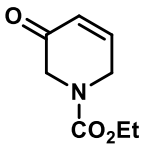
^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.91 (m, 1H), 5.82 (m, 1H), 4.21 (m, 1H), 4.15 (q, *J* = 7.1 Hz, 2H), 4.01 (m, 1H), 3.84 (dq, *J* = 18.6, 2.2 Hz, 1H), 3.62 (m, 1H), 3.56 (m, 1H), 2.14 (bs, 1H), 1.26 (t, *J* = 7.1 Hz, 3H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 156.1, 128.3, 127.5, 126.7, 63.5, 61.6, 47.7, 43.2, 14.6; ppm.

IR: 3415, 2981, 2878, 1676, 1428, 1230, 1113, 1060, 1001, 769 cm^{-1}

HRMS: m/z calculated for $C_8H_{13}O_3N_1Na^+$: 194.0793; found: 194.0795;

Ethyl 3-oxo-3,6-dihydropyridine-1(2*H*)-carboxylate **11**



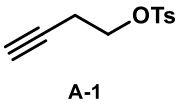
11

Jones reagent (6.4 mL, 1 eq., 19.3 mmol) was added to a mixture of **P-7** (3 g, 19.3 mmol) in aceton (95 mL) at 0 °C over a period of 30 min. The resulting mixture was quenched with MeOH and diluted with water. The aqueous phase was extracted with CH_2Cl_2 (3x), the combined organic phases were neutralized with sat. $NaHCO_3$, washed with water, brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation at **room temperature** to obtain the rather unstable crude product **11** (2.48 g, 84%) as clear colorless liquid, which was used immediately in the next step without further purification. The analytical data matches the data in literature.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.03 (m, 1H), 6.17 (dt, *J* = 10.2, 2.1 Hz, 1H), 4,27 (m, 2H), 4.18 (q, *J* = 7.1 Hz, 2H), 4.15 (m, 2H), 1.27 (t, *J* = 7.1 Hz, 3H); ppm.

Synthetic sequence for the preparation of alkyne A-3

But-3-yn-1-yl 4-methylbenzenesulfonate **A-1**



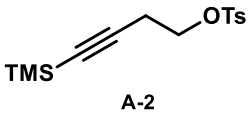
A-1

To a solution of but-3-yn-1-ol (10 g, 143 mmol) in CH_2Cl_2 (240 mL) were added NEt_3 (40 mL, 2 eq., 285 mmol) and TsCl (27.5 g, 1.01 eq., 144 mmol) at 0 °C. The solution was stirred for 18 h at r.t. and then quenched with sat. NH_4Cl. The mixture was extracted with CH_2Cl_2 (3x), the combined organic layers were neutralized with sat. $NaHCO_3$, washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation to afford the crude product **A-1** (30 g, 94%) as clear colorless oil, which was used in the next step without further purification. The analytical data matches the data in literature.[3]

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.80 (m, 2H), 7.35 (m, 2H), 4.10 (t, *J* = 7.0 Hz, 2H), 2.55 (dt, *J* = 7.0, 2.6 Hz, 2H), 2.44 (s, 3H), 1.97 (t, *J* = 2.6 Hz, 1H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 145.0, 132.8, 129.9, 128.0, 78.4, 70.7, 67.4, 21.6, 19.4; ppm.
IR: 3290, 1598, 1356, 1173, 1096, 976, 902, 814, 764, 661 cm^{-1}
HRMS: m/z calculated for $C_{11}H_{12}O_3S_1Na^+$: 247.0405; found: 247.0400;

[3] J. M. Ready, J. Bian, M. V. Wingerden, *J. Am. Chem. Soc.* **2006**, *128*, 7428-7429.

4-(Trimethylsilyl) but-3-yn-1-yl 4-methylbenzenesulfonate **A-2**



A-2

To a solution of **A-1** (30 g, 134 mmol) in THF (80 mL) was added *n*BuLi (59 mL, 1.1 eq., 2.5 M in hexane, 147 mmol) dropwise at -78 °C. The resulting dark brown solution was stirred for 1 h at -78 °C and TMSCl (22 mL, 1.3 eq., 174 mmol) was added. The solution was allowed to warm up to r.t. overnight and was then treated with sat. NH_4Cl. The aqueous layer was extracted with diethyl ether (3x), the combined organic phases were washed with brine and dried over $MgSO_4$. The solvent was removed under reduced pressure to afford the crude product **A-2** (37.7 g, 95%) as brown oil, which was used in the next step without further purification. The analytical data matches the data in literature.

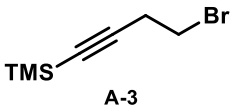
^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.79 (m, 2H), 7.34 (m, 2H), 4.07 (t, *J* = 7.3 Hz, 2H), 2.58 (t, *J* = 7.3 Hz, 2H), 2.44 (s, 3H), 0.11 (s, 9H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.9, 132.9, 129.9, 127.9, 100.3, 87.4, 67.5, 21.6, 20.7, -0.2; ppm.

IR: 2960, 2181, 1599, 1362, 1250, 1175, 978, 905, 840, 760 cm^{-1}

HRMS: m/z calculated for $C_{14}H_{20}O_3Si_1S_1Na^+$: 319.0800; found: 319.0798;

(4-Bromobut-1-yn-1-yl) trimethylsilane **A-3**



A-3

To a solution of **A-2** (37.7 g, 127 mmol) in acetone (160 mL) were added LiBr (23.2 g, 2.1 eq., 267 mmol) in small portions and TBAI (938 mg, 0.02 eq., 2.54 mmol). After stirring for 36 h at r.t., the resulting mixture was treated with sat. $NaHCO_3$. The mixture was extracted with diethyl ether (3x), the combined organic layers were washed with brine, dried over $MgSO_4$ and concentrated under reduced pressure. Vacuum distillation (10 mbar, 62-64 °C) of the residue afforded product **A-3** (22.4 g, 86%) as clear colorless liquid. The analytical data matches the data in literature.

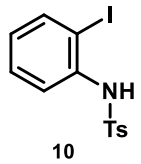
^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.43 (t, *J* = 7.5 Hz, 2H), 2.77 (t, *J* = 7.5 Hz, 2H), 0.16 (s, 9H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 103.2, 87.0, 29.2, 24.3, -0.1; ppm.

IR: 2960, 2179, 1250, 1212, 1055, 998, 837, 759, 699, 679 cm^{-1}

Synthetic sequence for the preparation of aniline 10

N-(2-Iodophenyl)-4-methylbenzenesulfonamide **10**



10

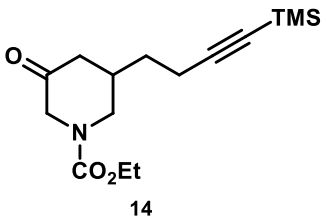
To a solution of *o*-iodoaniline (15 g, 68.5 mmol) in CH_2Cl_2 (140 mL) were added pyridine (16.6 mL, 3 eq., 205 mmol) and TsCl (13.3 g, 1.02 eq., 69.8 mmol) at r.t.. After stirring for 18 h at the same temperature, the resulting mixture was quenched with water, the aqueous layer was extracted with CH_2Cl_2 (3x), the combined organic layers were washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation and the residue was purified by column chromatography (hexane/EtOAc, 5:1) to give **10** (22.8 g, 89%) as white solid. The analytical data matches the data in literature.[4]

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.64 (m, 4H), 7.30 (m, 1H), 7.21 (m, 2H), 6.82 (ddd, *J* = 15.4, 7.4, 1.6 Hz, 1H), 6.80 (bs, 1H), 2.38 (s, 3H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.2, 139.1, 137.5, 135.9, 129.6, 129.5, 127.4, 126.8, 122.4, 92.3, 21.6; ppm.
IR: 3301, 1473, 1395, 1336, 1162, 1091, 1015, 911, 813, 753 cm^{-1}
HRMS: m/z calculated for $C_{13}H_{12}O_2N_1S_1I_1Na^+$: 395.9531; found: 395.9537;

[4] K. A. Jacobson *et al.*, *J. Med. Chem.* **2007**, *50*, 1810-1827.

Synthetic sequence for the preparation of (20*S*)-Hydroxy-1,2-dehydro-pseudoaspidospermidine (4)

Ethyl 3-oxo-5-(4-(trimethylsilyl) but-3-yn-1-yl) piperidine-1-carboxylate **14**



14

To a stirred mixture of Mg turnings (856 mg, 2.4 eq., 35.2 mmol) in THF (20 mL) was added dropwise a solution of **A-3** (7.25 g, 2.4 eq., 35.2 mmol) in THF (60 mL) at r.t.. The resulting Grignard reagent was stirred for 1 h at 40 °C. Afterwards, the suspension was cooled to r.t. and LiCl (1.24 g, 2 eq., 29.4 mmol) was added. After stirring for 30 min at r.t., the resulting mixture was cooled to -48 °C and CuCN (1.58 g, 1.2 eq., 17.6 mmol) was added. The reaction was stirred for 1 h at the same temperature and then cooled to -70 °C. Thereafter, a solution of **11** (2.48 g, 14.7 mmol) in THF (10 mL) was added dropwise *via* syringe. After stirring at -70 °C for 1 h, the mixture was quenched with an aq. solution of NH_4Cl/NH_3 (8:1). The aqueous phase was extracted with diethyl ether (3x), the combined organic layers were washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation. The residue was purified by column chromatography (hexane/EtOAc, 5:1) to give **14** (3.79 g, 87%) as clear slightly yellow liquid.

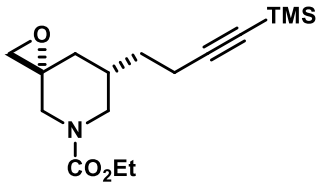
^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.15 (q, *J* = 7.0 Hz, 2H), 4.07 (d, *J* = 18.0 Hz, 1H), 3.97 (bm, 1H), 3.87 (bm, 1H), 3.21 (dd, *J* = 12.3, 8.8 Hz, 1H), 2.63 (dd, *J* = 14.7, 3.0 Hz, 1H), 2.30 (t, *J* = 7.2 Hz, 2H), 2.20 (m, 2H), 1.63 (m, 1H), 1.51 (m, 1H), 1.26 (t, *J* = 7.0 Hz, 3H), 0.13 (s, 9H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 204.8, 155.3, 105.6, 85.7, 61.9, 54.0, 46.9, 44.5, 33.3, 31.9, 17.2, 14.6, 0.1; ppm.

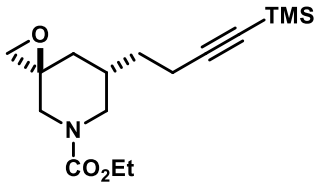
IR: 2959, 2176, 1697, 1431, 1248, 1225, 1209, 1120, 841, 760 cm^{-1}

HRMS: m/z calculated for $C_{15}H_{25}O_3N_1Si_1H^+$: 296.1687; found: 296.1682;

Ethyl (3*R*,7*S*)-7-(4-(trimethylsilyl)but-3-yn-1-yl)-1-oxa-5-azaspiro[2.5]octane-5-carboxylate **15a** and Ethyl (3*S*,7*S*)-7-(4-(trimethylsilyl)but-3-yn-1-yl)-1-oxa-5-azaspiro[2.5]octane-5-carboxylate **15b**



15a



15b

Trimethylsulfoxonium iodide (560 mg, 1.5 eq., 2.54 mg) was dissolved in a solution of THF/DMSO (1:1) (17 mL). The solution was cooled to 0 °C and NaH (102 mg, 1.5 eq., 60% in mineral oil, 2.54 mmol) was added. After stirring for 30 min, **14** (500 mg, 1.69 mmol) was added and the resulting solution was stirred for 2 h at the same temperature. The reaction was treated with sat. NH_4Cl, the mixture was extracted with diethyl ether (3x), the combined organic phases were washed with brine, dried over $MgSO_4$ and concentrated under reduced pressure. The residue was purified by column chromatography (hexane/EtOAc, 3:1) to give **15a** and **15b** (327 mg, 77%) as clear colorless oils in a 1:5 mixture of stereoisomers.

Fr. 1 (minor (3*R*,7*S*) **15a**):

^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.13 (q, *J* = 7.1 Hz, 2H), 3.89 (bs, 1H), 3.60 (bs, 1H), 3.24 (d, *J* = 13.2 Hz, 1H), 2.84 (dd, *J* = 13.2, 9.8 Hz, 1H), 2.75 (bs, 1H), 2.61 (dd, *J* = 4.7, 1.3 Hz, 1H), 2.29 (m, 2H), 1.92 (bs, 1H), 1.70 (dd, *J* = 13.2, 4.2 Hz, 1H), 1.64 (m, 1H), 1.56 (m, 1H), 1.50 (m, 1H), 1.25 (t, *J* = 7.1 Hz, 3H), 0.14 (s, 9H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 155.5, 106.3, 85.3, 61.5, 55.5, 53.4, 50.0, 48.2, 37.2, 34.7, 31.3, 17.4, 14.7, 0.1; ppm.

IR: 2957, 2174, 1699, 1429, 1248, 1213, 1115, 841, 760, 417 cm^{-1}

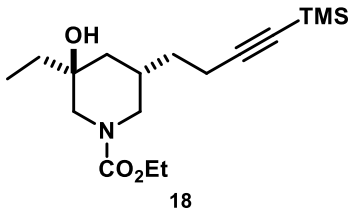
HRMS: m/z calculated for $C_{16}H_{27}O_3N_1Si_1H^+$: 310.1838; found: 310.1843;

Fr. 2 (major (3*S*,7*S*) **15b**):

^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.13 (q, *J* = 7.0 Hz, 2H), 4.03 (bm, 1H), 3.55 (m, 1H), 3.33 (d, *J* = 13.7 Hz, 1H), 2.67 (m, 1H), 2.71 (bm, 1H), 2.68 (d, *J* = 4.7 Hz, 1H), 2.26 (t, *J* = 7.5 Hz, 2H), 2.01 (m, 1H), 1.59 (m, 3H), 1.45 (m, 1H), 1.24 (t, *J* = 7.0 Hz, 3H), 0.13 (s, 9H); ppm.

^{13}C NMR (100 MHz, $CDCl_3$): δ = 155.7, 106.4, 85.1, 61.5, 55.4, 52.3, 49,9, 47.9, 37.1, 33.6, 32.1, 17.4, 14.6, 0.0; ppm.
IR: 2959, 2174, 1699, 1429, 1248, 1209, 1121, 843, 762, 403 cm^{-1}
HRMS: m/z calculated for $C_{16}H_{27}O_3N_1Si_1H^+$: 310.1838; found: 310.1843;

Ethyl (3*S*,5*S*)-3-ethyl-3-hydroxy-5-(4-(trimethylsilyl) but-3-yn-1-yl) piperidine-1-carboxylate **18**

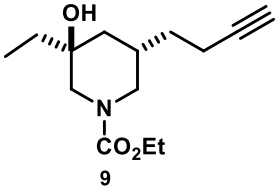


18

To a solution of **15b** (270 mg, 0.87 mmol) in THF (4.5 mL) was added CuI (17 mg, 0.1 eq., 0.09 mmol). The mixture was cooled to -40 °C and MeMgBr (0.38 mL, 1.3 eq., 3 M in Et_2O, 1.13 mmol) was added. After stirring for 30 min at the same temperature, the reaction was quenched with sat. NH_4Cl, the aqueous phase was extracted with diethyl ether (3x), the combined organic phases were washed with brine, dried over $MgSO_4$ and concentrated under reduced pressure. The residue was purified by column chromatography (hexane/EtOAc, 3:1) to afford **18** (261 mg, 92%) as clear colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.18 (bs, 1H), 4.14 (q, *J* = 7.1 Hz, 2H), 3.98 (bs, 1H), 2.60 (d, *J* = 2.6 Hz, 1H), 2.26 (m, 3H), 1.93 (m, 1H), 1.82 (m, 1H), 1.74 (bs, 1H), 1.48 (m, 3H), 1.40 (m, 1H), 1.25 (t, *J* = 7.1 Hz, 3H), 0.98 (m, 1H), 0.95 (t, *J* = 7.5 Hz, 3H), 0.13 (s, 9H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 156.6, 106.8, 84.8, 70.1, 61.5, 53.3, 49.4, 41.1, 33.2, 32.7, 31.2, 17.3, 14.6, 7.1, 0.1; ppm.
IR: 3428, 2960, 2927, 2172, 1682, 1436, 1249, 1016, 843, 761 cm^{-1}
HRMS: m/z calculated for $C_{17}H_{31}O_3N_1Si_1H^+$: 326.2151; found: 326.2153;

Ethyl (3*S*,5*S*)-5-(but-3-yn-1-yl)-3-ethyl-3-hydroxypiperidine-1-carboxylate **9**

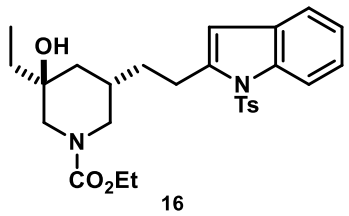


9

To a solution of **18** (770 mg, 2.37 mmol) in MeOH (24 mL) was added K_2CO_3 (817 mg, 2.5 eq., 5.91 mmol). The mixture was stirred for 7 h at r.t. and then treated with water. The aqueous layer was extracted with diethyl ether (3x), the combined organic phases were washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation to obtain the crude product **9** (510 mg, 85%) as clear colorless liquid, which was used in the next step without further purification.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.22 (bs, 1H), 4.14 (q, *J* = 7.1 Hz, 2H), 3.99 (bs, 1H), 2.61 (d, *J* = 13.6 Hz, 1H), 2.24 (m, 3H), 1.99 (m, 1H), 1.95 (t, *J* = 2.5 Hz, 1H), 1.82 (m, 1H), 1.71 (m, 1H), 1.49 (q, *J* = 7.5 Hz, 2H), 1.41 (m, 2H), 1.26 (t, *J* = 7.1 Hz, 3H), 0.98 (d, *J* = 12.8 Hz, 1H), 0.96 (t, *J* = 7.5 Hz, 3H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 156.2, 83.8, 70.2, 68.7, 61.5, 53.4, 49.3, 41.0, 33.1, 32.5, 30.8, 15.8, 14.7, 7.1; ppm.
IR: 3422, 3300, 2976, 2925, 1679, 1432, 1266, 1162, 1101, 1012 cm^{-1}
HRMS: calculated for $C_{14}H_{23}O_3N_1Na^+$: 276.1576; found: 276.1577;

Ethyl (3*S*,5*S*)-3-ethyl-3-hydroxy-5-(2-(1-tosyl-1*H*-indol-2-yl) ethyl) piperidine-1-carboxylate **16**

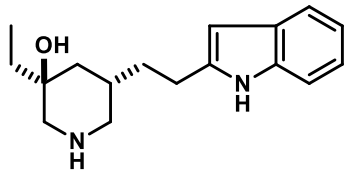


16

To a solution of **9** (510 mg, 2.01 mmol) in DMF (7 mL) were added **10** (825 mg, 1.1 eq., 2.21 mmol) and NEt_3 (0.84 mL, 3 eq., 6.03 mmol). The mixture was degassed followed by addition of CuI (38 mg, 0.1 eq., 0.20 mmol) and $PdCl_2(PPh_3)_2$ (70 mg, 0.05 eq., 0.1 mmol). After stirring for 3 h at 70 °C, the resulting solution was poured into sat. NH_4Cl, the aqueous layer was extracted with diethyl ether (3x), the combined organic phases were washed with brine, dried over $MgSO_4$ and concentrated under reduced pressure. The residue was purified by column chromatography (hexane/EtOAc, 1:1) to afford **16** (840 mg, 84%) as brown oil.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.15 (d, *J* = 8.2 Hz, 1H), 7.60 (d, *J* = 8.2 Hz, 2H), 7.40 (d, *J* = 7.5 Hz, 1H), 7.23 (m, 2H), 7.18 (d, *J* = 8.2 Hz, 2H), 6.39 (s, 1H), 4.28 (bs, 1H), 4.16 (q, *J* = 7.1 Hz, 2H), 4.01 (bs, 1H), 3.02 (m, 2H), 2.62 (d, *J* = 13.8 Hz, 1H), 2.35 (m, 1H), 2.33 (s, 3H), 1,97 (m, 1H), 1.89 (m, 1H), 1.65 (m, 4H), 1.51 (q, *J* = 7.5 Hz, 2H), 1.28 (t, *J* = 7.1 Hz, 3H), 0.97 (t, *J* = 7.5 Hz, 3H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 156.6, 144.7, 141.7, 137.3, 136.1, 129.8, 129.7, 126.2, 124.0, 123.6, 120.2, 114.9, 109.2, 70.3, 61.5, 53.5, 49.6, 41.3, 33.5, 33.2, 31.4, 26.4, 21.6, 14.7, 7.1; ppm.
IR: 3422, 2976, 2922, 1682, 1451, 1367, 1248, 1180, 1091, 812 cm^{-1}
HRMS: m/z calculated for $C_{27}H_{34}O_5N_2S_1H^+$: 499.2267; found: 499.2266;

(3*S*,5*S*)-5-(2-(1*H*-indol-2-yl) ethyl)-3-ethylpiperidin-3-ol **19**

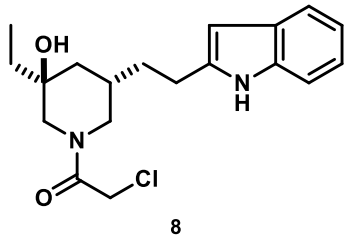


19

To a mixture of **16** (1.42 g, 2.85 mmol) in ethylene glycol (28 mL) were added KOH (3.2 g, 20 eq., 57 mmol) and hydrazine (0.9 mL, 10 eq., 28.5 mmol). The mixture was stirred for 4 h at 140 °C, cooled to r.t. and treated with water. The mixture was extracted with CH_2Cl_2 (3x), the combined organic layers were washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation to yield the crude product **19** (690 mg, 89%) as chewy greenish oil, which was used in the next step without further purification.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.12 (s, 1H), 7.52 (d, *J* = 7.5 Hz, 1H), 7.31 (d, *J* = 7.3 Hz, 1H), 7.09 (m, 2H), 6.22 (s, 1H), 3.08 (m, 1H), 2.73 (bm, 5H), 2.39 (d, *J* = 11.8 Hz, 1H), 2.12 (t, *J* = 11.3 Hz, 1H), 1.88 (m, 1H), 1.78 (m, 1H), 1.58 (m, 2H), 1.44 (m, 2H), 0.95 (m, 1H), 0.92 (t, *J* = 7.5 Hz, 3H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 139.6, 135.8, 128.8, 121.0, 119.7, 119.6, 110.5, 99.3, 69.3, 55.5, 52.0, 41.7, 33.8, 32.9, 32.1, 25.4, 7.1; ppm.
IR: 3400, 3250, 2920, 1550, 1457, 1286, 967, 887, 782, 732 cm^{-1}
HRMS: m/z calculated for $C_{17}H_{24}O_1N_2H^+$: 273.1967; found: 273.1965;

1-((3*S*,5*S*)-5-(2-(1*H*-indol-2-yl) ethyl)-3-ethyl-3-hydroxypiperidin-1-yl)-2-chloroethan-1-one **8**



8

To a solution of **19** (690 mg, 2.54 mmol) in CH_2Cl_2 (25 mL) were added NEt_3 (0.35 mL, 1 eq., 2.54 mmol) and $(ClAc)_2O$ (650 mg, 1.5 eq., 3.80 mmol) at 0 °C. The solution was stirred for 30 min at the same temperature and quenched with water. The aqueous phase was extracted with CH_2Cl_2 (3x), the combined organic phases were washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation. The residue was purified by column chromatography (hexane/EtOAc, 1:1) to give **8** (664 mg, 75%) as slightly yellow oil.

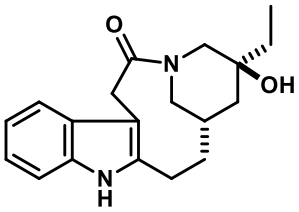
^{1}H NMR (400 MHz, $CDCl_3$, two rotamers): δ = 8.59 (s, 2H (ma)), 8.16 (s, 1H (mi)), 7.51 (m, 3H (ma,mi)), 7.33 (m, 3H (ma,mi)), 7.09 (m, 6H (ma,mi)), 6.26 (s, 1H (mi)), 6.19 (s, 2H (ma)), 4.69 (bd, *J* = 12.8 Hz, 2H (ma)), 4.41 (bd, *J* = 13.7 Hz, 1H (mi)), 4.27 (d, *J* = 12.8 Hz, 2H (ma)), 4.12 (d, *J* = 12.8 Hz, 2H (ma)), 4.02 (d, *J* = 12.6 Hz, 1H (mi)), 3.98 (d, *J* = 12.6 Hz, 1H (mi)), 3.78 (bd, *J* = 13.7 Hz, 1H (mi)), 3.62 (m, 2H (ma)), 2.96 (d, *J* = 13.9 Hz, 2 H (ma)), 2.77 (m, 6H (ma,mi)), 2.62 (m, 1H (mi)), 2.44 (d, *J* = 13.7 Hz, 1H (mi)), 2.12 (m, 6H (ma,mi)), 1.90 (m, 3 H (ma,mi)), 1.76 (m, 4H (ma,mi)), 1.66 (m, 2H (ma,mi)), 1.57 (m, 3H (ma,mi)), 1.51 (m, 5H (ma,mi)), 1.11 (m, 3H (ma,mi)), 0.96 (t, *J* = 7.5 Hz, 9H (ma,mi)); ppm.

^{13}C NMR (100 MHz, $CDCl_3$, two rotamers): δ = 171.2, 167.0, 139.1, 138.8, 136.1, 136.0, 128.7, 128.6, 121.3, 120.9, 119.8, 119.8, 119.7, 119.5, 110.7, 110.4, 99.7, 99.3, 70.8, 70.8, 55.7, 52.1, 51.8, 48.5, 42.1, 41.5, 41.3, 41.1, 33.6, 33.3, 33.2, 33.0, 32.4, 31.0, 25.6, 25.1, 7.1, 7.0; ppm.

IR: 3400, 3310, 2924, 1637, 1458, 1287, 1138, 910, 784, 734 cm^{-1}

HRMS: m/z calculated for $C_{19}H_{25}O_2N_2Cl_1H^+$: 349.1683; found: 349.1679;

(5*S*,7*S*)-5-Ethyl-5-hydroxy-1,4,5,6,7,8,9,10-octahydro-2*H*-3,7-methano[1]azacycloundecino[5,4-b]indol-2-one **17**

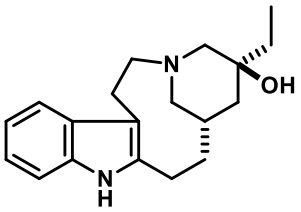


17

A mixture of **8** (250 mg, 0.72 mmol) and Na_2CO_3 (304 mg, 4 eq., 2.87 mmol) in MeOH (72 mL) and water (48 mL) was placed in a quarz vessel. The vessel was sonificated under a nitrogen atmosphere for 30 min and then irradiated (λ=254 nm) at r.t. for 1 h. Afterwards, the methanol was evaporated under reduced pressure and the residue was diluted with $NaHCO_3$. The aqueous layer was extracted with diethyl ether (3x), the combined organic phases were washed with brine, dried over $MgSO_4$ and the solvent was removed by rotary evaporation. The residue was purified by column chromatography (hexane/EtOAc, 1:1) to afford **17** (101 mg, 45%) as white solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (m, 1H), 7.81 (bs, 1H), 7.23 (m, 1H), 7.12 (m, 2H), 4.6 (d, *J* = 14.1 Hz, 1H), 4.36 (dt, *J* = 14.1, 1.7 Hz, 1H), 4.12 (d, *J* = 13.7 Hz, 1H) 3.82 (d, *J* = 13.7 Hz, 1H), 3.27 (ddd, *J* = 15.1, 12.0, 6.5 Hz, 1H), 2.91 (ddd, *J* = 15.1, 5.5, 1.2 Hz, 1H), 2.77 (d, *J* = 14.1 Hz, 1H), 2.55 (dd, *J* = 14.1, 10.0 Hz, 1H), 2.13 (m, 1H), 1.51 (m, 2H), 1.44 (m, 2H), 1.35 (m, 3H), 0.84 (t, *J* = 7.5 Hz, 3H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 175.0, 134.5, 132.6, 129.6, 121.7, 120.0, 119.2, 110.1, 107.3, 74.3, 55.2, 51.9, 42.9, 35.2, 34.1, 32.2, 28.0, 25.9, 7.2; ppm.
IR: 3289, 2924, 2855, 1624, 1460, 1241, 1128, 1015, 910, 732 cm^{-1}
HRMS: m/z calculated for $C_{19}H_{24}O_2N_2H^+$: 313.1916; found: 313.1913;
MP: 52-55 °C

Isovelbanamine (**7**)



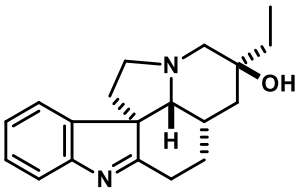
(±)-isovelbanamine (**7**)

To a solution of **17** (100 mg, 0.32 mmol) in THF (12 mL) was added LAH (1.0 mL, 3 eq., 1 M in THF, 1.0 mmol). After stirring for 3 h at 50 °C, the reaction was cooled to r.t. and poured into an aqueous solution of Na/K tartrate. The aqueous phase was extracted with CH_2Cl_2 (3x), the combined organic layers were washed with brine and dried over $MgSO_4$. The solvent was removed by rotary evaporation and the residue was purified by column chromatography (CH_2Cl_2/MeOH 20:1) to give **7** (82 mg, 86%) as white solid. The analytical data matches the data in literature.[5]

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (s, 1H), 7.45 (m, 1H), 7.28 (m, 1H), 7.09 (m, 2H), 3.50 (dd, *J* = 14.1, 10.6 Hz, 1H), 2.93 (m, 2H), 2.84 (d, *J* = 11.0 Hz, 1H), 2.70 (m, 2H), 2.54 (m, 2H), 2.46 (d, *J* = 11.0 Hz, 1H), 2.35 (m, 1H), 1.94 (m, 2H), 1.79 (m, 1H), 1.62 (dd, *J* = 13.5, 6.7 Hz, 1H), 1.52 (m, 3H), 1.27 (bs, 1H), 0.90 (t, *J* = 7.4 Hz, 3H); ppm.
^{13}C NMR (100 MHz, $CDCl_3$): δ = 138.0, 135.5, 128.4, 120.9, 119.0, 117.7, 110.1, 109.6, 72.7, 64.5, 52.4, 50.6, 37.4, 35.2, 32.8, 30.7, 24.9, 22.5, 7.5; ppm.
IR: 3402, 3281, 2922, 2854, 1615, 1463, 1337, 1134, 924, 740 cm^{-1}
HRMS: m/z calculated for $C_{19}H_{26}O_1N_2H^+$: 299.2123; found: 299.2122;

[5] J. P. Kutney, F. Bylsma, *Helv. Chim. Acta* **1975**, *58*, 1672-1689.

(20*S*)-Hydroxy-1,2-dehydro-pseudoaspidospermidine (**4**)



(±)-20*S*-Hydroxy-1,2-dehydro-pseudoaspidospermidine (**4**)

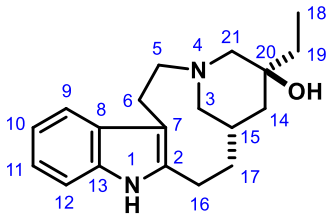
To a solution of **7** (25 mg, 84 μmol) in CH_3CN (3.6 mL) was added a sat. $NaHCO_3$ solution (0.4 mL). The mixture was cooled to 0 °C and iodine (22 mg, 1.05 eq., 88 μmol) was added. The reaction mixture was stirred for 30 min and then quenched with sat. $Na_2S_2O_3$. The aqueous layer was extracted with CH_2Cl_2 (3x), the combined organic phases were washed with brine, dried over $MgSO_4$ and the solvent was removed by rotary evaporation. The residue was purified by column chromatography (CH_2Cl_2 /MeOH 10:1) to give **4** (20 mg, 80%) as white foam. The analytical data matches the data in literature.[6,7]

^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.51 (d, *J* = 7.7 Hz, 1H), 7.37 (m, 1H), 7.30 (m, 1H), 7.18 (m, 1H), 3.19 (m, 1H), 3.12 (dd, *J* = 10.7, 1.0 Hz, 1H), 2.98 (ddd, *J* = 15.0, 10.8, 3.6 Hz, 1H), 2.90 (bm, 1H), 2.85 (bm, 1H), 2.80 (m, 1H), 2.50 (m, 1H), 2.40 (m, 1H), 2.31 (m, 1H), 1.94 (m, 1H), 1.83 (m, 2H), 1.76 (m, 2H), 1.55 (bm, 1H), 1.44 (m, 1H), 0.97 (t, *J* = 7.5 Hz, 3H); ppm.
^{13}C NMR (150 MHz, $CDCl_3$): δ = 190.0, 154.6, 146.7, 127.8, 125.4, 121.6, 119.9, 74.3, 70.9, 62.7, 61.5, 54.0, 39.3, 35.4, 34.1, 31.6, 25.5, 25.5, 7.8; ppm.
IR: 3297, 2924, 2856, 2788, 1576, 1456, 1260, 1096, 1017, 798 cm^{-1}
HRMS: m/z calculated for $C_{19}H_{24}O_1N_2H^+$: 297.1967; found: 297.1965;

[6] T. A. van Beek, R. Verpoorte, A. B. Svendsen, *Tetrahedron* **1984**, *40*, 737-748.
[7] H. Zhang, X. Wang, L. Lin, J. Ding, J. Yue, *J. Nat. Prod.* **2007**, *70*, 54-59.

Spectral comparison of natural producs 7 and 4

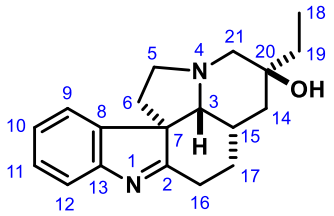
Isovelbanamine (**7**)



No.	Carbon type	**This work** Synthetic material		**Literature** Synthetic material[5]	
		^{13}C [ppm] (150 MHz, $CDCl_3$)	^{1}H [ppm] (600 MHz, $CDCl_3$)	^{13}C [ppm]	^{1}H [ppm] (60 MHz, $CDCl_3$)
2	C	138.0	---	nr	nr
13	C	135.5	---	nr	nr
8	C	128.4	---	nr	nr
11	CH	120.9	7.11 (m, 1H)	nr	7.0-7.5 (diffuse, 4H)
10	CH	119.0	7.07 (m, 1H)	nr	
9	CH	117.7	7.45 (m, 1H)	nr	
12	CH	110.1	7.28 (m, 1H)	nr	
7	C	109.6	---	nr	nr
20	C	72.7	---	nr	nr
21	CH_2	64.5	2.84 (d, *J* = 11.0 Hz, 1H), 2.46 (d, *J* = 11.0 Hz, 1H)	nr	nr
5	CH_2	52.4	2.54 (m, 2H)	nr	nr
3	CH_2	50.6	2.70 (m, 1H), 2.35 (m, 1H)	nr	nr
15	CH_2	37.4	1.62 (dd, *J* = 13.5, 6.7 Hz, 1H), 1.55 (m, 1H)	nr	nr
19	CH_2	35.2	1.50 (m, 2H)	nr	nr
17	CH_2	32.8	1.98 (m, 1H), 1.79 (m, 1H)	nr	nr
14	CH	30.7	1.97 (m, 1H)	nr	nr
6	CH_2	24.9	2.93 (m, 2H)	nr	nr
16	CH_2	22.5	3.50 (dd, *J* = 14.1, 10.6 Hz, 1H), 2.70 (m, 1H)	nr	3.44 (m, 1H)
18	CH_3	7.5	0.90 (t, *J* = 7.4 Hz, 3H)	nr	0.87 (t, 3H)
1	NH	---	7.84 (bs, 1H)	---	7.74 (bs, 1H)
	OH	---	1.27 (bs, 1H)	---	1.23 (bs, 1H)

nr = not reported

(20*S*)-Hydroxy-1,2-dehydro-pseudoaspidospermidine (**4**)

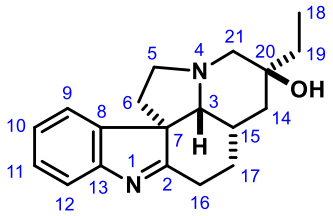


No.	Carbon type	**This work** Synthetic material	**Literature** Isolation material[6]	**Literature** Isolation material[7]
		^{1}H [ppm] (600 MHz, $CDCl_3$)	^{1}H [ppm] (300 MHz, $CDCl_3$)	^{1}H [ppm] (400 MHz, $CDCl_3$)[a]
11	CH	7.30 (m, 1H)	7.30 (ddd, *J* = 7.7, 7.7, 1.1 Hz, 1H)	nr
10	CH	7.18 (m, 1H)	7.17 (ddd, *J* = 7.7, 7.7, 1.4 Hz, 1H)	nr
9	CH	7.37 (m, 1H)	7.35 (ddd, *J* = 7.7, 1.4, <0.5 Hz, 1H)	nr
12	CH	7.51 (d, *J* = 7.7 Hz, 1H)	7.51 (ddd, *J* = 7.7, 1.1, <0.5 Hz, 1H)	nr
3	CH	2.85 (bm, 1H)	2.82 (dd, *J* = 2.9, >1.0 Hz, 1H)	nr
21	CH_2	3.12 (dd, *J* = 10.7, 1.0 Hz, 1H), 2.40 (m, 1H)	3.12 (dd, *J* = 10.5, 1.8 Hz, 1H), 2.36 (d, *J* = 10.5, 1H)	nr
5	CH_2	3.19 (m, 1H), 2.90 (bm, 1H)	3.18 (ddd, *J* = 8.4, 6.7, ~2.0 Hz, 1H), 2.88 (ddd, *J* = 11.4, 8.4, 4.8 Hz, 1H)	nr
15	CH_2	1.83 (m, 1H), 1.44 (m, 1H)	1.83 (ddd, *J* = 13.6, 1.9, 1.8 Hz, 1H), 1.41 (ddd, *J* = 13.6, 5.6, ~0.5 Hz, 1H)	nr
6	CH_2	2.31 (m, 1H), 1.83 (m, 1H)	2.31 (ddd, *J* = 12.1, 11.4, 6.7 Hz, 1H), 2.88 (ddd, *J* = 12.1, 4.8, ~2.0 Hz, 1H)	nr
19	CH_2	1.94 (m, 1H), 1.76 (m, 1H)	1.96 (dd, *J* = 14.8, 7.5, 1H), 1.77 (ddd, *J* = 14.8, 7.5, ~0.5 Hz, 1H)	nr
14	CH	1.55 (m, 1H)	1.53 (m, 1H)	nr
16	CH_2	2.98 (ddd, *J* = 15.0, 10.8, 3.6 Hz, 1H), 2.80 (m, 1H)	2.97 (ddd, *J* = 15.4, 11.0, 3.7 Hz, 1H), 2.78 (ddd, *J* = 15.4, 9.9, 6.5 Hz, 1H)	nr
17	CH_2	2.50 (m, 1H), 1.76 (m, 1H)	2.52 (dddd, *J* = 12.9, 12.2, 11.0, 6.5 Hz), 1.75 (m, 1H)	nr
18	CH_3	0.97 (t, *J* = 7.5 Hz, 3H)	0.97 (t, *J* = 7.5 Hz, 3H)	nr
	OH	---	nr	nr

[a] ^{1}H spectra is only reported by a screenshot in the supporting information.

nr = not reported

(20*S*)-Hydroxy-1,2-dehydro-pseudoaspidospermidine (**4**)



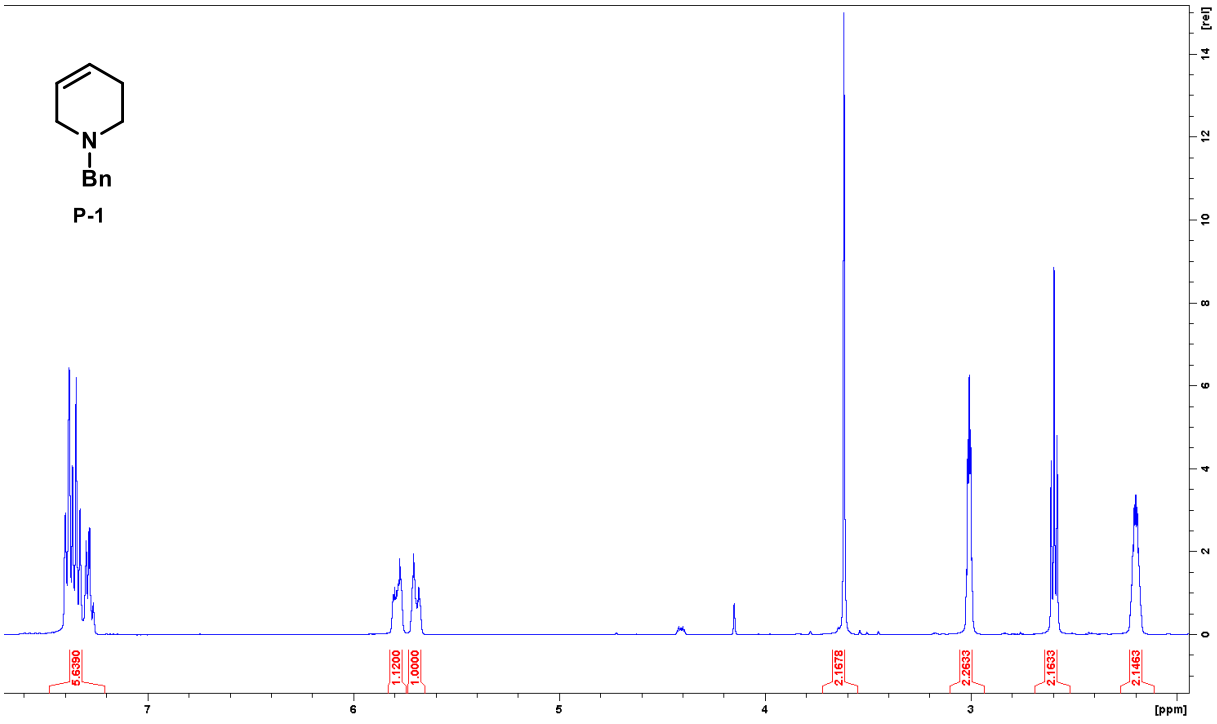
No.	Carbon type	**This work** Synthetic material	**Literature** Isolation material[6]	**Literature** Isolation material[7]	**Shift comparison**
		^{13}C [ppm] (150 MHz, $CDCl_3$)	^{13}C [ppm]	^{13}C [ppm] (100 MHz, $CDCl_3$)	[ppm]
2	C	190.0[b]	nr	190.0	0.0
13	C	154.6	nr	154.5	+0.1
8	C	146.7[b]	nr	146.6	+0.1
11	CH	127.8	nr	127.7	+0.1
10	CH	125.4	nr	125.3	+0.1
9	CH	121.6	nr	121.5	+0.1
12	CH	119.9	nr	119.8	+0.1
3	CH	74.3	nr	74.4	-0.1
20	C	70.9	nr	70.9	0.0
21	CH_2	62.7	nr	62.8	-0.1
7	C	61.5	nr	61.5	0.0
5	CH_2	54.0	nr	54.0	0.0
15	CH_2	39.3	nr	39.2	+0.1
6	CH_2	35.4	nr	35.4	0.0
19	CH_2	34.1	nr	34.0	+0.1
14	CH	31.6	nr	31.6	0.0
16	CH_2	25.5	nr	25.4	+0.1
17	CH_2	25.5	nr	25.4	+0.1
18	CH_3	7.8	nr	7.8	0.0

[b] This signal is detected and verified by HMBC

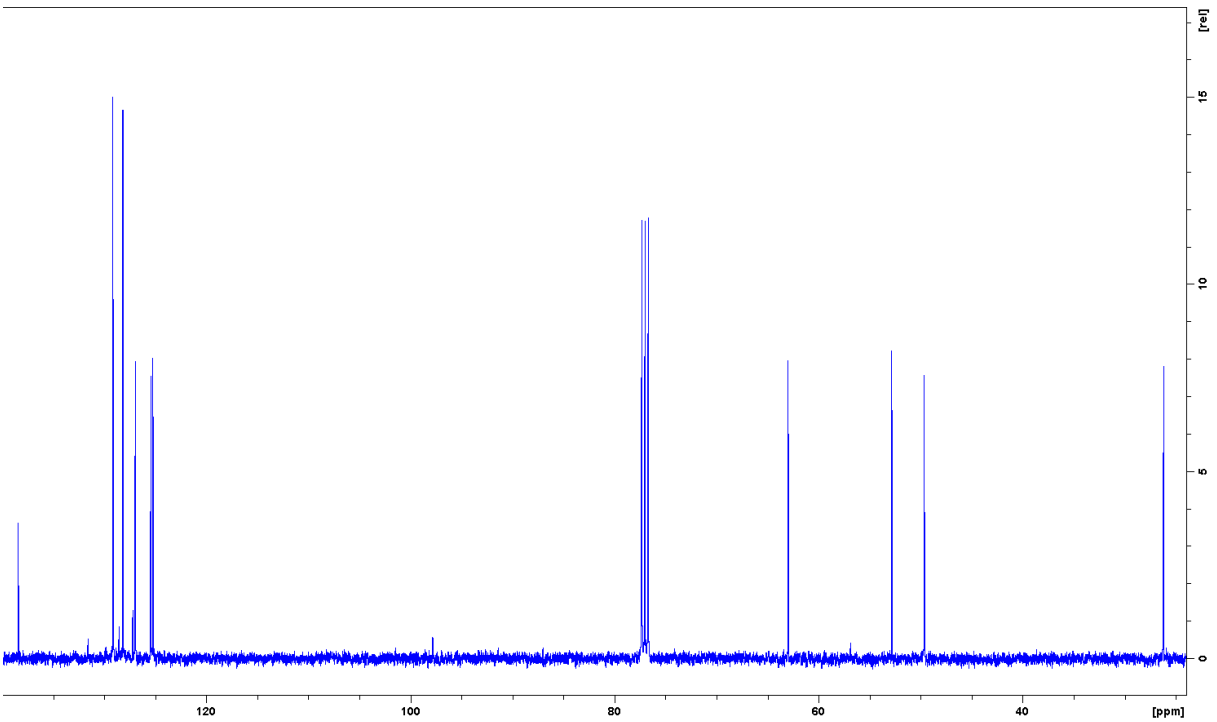
nr = not reported

Spectra

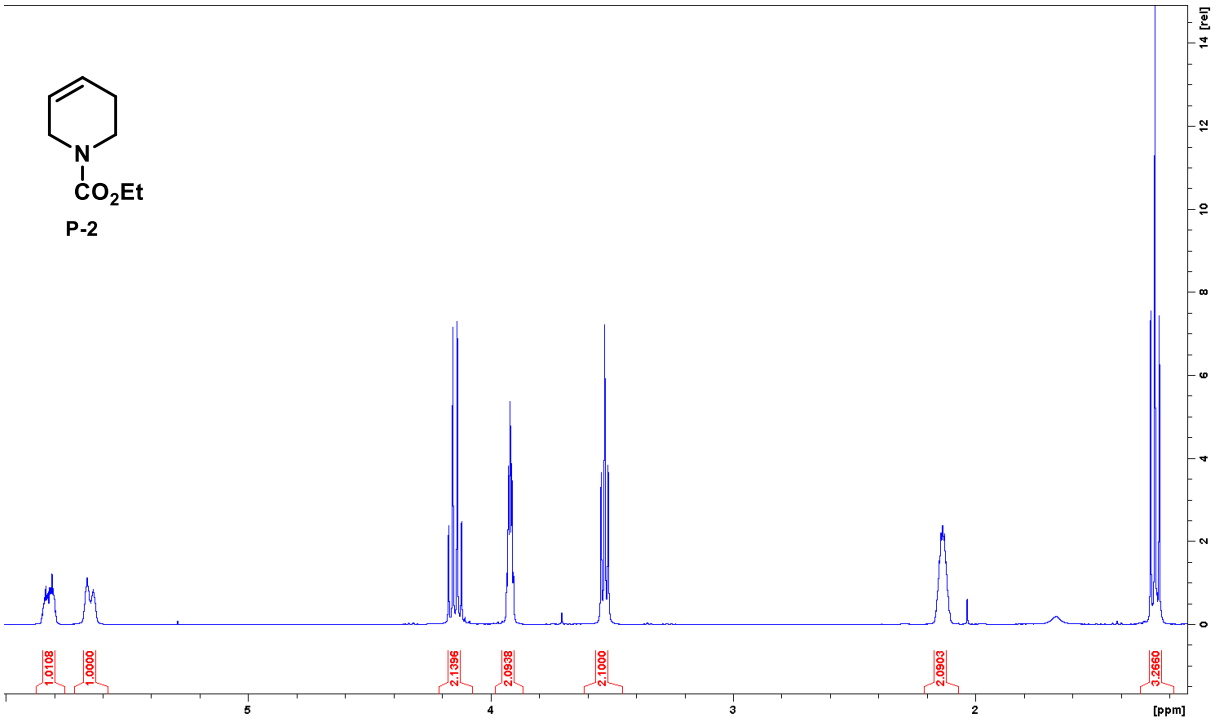
^{1}H NMR (400 MHz, $CDCl_3$)



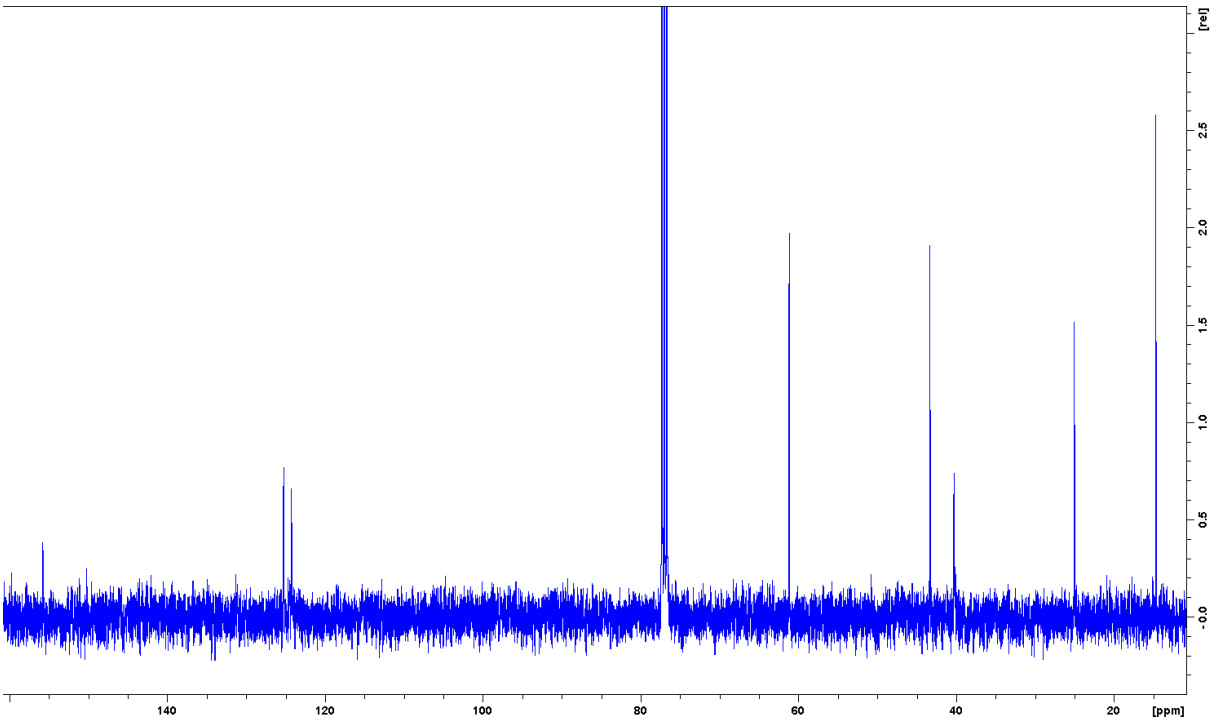
^{13}C NMR (100 MHz, $CDCl_3$)



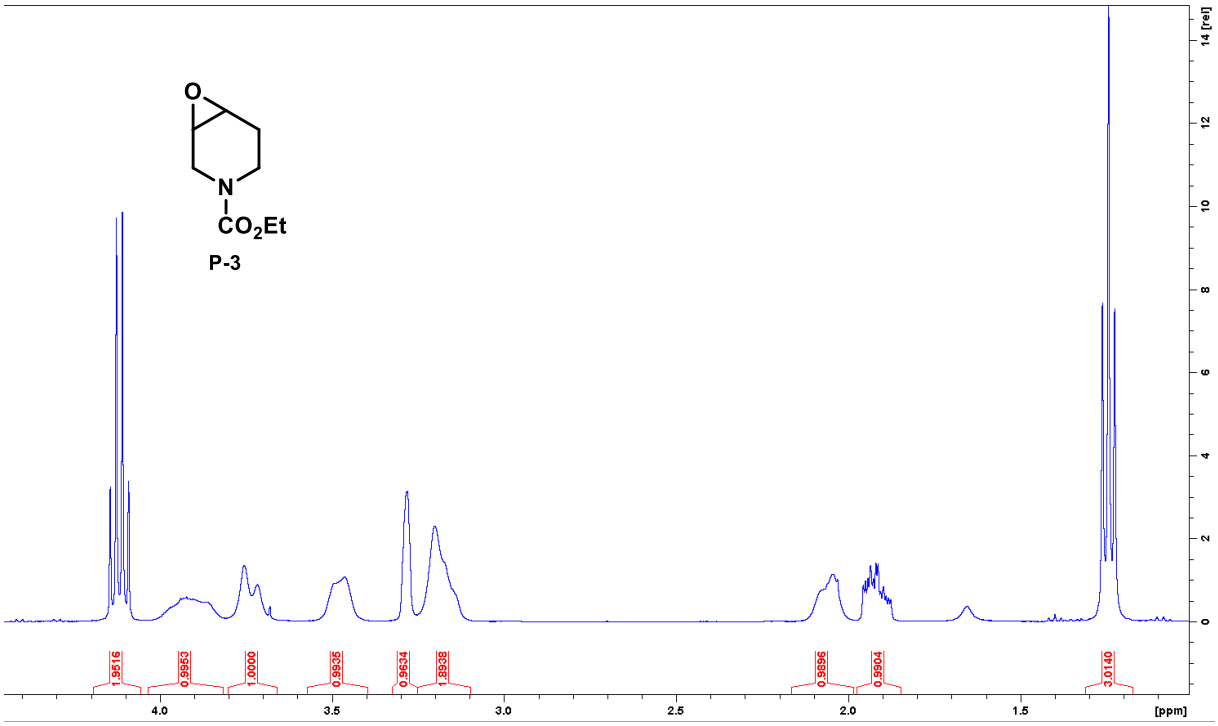
^{1}H NMR (400 MHz, $CDCl_3$)



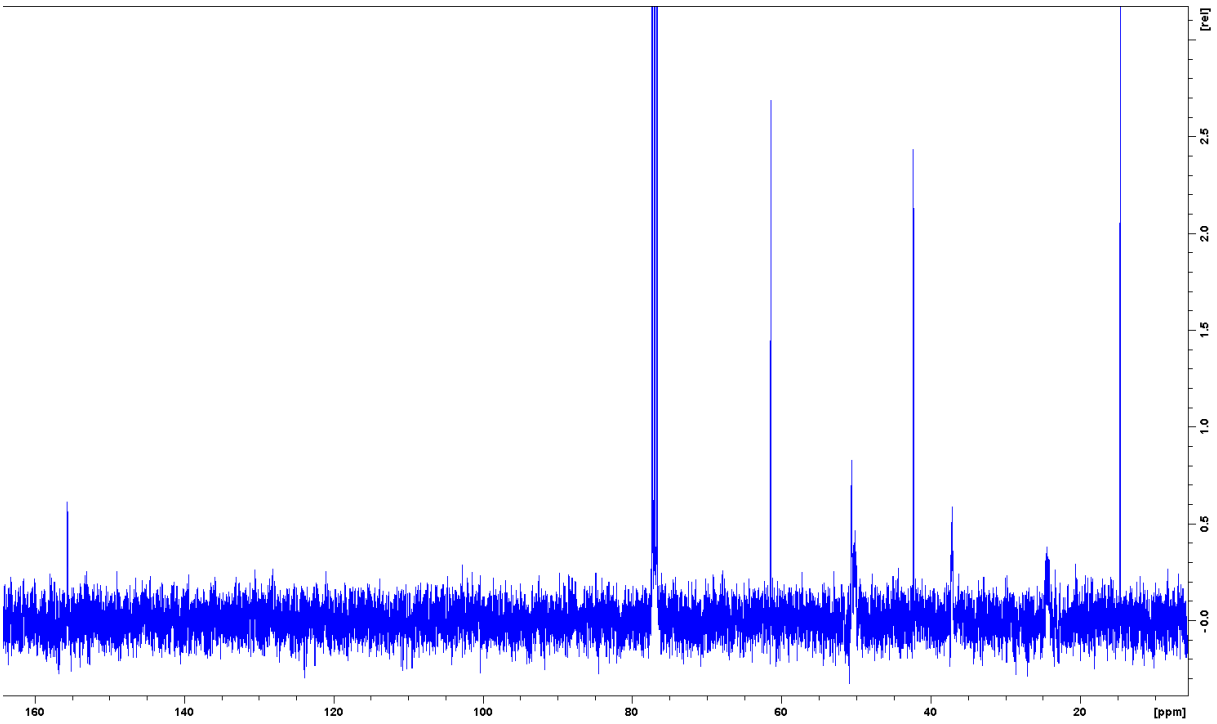
^{13}C NMR (100 MHz, $CDCl_3$)



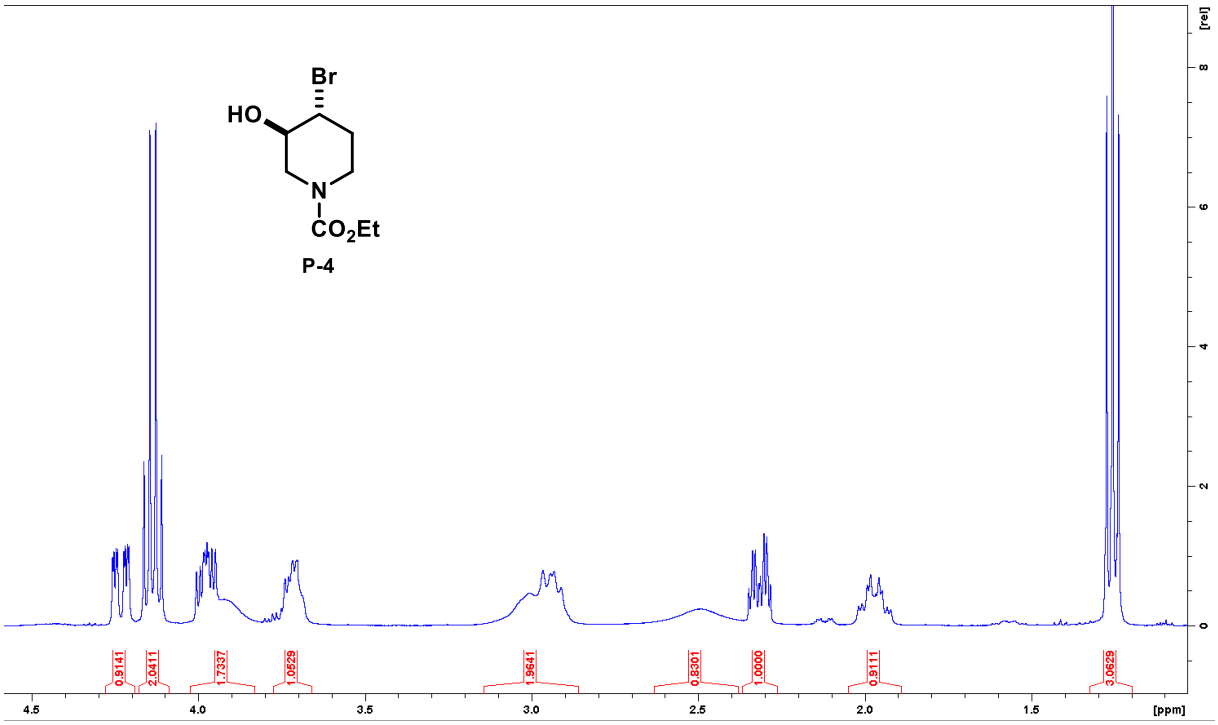
^{1}H NMR (400 MHz, $CDCl_3$)



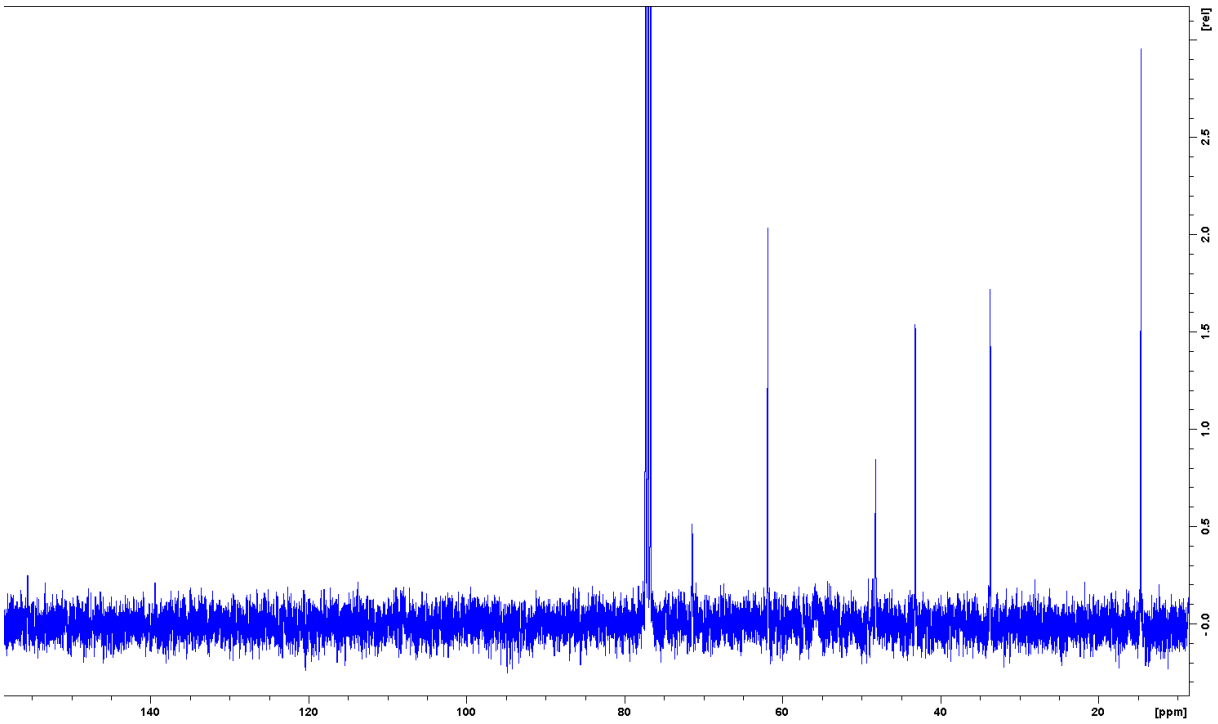
^{13}C NMR (100 MHz, $CDCl_3$)



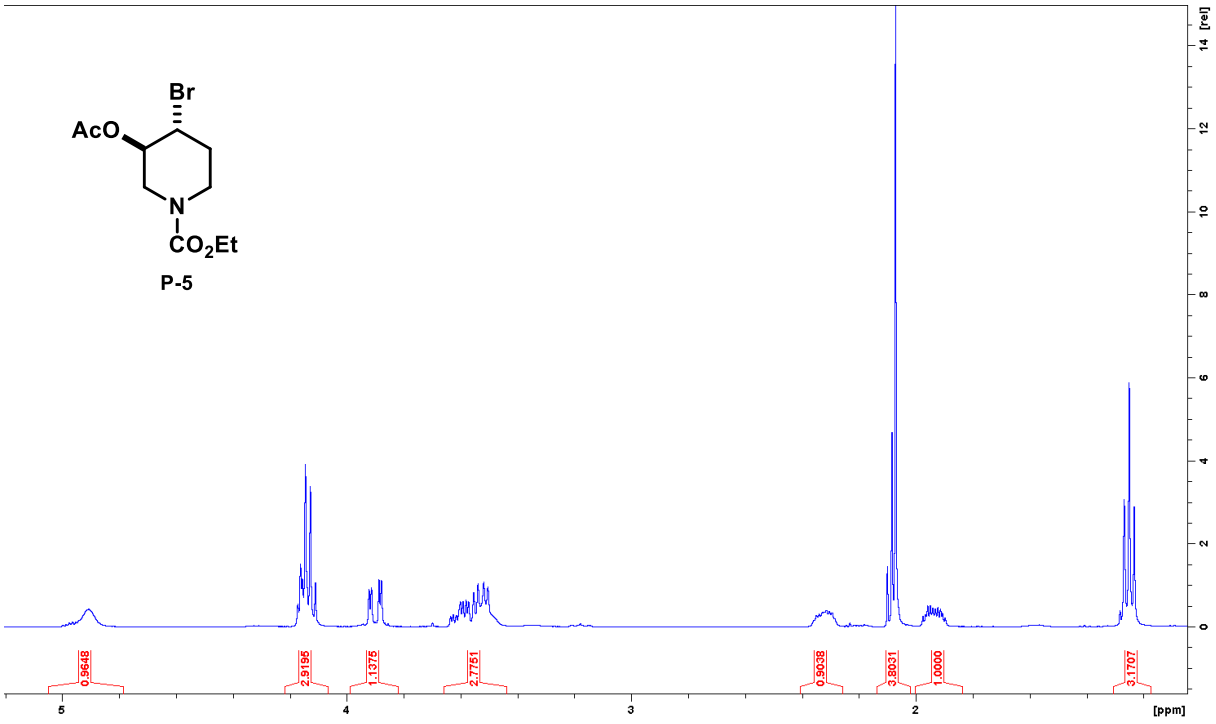
^{1}H NMR (400 MHz, $CDCl_3$)



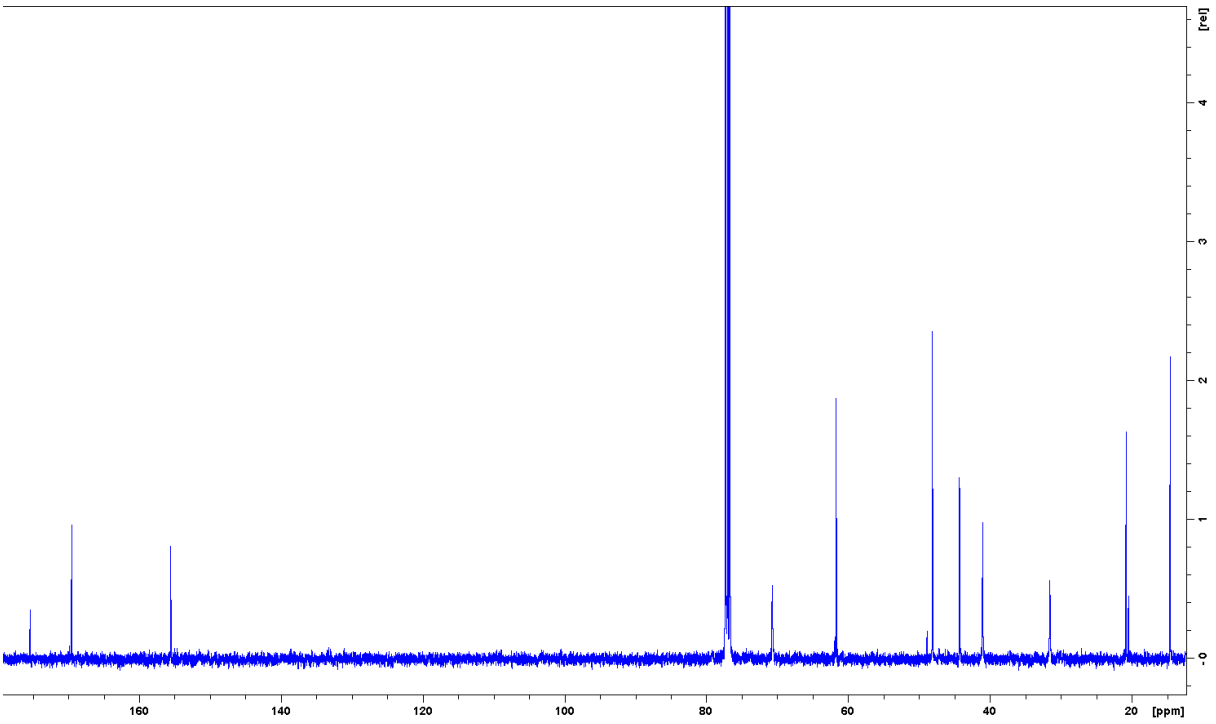
^{13}C NMR (100 MHz, $CDCl_3$)



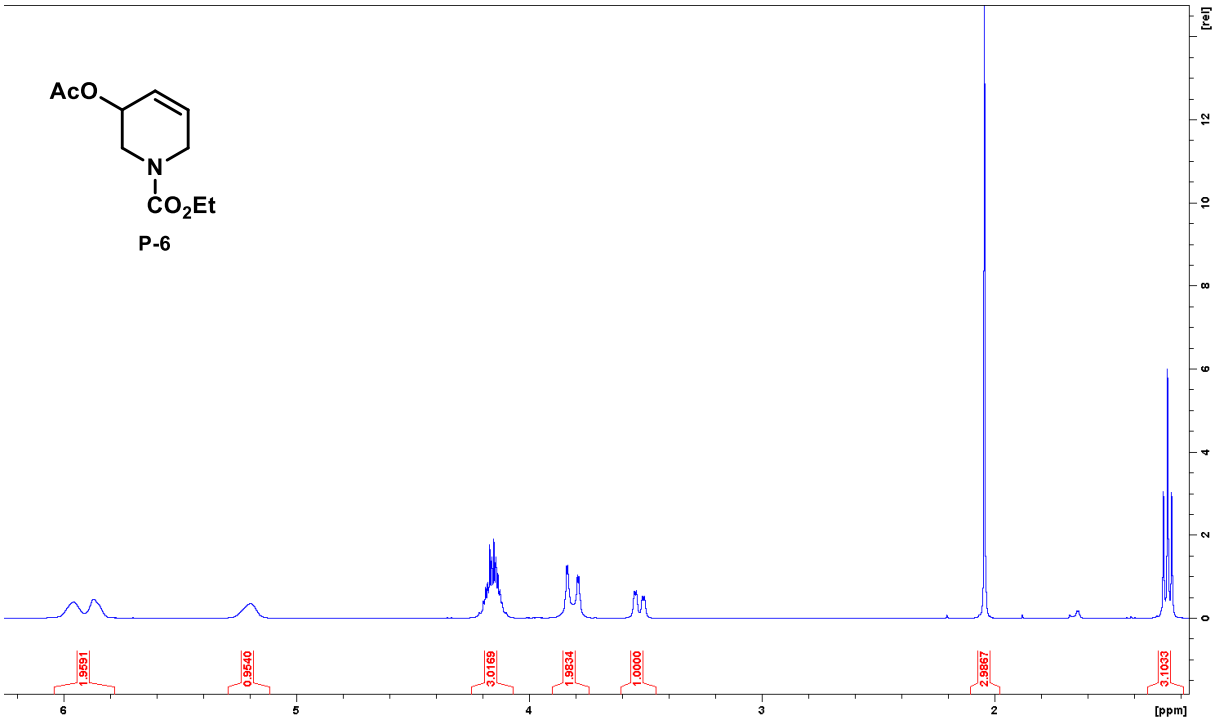
^{1}H NMR (400 MHz, $CDCl_3$)



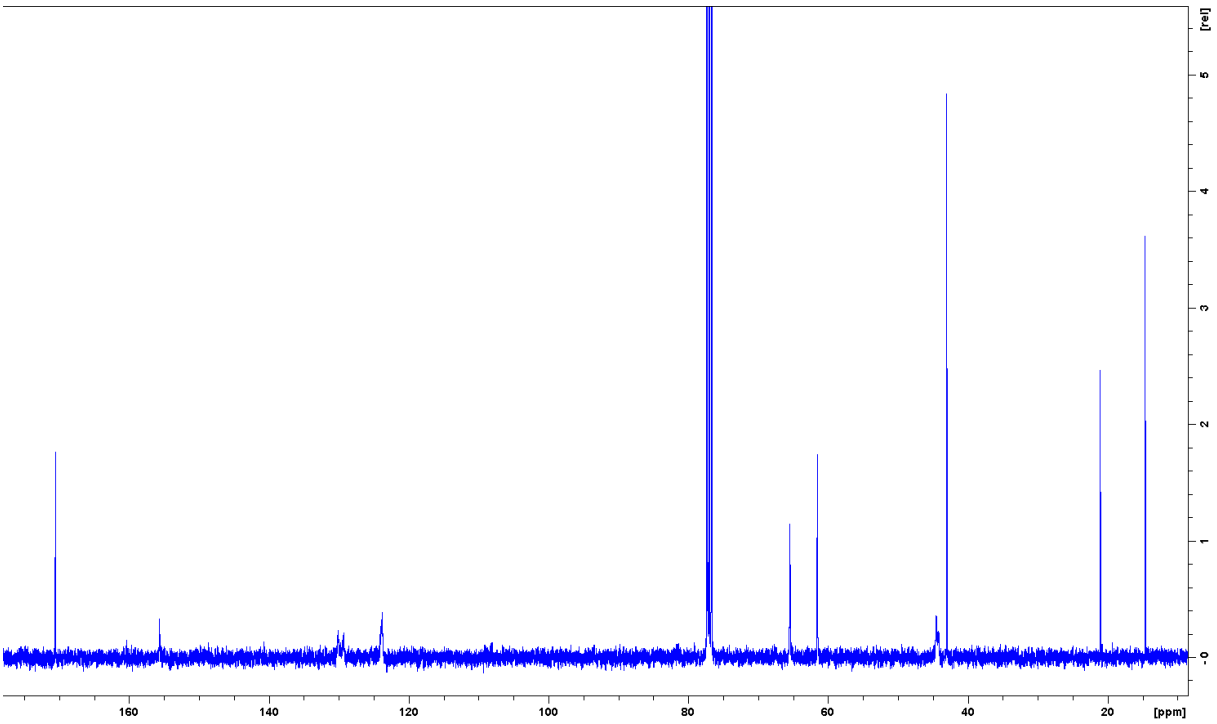
^{13}C NMR (100 MHz, $CDCl_3$)



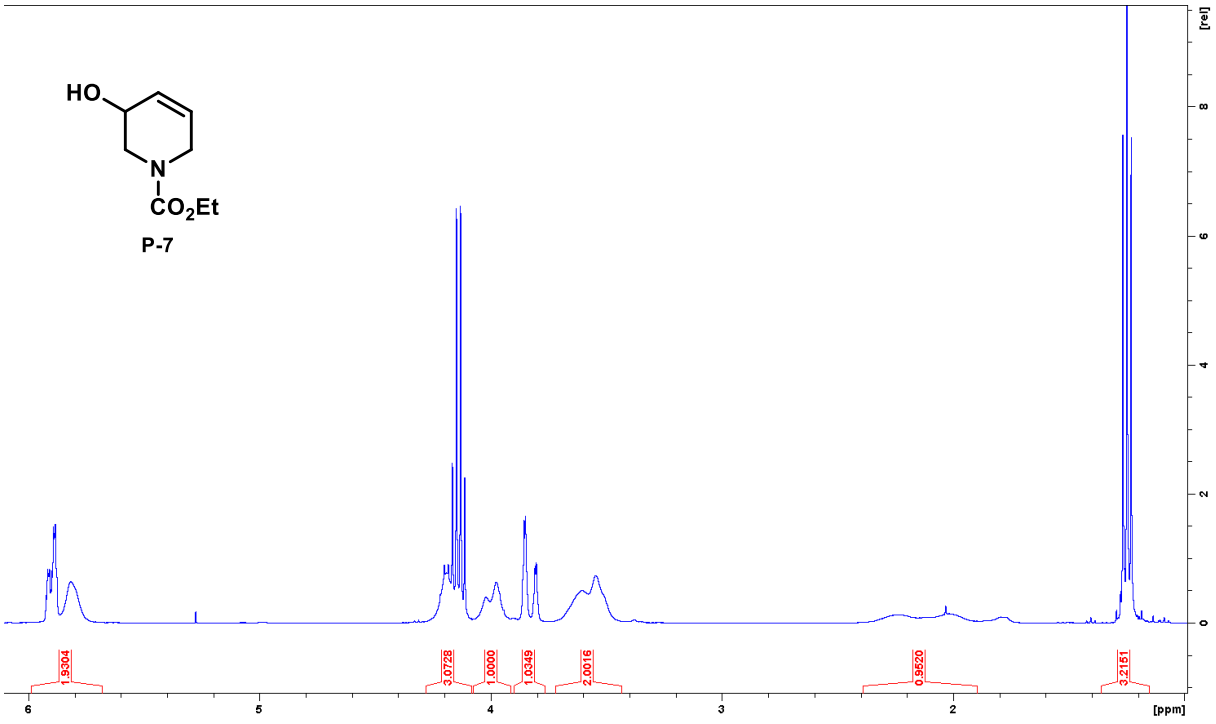
^{1}H NMR (400 MHz, $CDCl_3$)



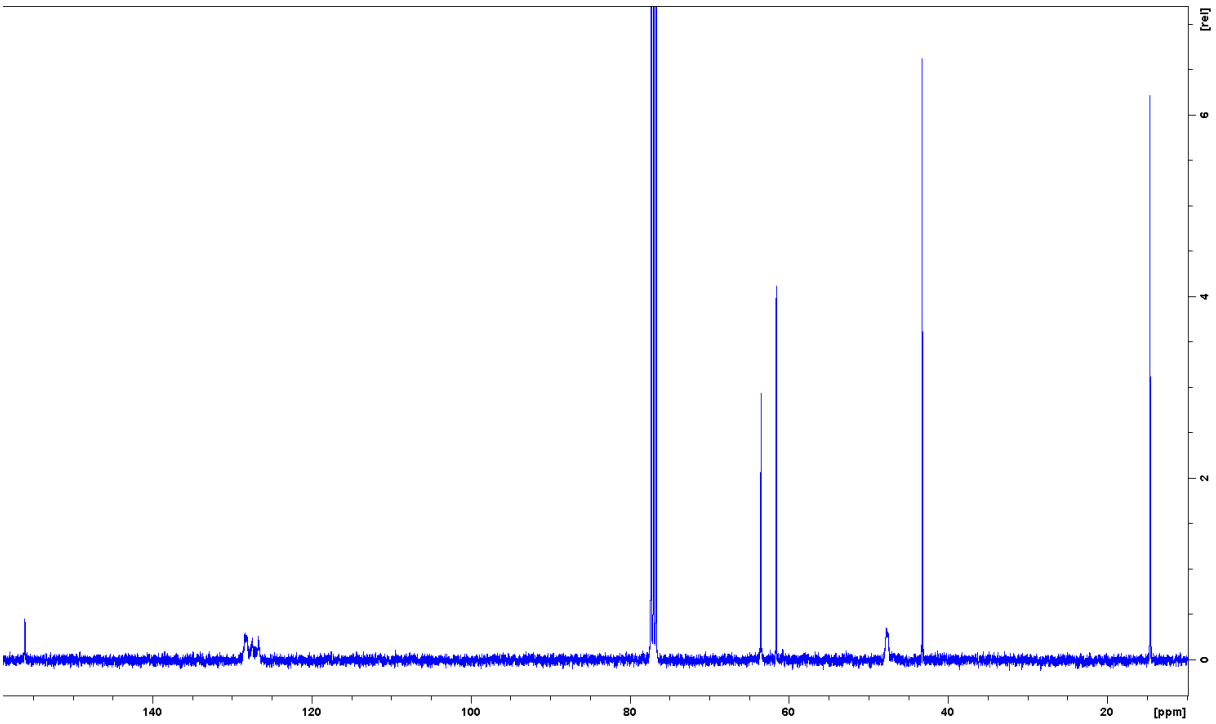
^{13}C NMR (100 MHz, $CDCl_3$)



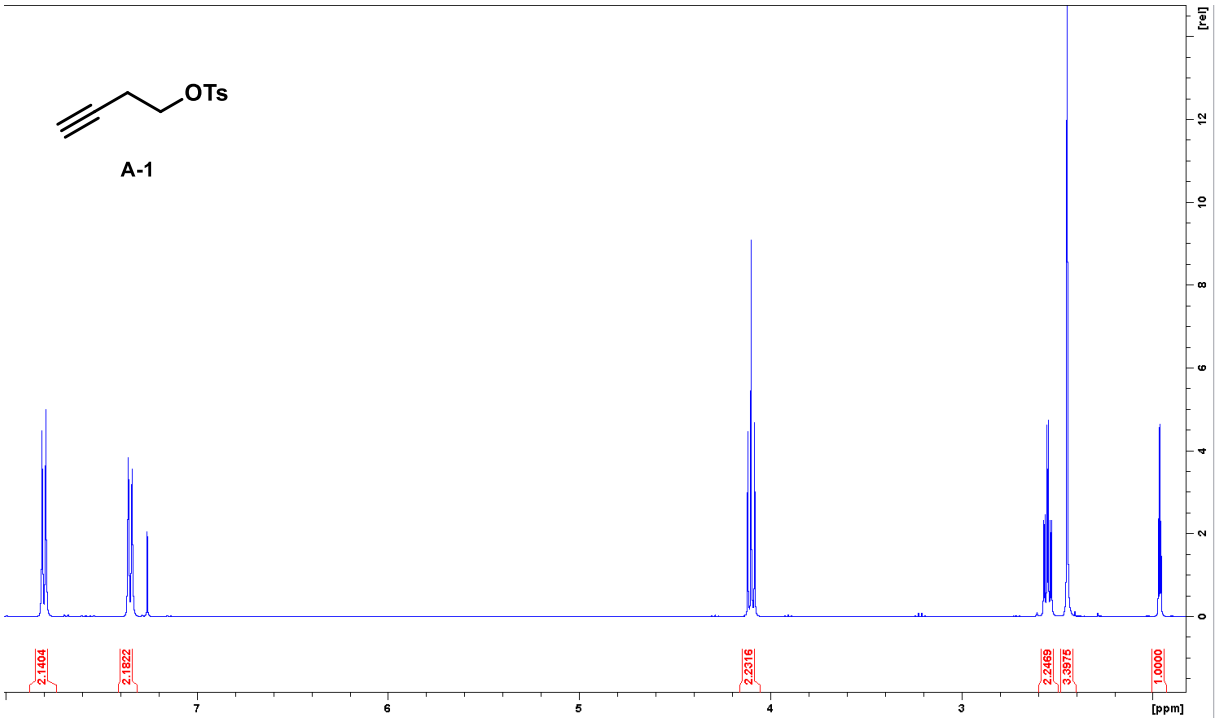
^{1}H NMR (400 MHz, $CDCl_3$)



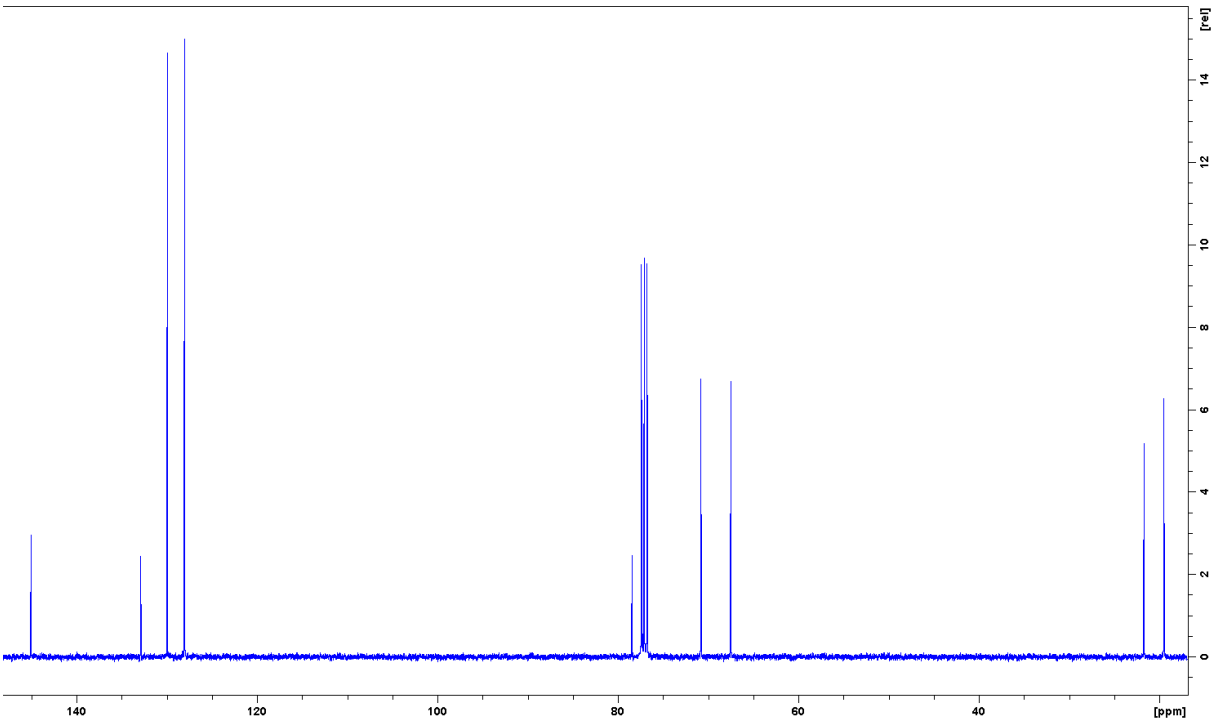
^{13}C NMR (100 MHz, $CDCl_3$)



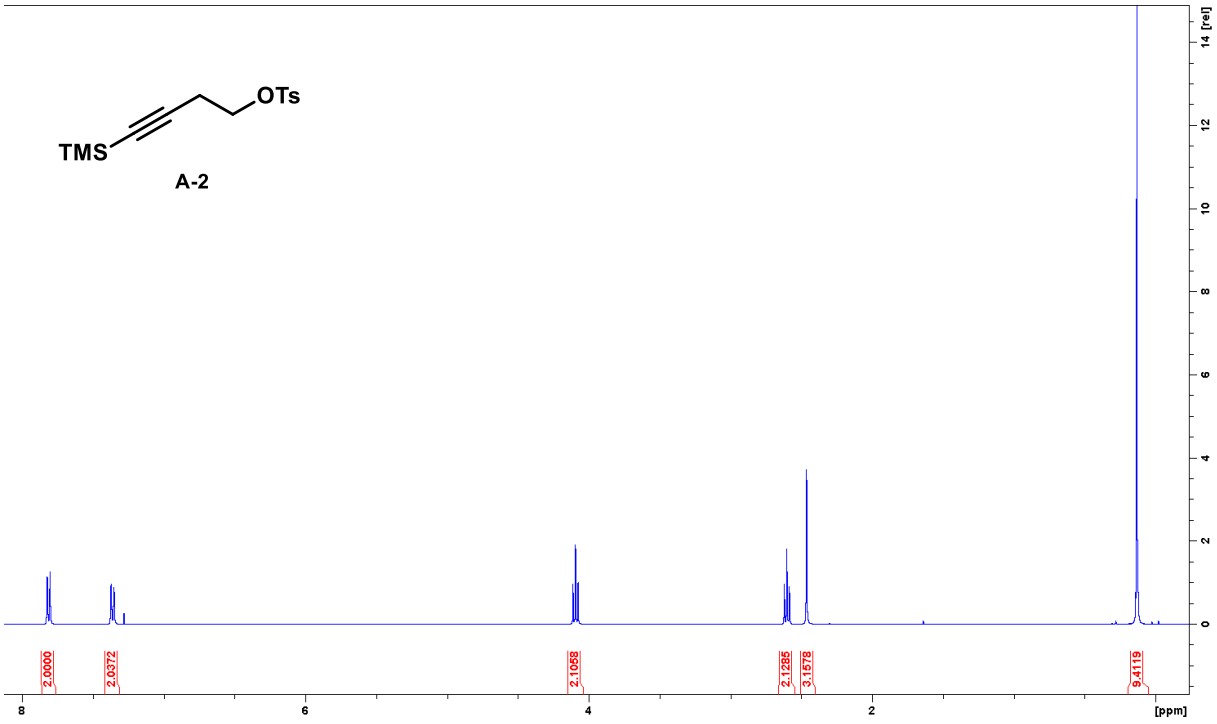
^{1}H NMR (400 MHz, $CDCl_3$)



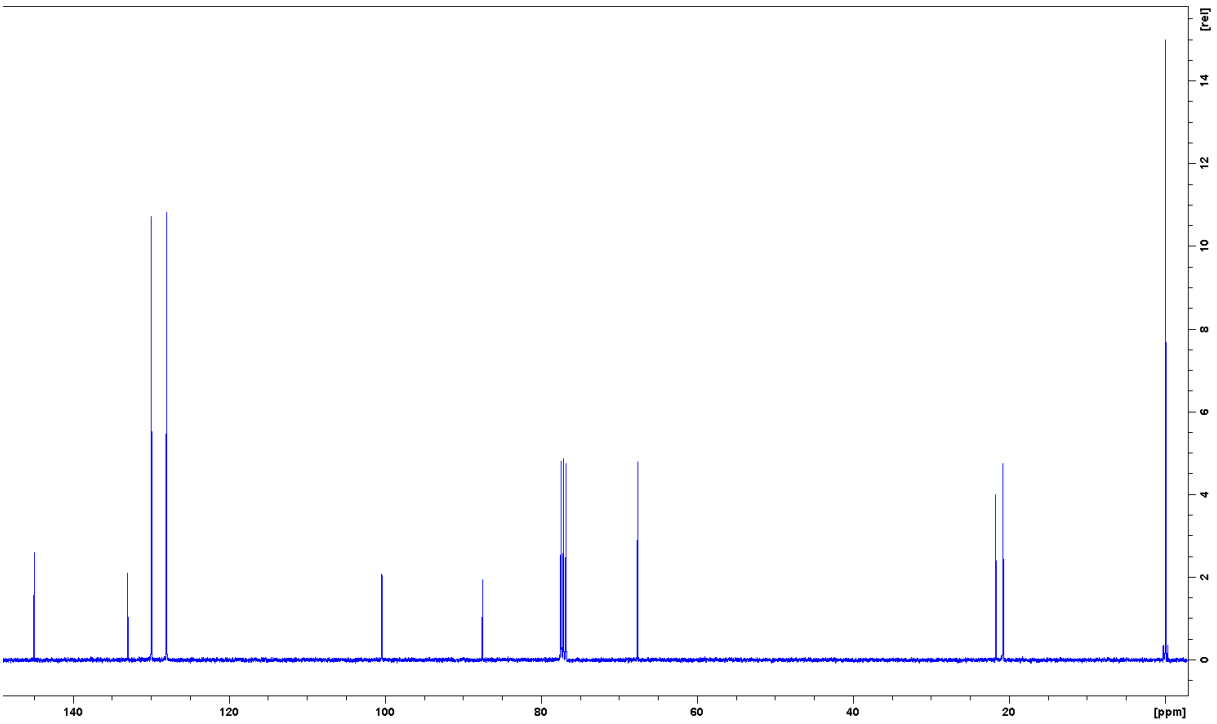
^{13}C NMR (100 MHz, $CDCl_3$)



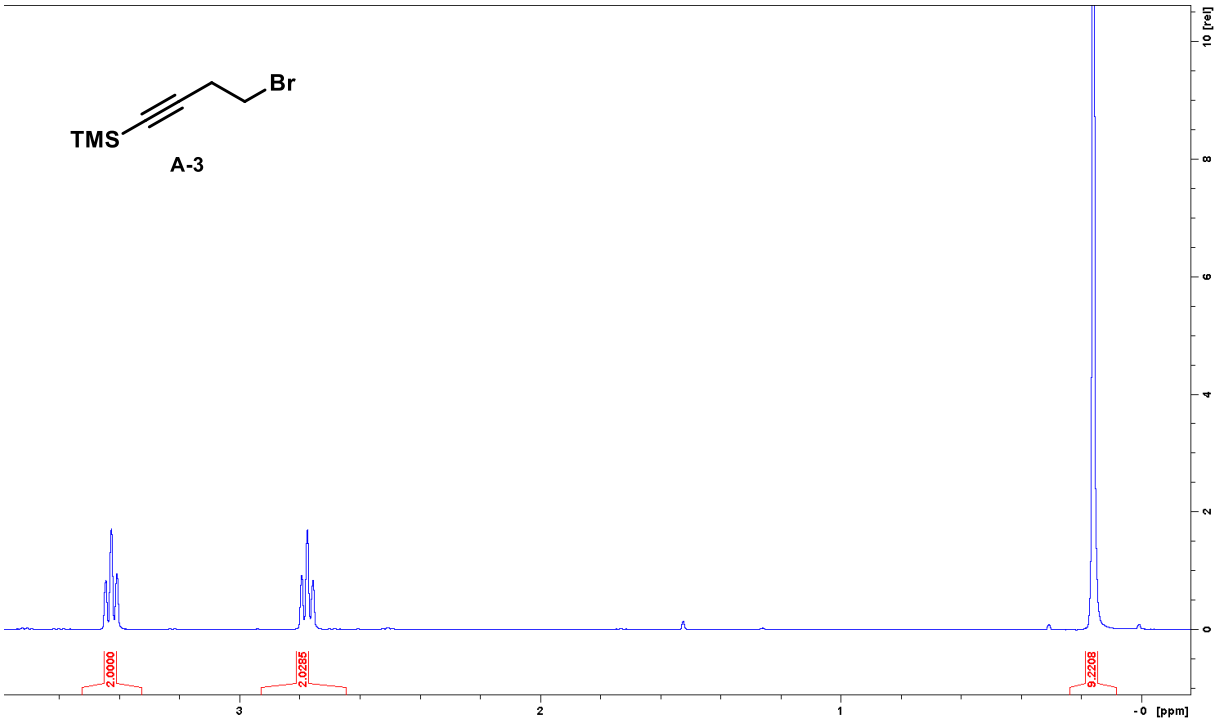
^{1}H NMR (400 MHz, $CDCl_3$)



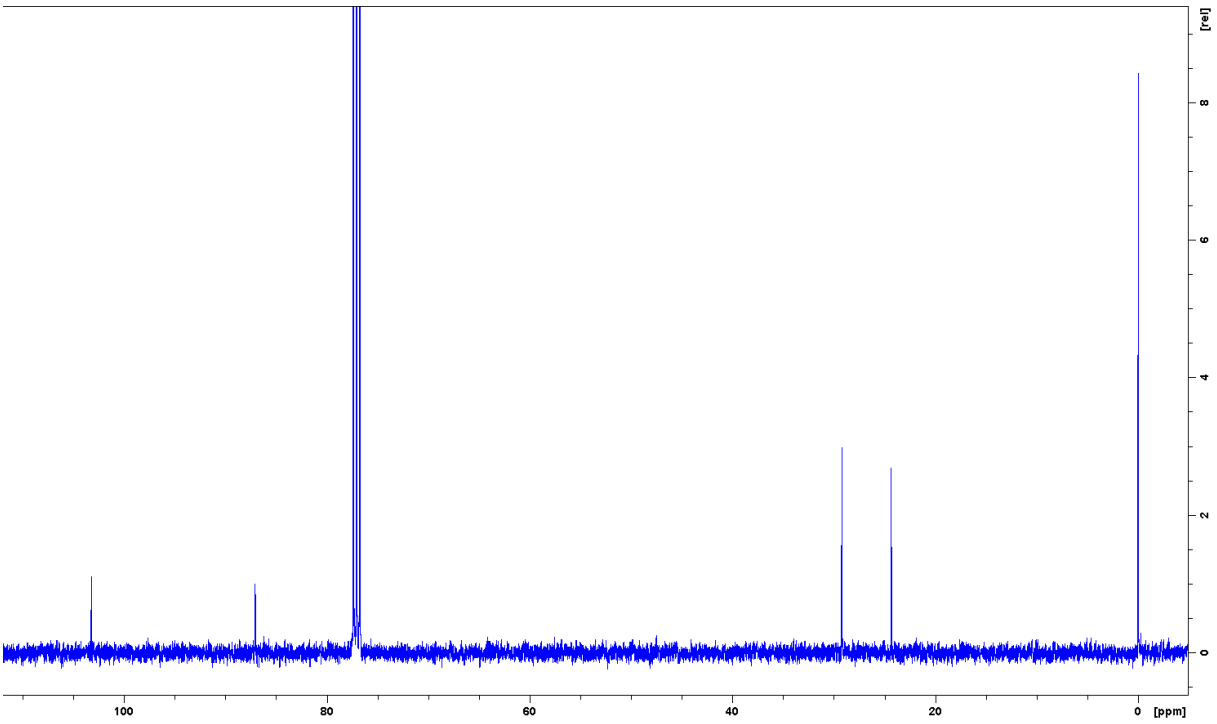
^{13}C NMR (100 MHz, $CDCl_3$)



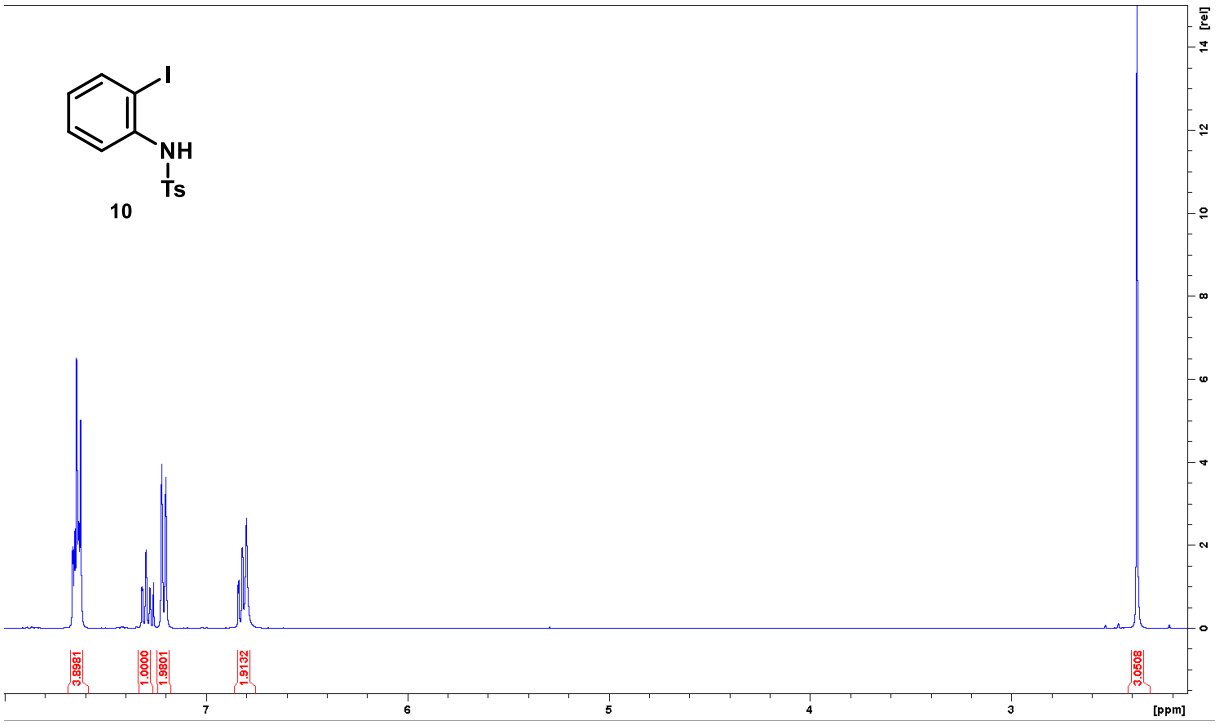
^{1}H NMR (400 MHz, $CDCl_3$)



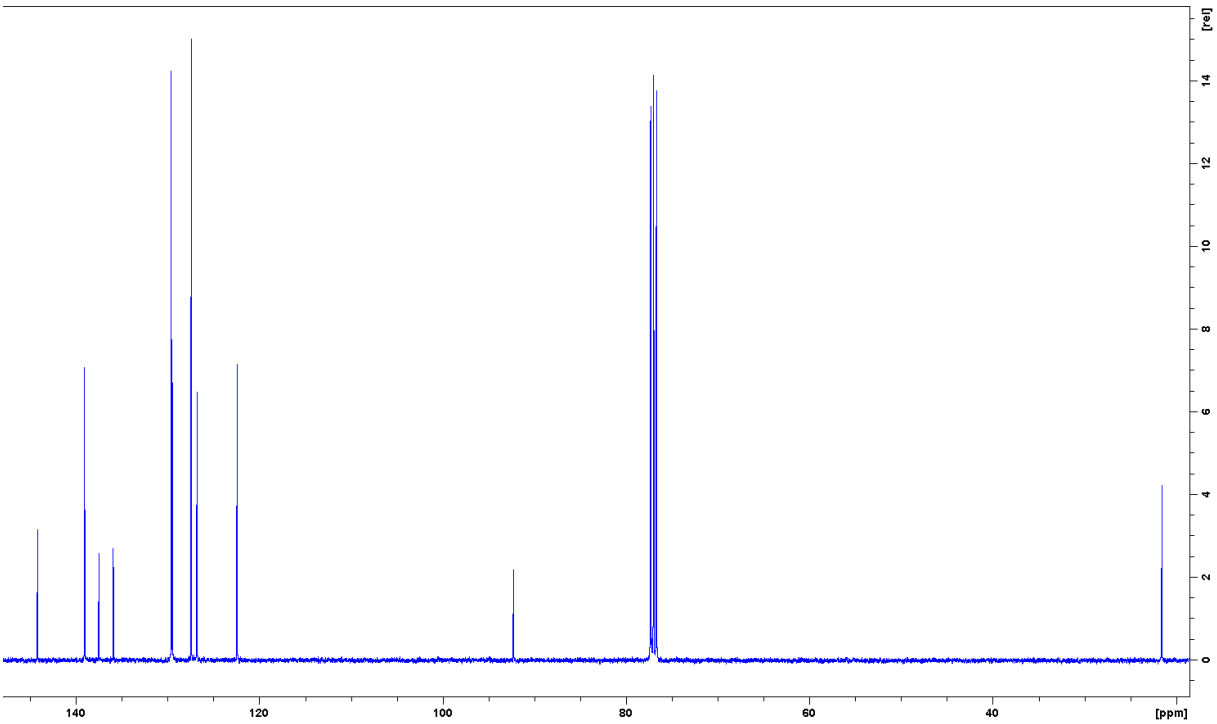
^{13}C NMR (100 MHz, $CDCl_3$)



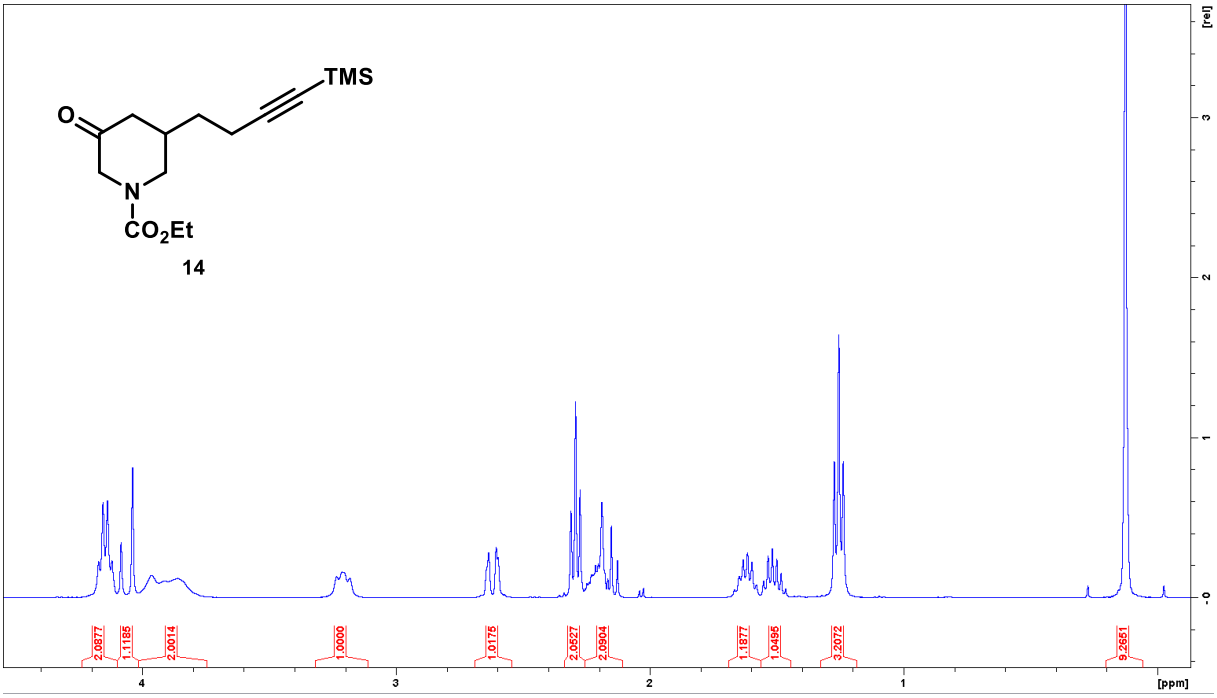
^{1}H NMR (400 MHz, $CDCl_3$)



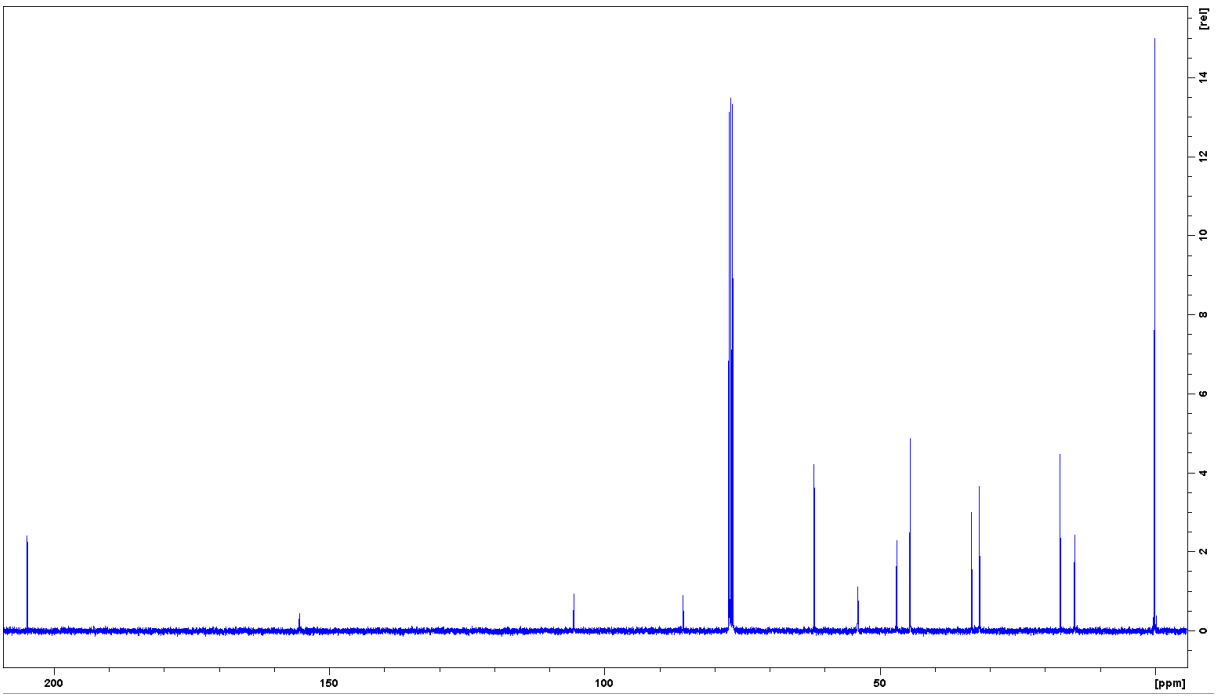
^{13}C NMR (100 MHz, $CDCl_3$)



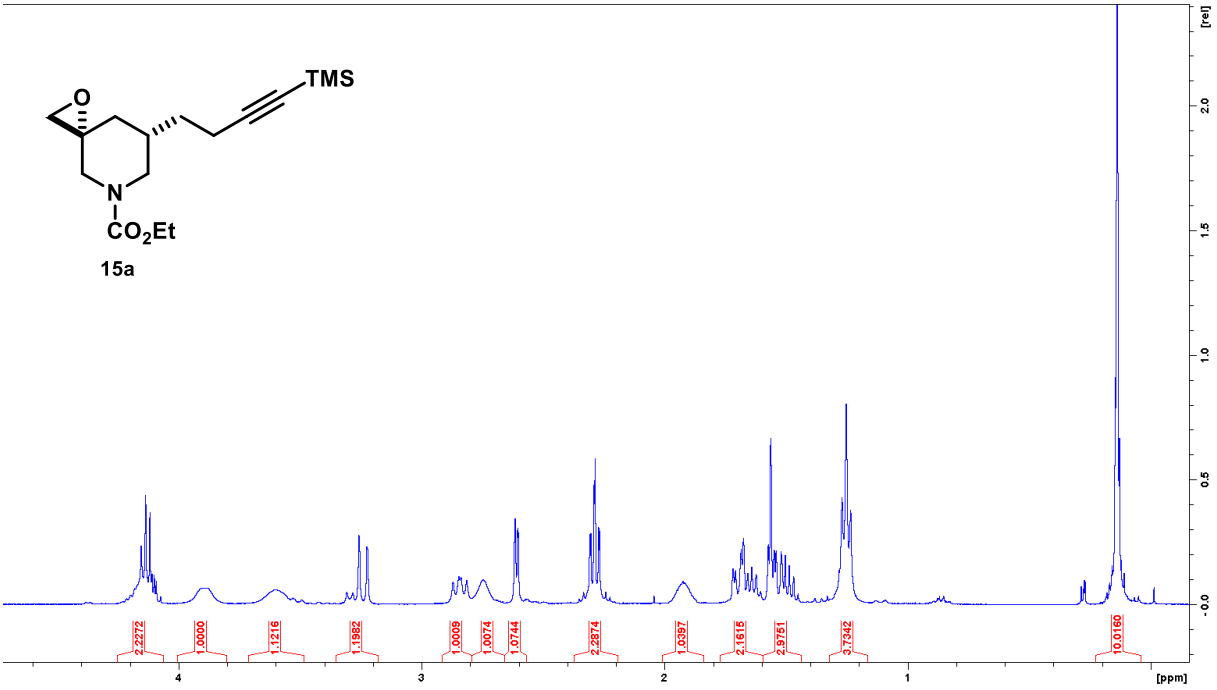
^{1}H NMR (400 MHz, $CDCl_3$)



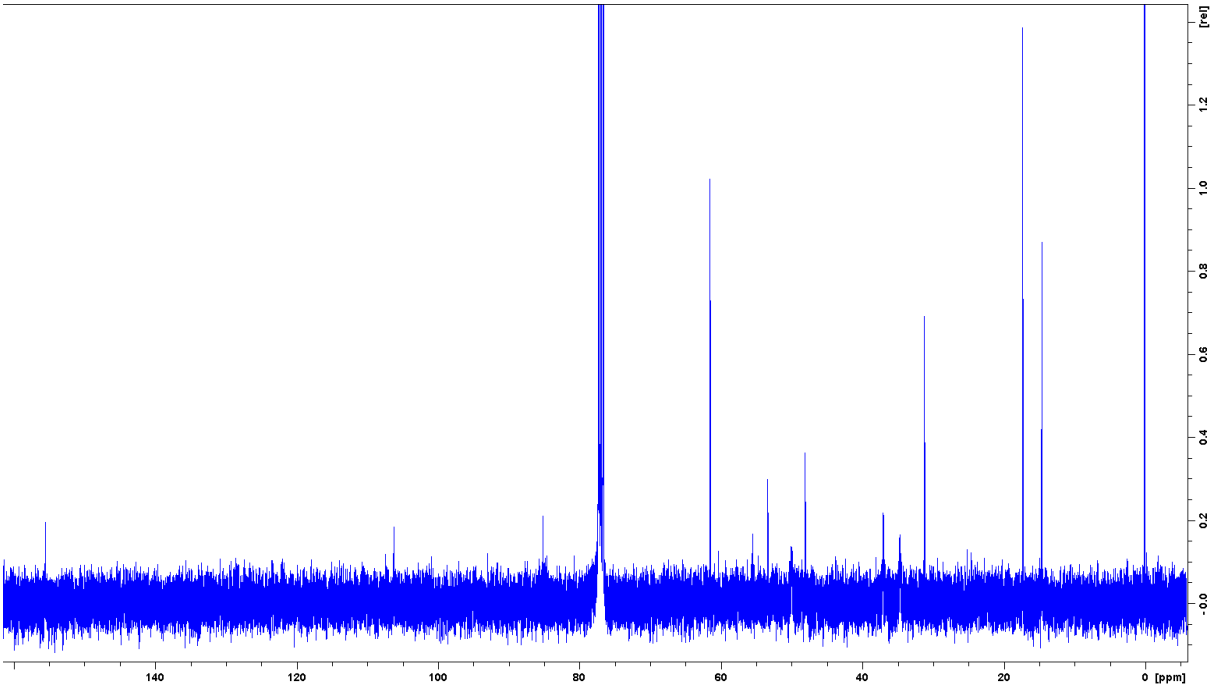
^{13}C NMR (100 MHz, $CDCl_3$)



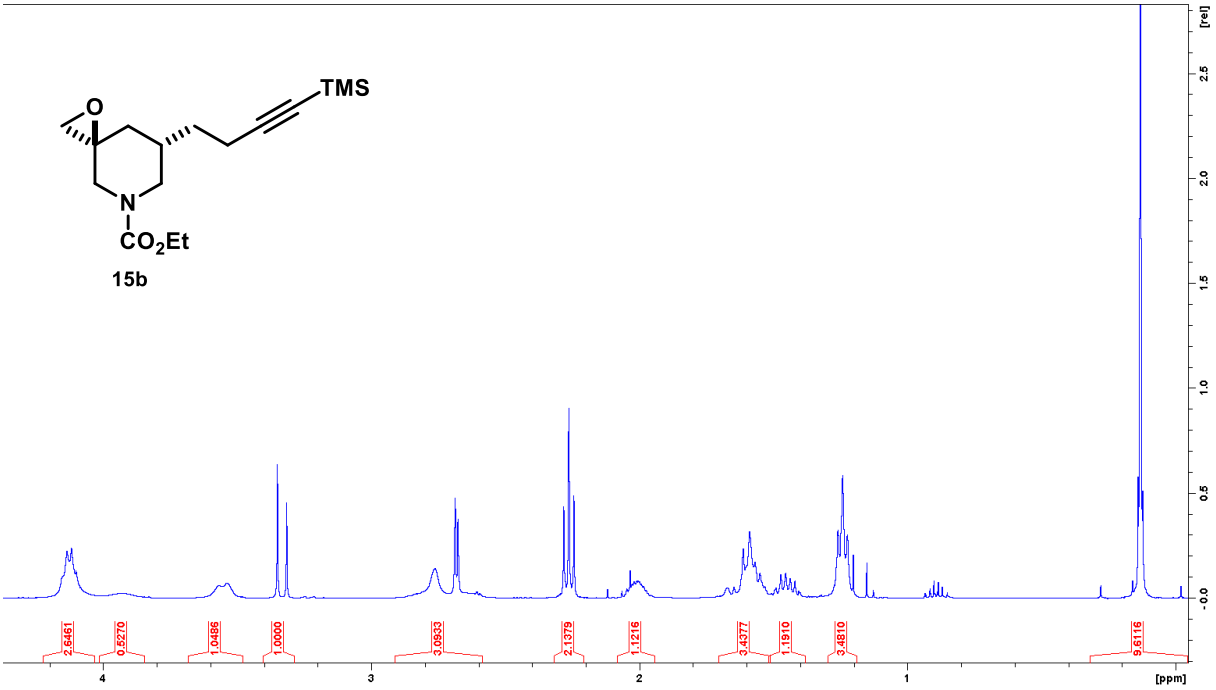
^{1}H NMR (400 MHz, $CDCl_3$)



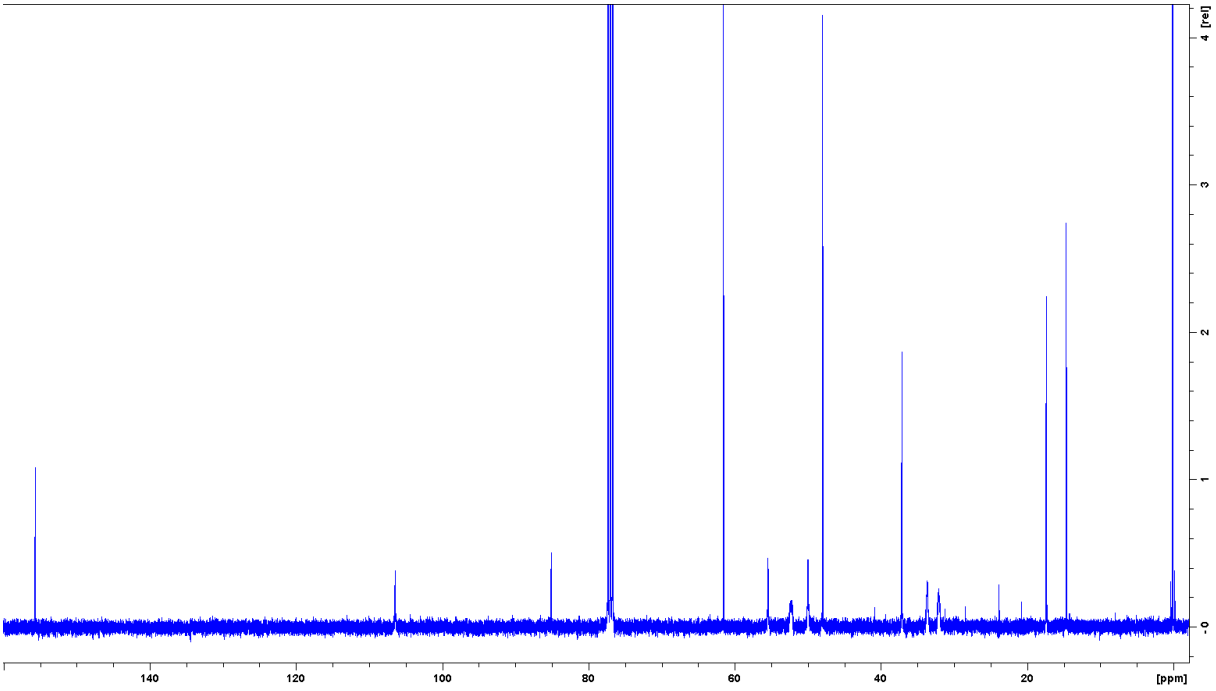
^{13}C NMR (100 MHz, $CDCl_3$)



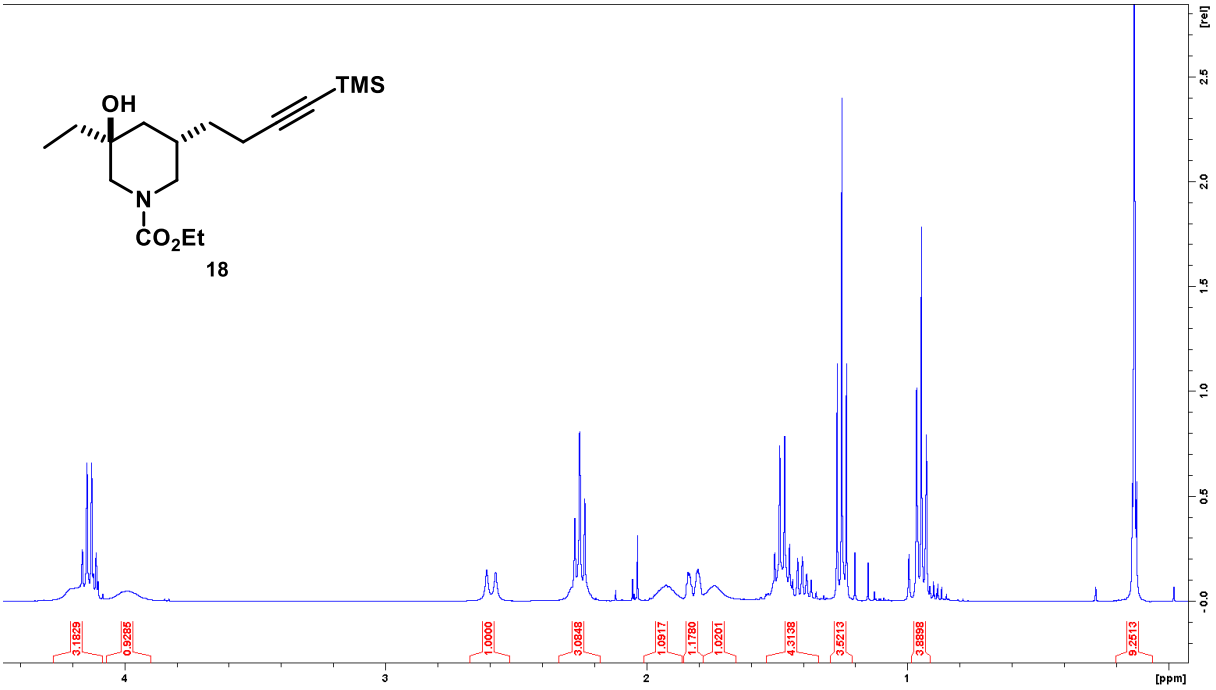
^{1}H NMR (400 MHz, $CDCl_3$)



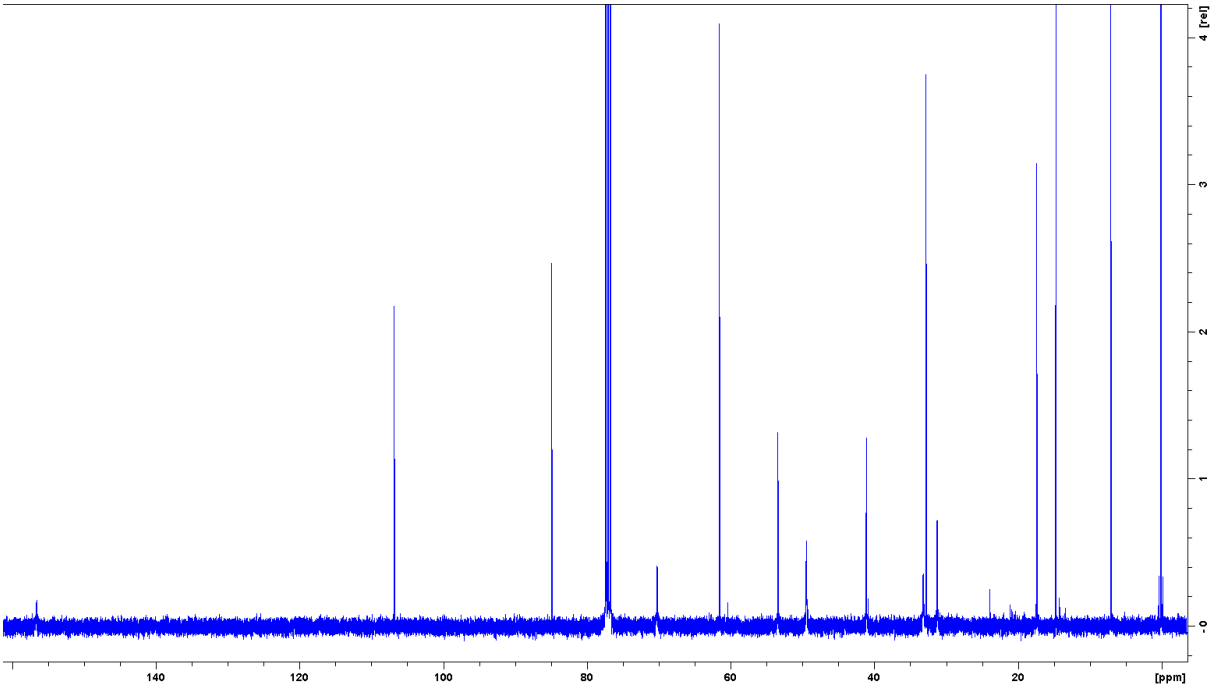
^{13}C NMR (100 MHz, $CDCl_3$)



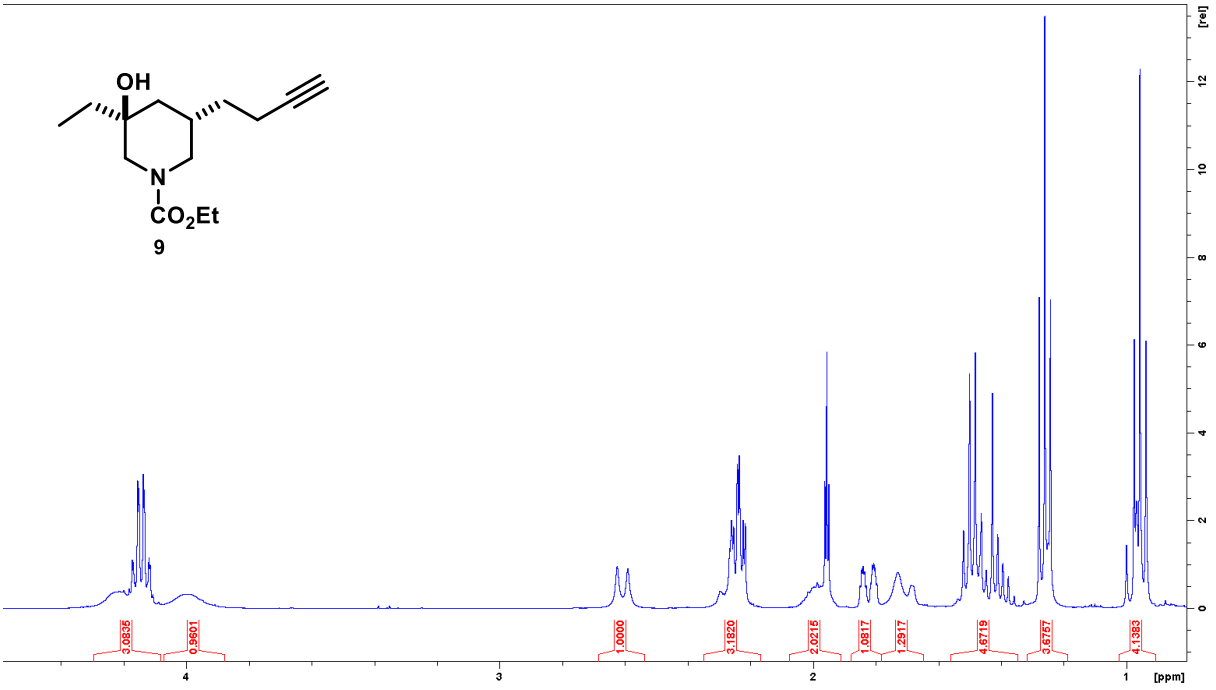
^{1}H NMR (400 MHz, $CDCl_3$)



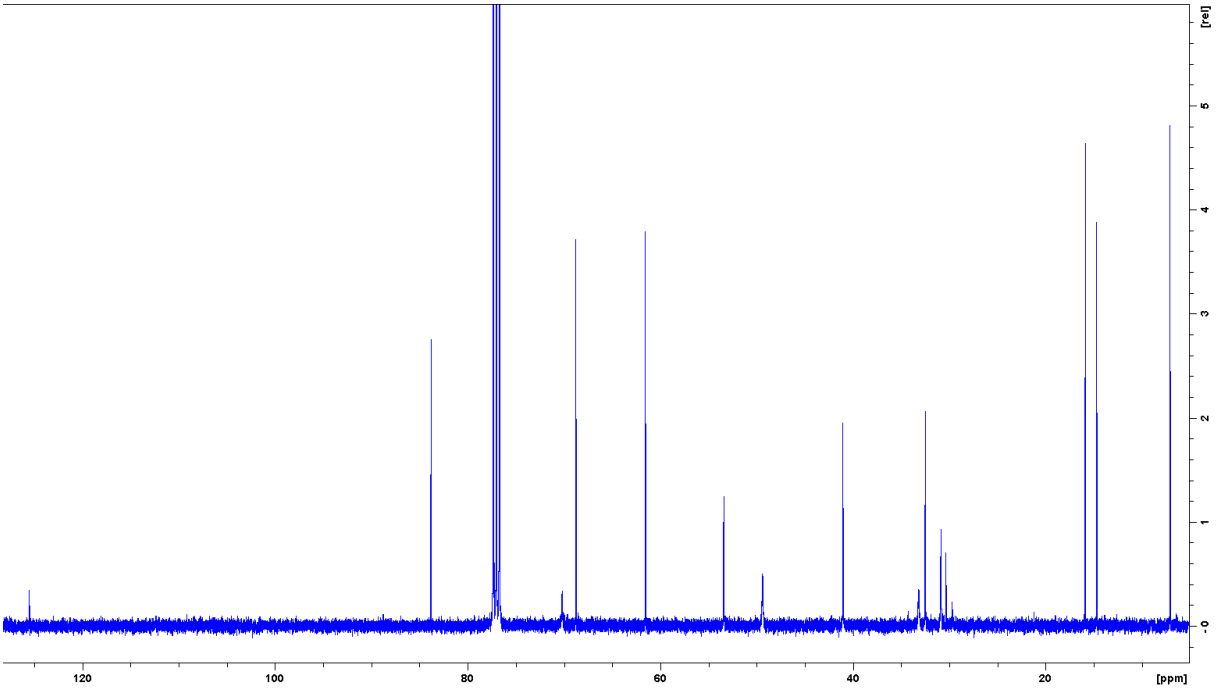
^{13}C NMR (100 MHz, $CDCl_3$)



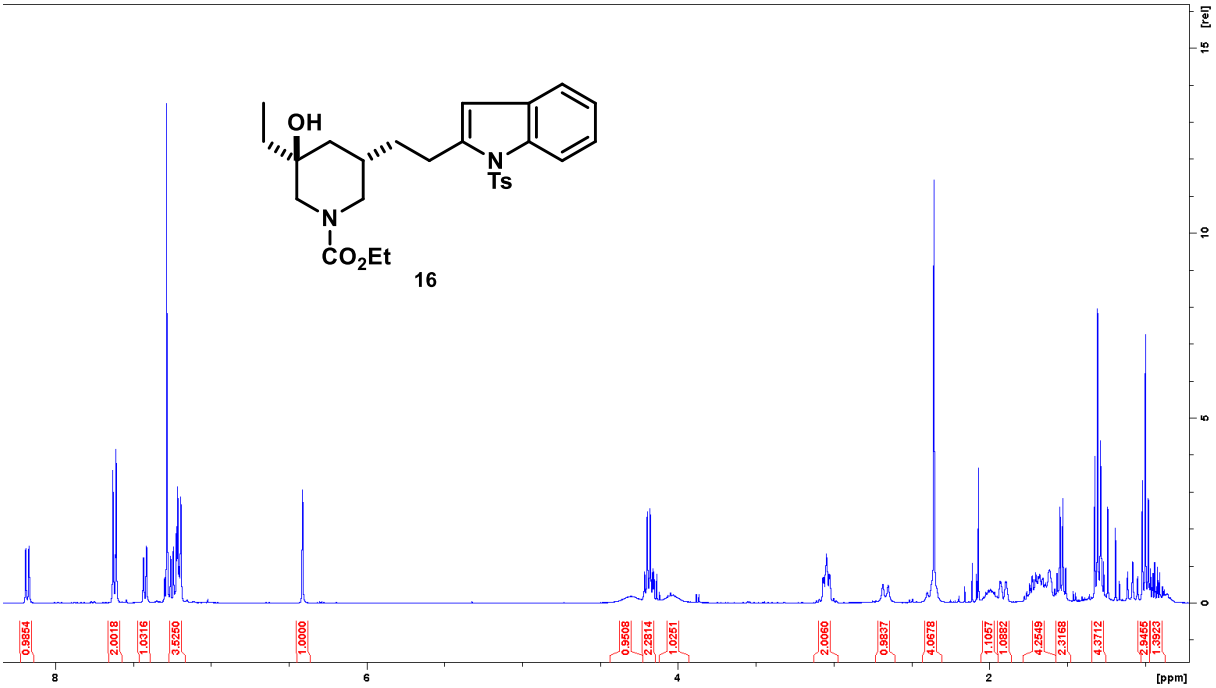
^{1}H NMR (400 MHz, $CDCl_3$)



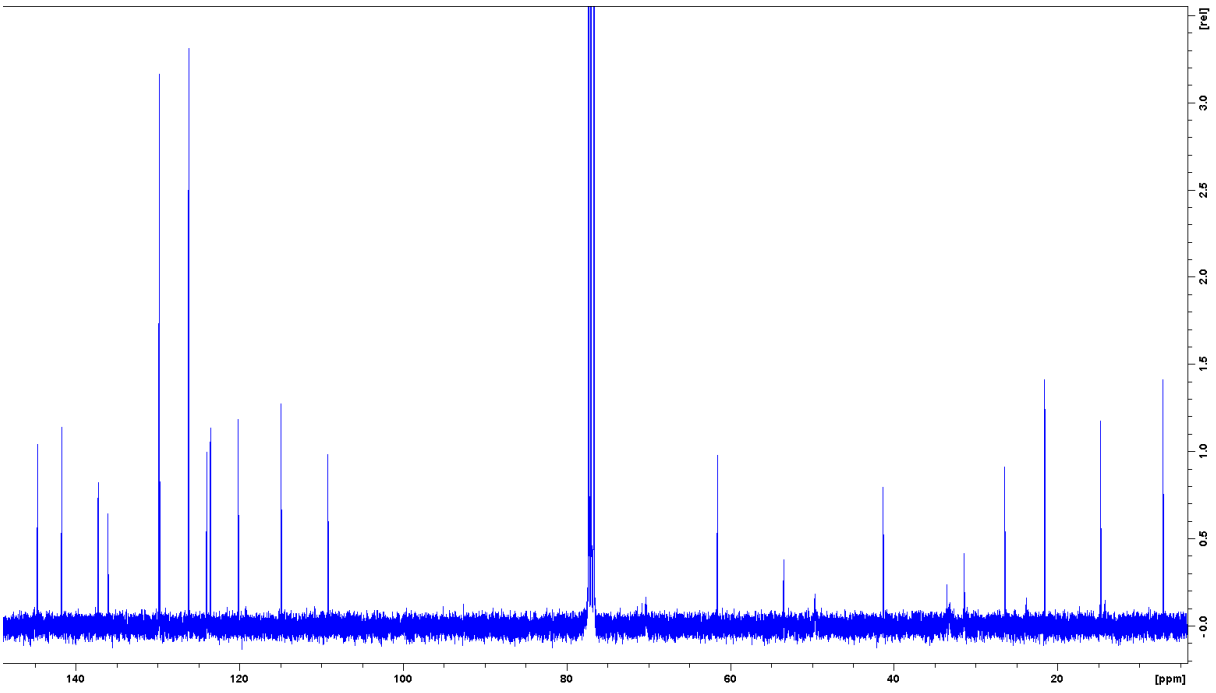
^{13}C NMR (100 MHz, $CDCl_3$)



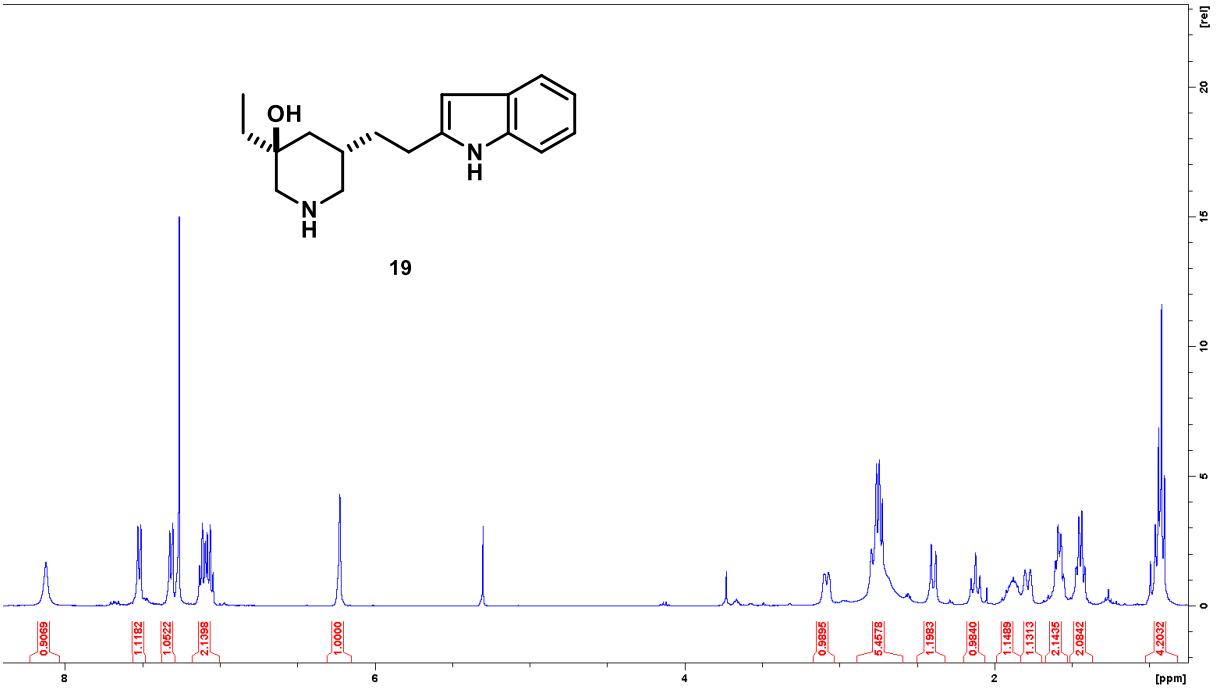
^{1}H NMR (400 MHz, $CDCl_3$)



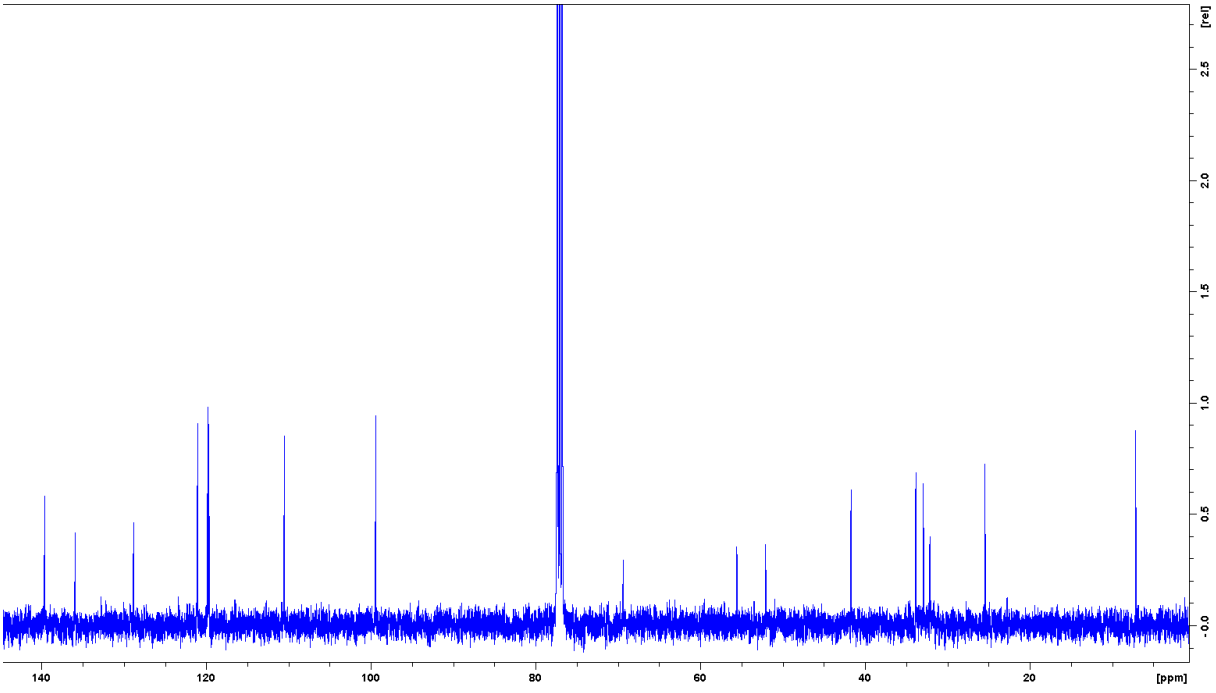
^{13}C NMR (100 MHz, $CDCl_3$)



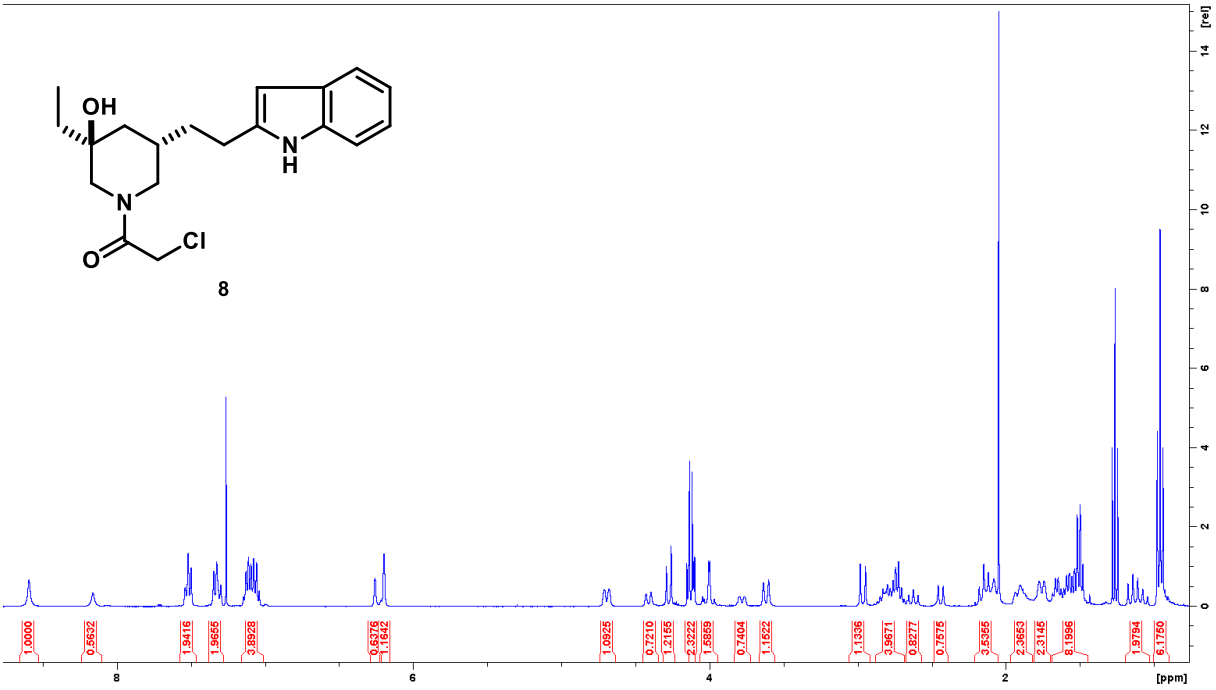
^{1}H NMR (400 MHz, $CDCl_3$)



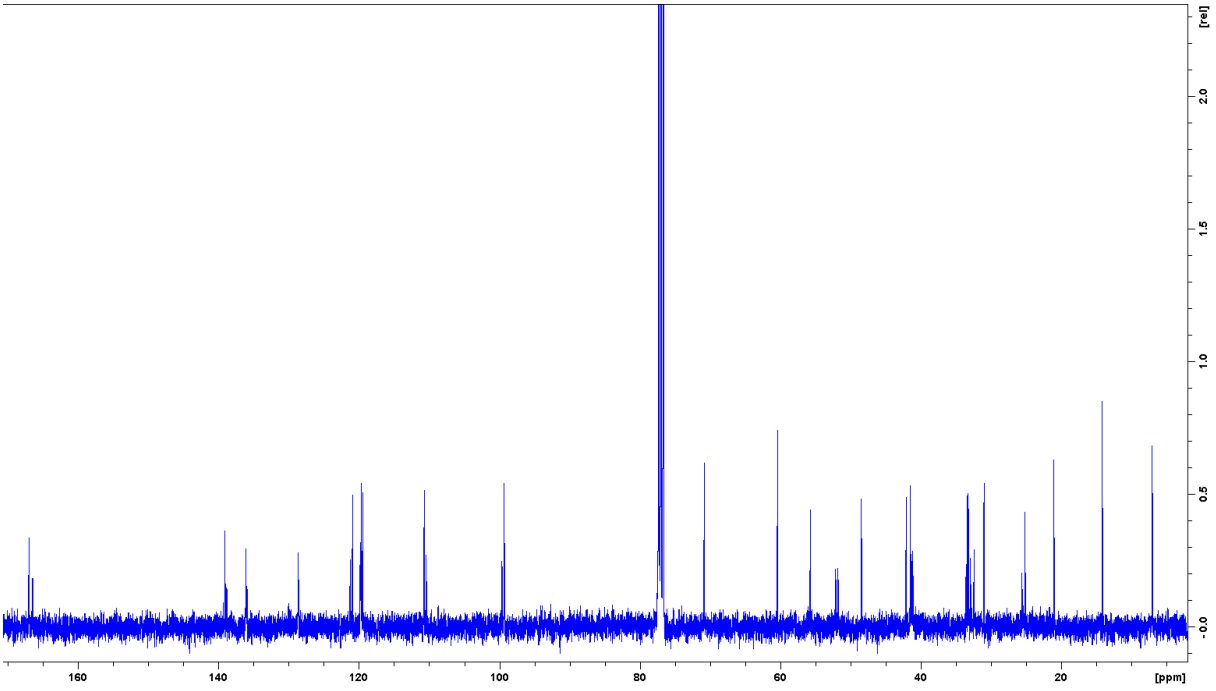
^{13}C NMR (100 MHz, $CDCl_3$)



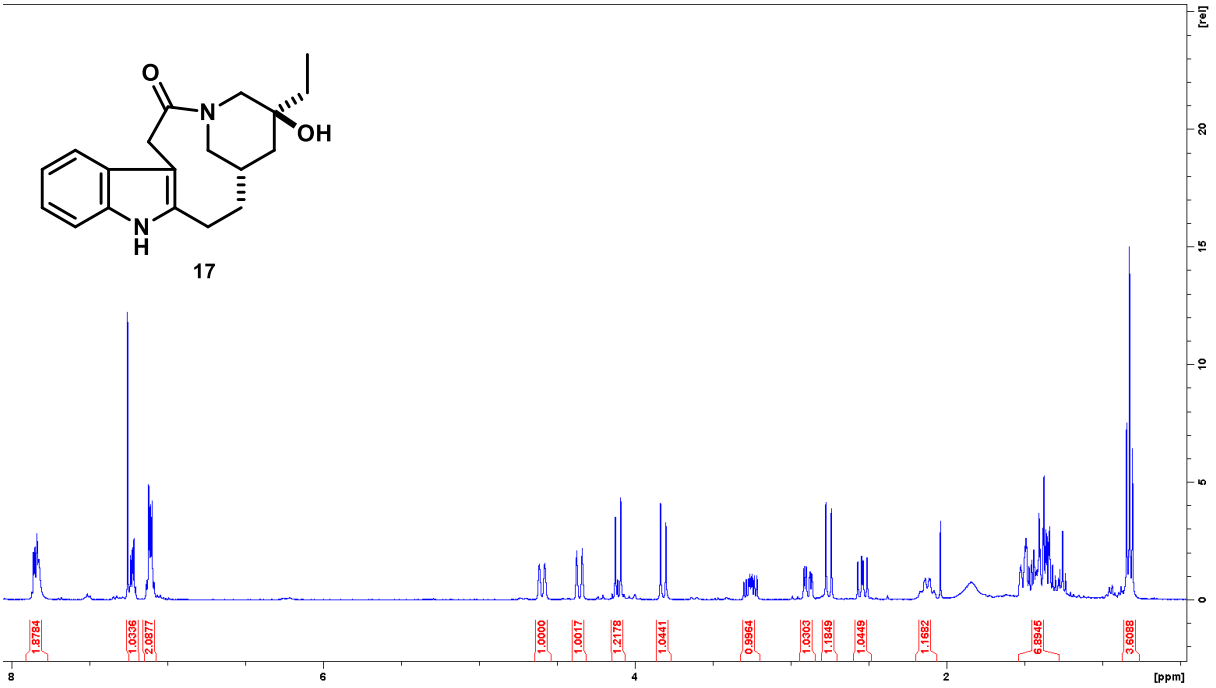
^{1}H NMR (400 MHz, $CDCl_3$, two rotamers)



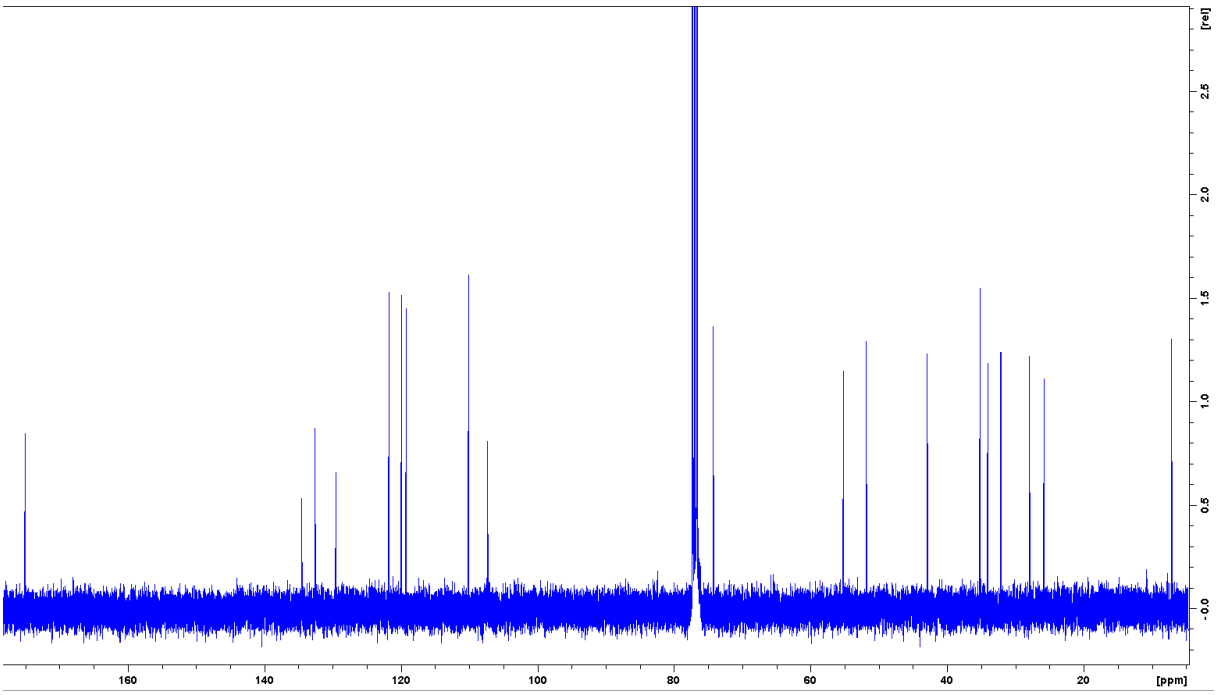
^{13}C NMR (100 MHz, $CDCl_3$, two rotamers)



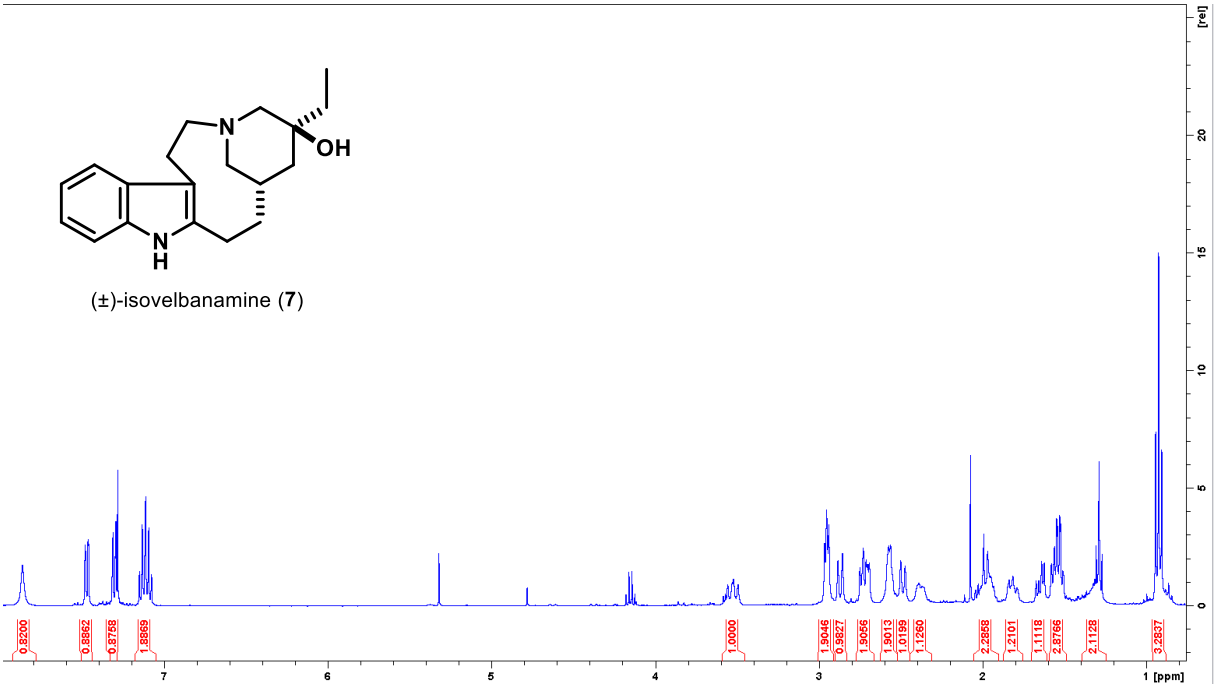
^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C NMR (100 MHz, $CDCl_3$)

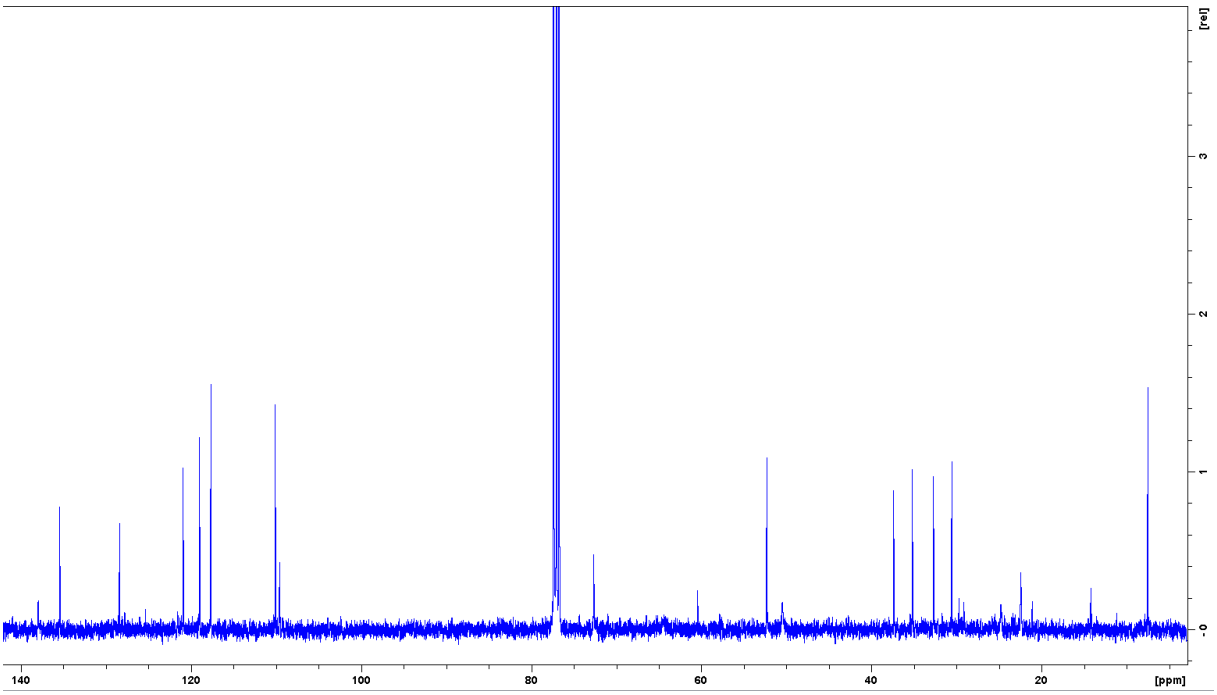


^{1}H NMR (400 MHz, $CDCl_3$)

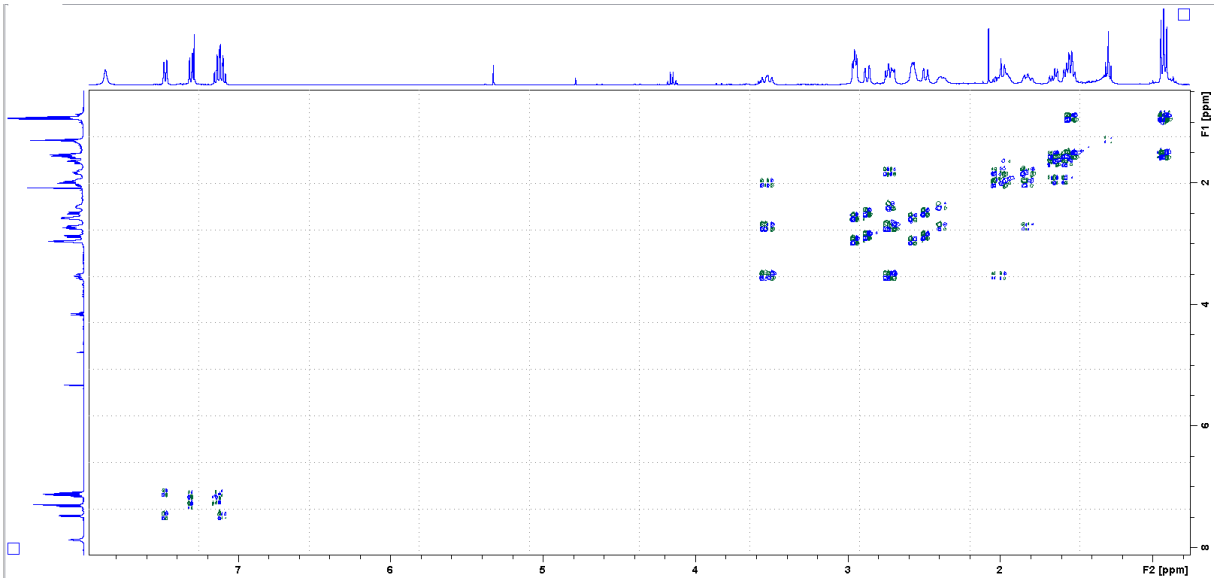


(±)-isovelbanamine (**7**)

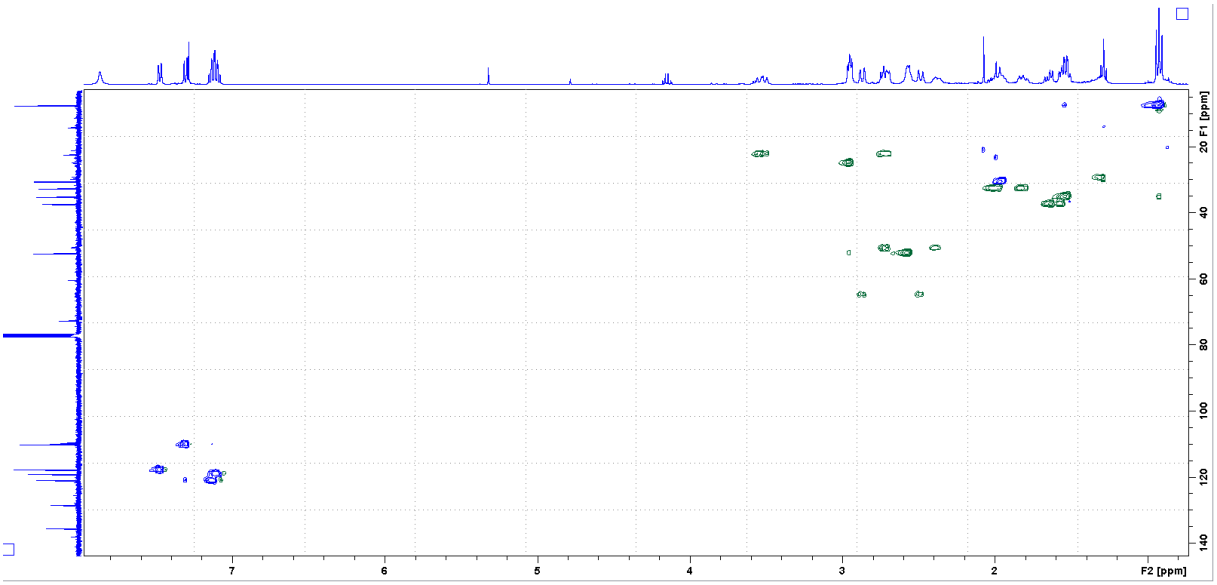
^{13}C NMR (100 MHz, $CDCl_3$)



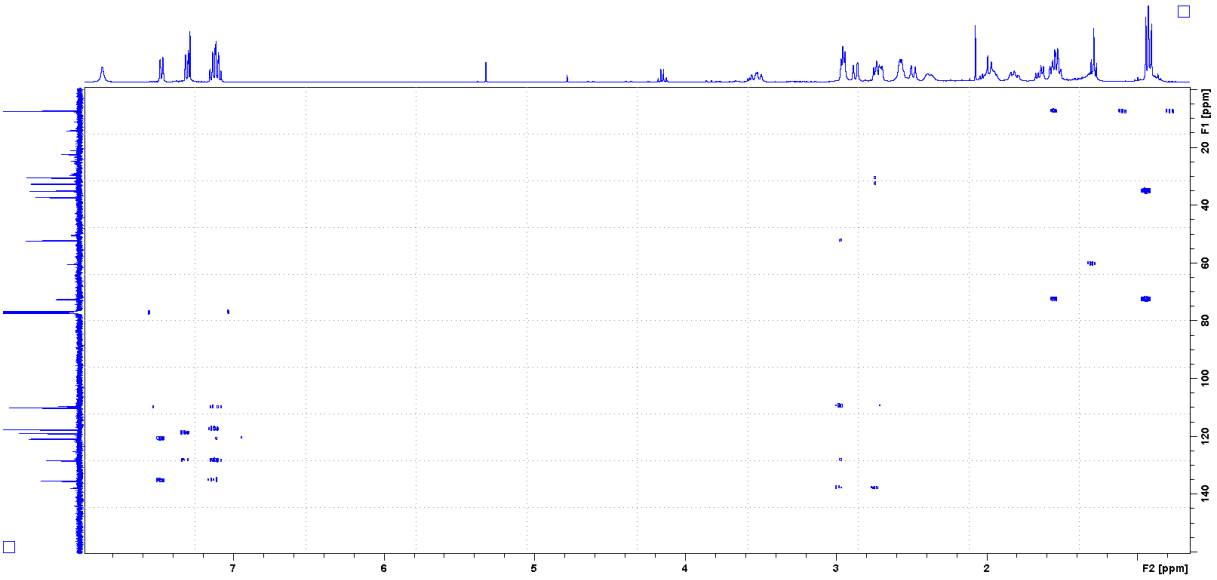
COSY (100 MHz, $CDCl_3$)



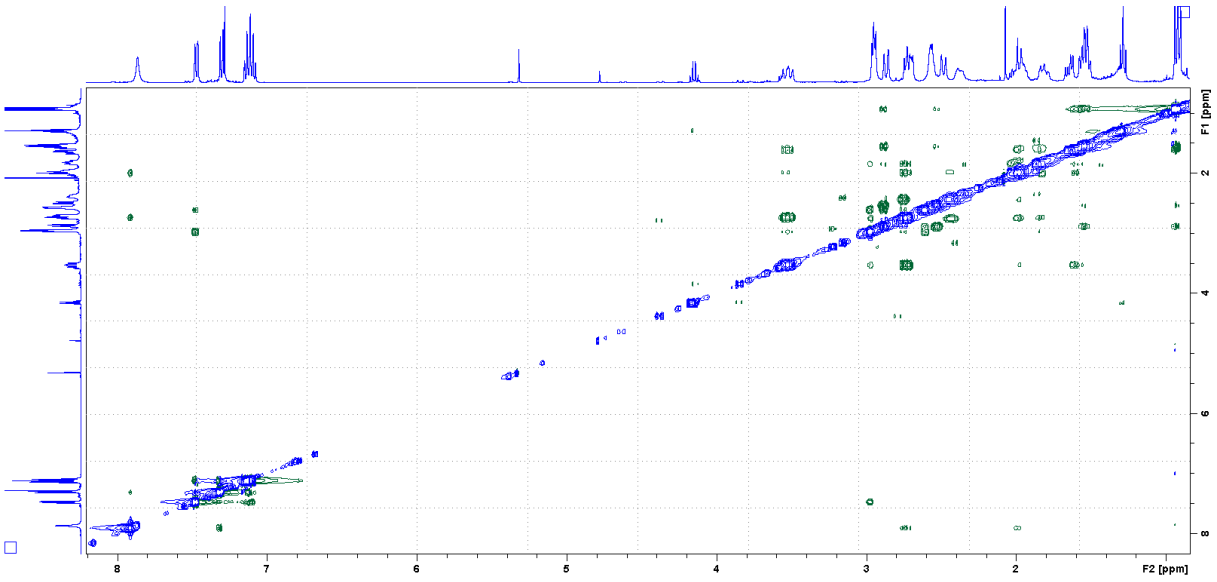
HSQC (100 MHz, $CDCl_3$)



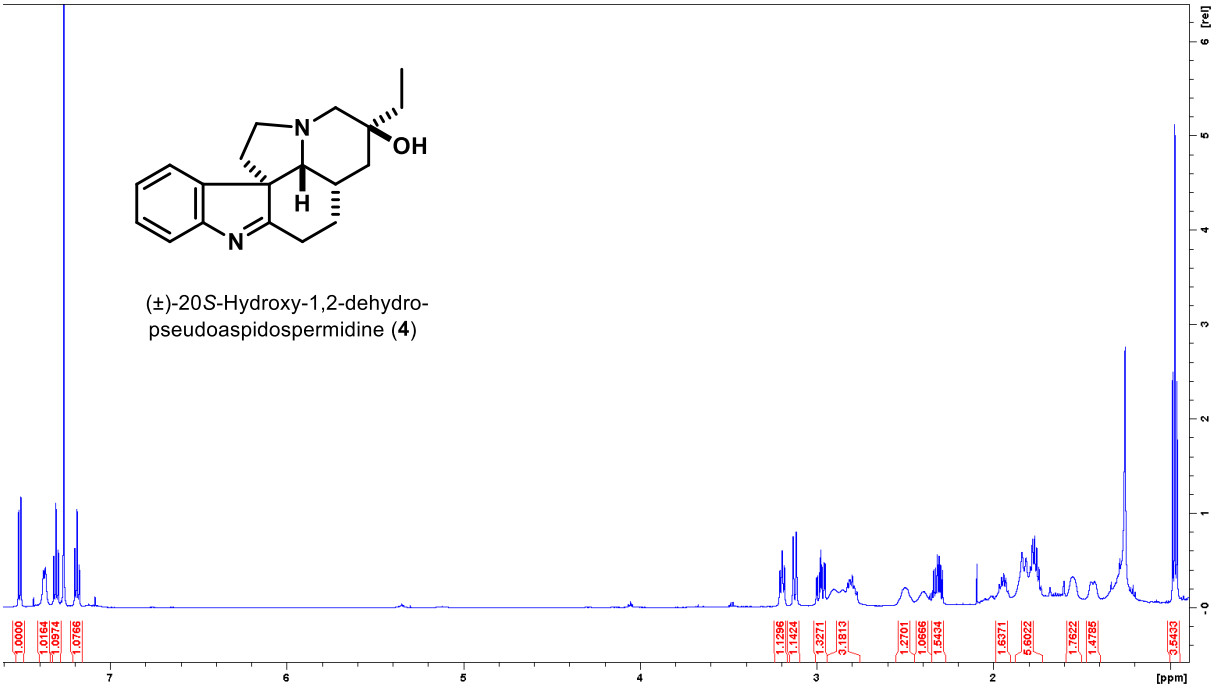
HMBC (100 MHz, $CDCl_3$)



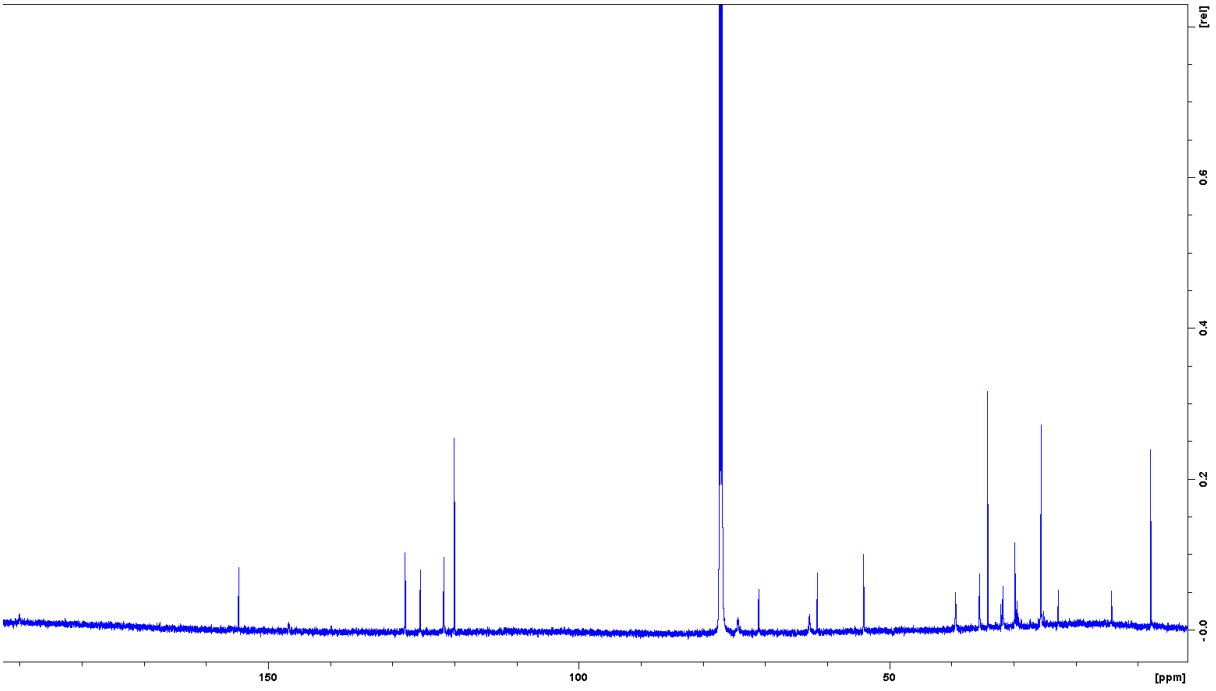
NOESY (100 MHz, $CDCl_3$)



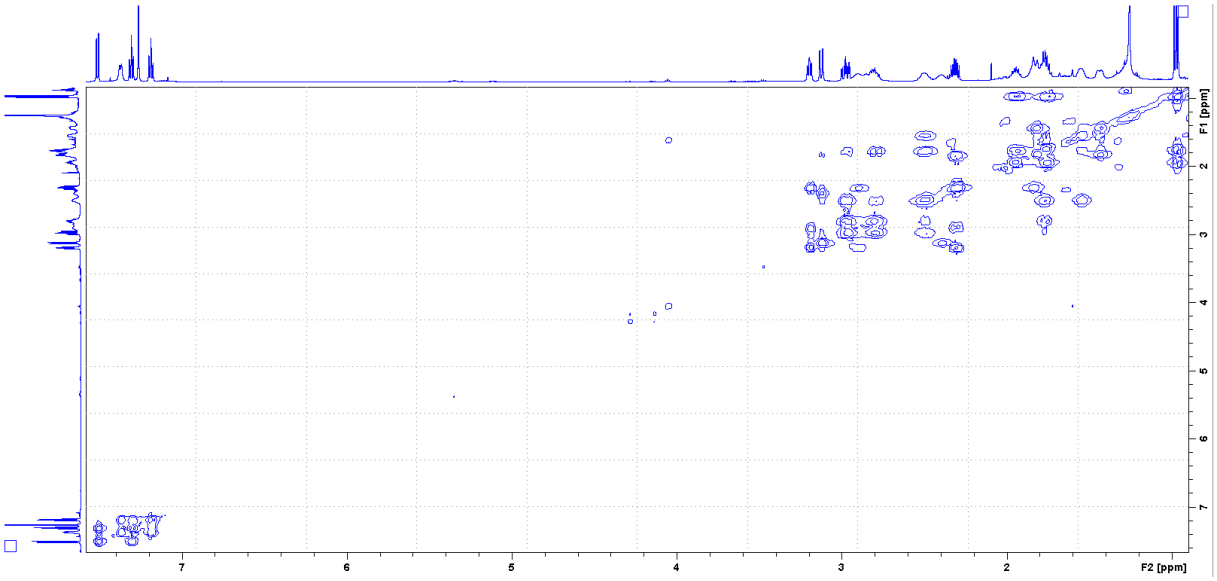
^{1}H NMR (600 MHz, $CDCl_3$)



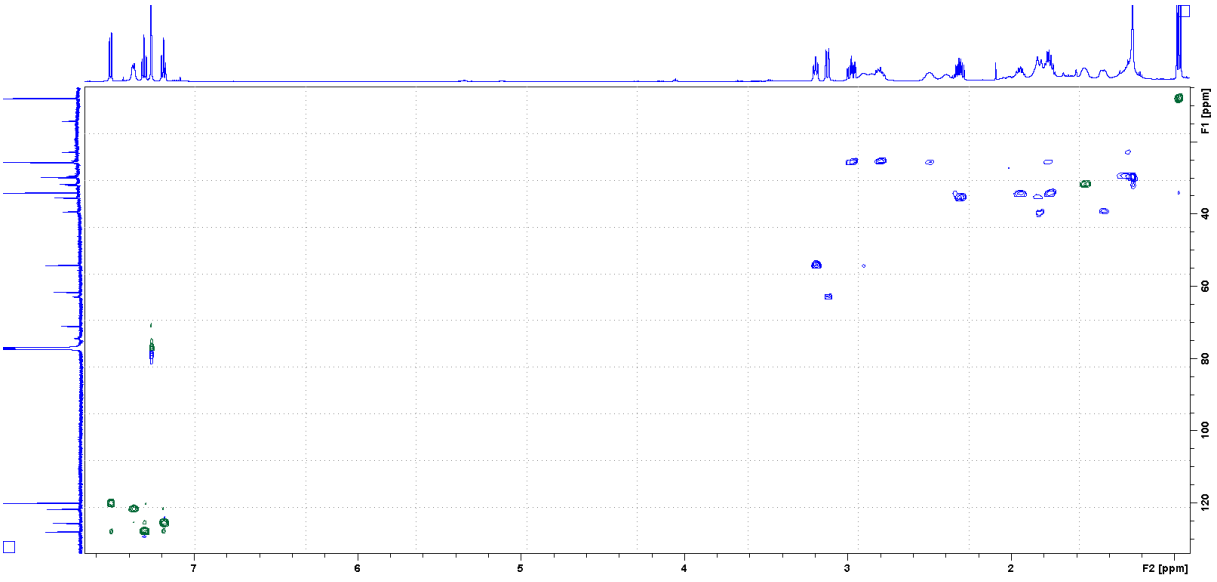
^{13}C NMR (150 MHz, $CDCl_3$)



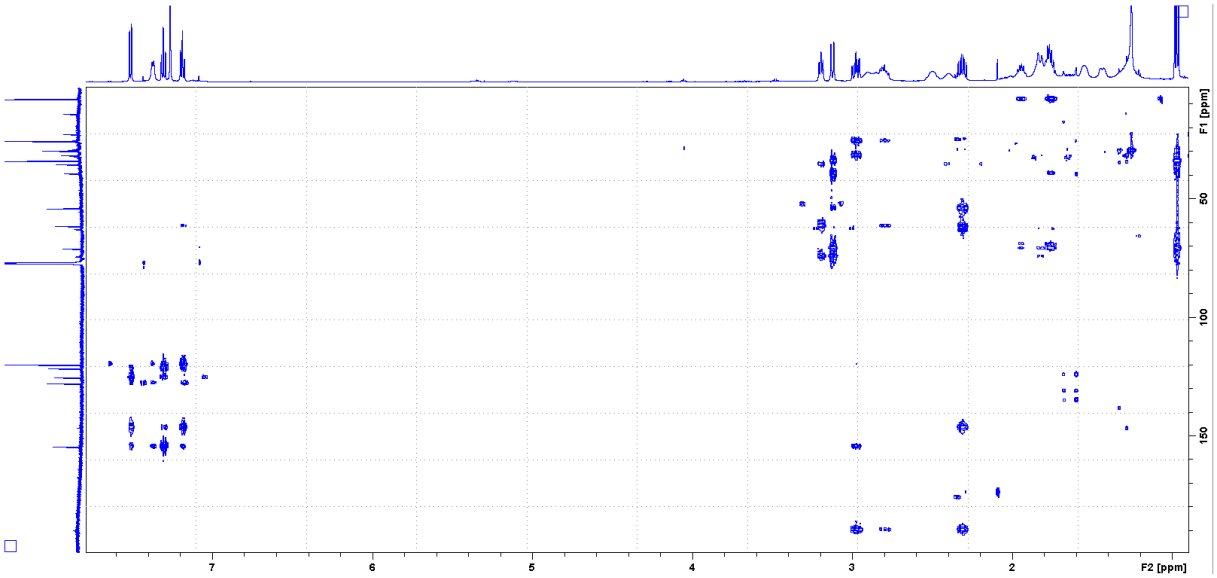
COSY (150 MHz, $CDCl_3$)



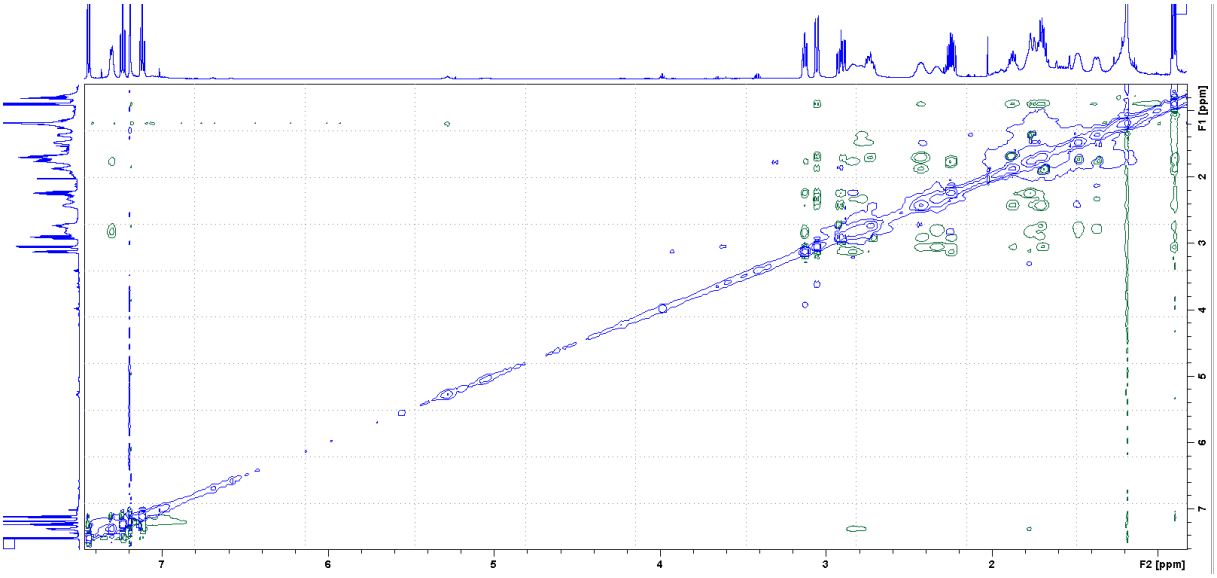
HSQC (150 MHz, $CDCl_3$)



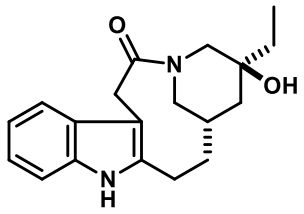
HMBC (150 MHz, $CDCl_3$)



NOESY (150 MHz, $CDCl_3$)



X-ray structure analysis of compound 17



17

Compound **17** submitted for X-ray structure analysis

CCDC number: 1519086

Table 1. Crystal data and structure refinement for cl1208_9-11.

Identification code	Z:_9-11_9-11	
Empirical formula	C19 H24 N2 O2	
Formula weight	312.40	
Temperature	100(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	P 21/n	
Unit cell dimensions	a = 10.7852(8) Å	α= 90°.
	b = 9.4641(8) Å	β= 105.748(6)°.
	c = 16.0760(13) Å	γ = 90°.
Volume	1579.3(2) $Å^3$	
Z	4	
Density (calculated)	1.314 Mg/m^3	
Absorption coefficient	0.086 mm^{-1}	
F(000)	672	
Crystal size, colour, habit	0.3 x 0.2 x 0.1 mm^3, colourless plate	
Theta range for data collection	2.044 to 26.071°.	
Index ranges	-13<=h<=13, -11<=k<=11, -19<=l<=19	
Reflections collected	19880	
Independent reflections	3087 [R(int) = 0.1432]	
Completeness to theta = 25.242°	100.0 %	
Absorption correction	Integration	
Max. and min. transmission	0.9892 and 0.9513	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	3087 / 0 / 213	
Goodness-of-fit on F^2	1.033	

Final R indices [I>2sigma(I)]	R1 = 0.0689, wR2 = 0.1228
R indices (all data)	R1 = 0.1276, wR2 = 0.1409
Extinction coefficient	n/a
Largest diff. peak and hole	0.239 and -0.208 e.Å^{-3}

Table 2. Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters (Å^{2}x 10^3) for cl1208_9-11. U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
C(1)	7870(3)	2620(3)	1327(2)	19(1)
C(2)	6842(3)	3518(3)	2735(2)	21(1)
C(3)	7266(3)	3876(3)	772(2)	19(1)
C(5)	4961(3)	3456(3)	498(2)	17(1)
C(6)	5026(3)	4297(3)	1331(2)	20(1)
C(7)	5608(3)	3540(3)	2189(2)	18(1)
C(8)	4826(3)	2685(3)	2589(2)	18(1)
C(9)	3519(3)	2294(4)	2350(2)	23(1)
C(10)	3064(3)	1417(4)	2880(2)	26(1)
C(11)	3890(3)	937(4)	3672(2)	25(1)
C(12)	5162(3)	1335(3)	3937(2)	22(1)
C(13)	5631(3)	2182(3)	3384(2)	20(1)
C(15)	8299(3)	1609(3)	727(2)	19(1)
C(16)	8116(3)	4096(4)	2666(2)	22(1)
C(17)	8814(3)	3103(3)	2172(2)	21(1)
C(18)	8392(3)	-877(3)	-485(2)	22(1)
C(19)	7561(3)	431(3)	-752(2)	21(1)
C(20)	7130(3)	1145(3)	-21(2)	19(1)
C(21)	6226(3)	2386(3)	-422(2)	19(1)
N(1)	6032(2)	3405(3)	219(2)	17(1)
N(2)	6853(2)	2688(3)	3447(2)	20(1)
O(1)	3934(2)	2890(2)	93(1)	25(1)
O(2)	6393(2)	203(3)	359(2)	25(1)

Table 3. Bond lengths [Å] and angles [°] for cl1208_9-11.

C(1)-C(15)	1.518(4)
C(1)-C(3)	1.522(4)
C(1)-C(17)	1.529(4)
C(2)-C(7)	1.381(4)
C(2)-N(2)	1.385(4)
C(2)-C(16)	1.510(4)
C(3)-N(1)	1.456(4)
C(5)-O(1)	1.244(4)
C(5)-N(1)	1.349(4)
C(5)-C(6)	1.542(4)
C(6)-C(7)	1.530(4)
C(7)-C(8)	1.440(4)
C(8)-C(9)	1.407(4)
C(8)-C(13)	1.419(4)
C(9)-C(10)	1.373(5)
C(10)-C(11)	1.416(5)
C(11)-C(12)	1.374(5)
C(12)-C(13)	1.390(4)
C(13)-N(2)	1.380(4)
C(15)-C(20)	1.551(4)
C(16)-C(17)	1.551(4)
C(18)-C(19)	1.520(4)
C(19)-C(20)	1.533(4)
C(20)-O(2)	1.436(4)
C(20)-C(21)	1.550(4)
C(21)-N(1)	1.468(4)
C(15)-C(1)-C(3)	106.0(2)
C(15)-C(1)-C(17)	120.6(3)
C(3)-C(1)-C(17)	111.3(3)
C(7)-C(2)-N(2)	108.9(3)
C(7)-C(2)-C(16)	133.4(3)
N(2)-C(2)-C(16)	117.5(3)
N(1)-C(3)-C(1)	107.1(2)
O(1)-C(5)-N(1)	122.1(3)
O(1)-C(5)-C(6)	120.2(3)
N(1)-C(5)-C(6)	117.7(3)

C(7)-C(6)-C(5)	116.9(2)
C(2)-C(7)-C(8)	106.8(3)
C(2)-C(7)-C(6)	132.0(3)
C(8)-C(7)-C(6)	121.3(3)
C(9)-C(8)-C(13)	118.8(3)
C(9)-C(8)-C(7)	133.7(3)
C(13)-C(8)-C(7)	107.5(3)
C(10)-C(9)-C(8)	119.4(3)
C(9)-C(10)-C(11)	120.6(3)
C(12)-C(11)-C(10)	121.5(3)
C(11)-C(12)-C(13)	117.8(3)
N(2)-C(13)-C(12)	131.3(3)
N(2)-C(13)-C(8)	106.7(3)
C(12)-C(13)-C(8)	122.0(3)
C(1)-C(15)-C(20)	110.3(2)
C(2)-C(16)-C(17)	113.3(3)
C(1)-C(17)-C(16)	109.7(3)
C(18)-C(19)-C(20)	114.9(2)
O(2)-C(20)-C(19)	111.7(3)
O(2)-C(20)-C(21)	106.8(2)
C(19)-C(20)-C(21)	107.6(2)
O(2)-C(20)-C(15)	105.8(2)
C(19)-C(20)-C(15)	111.5(3)
C(21)-C(20)-C(15)	113.3(2)
N(1)-C(21)-C(20)	113.5(2)
C(5)-N(1)-C(3)	120.6(2)
C(5)-N(1)-C(21)	123.8(2)
C(3)-N(1)-C(21)	110.4(2)
C(13)-N(2)-C(2)	110.0(2)

Symmetry transformations used to generate equivalent atoms:

Table 4. Anisotropic displacement parameters ($Å^2 x\ 10^3$)for cl1208_9-11. The anisotropic displacement factor exponent takes the form: $-2\pi^2[\ h^2 a^{*2} U^{11} + ... + 2\ h\ k\ a^*\ b^*\ U^{12}\ ]$

	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
C(1)	16(2)	24(2)	17(1)	-1(1)	3(1)	-2(1)
C(2)	24(2)	23(2)	15(2)	-4(1)	6(1)	2(1)
C(3)	22(2)	19(2)	17(2)	-2(1)	6(1)	-4(1)
C(5)	20(2)	16(2)	14(1)	5(1)	2(1)	4(1)
C(6)	17(2)	23(2)	18(2)	1(1)	1(1)	4(1)
C(7)	16(2)	22(2)	16(1)	-3(1)	3(1)	1(1)
C(8)	21(2)	17(2)	16(1)	-5(1)	5(1)	3(1)
C(9)	22(2)	28(2)	17(2)	-6(1)	0(1)	1(1)
C(10)	23(2)	33(2)	24(2)	-9(2)	8(1)	-4(2)
C(11)	31(2)	25(2)	26(2)	-1(1)	16(2)	0(2)
C(12)	30(2)	21(2)	16(1)	1(1)	7(1)	9(1)
C(13)	23(2)	20(2)	17(1)	-2(1)	6(1)	5(1)
C(15)	18(2)	22(2)	18(2)	2(1)	5(1)	2(1)
C(16)	21(2)	26(2)	14(1)	-1(1)	-1(1)	-2(1)
C(17)	18(2)	26(2)	17(1)	1(1)	2(1)	-2(1)
C(18)	20(2)	24(2)	22(2)	-4(1)	6(1)	0(1)
C(19)	22(2)	23(2)	20(2)	0(1)	8(1)	-1(1)
C(20)	22(2)	17(2)	18(2)	1(1)	5(1)	-3(1)
C(21)	20(2)	23(2)	12(1)	1(1)	3(1)	-1(1)
N(1)	18(1)	16(1)	14(1)	-1(1)	1(1)	0(1)
N(2)	20(1)	24(2)	15(1)	2(1)	2(1)	5(1)
O(1)	16(1)	38(1)	20(1)	-2(1)	2(1)	-5(1)
O(2)	33(2)	20(1)	25(1)	1(1)	14(1)	-2(1)

Table 5. Hydrogen coordinates (x 10^4) and isotropic displacement parameters ($Å^2$x 10^3) for cl1208_9-11.

	x	y	z	U(eq)
H(1)	7150	2136	1495	23
H(3A)	7139	4669	1142	23
H(3B)	7831	4200	418	23
H(6A)	5533	5166	1321	24
H(6B)	4141	4594	1317	24
H(9A)	2957	2634	1826	28
H(10A)	2187	1129	2714	32
H(11A)	3557	327	4029	30
H(12A)	5703	1040	4479	27
H(15A)	8705	767	1056	23
H(15B)	8947	2076	487	23
H(16A)	8683	4259	3255	26
H(16B)	7966	5020	2367	26
H(17A)	9545	3608	2045	25
H(17B)	9158	2271	2534	25
H(18A)	7869	-1639	-343	26
H(18B)	9106	-659	22	26
H(18C)	8735	-1177	-962	26
H(19A)	6785	165	-1215	25
H(19B)	8050	1127	-998	25
H(21A)	6592	2887	-842	22
H(21B)	5379	1998	-744	22
H(2A)	7539	2510	3876	24
H(22)	6410(60)	-450(60)	180(40)	90(20)

Table 6. Torsion angles [°] for cl1208_9-11.

C(15)-C(1)-C(3)-N(1)	72.5(3)
C(17)-C(1)-C(3)-N(1)	-154.7(2)
O(1)-C(5)-C(6)-C(7)	100.0(3)
N(1)-C(5)-C(6)-C(7)	-82.3(3)
N(2)-C(2)-C(7)-C(8)	0.2(3)
C(16)-C(2)-C(7)-C(8)	174.6(3)
N(2)-C(2)-C(7)-C(6)	178.5(3)
C(16)-C(2)-C(7)-C(6)	-7.2(6)
C(5)-C(6)-C(7)-C(2)	94.4(4)
C(5)-C(6)-C(7)-C(8)	-87.6(4)
C(2)-C(7)-C(8)-C(9)	-179.1(3)
C(6)-C(7)-C(8)-C(9)	2.4(5)
C(2)-C(7)-C(8)-C(13)	0.7(3)
C(6)-C(7)-C(8)-C(13)	-177.7(3)
C(13)-C(8)-C(9)-C(10)	-1.3(4)
C(7)-C(8)-C(9)-C(10)	178.6(3)
C(8)-C(9)-C(10)-C(11)	1.7(5)
C(9)-C(10)-C(11)-C(12)	0.3(5)
C(10)-C(11)-C(12)-C(13)	-2.5(5)
C(11)-C(12)-C(13)-N(2)	-176.5(3)
C(11)-C(12)-C(13)-C(8)	2.9(5)
C(9)-C(8)-C(13)-N(2)	178.5(3)
C(7)-C(8)-C(13)-N(2)	-1.4(3)
C(9)-C(8)-C(13)-C(12)	-1.0(4)
C(7)-C(8)-C(13)-C(12)	179.1(3)
C(3)-C(1)-C(15)-C(20)	-59.5(3)
C(17)-C(1)-C(15)-C(20)	173.1(3)
C(7)-C(2)-C(16)-C(17)	-84.0(4)
N(2)-C(2)-C(16)-C(17)	90.0(3)
C(15)-C(1)-C(17)-C(16)	-178.6(3)
C(3)-C(1)-C(17)-C(16)	56.4(3)
C(2)-C(16)-C(17)-C(1)	48.2(3)
C(18)-C(19)-C(20)-O(2)	-59.3(4)
C(18)-C(19)-C(20)-C(21)	-176.2(3)
C(18)-C(19)-C(20)-C(15)	58.9(3)
C(1)-C(15)-C(20)-O(2)	-72.4(3)
C(1)-C(15)-C(20)-C(19)	165.9(2)

C(1)-C(15)-C(20)-C(21)	44.3(3)
O(2)-C(20)-C(21)-N(1)	76.4(3)
C(19)-C(20)-C(21)-N(1)	-163.5(2)
C(15)-C(20)-C(21)-N(1)	-39.7(3)
O(1)-C(5)-N(1)-C(3)	-170.1(3)
C(6)-C(5)-N(1)-C(3)	12.2(4)
O(1)-C(5)-N(1)-C(21)	-18.0(4)
C(6)-C(5)-N(1)-C(21)	164.3(3)
C(1)-C(3)-N(1)-C(5)	86.6(3)
C(1)-C(3)-N(1)-C(21)	-68.8(3)
C(20)-C(21)-N(1)-C(5)	-102.5(3)
C(20)-C(21)-N(1)-C(3)	52.0(3)
C(12)-C(13)-N(2)-C(2)	-179.0(3)
C(8)-C(13)-N(2)-C(2)	1.5(3)
C(7)-C(2)-N(2)-C(13)	-1.1(3)
C(16)-C(2)-N(2)-C(13)	-176.5(3)

Symmetry transformations used to generate equivalent atoms: