Copper-catalysed hydroamidation for the formation of pyrrolinone derivatives

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Electronic Supplementary Information

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I. General Information

Reactions were performed under inert nitrogen atmosphere with anhydrous solvent unless otherwise stated. All glassware was oven dried at >100 °C, and allowed to cool to room temperature under a positive nitrogen pressure. Reactions were monitored by TLC until deemed complete using aluminum backed silica plates. Plates were visualized under ultraviolet light (254 nm) and/or by staining with $KMnO_4$. Cooling of reaction mixtures to 0 °C was achieved using an ice water bath.

Reagents were purchased from Sigma-Aldrich Chemical Co. Ltd., Alfa Aesar, Acros Organics Ltd., Fluorochem Ltd. or Strem Chemicals Inc. and were used as supplied. All alkynes were distilled and degassed with N_2 before use. Anhydrous solvents were obtained by passing through anhydrous alumina columns using an Innovative Technology Inc. PS-400-7 solvent purification system, and were degassed with nitrogen flow before use. Column chromatography was carried out using matrix 60 silica. Petrol refers to the fraction of light petroleum ether boiling in the range of 40 – 60 °C.

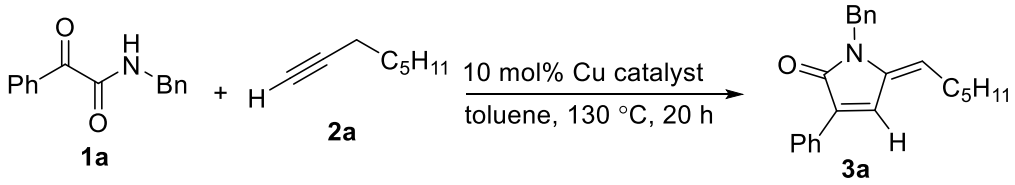
^{1}H NMR spectra were obtained on a Bruker AVIII400 (400 MHz) or AVIII500 (500 MHz) spectrometer using the residual solvent as an internal standard. ^{13}C NMR spectra were obtained on a Bruker AVIII400 (101 MHz) spectrometer using the residual solvent as an internal standard. Chemical shifts (δ) were reported in parts per million (ppm) with the multiplicities of the spectra reported as following: bs, broad singlet; s, singlet; d, doublet; t, triplet; q, quartet; p, quintet; h, sextet; m, multiplet; app., apparent. Coupling constants (*J*) were given in Hertz (Hz) and rounded to the nearest 0.5 Hz.

Low resolution ESI mass spectra were recorded on a Waters LCT Premier spectrometer. High resolution mass spectrometry measurements were recorded on a Brucker Daltronics MicroTOF (ESI) spectrometer or on a Micromass LCT (FI) spectrometer by the internal service at Chemistry Research Laboratory, University of Oxford.

Infrared spectra were recorded as thin films on a Bruker Tensor 27 FT-IR spectrometer. Melting points were determined using a Stuart Scientific Melting Point Apparatus SMP1.

II. Optimisation Tables

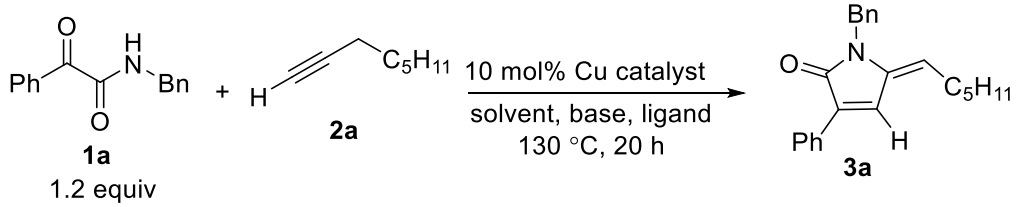
Table S1. Copper catalyst screening for the reaction between 1a and 2a[a]



entry	Copper (I) sources	yield[b]
1	CuBr	0%
2	CuOAc	0%
3	CuMeSal	2%
4	$CuBr(PPh_3)_3$	0%
5	$(CF_3SO_3Cu)_2 \cdot C_6H_6$	5%
6	[(^{i}Pr)CuCl]	0%
7	$[Cu(C_{12}H_8N_2)[P(C_6H_5)_3]_2]NO_3 \cdot {}^1/_2CH_2Cl_2$	0%
8	$Cu(OAc)_2$	0%
9	$CuBr_2$	0%
10	$Cu(acac)_2$	0%
11	$Cu(OTf)_2$	0%
13	$CuCO_3 \cdot Cu(OH)_2$	0%
14	$(CuMeCN)_4PF_6$	0%
15	$(CuMeCN)_4OTf$	0%
16[c]	$(CuMeCN)_4BF_4$	0%

[a]Reaction condition: 130 °C, 20 h, under N_2. [b]Yields determined by ^1H NMR spectra of the crude reaction mixtures using nitromethane as an internal standard. [c]KPF_6 (0.03 mmol) added.

Table S2. Solvent, base and ligand screening for the reaction between 1a and 2a[a]



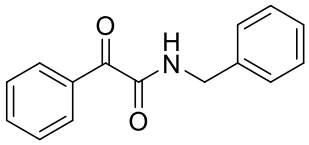
entry	Solvent	Base	Ligand	yield[b]
1	Acetonitrile	-	-	0%
2	*o*-Xylene	-	-	15%
3	*p*-Xylene	-	-	16%
4	1,1,2-Trichloroethane	-	-	2%
5	1,2-Dichlorobenzene	-	-	52%
6	*α*,*α*,*α*-Trifluorotoluene	-	-	39%
7	Toluene	K_3PO_4	-	0%
8	Toluene	KH_2PO_4	-	0%
9	Toluene	NaOAc	-	0%
10	Toluene	-	dppe	0%
11	Toluene	-	dppp	0%
12	Toluene	-	dppb	8%
13	Toluene	-	dppBz	9%
14	Toluene	-	dcpe	5%
15	Toluene	-	1,10-phenanthroline	0%
16	Toluene	-	bipyridine	0%

[a]Reaction condition: 130 °C, 20 h, under N_2. [b]Yields determined by ^{1}H NMR spectra of the crude reaction mixtures using nitromethane as an internal standard.

III. Synthesis of *α*-keto amides

α-Keto acids were either commercially purchased or prepared by oxidation of the corresponding methyl ketones using SeO_2.[1] The crude mixture was filtered through a plug of celite, dried under vacuum and used without further purification.

N-Benzyl-2-oxo-2-phenylacetamide (1a)

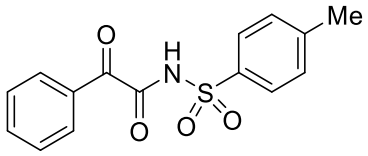


General procedure A:[2]

To a solution of benzoylformic acid (675 mg, 4.5 mmol) and Et_3N (1.25 mL, 9.0 mmol) in 1,2-dichloroethane (12 mL) at 0 °C under N_2 atmosphere was added thionyl chloride (653 µL, 9.0 mmol) dropwise. The mixture was stirred at rt for 20 min before a solution of benzylamine (492 µL, 4.5 mmol) in 1,2-dichloroethane (6 mL) was added slowly at 0 °C. The solution was heated to 60 °C and left to stir for 16 h. The stirring solution was cooled to rt before the slow addition of aqueous solution of $NaHCO_3$ (sat., 20 mL). The organic layer was washed with water (3 × 10 mL), dried over $MgSO_4$, filtered and concentrated under vacuum. The residue was purified by column chromatography (Petrol/EtOAc = 9:1) and recrystallised (Petrol/CH_2Cl_2) to give **1a** as a crystalline white solid (578 mg, 2.4 mmol, 54%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.36 (2H, d, *J* = 7.5 Hz, Ar-*H*), 7.63 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.49 (2H, t, *J* = 7.5 Hz, Ar-*H*), 7.45 (1H, bs, N-*H*), 7.39 – 7.29 (m, 5H, Ar-*H*), 4.58 (2H, d, *J* = 6.0 Hz, C*H*$_2$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 187.7, 161.7, 137.2, 134.6, 133.4, 131.4, 129.0, 128.6, 128.0, 127.9, 43.6; **LRMS (ESI) m/z**: 262.1 [$C_{15}H_{13}NO_2Na$, $(M+Na)^+$]. This data is consistent with literature.[3]

N-Tosyl-2-oxo-2-phenylacetamide (1b)



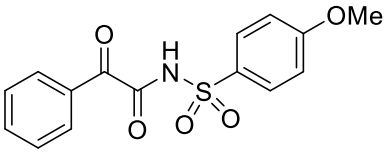
General procedure B:[4]

To a solution of benzoylformic acid (1.50 g, 10 mmol) and 1 drop of DMF in CH_2Cl_2 (20 mL) was added oxalyl chloride (1.0 mL, 12 mmol) dropwise, and the yellow mixture was left to stir

at rt for 3 h. The solvent was removed under vacuum and the residue was dissolved in toluene (10 mL). The resulting solution was then added dropwise to a solution of 4-methylbenzenesulfonamide (1.71 g, 10 mmol), DMAP (6.1 mg, 0.05 mmol) and Et_3N (2.8 mL, 20 mmol) in EtOAc (20 mL) at 0 °C. The mixture was left to stir at rt for 18 h. An aqueous solution of HCl (1 M) was added to the mixture until a clear organic layer was obtained. The aqueous layer was extracted with EtOAc (2 × 40 mL) and the combined organic layer was washed with brine, dried over $MgSO_4$, filtered and concentrated under vacuum. The residue was purified by column chromatography (CH_2Cl_2/EtOAc/AcOH = 90:10:2) to give **1b** as a light yellow solid (1.91 g, 6.28 mmol, 63%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.64 (1H, bs, N-*H*), 8.25 (2H, d, *J* = 7.5 Hz, Ar-*H*), 8.03 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.64 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.45 (2H, t, *J* = 7.5 Hz, Ar-*H*), 7.36 (2H, d, *J* = 8.0 Hz, Ar-*H*), 2.43 (3H, s, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 184.1, 158.2, 145.8, 135.5, 135.0, 131.9, 131.5, 129.9, 128.9, 128.7, 21.8; **LRMS (ESI) m/z**: 326.0 [$C_{15}H_{13}NO_4SNa$, $(M+Na)^+$]. This data is consistent with literature.[4]

***N*-((4-Methoxyphenyl)sulfonyl)-2-oxo-2-phenylacetamide (1c)**

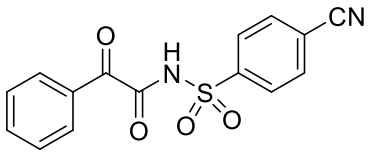


Compound **1c** was prepared according to general procedure B, using benzoylformic acid (300 mg, 2 mmol), oxalyl chloride (200 µL, 2.4 mmol), 1 drop of DMF in CH_2Cl_2 (4 mL), toluene (2 mL), 4-methoxybenzenesulfonamide (190 mg, 2 mmol), DMAP (1.2 mg, 0.01 mmol), Et_3N (558 µL, 4 mmol) and EtOAc (4 mL). The residue was purified by column chromatography (100% Et_2O) to give a white solid (250 mg, 0.79 mmol, 40%)

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.55 (1H, bs, N-*H*), 8.26 (2H, d, *J* = 7.0 Hz, Ar-*H*), 8.08 (2H, d, *J* = 9.0 Hz, Ar-*H*), 7.65 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.46 (2H, dd, *J* = 7.5, 7.0 Hz, Ar-*H*), 7.02 (2H, d, *J* = 9.0 Hz, Ar-*H*), 3.88 (3H, s, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 184.2, 164.5, 158.1, 135.5, 131.9, 131.6, 131.2, 129.2, 128.9, 114.4, 55.9; **mp (Et_2O)**: 112 – 116 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3649, 3247, 2980, 2844, 2361, 2342, 1718, 1678, 1595, 1578, 1498, 1419, 1354, 1317, 1265, 1191, 1166, 1089, 1023, 1002, 977, 872, 835, 805, 771, 744, 687, 676, 665, 627; **LRMS**

(ESI) m/z: 342.0 [$C_{15}H_{13}NNaO_5S$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{15}H_{13}NNaO_5S$, $(M+Na)^+$]: 342.04066; found 342.04077.

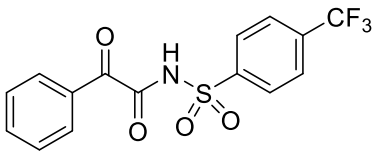
N-((4-Cyanophenyl)sulfonyl)-2-oxo-2-phenylacetamide (1d)



Compound **1d** was prepared according to general procedure B, using benzoylformic acid (600 mg, 4 mmol), oxalyl chloride (406 µL, 4.8 mmol), 1 drop of DMF in CH_2Cl_2 (8 mL), toluene (4 mL), 4-cyanobenzenesulfonamide (730 mg, 4 mmol), DMAP (2.4 mg, 0.02 mmol), Et_3N (1.1 mL, 8 mmol) and EtOAc (8 mL). The residue was purified by recrystallisation (Petrol/EtOAc) to give a white solid (823 mg, 2.6 mmol, 66%)

^{1}H NMR (400 MHz, acetone-d_6) δ 11.68 (1H, bs, N-*H*), 8.32 (2H, d, *J* = 8.5 Hz, Ar-*H*), 8.13 (2H, d, *J* = 8.5 Hz, Ar-*H*), 8.00 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.74 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.60 – 7.51 (2H, dd, *J* = 8.0, 7.5 Hz, Ar-*H*); **^{13}C NMR (101 MHz, acetone-d_6)** δ 186.4, 162.6, 143.7, 135.9, 134.1, 133.0, 131.1, 129.9, 129.8, 118.4, 118.0; **mp (Petrol/EtOAc)**: 181 – 183 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3657, 3265, 3098, 2981, 2888, 2361, 2341, 2233, 1738, 1673, 1594, 1473, 1462, 1447, 1430, 1383, 1359, 1270, 1172, 1117, 1085, 1003, 967, 955, 879, 846, 831, 803, 746, 686, 671, 643; **LRMS (ESI) m/z**: 313.0 [$C_{15}H_9N_2O_4S$, $(M-H)^-$]; **HRMS (ESI)**: calcd for [$C_{15}H_9N_2O_4S$, $(M-H)^-$]: 313.02885; found 313.02881.

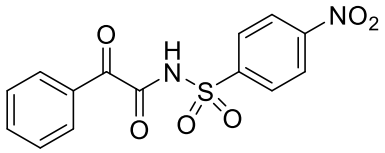
N-((4-(Trifluoromethyl)phenyl)sulfonyl)-2-oxo-2-phenylacetamide (1e)



Compound **1e** was prepared according to general procedure B, using benzoylformic acid (300 mg, 2 mmol), oxalyl chloride (200 µL, 2.4 mmol), 1 drop of DMF in CH_2Cl_2 (4 mL), toluene (2 mL), 4-(trifluoromethyl)benzenesulfonamide (450 mg, 2 mmol), DMAP (1.2 mg, 0.01 mmol), Et_3N (558 µL, 4 mmol) and EtOAc (4 mL). The residue was purified by column chromatography (CH_2Cl_2/EtOAc/AcOH = 90:10:2) to give a white solid (573 mg, 1.6 mmol, 80%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.71 (1H, bs, N-*H*), 8.34 – 8.23 (4H, m, Ar-*H*), 7.85 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.67 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.48 (2H, dd, *J* = 8.0, 7.5 Hz, Ar-*H*); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 183.6, 158.1, 141.3, 136.1 (q, $^2J_{C\text{-}F}$ = 33.0 Hz), 135.8, 131.7, 131.6, 129.4, 129.0, 126.5 (q, $^3J_{C\text{-}F}$ = 4.0 Hz), 123.1 (q, $^1J_{C\text{-}F}$ = 277.0 Hz); **^{19}F NMR (377 MHz, $CDCl_3$)** -63.3; **mp (CH_2Cl_2/EtOAc/AcOH)**: 124 – 127 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3657, 2981, 2972, 2930, 2890, 2859, 2360, 2342, 1742, 1684, 1597, 1461, 1449, 1375, 1323, 1242, 1172, 1139, 1110, 1092, 1063, 1019, 967, 956, 877, 845, 845, 796, 771, 744, 713, 688; **LRMS (ESI) m/z**: [$C_{15}H_{10}F_3NNaO_4S$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{15}H_{10}F_3NNaO_4S$, $(M+Na)^+$]: 380.01748; found 380.01746.

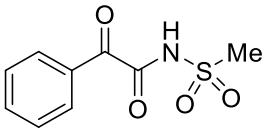
N-((4-Nitrophenyl)sulfonyl)-2-oxo-2-phenylacetamide (1f)



Compound **1f** was prepared according to general procedure B, using benzoylformic acid (750 mg, 5 mmol), oxalyl chloride (510 µL, 6 mmol), 1 drop of DMF in CH_2Cl_2 (10 mL), toluene (5 mL), 4-nitrobenzenesulfonamide (1.01 g, 5 mmol), DMAP (3 mg, 0.025 mmol), Et_3N (1.4 mL, 10 mmol) and EtOAc (10 mL). The residue was purified by recrystallisation (Petrol/CH_2Cl_2) to give a white solid (1.27 g, 3.8 mmol, 76%)

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.68 (1H, bs, N-*H*), 8.39 – 8.33 (4H, m, Ar-*H*), 8.28 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.72 – 7.63 (1H, m, Ar-*H*), 7.49 (2H, dd, *J* = 8.0, 8.0 Hz, Ar-*H*); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 183.4, 158.0, 151.2, 143.3, 135.9, 131.64, 131.61, 130.3, 129.1, 124.5; **mp (Petrol/CH_2Cl_2)**: 143 – 145 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3657, 3240, 2981, 2888, 2360, 2341, 2163, 1736, 1674, 1594, 1527, 1473, 1462, 1449, 1384, 1355, 1313, 1270, 1252, 1171, 1086, 1002, 967, 956, 913, 890, 854, 823, 798, 737, 684, 672, 623; **LRMS (ESI) m/z**: 357.0 [$C_{14}H_{10}N_2NaO_6S$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{14}H_{10}N_2NaO_6S$, $(M+Na)^+$]: 357.01518; found 357.01547.

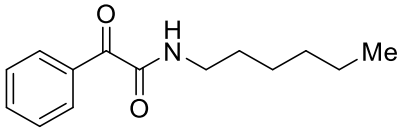
N-(Methylsulfonyl)-2-oxo-2-phenylacetamide (1g)



Compound **1g** was prepared according to general procedure B, using benzoylformic acid (300 mg, 2 mmol), oxalyl chloride (200 µL, 2.4 mmol), 1 drop of DMF in CH_2Cl_2 (4 mL), toluene (10 mL), methanesulfonamide (190 mg, 2 mmol), DMAP (1.2 mg, 0.01 mmol), Et_3N (558 µL, 4 mmol) and EtOAc (4 mL). The residue was purified by column chromatography (CH_2Cl_2/EtOAc/AcOH = 80:20:2) to give a white solid (95 mg, 0.42 mmol, 21%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.44 (1H, bs, N-*H*), 8.33 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.70 (1H, t, *J* = 8.0 Hz, Ar-*H*), 7.52 (2H, t, *J* = 8.0 Hz, Ar-*H*), 3.39 (3H, s, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 183.5, 159.1, 135.5, 131.5, 131.3, 128.7, 41.4; **mp (CH_2Cl_2/EtOAc/AcOH)**: 128 – 131 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3238, 3045, 2981, 2360, 1714, 1687, 1598, 1432, 1400, 1332, 1320, 1279, 1135, 989, 970, 886, 684, 669, 607; **LRMS (ESI) m/z**: 226.0 [$C_9H_8NO_4S$, $(M-H)^-$]; **HRMS (ESI)**: calcd for [$C_9H_9NO_4SNa$, $(M+Na)^+$]: 250.01445; found 250.01466. This data is consistent with literature.[4]

N-Hexyl-2-oxo-2-phenylacetamide (1h)

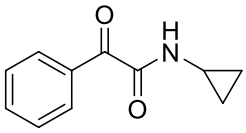


Compound **1h** was prepared according to general procedure A, using benzoylformic acid (750 mg, 5.0 mmol), Et_3N (1.4 mL, 10.0 mmol), thionyl chloride (725 µL, 10.0 mmol), hexylamine (660 µL, 5.0 mmol) and 1,2-dichloroethane (20 mL). The residue was purified by column chromatography (Petrol/Et_2O = 9:1) to give a yellow oil (1.0 g, 4.3 mmol, 86%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.29 (2H, d, *J* = 7.5 Hz, Ar-*H*), 7.58 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.43 (2H, dd, *J* = 7.5, 7.5 Hz, Ar-*H*), 7.30 (1H, bs, N-*H*), 3.35 (2H, dt, *J* = 6.5, 6.5 Hz, NHC*H*$_2$), 1.62 – 1.49 (2H, m, NHCH$_2$C*H*$_2$), 1.40 – 1.21 (6H, m, 3 × C*H*$_2$), 0.87 (3H, t, *J* = 6.0 Hz, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 188.1, 162.0, 134.3, 133.4, 131.1, 128.4, 39.5, 31.4, 29.2, 26.5, 22.5, 14.0; **IR (cm^{-1})** $\tilde{\nu}$ = 3657, 3308, 2981, 2931, 2889, 1659, 1597, 1523, 1449, 1381, 1318, 1260, 1216, 1177, 1155, 1073, 954, 816, 745, 687, 672; **LRMS (ESI) m/z**: 234.2 [$C_{14}H_{20}NO_2$,

$(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{14}H_{20}NO_2$, $(M+H)^+$]: 234.14886; found 234.14905. This data is consistent with literature.[5]

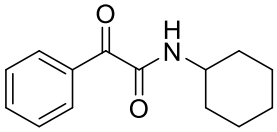
N-Cyclopropyl-2-oxo-2-phenylacetamide (1i)



Compound **1i** was prepared according to general procedure A, using benzoylformic acid (600 mg, 4.0 mmol), Et_3N (1.12 mL, 8.0 mmol), thionyl chloride (580 µL, 8.0 mmol), cyclopropylamine (280 µL, 4.0 mmol) and 1,2-dichloroethane (16 mL). The residue was purified by column chromatography (Petrol/Et_2O = 9:1) and recrystallisation (Petrol/Et_2O) to give a white solid (374 mg, 2.0 mmol, 49%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.61 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.46 (2H, dd, *J* = 8.0, 7.5 Hz, Ar-*H*), 7.17 (1H, bs, N-*H*), 2.89 – 2.83 (1H, m, NHC*H*), 0.92 – 0.85 (2H, m, CH_2), 0.67 – 0.62 (2H, m, CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 187.7, 163.2, 134.5, 133.3, 131.4, 128.6, 22.7, 6.7, 6.6; **mp (Petrol/Et_2O)**: 69 – 71 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3275, 3068, 2981, 2360, 2341, 1653, 1596, 1519, 1449, 1362, 1284, 1234, 1202, 1180, 1051, 931, 850, 792, 747, 688, 670; **LRMS (ESI) m/z**: 188.1 [$C_{11}H_{10}NO_2$, $(M-H)^-$]; **HRMS (ESI)**: calcd for [$C_{11}H_{12}NO_2$, $(M+H)^+$]: 190.08626; found 190.08626

N-Cyclohexyl-2-oxo-2-phenylacetamide (1j)

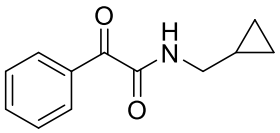


Compound **1j** was prepared according to general procedure A, using benzoylformic acid (450 mg, 3.0 mmol), Et_3N (836 µL, 6.0 mmol), thionyl chloride (435 µL, 6.0 mmol), cyclohexanamine (343 µL, 3.0 mmol) and 1,2-dichloroethane (12 mL). The residue was purified by column chromatography (Petrol/Et_2O = 9:1) and recrystallisation (Petrol/Et_2O) to give a white solid (295 mg, 1.3 mmol, 43%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.61 (1H, t, *J* = 7.0 Hz, Ar-*H*), 7.47 (2H, dd, *J* = 8.0, 7.0 Hz, Ar-*H*), 6.99 (1H, bs, N-*H*), 3.85 (1H, tdt, *J* = 11.0, 8.0, 4.0 Hz, NHC*H*), 2.02 – 1.93 (2H, m, CH_2), 1.79 – 1.73 (2H, m, CH_2), 1.67 – 1.62 (1H, m, C$H_A$$H_B$),

1.47 – 1.33 (2H, m, CH_2), 1.31 – 1.19 (3H, m, CH_2, CH$_A$$H_B$); **^{13}C NMR (101 MHz, CDCl$_3$)** δ 188.2, 161.0, 134.4, 133.6, 131.3, 128.6, 48.6, 32.8, 25.5, 24.8; **mp (Petrol/Et$_2$O)**: 114 – 116 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3274, 3085, 2935, 2855, 2360, 1680, 1664, 1640, 1596, 1551, 1449, 1246, 1217, 1179, 1153, 1088, 961, 838, 752, 693, 672; **HRMS (FI)**: calcd for [$C_{14}H_{18}NO_2$, $(M+H)^+$]: 232.13321; found 232.13335. This data is consistent with literature.[6]

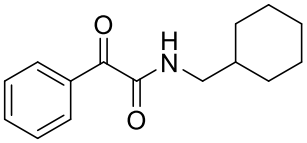
N-(Cyclopropylmethyl)-2-oxo-2-phenylacetamide (1k)



Compound **1k** was prepared according to general procedure A, using benzoylformic acid (600 mg, 4.0 mmol), Et$_3$N (1.12 mL, 8.0 mmol), thionyl chloride (580 µL, 8.0 mmol), cyclopropylmethanamine (350 µL, 4.0 mmol) and 1,2-dichloroethane (16 mL). The residue was purified by column chromatography (Petrol/Et$_2$O = 95:5) and recrystallisation (Petrol/Et$_2$O) to give a white solid (381 mg, 1.9 mmol, 47%).

^{1}H NMR (400 MHz, CDCl$_3$) δ 8.33 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.61 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.47 (2H, dd, *J* = 7.5, 8.0 Hz, Ar-*H*), 7.21 (1H, bs, N-*H*), 3.25 (2H, dd, *J* = 6.5, 6.5 Hz, NHCH_2), 1.11 – 0.96 (1H, m, C*H*), 0.61 – 0.50 (2H, m, CH(CH_2)), 0.30 – 0.24 (2H, m, CH(CH_2)); **^{13}C NMR (101 MHz, CDCl$_3$)** δ 188.1, 161.7, 134.5, 133.5, 131.3, 128.6, 44.4, 10.6, 3.7; **mp (Petrol/Et$_2$O)**: 38 – 40 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3305, 3080, 2981, 2361, 2341, 1657, 1596, 1523, 1449, 1268 1217, 1023, 833, 746, 688, 672; **LRMS (ESI) m/z**: 226.0 [$C_{12}H_{13}NNaO_2$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{12}H_{13}NNaO_2$, $(M+Na)^+$]: 226.08385; found 226.08417.

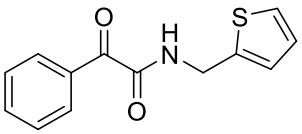
N-(Cyclohexylmethyl)-2-oxo-2-phenylacetamide (1l)



Compound **1l** was prepared according to general procedure A, using benzoylformic acid (600 mg, 4.0 mmol), Et$_3$N (1.12 mL, 8.0 mmol), thionyl chloride (580 µL, 8.0 mmol), cyclohexylmethanamine (510 µL, 4.0 mmol) and 1,2-dichloroethane (16 mL). The residue was purified by column chromatography (Petrol/Et$_2$O = 95:5) and recrystallisation (Petrol/Et$_2$O) to give a white solid (720 mg, 2.9 mmol, 73%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.62 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.47 (2H, dd, *J* = 8.0, 7.5 Hz, Ar-*H*), 7.15 (1H, bs, N-*H*), 3.24 (2H, dd, *J* = 6.5, 6.5 Hz, NHCH_2), 1.81 – 1.72 (4H, m, Cy-CH_2), 1.71 – 1.63 (1H, m, Cy-CH_AH$_B$), 1.51 – 1.64 (1H, m, NHCH$_2$C*H*), 1.33 – 1.08 (3H, m, Cy-CH_2, Cy-CH$_A$$H_B$), 1.04 – 0.94 (2H, m, Cy-CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 188.1, 161.9, 134.5, 133.5, 131.4, 128.6, 45.7, 38.0, 30.9, 26.4, 25.9; **mp (Petrol/Et_2O)**: 94 – 96 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3273, 2981, 2926, 2854, 2361, 2341, 1664, 1597, 1524, 1449, 1225, 1178, 905, 726, 688, 672, 648; **LRMS (ESI) m/z**: 244.1 [$C_{15}H_{18}NO_2$, $(M-H)^-$]; **HRMS (ESI)**: calcd for [$C_{15}H_{20}NO_2$, $(M+H)^+$]: 246.14886; found 246.14874.

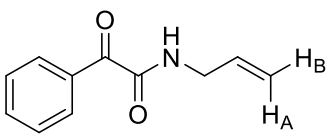
N-(Thiophen-2-ylmethyl)-2-oxo-2-phenylacetamide (1m)



Compound **1m** was prepared according to general procedure A, using benzoylformic acid (750 mg, 5.0 mmol), Et_3N (1.4 mL, 10.0 mmol), thionyl chloride (725 µL, 10.0 mmol), 2-(aminomethyl)thiophene (513 µL, 5.0 mmol) and 1,2-dichloroethane (20 mL). The residue was purified by column chromatography (Petrol/Et_2O = 4:1) and recrystallisation (Petrol/Et_2O) to give a white solid (655 mg, 2.7 mmol, 53%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.30 (2H, d, *J* = 7.0 Hz, Ar-*H*), 7.58 (1H, t, *J* = 7.5 Hz, Ar-*H*), 7.44 (2H, app. t, *J* = 7.5, 7.0 Hz, Ar-*H*), 7.41 (1H, bs, N-*H*), 7.21 (1H, d, *J* = 5.0 Hz, Ar-*H*), 6.99 (1H, d, *J* = 3.5 Hz, Ar-*H*), 6.92 (1H, dd, *J* = 5.0, 3.5 Hz, Ar-*H*), 4.69 (2H, d, *J* = 6.0 Hz, CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 187.4, 161.4, 139.5, 134.6, 133.3, 131.4, 128.6, 127.1, 126.7, 125.8, 38.2; **mp (Petrol/Et_2O)**: 95 – 97 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3661, 3255, 3085, 2981, 2888, 2361, 2341, 1681, 1639, 1595, 1563, 1533, 1451, 1431, 1371, 1347, 1219, 1179, 1053, 1041, 1022, 1001, 940, 928, 853, 800, 749, 688, 630; **LRMS (ESI) m/z**: 244.0 [$C_{13}H_{10}NO_2S$, $(M-H)^-$]; **HRMS (ESI) m/z**: calcd for [$C_{13}H_{10}NO_2S$, $(M-H)^-$]: 244.04377; found 244.04355.

N-Allyl-2-oxo-2-phenylacetamide (1n)

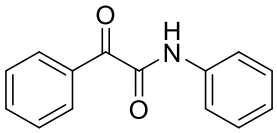


Compound **1n** was prepared according to general procedure A, using benzoylformic acid (450 mg, 3.0 mmol), Et_3N (836 µL, 6.0 mmol), thionyl chloride (435 µL, 6.0 mmol),

allylamine (343 µL, 3.0 mmol) and 1,2-dichloroethane (12 mL). The residue was purified by column chromatography (Petrol/Et_2O = 9:1) and recrystallisation (Petrol/Et_2O) to give a white solid (229 mg, 1.2 mmol, 40%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.63 (1H, t, *J* = 7.0 Hz, Ar-*H*), 7.48 (2H, dd, *J* = 8.0, 7.0 Hz, Ar-*H*), 7.18 (1H, bs, N-*H*), 5.90 (ddt, *J* = 17.0, 10.0, 5.5 Hz, $CH_2CHCH_AH_B$), 5.28 (1H, dd, *J* = 17.0, 1.0 Hz, $CHCH_AH_B$), 5.22 (dd, *J* = 10.0, 1.0 Hz, $CHCH_AH_B$), 4.02 (2H, dd, *J* = 5.5, 1.5 Hz, $CH_2CHCH_AH_B$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 187.7, 161.7, 134.6, 133.4, 133.1, 131.4, 128.7, 117.4, 41.8; **mp (Petrol/Et_2O)**: 58 – 60 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3259, 3098, 2918, 2360, 1681, 1653, 1635, 1595, 1571, 1451, 1430, 1265, 1227, 1179, 1018, 993, 943, 928, 892, 690; **HRMS (FI)**: calcd for $[C_{11}H_{12}NO_2, (M+H)^+]$: 190.08625; found 190.08626. This data is consistent with literature.[7]

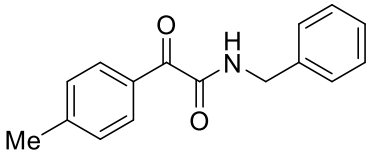
N-Phenyl-2-oxo-2-phenylacetamide (1o)



Compound **1o** was prepared according to general procedure A, using benzoylformic acid (600 mg, 4.0 mmol), Et_3N (1.12 mL, 8.0 mmol), thionyl chloride (580 µL, 8.0 mmol), aniline (364 µL, 4.0 mmol) and 1,2-dichloroethane (16 mL). The residue was purified by column chromatography (Petrol/Et_2O = 9:1) to give a yellow solid (788 mg, 3.5 mmol, 87%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.04 (1H, bs, N-*H*), 8.40 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.71 (2H, d, *J* = 8.5 Hz, Ar-*H*), 7.64 (2H, dd, *J* = 8.0, 7.0 Hz, Ar-*H*), 7.49 (1H, t, *J* = 7.0 Hz, Ar-*H*), 7.39 (2H, dd, *J* = 8.5, 7.5 Hz, Ar-*H*), 7.20 (1H, t, *J* = 7.5 Hz, Ar-*H*); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 187.5, 159.1, 136.7, 134.7, 133.1, 131.5, 129.3, 128.6, 125.3, 120.0; **mp (Petrol/Et_2O)**: 59 – 61 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3346, 3062, 1667, 1595, 1530, 1495, 1445, 1278, 1241, 1171, 1080, 1030, 1004, 989, 907, 879, 789, 744, 688; **HRMS (FI)**: calcd for $[C_{14}H_{12}NO_2, (M+H)^+]^+$: 226.08626; found 226.08629. This data is consistent with literature.[6]

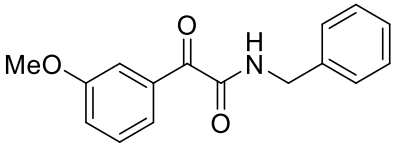
_N_-Benzyl-2-oxo-2-(_p_-tolyl)acetamide (1p)



Compound **1p** was prepared according to general procedure A, using crude 2-oxo-2-(*p*-tolyl)acetic acid (985 mg, 6.0 mmol), Et_3N (1.67 mL, 12.0 mmol), thionyl chloride (871 µL, 12.0 mmol), benzylamine (655 µL, 6.0 mmol) and 1,2-dichloroethane (24 mL). The residue was purified by column chromatography (100% CH_2Cl_2) and recrystallised in Petrol/Et_2O to give white crystals (341 mg, 1.3 mmol, 22%)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.29 (2H, d, *J* = 8.5 Hz, Ar-*H*), 7.45 (1H, s, N-*H*), 7.39 – 7.26 (7H, m, Ar-*H*), 4.57 (2H, d, *J* = 6.0 Hz, C*H*$_2$), 2.43 (3H, s, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 187.1, 161.9, 145.8, 137.3, 131.5, 130.9, 129.4, 128.9, 128.0, 127.9, 43.6, 22.0; **mp (Petrol/Et_2O)**: 82 – 84 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3267, 3092, 2925, 1675, 1642, 1605, 1567, 1497, 1454, 1431, 1409, 1382, 1364, 1308, 1226, 1210, 1176, 1118, 1083, 1060, 1031, 1017, 939, 904, 839, 790, 767, 730, 697, 680, 618; **LRMS (ESI) m/z**: 276.0 [$C_{16}H_{15}NNaO_2$, $(M+Na)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{16}H_{15}NNaO_2$, $(M+Na)^+$]: 276.09950; found 276.09949. This data is consistent with literature.[8]

_N_-Benzyl-2-oxo-2-(3-methoxyphenyl)acetamide (1q)

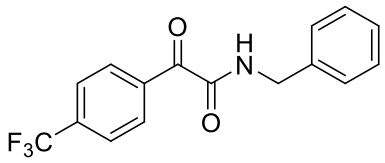


Compound **1q** was prepared according to general procedure A, using crude 2-(3-methoxyphenyl)-2-oxoacetic acid (1.26 g, 7.0 mmol), Et_3N (1.95 mL, 14.0 mmol), thionyl chloride (1.02 mL, 14.0 mmol), benzylamine (765 µL, 7.0 mmol) and 1,2-dichloroethane (28 mL). The residue was purified by column chromatography (100% CH_2Cl_2) to give an orange oil (893 mg, 3.3 mmol, 47%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.86 (1H, s, Ar-*H*), 7.43 (1H, bs, N-*H*), 7.42 – 7.28 (6H, m, Ar-*H*), 7.18 (1H, d, *J* = 8.0 Hz, Ar-*H*), 4.57 (2H, d, *J* = 6.0 Hz, C*H*$_2$), 3.86 (3H, s, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 187.4, 161.7, 159.6, 137.2, 134.5,

129.7, 129.0, 128.0, 127.95, 124.3, 121.7, 114.8, 55.6, 43.6; **IR (cm^{-1})** $\tilde{\nu}$ = 3307, 3066, 3031, 2980, 2836, 2361, 1658, 1596, 1580, 1521, 1485, 1454, 1429, 1360, 1324, 1288, 1252, 1195, 1174, 1082, 1042, 994, 952, 876, 823, 782, 765, 730, 699, 683; **LRMS (ESI) m/z**: 292.0 [$C_{16}H_{16}NO_3$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{16}H_{16}NO_3$, $(M+H)^+$]: 292.09441; found 292.09424.

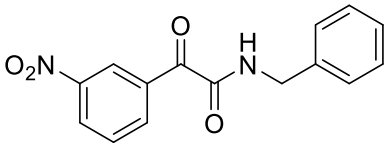
N-Benzyl-2-oxo-2-(4-(trifluoromethyl)phenyl)acetamide (1r)



Compound **1r** was prepared according to general procedure A, using crude 2-oxo-2-(4-(trifluoromethyl)phenyl)acetic acid (1.31 g, 6.0 mmol), Et_3N (1.67 mL, 12.0 mmol), thionyl chloride (871 µL, 12.0 mmol), benzylamine (655 µL, 6.0 mmol) and 1,2-dichloroethane (24 mL). The residue was purified by column chromatography (Petrol/Et_2O 95:5) and recrystallised in Petrol/Et_2O to give light orange crystals (454 mg, 1.5 mmol, 25%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.74 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.51 (1H, bs, N-*H*), 7.41 – 7.27 (5H, m, Ar-*H*), 4.58 (2H, d, *J* = 6.0 Hz, CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 186.7, 160.9, 137.0, 136.1, 135.4 (q, *J* = 33.0 Hz), 131.7, 129.0, 128.1, 128.0, 125.6 (q, *J* = 4.0 Hz), 123.6 (q, *J* = 273.0 Hz), 43.7; **^{19}F NMR (377 MHz, $CDCl_3$)** -63.3; **mp (Petrol/Et_2O)**: 104 – 106 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3377, 2981, 2889, 2361, 1665, 1532, 1506, 1455, 1409, 1323, 1248, 1213, 1167, 1124, 1110, 1068, 1029, 1016, 937, 901, 863, 830, 802, 765, 731, 698, 640; **LRMS (ESI) m/z**: 330.2 [$C_{16}H_{12}F_3NNaO_2$, $(M+Na)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{16}H_{13}F_3NO_2$, $(M+H)^+$]: 308.08929; found 308.08939. This data is consistent with literature.[8]

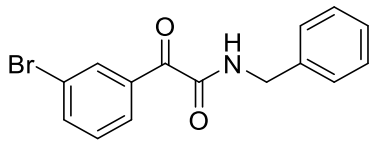
N-Benzyl-2-oxo-2-(3-nitrophenyl)acetamide (1s)



Compound **1s** was prepared according to general procedure A, using crude 2-(3-nitrophenyl)-2-oxoacetic acid (1.4 g, 5.0 mmol), Et_3N (1.39 mL, 10.0 mmol), thionyl chloride (725 µL, 10.0 mmol), benzylamine (546 µL, 5.0 mmol) and 1,2-dichloroethane (20 mL). The residue was purified by column chromatography (Petrol/CH_2Cl_2 1:1) and recrystallised in Petrol/Et_2O to give light yellow crystals (380 mg, 1.3 mmol, 30%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.21 (1H, s, Ar-*H*), 8.75 (1H, d, *J* = 8.0 Hz, Ar-*H*), 8.47 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.70 (1H, t, *J* = 8.0 Hz, Ar-*H*), 7.52 (1H, bs, N-*H*), 7.41 – 7.28 (5H, m, Ar-*H*), 4.59 (2H, d, *J* = 6.0 Hz, C*H*$_2$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 185.3, 160.4, 148.3, 137.0, 136.8, 134.6, 129.9, 129.1, 128.6, 128.2, 128.1, 126.3, 43.8; **mp (Petrol/Et_2O)**: 106 – 108 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3385, 2980, 2888, 2361, 1669, 1613, 1530, 1497, 1474, 1455, 1437, 1382, 1349, 1251, 1214, 1153, 1081, 1030, 953, 801, 732, 700, 670; **LRMS (ESI) m/z**: 307.0 [$C_{15}H_{12}N_2NaO_4$, $(M+Na)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{15}H_{12}N_2NaO_4$, $(M+Na)^+$]: 307.06893; found 307.06903.

N-Benzyl-2-oxo-2-(3-bromophenyl)acetamide (1t)

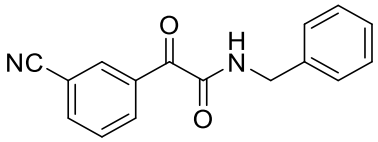


Compound **1t** was prepared according to general procedure A, using crude 2-(3-bromophenyl)-2-oxoacetic acid (1.6 g, 7.0 mmol), Et_3N (1.95 mL, 14.0 mmol), thionyl chloride (1.02 mL, 14.0 mmol), benzylamine (765 µL, 7.0 mmol) and 1,2-dichloroethane (28 mL). The residue was purified by column chromatography (Petrol/Et_2O 95:5) and recrystallised in Petrol/Et_2O to give white crystals (839 mg, 2.6 mmol, 38%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.53 (1H, bs, Ar-*H*), 8.35 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.77 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.49 (1H, s, N-*H*), 7.40 – 7.32 (6H, m, Ar-*H*), 4.58 (2H, d, *J* = 6.0 Hz, C*H*$_2$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 186.2, 161.0, 137.4, 137.0, 135.1, 134.1(2 × C), 130.2, 130.0, 129.0, 128.0, 122.8, 43.7; **mp (Petrol/Et_2O)**: 70 – 71 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3308, 3065, 2981, 2889, 2360, 1680, 1663, 1587, 1561, 1521, 1497, 1455, 1414, 1383, 1361, 1289, 1242, 1211, 1166, 1070, 1029, 999, 950, 900, 776, 720, 698, 677; **LRMS (ESI) m/z [relative intensity]**: 340.0 [100, [$C_{15}H_{13}{}^{79}BrNO_2$, $(M(^{79}Br)+H)^+$]], 342.0 [100, [$C_{15}H_{13}{}^{81}BrNO_2$,

(M(^{81}Br)+H)$^+$]]; **HRMS (ESI) m/z**: calcd for [$C_{15}H_{13}{}^{79}BrNO_2$, (M(^{79}Br)+H)$^+$]: 318.01242; found 318.01245, calcd for [$C_{15}H_{13}{}^{81}BrNO_2$, (M(^{81}Br)+H)$^+$]: 320.01037; found 320.01030.

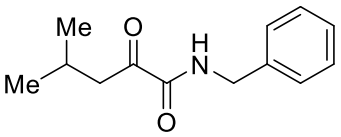
N-Benzyl-2-oxo-2-(3-cyanophenyl)acetamide (1u)



Compound **1u** was prepared according to general procedure A, using 2-(3-cyanophenyl)-2-oxoacetic acid (1.05 g, 6.0 mmol), Et_3N (1.67 mL, 12.0 mmol), thionyl chloride (871 µL, 12.0 mmol), benzylamine (655 µL, 6.0 mmol) and 1,2-dichloroethane (24 mL). The residue was purified by column chromatography (Petrol/Et_2O 4:1) and recrystallised in Petrol/Et_2O to give white crystals (390 mg, 1.5 mmol, 25%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.73 (1H, s, Ar-*H*), 8.61 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.89 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.62 (1H, dd, *J* = 8.0, 8.0 Hz, Ar-*H*), 7.49 (1H, s, N-*H*), 7.41 – 7.30 (5H, m, Ar-*H*), 4.57 (2H, d, *J* = 6.0 Hz, CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 185.4, 160.5, 137.2, 136.8, 135.3, 135.1, 134.2, 129.6, 129.1, 128.2, 128.1, 117.9, 113.2, 43.8; **mp (Petrol/Et_2O)**: 70 – 71 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3350, 3068 2981, 2233, 1668, 1599, 1523, 1498, 1476, 1455, 1426, 1361, 1292, 1238, 1159, 1070, 1029, 953, 828, 788, 762, 730, 700, 680; **LRMS (ESI) m/z**: 287.0 [$C_{16}H_{12}N_2NaO_2$, (M+Na)$^+$]; **HRMS (ESI) m/z**: calcd for [$C_{16}H_{13}N_2O_2$, (M+H)$^+$]: 265.09715; found 265.09729.

N-Benzyl-4-methyl-2-oxopentanamide (1v)

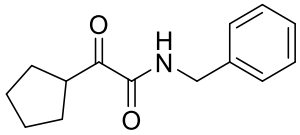


Compound **1v** was synthesised by modifying a literature procedure.[9] A solution of 4-methyl-2-oxovaleric acid (370 µL, 3.0 mmol), Et_3N (418 µL, 3.0 mmol), DMAP (37 mg, 0.3 mmol), *N*,*N*'-dicyclohexylcarbodiimide (469 µL, 3.0 mmol) in 1,2-dichloroethane (10 mL) was stirred at rt until efferevescence was no longer observed. Benzylamine (328 µL, 3.0 mmol) was then added dropwise and the reaction mixture was left to stir at rt overnight before heating at 60 °C

for 4 hours. The crude mixture was then filtered through a plug of celite, purified by column chromatography (Petrol/Et_2O 95:5) and recrystallisation (Petrol/Et_2O) to give a white solid (125 mg, 0.6 mmol, 19%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.24 (5H, m, Ar-*H*), 4.46 (2H, d, *J* = 6.0 Hz,NCH_2), 2.83 (2H, d, *J* = 7.0 Hz, CH_2), 2.24 – 2.12 (1H, m, C*H*), 0.95 (6H, dd, *J* = 7.0 Hz, 2 × CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 198.9, 160.2, 137.2, 129.0, 128.03, 127.99, 45.5, 43.5, 24.5, 22.7; **mp (Petrol/Et_2O)**: 68 – 70 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3281, 2981, 2889, 2361, 1721, 1671, 1530, 1457, 1433, 1383, 1252, 1149, 1078, 954, 816, 750, 699, 679; **LRMS (ESI) m/z**: 220.2 [$C_{13}H_{18}NO_2$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{13}H_{18}NO_2$, $(M+H)^+$]: 220.13321; found 220.13344.

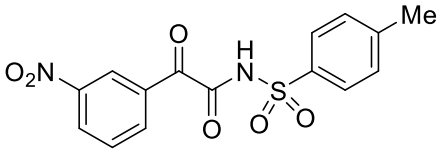
N-Benzyl-2-cyclopentyl-2-oxoacetamide (1w)



Compound **1w** was synthesised by modifying a literature procedure[9]. A solution of 4-methyl-2-oxovaleric acid (370 µL, 3.0 mmol), Et_3N (418 µL, 3.0 mmol), DMAP (37 mg, 0.3 mmol), *N*,*N'*-dicyclohexylcarbodiimide (469 µL, 3.0 mmol) in 1,2-dichloroethane (10 mL) was stirred at rt until efferevescence was no longer observed. Benzylamine (328 µL, 3.0 mmol) was then added dropwise and the reaction mixture was left to stir at rt overnight before heating at 60 °C for 4 hours. The crude mixture was then filtered through a plug of celite, purified by column chromatography (Petrol/Et_2O 95:5) and recrystallisation (Petrol/Et_2O) to give white crystals (94 mg, 0.4 mmol, 7%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.25 (5H, m, Ar-*H*), 4.48 (2H, d, *J* = 6.0 Hz, NCH_2), 3.81 (1H, tt, *J* = 9.0, 7.0 Hz, C*H*), 2.00 – 1.87 (2H, m, CH_2), 1.81 – 1.70 (2H, m, CH_2), 1.69 – 1.57 (4H, m, 2 × CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 200.9, 160.3, 137.2, 129.0, 128.01, 127.95, 44.8, 43.6, 29.1, 26.4; **mp (Petrol/Et_2O)**: 47 – 49 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3328, 2980, 2889, 2360, 1717, 1680, 1666, 1534, 1496, 1473, 1453, 1428, 1382, 1252, 1153, 1126, 1070, 1028, 954, 881, 817, 781, 724, 695; **LRMS (ESI) m/z**: 254.2 [$C_{14}H_{17}NNaO_2$, $(M+Na)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{14}H_{18}NO_2$, $(M+H)^+$]: 232.13321; found 232.13306.

***N*-Tosyl-2-(3-nitrophenyl)-2-oxo-acetamide (1x)**

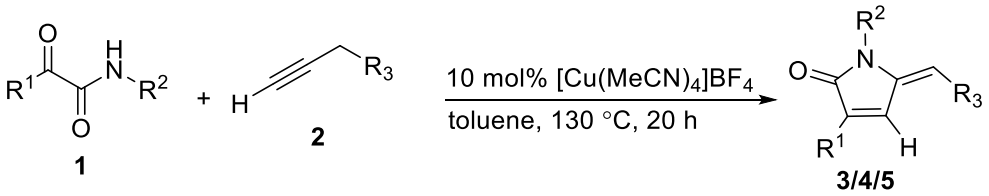


Compound **1x** was prepared according to general procedure B, using crude 2-(3-nitrophenyl)-2-oxoacetic acid (1.95 g, 10.0 mmol), oxalyl chloride (1.01 mL, 12 mmol), 1 drop of DMF in CH_2Cl_2 (20 mL), toluene (10 mL), 4-methylbenzenesulfonamide (1.71 g, 10 mmol), DMAP (6 mg, 0.05 mmol), Et_3N (2.8 mL, 20 mmol) and EtOAc (20 mL). The residue was purified by recrystallisation (Petrol/Acetone) to give a light yellow solid (1.21 g, 3.5 mmol, 35%).

^{1}H NMR (400 MHz, *d*$_6$-DMSO) δ 8.53 (1H, d, *J* = 8.0 Hz, Ar-*H*), 8.49 (1H, s, Ar-*H*), 8.23 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.92 – 7.82 (4H, m, Ar-*H*), 7.49 (2H, d, *J* = 8.0 Hz, Ar-*H*), 2.43 (3H, s, C*H*$_3$); **^{13}C NMR (101 MHz, *d*$_6$-DMSO)** δ 185.3, 163.3, 148.3, 145.3, 136.6, 136.0, 133.7, 131.4, 130.3, 129.4, 128.1, 124.6, 21.6; **mp (Petrol/Acetone)**: 189 – 190 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3292, 3111, 3068, 2981, 2361, 2341, 1726, 1686, 1611, 1575, 1530, 1428, 1348, 1287, 1258, 1190, 1172, 1136, 1086, 1010, 948, 890, 861, 831, 816, 798, 786, 733, 695, 676; **LRMS (ESI) m/z**: 371.0[$C_{15}H_{12}N_2NaO_6S$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{14}H_{10}N_2NaO_6S$, $(M+Na)^+$]: 371.03083; found 371.03088.

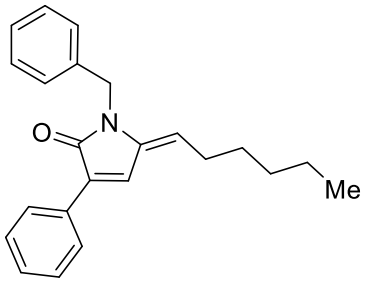
IV. Copper-catalysed Synthesis of Pyrrolinone Derivatives

General procedure C:



To an oven-dried, round-bottomed 10 mL microwave reaction vial equipped with a stirrer was added $[Cu(MeCN)_4]BF_4$ (9.4 mg, 0.03 mmol) and *α*-keto amide **1** (0.36 mmol, 1.2 equiv.). The vial was sealed with a microwave vial cap, and then evacuated under vacuum (<1 mbar) and back-filled with N_2 gas for 3 times. Degassed dry toluene (0.5 mL) and degassed alkyne (0.30 mmol, 1.0 equiv.) were then added respectively. The solution was stirred and heated at 130 °C for 20 h. The reaction mixture was diluted with CH_2Cl_2, filtered through a plug of celite and concentrated under reduced pressure. The residue was purified by column chromatography to give the resulting product.

(*E*)-1-Benzyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3a)

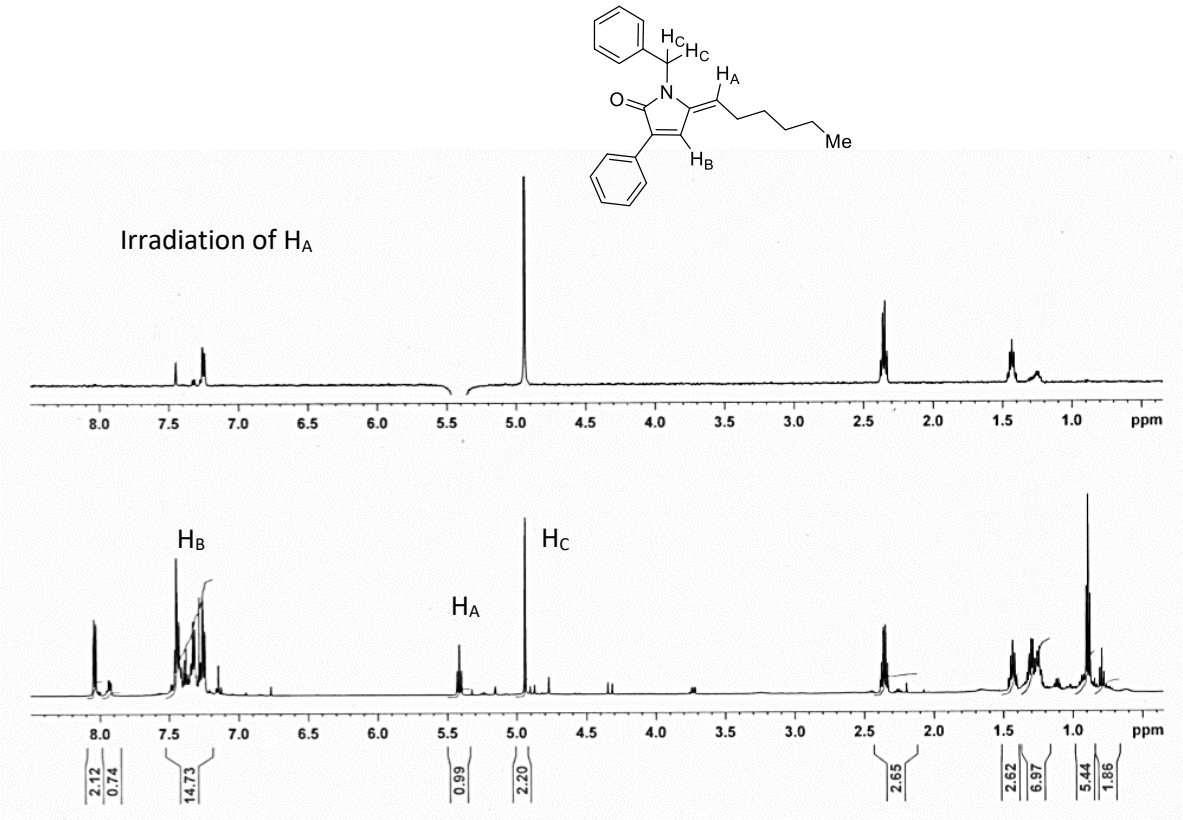


Compound **3a** was synthesised according to general procedure C using **1aa** (86 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 95:5) and obtained as a yellow oil (60 mg, 0.14 mmol, 60%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 – 7.99 (2H, m, Ar-*H*), 7.44 – 7.38 (3H, m, 2 × Ar-*H* and C=C*H*), 7.37 – 7.28 (3H, m, Ar-*H*), 7.26 – 7.20 (3H, m, Ar-*H*), 5.39 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.92 (2H, s, NCH_2), 2.32 (2H, app. q, *J* = 8.0 Hz, C=CHCH_2), 1.44 – 1.39 (2H, m, C=CHCH_2CH_2), 1.35 – 1.13 (4H, m, CH_2CH_2CH_3), 0.86 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.8, 137.9, 137.6, 133.4, 131.7, 128.8, 128.7, 128.6, 127.4, 127.2, 127.0, 125.2, 116.4, 42.9, 31.3, 30.0, 27.7, 22.5, 14.1; **IR (cm^{-1})** $\tilde{\nu}$ = 2927, 2858, 2360, 1683, 1494, 1402, 1346, 1177, 1075, 1029, 848, 751, 694, 668; **LRMS (ESI) m/z**: 354.2

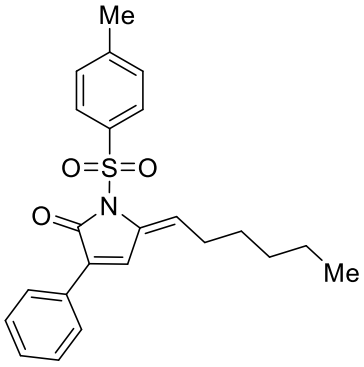
[$C_{23}H_{25}NONa$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{23}H_{26}NO$, $(M+H)^+$]: 332.20089; found 332.20068.

(*E*)-isomer configuration was confirmed by NOESY experiments.



Irradiation of H_A found that H_A and H_C are spatially closer together compared to H_A and H_B, indicating that **11a** has an (*E*)-configuration.

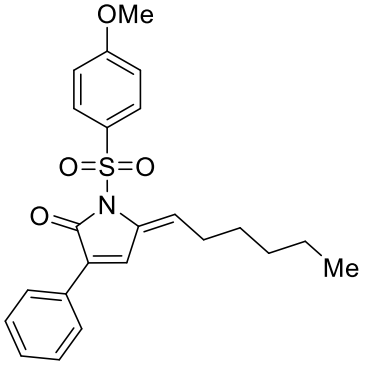
(*E*)-5-Hexylidene-3-phenyl-1-tosyl-1,5-dihydro-2*H*-pyrrol-2-one (3b)



Compound **3b** was synthesised according to general procedure C using *α*-keto amide **1ab** (109 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 9:1) and obtained as a yellow oil (98 mg, 0.25 mmol, 83%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (2H, d, *J* = 8.5 Hz, Ar-*H*), 7.83 – 7.78 (2H, m, Ar-*H*), 7.58 (1H, s, C=C*H*), 7.39 – 7.29 (5H, m, Ar-*H*), 6.88 (1H, t, *J* = 8.5 Hz, C=C*H*CH_2), 2.43 (2H, q, *J* = 8.5 Hz, C=CHC*H*$_2$), 2.40 (3H, s, Ar-C*H*$_3$) 1.61 – 1.52 (2H, m, C=CHCH_2C*H*$_2$), 1.39 – 1.32 (4H, m, C*H*$_2$C*H*$_2$CH_3), 0.94 – 0.90 (3H, m, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.9, 145.2, 135.9, 134.5, 131.4, 130.04, 130.01, 129.8, 129.4, 128.7, 128.1, 127.3, 122.9, 31.5, 29.7, 28.5, 22.6, 21.8, 14.1; **IR (cm^{-1})** $\tilde{\nu}$ = 2970, 2927, 2360, 1698, 1635, 1597, 1493, 1447, 1306, 1220, 1171, 1145, 1124, 1092, 1006, 991, 814, 773; **LRMS (ESI) m/z**: 396.2 [$C_{23}H_{26}NO_3S$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{23}H_{26}NO_3S$, $(M+H)^+$]: 396.16279; found 396.16229.

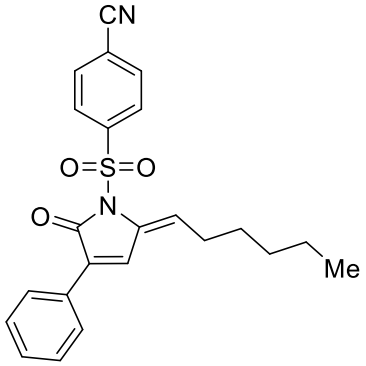
(*E*)-5-Hexylidene-1-((4-methoxyphenyl)sulfonyl)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3c)



Compound **3c** was synthesised according to general procedure C using *α*-keto amide **1ac** (115 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 4:1) and obtained as a yellow solid (92 mg, 0.22 mmol, 75%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (2H, d, *J* = 9.0 Hz , Ar-*H*), 7.80 (2H, d, *J* = 8.5 Hz, Ar-*H*), 7.57 (1H, s, C=C*H*), 7.41 – 7.23 (3H, m, Ar-*H*), 6.96 (2H, d, *J* = 8.5 Hz, Ar-*H*), 6.88 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 3.83 (3H, s, OCH_3), 2.43 (2H, q, *J* = 8.5 Hz, C=CHCH_2), 1.60 – 1.52 (2H, m, C=CHCH_2CH_2), 1.41 – 1.27 (4H, m, CH_2CH_2CH_3), 0.92 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.0, 164.0, 134.6, 131.4, 130.4, 130.3, 130.1, 129.9, 129.3, 128.7, 127.3, 122.9, 114.3, 55.8, 31.5, 29.7, 28.5, 22.6, 14.1; **mp (Petrol/Et_2O)**: 96 – 98 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3084, 2955, 2927, 2857, 2362, 2342, 1718, 1635, 1595, 1578, 1498, 1461, 1449, 1417, 1388, 1364, 1305, 1264, 1246, 1190, 1168, 1143, 1122, 1092, 1025, 1007, 994, 920, 866, 834, 804, 785, 750, 718, 692, 666, 647, 627, 615; **LRMS (ESI) m/z**: 412.2 [$C_{25}H_{26}NO_4S$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{25}H_{26}NO_4S$, $(M+H)^+$]: 412.15771; found 412.15759.

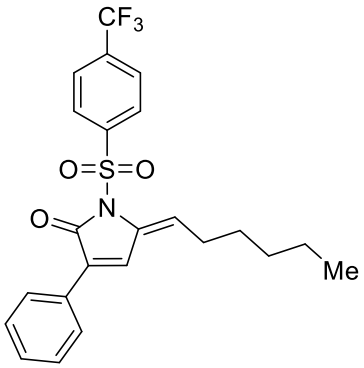
(*E*)-5-Hexylidene-1-((4-cyano)sulfonyl)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3d)



Compound **3d** was synthesised according to general procedure C, using *α*-keto amide **1ad** (113 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 9:1) and obtained as a white solid (79 mg, 0.19 mmol, 65%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (2H, d, *J* = 8.5 Hz, Ar-*H*), 7.82 (2H, d, *J* = 8.5 Hz, Ar-*H*), 7.77 (2H, dd, *J* = 8.0, 2.0 Hz, Ar-*H*), 7.62 (1H, s, C=C*H*), 7.42 – 7.30 (3H, m, Ar-*H*), 6.88 (1H, t, *J* = 8.5 Hz, C=C*H*CH_2), 2.50 – 2.39 (2H, m, C=CHCH_2), 1.66 – 1.53 (2H, m, C=CHCH_2CH_2), 1.41 – 1.31 (4H, m, CH_2CH_2CH_3), 0.93 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.8, 142.5, 134.2, 132.9, 131.3, 130.6, 129.7, 129.6, 128.83, 128.82, 127.3, 123.4, 117.7, 117.2, 31.5, 29.6, 28.6, 22.6, 14.1; **mp (Petrol/Et_2O)**: 112 – 114 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3095, 2956, 2928, 2858, 2349, 2234, 1722, 1635, 1490, 1449, 1394, 1369, 1305 1285, 1244, 1189, 1174, 1120, 1090, 1007, 995, 867, 838, 785, 750, 720, 692, 631; **LRMS (ESI) m/z**: 407.2 [$C_{23}H_{23}N_2O_3S$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{23}H_{23}N_2O_3S$, $(M+H)^+$]: 407.14239; found 407.14175.

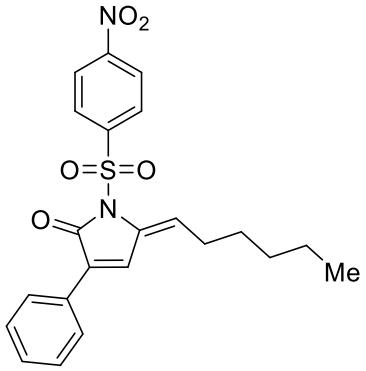
(*E*)-5-Hexylidene-3-phenyl-1-((4-(trifluoromethyl)phenyl)sulfonyl)-1,5-dihydro-2*H*-pyrrol-2-one (3e)



Compound **3e** was synthesised according to general procedure C, using *α*-keto amide **1ae** (129 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 9:1) and obtained as a yellow solid (94 mg, 0.21 mmol, 70%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.80– 7.77 (4H, m, Ar-*H*), 7.62 (1H, s, C=C*H*), 7.41 – 7.31 (3H, m, Ar-*H*), 6.90 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 2.51 – 2.40 (2H, m, C=CHC*H*$_2$), 1.63 – 1.52 (2H, m, C=CHCH_2C*H*$_2$), 1.42 – 1.31 (4H, m, C*H*$_2$C*H*$_2$$CH_3$), 0.94 (3H, t, *J* = 7.0 Hz, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.8, 142.1, 135.5 (q, *J* = 34.0 Hz), 134.3, 131.4, 130.5, 129.7, 129.6, 128.8, 128.7, 127.3, 126.3 (q, *J* = 3.0 Hz), 123.3, 123.1 (q, *J* = 273.0 Hz), 31.5, 29.6, 28.5, 22.6, 14.1; **^{19}F NMR (377 MHz, $CDCl_3$)** -63.3**; mp (Petrol/Et_2O)**: 85 – 87 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 2960, 2930, 2361, 2255, 1720, 1492, 1450, 1406, 1371, 1322, 1243, 1176, 1140, 1109, 1094, 1063, 1007, 995, 905, 843, 785, 726, 692, 649, 607; **LRMS (ESI) m/z**: 450.2 [$C_{23}H_{23}F_3NO_3S$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{23}H_{23}F_3NO_3S$, $(M+H)^+$]: 450.13453; found 450.13440.

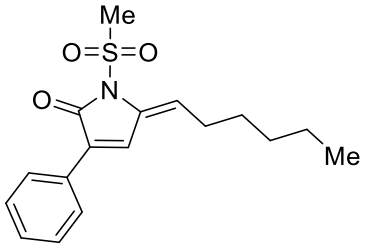
(*E*)-5-Hexylidene-1-((4-nitrophenyl)sulfonyl)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3f)



Compound **3f** was synthesised according to general procedure C, using *α*-keto amide **1af** (120 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 4:1) and obtained as a yellow solid (55 mg, 0.13 mmol, 43%).

^{1}H NMR (400 MHz, $CDCl_3$); δ 8.36 (2H, d, *J* = 9.0 Hz , Ar-*H*), 8.27 (2H, d, *J* = 9.0 Hz , Ar-*H*), 7.80 – 7.73 (2H, m, Ar-*H*), 7.62 (1H, s, C=C*H*), 7.41 – 7.32 (3H, m, Ar-*H*), 6.90 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 2.46 (2H, dd, *J* = 15.0, 8.0 Hz, C=CHC*H*$_2$), 1.65 – 1.53 (2H, m, C=CHCH$_2$C*H*$_2$), 1.44 – 1.33 (4H, m, C*H*$_2$C*H*$_2$CH$_3$), 0.93 (3H, t, *J* = 7.0 Hz, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.8, 150.9, 144.0, 134.2, 131.5, 130.6, 129.8, 129.7, 129.6, 128.9, 127.3, 124.4, 123.5, 31.6, 29.7, 28.6, 22.6, 14.2; **mp (Petrol/Et_2O)**: 90 – 92 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3658, 2981, 2889, 2360, 2341, 1721, 1636, 1607, 1532, 1473, 1462, 1382, 1251, 1151, 1089, 1073, 1007, 955, 855, 816, 785, 741, 683, 669, 648, 609; **LRMS (ESI) m/z**: 427.2 [$C_{22}H_{23}N_2O_5S$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{22}H_{23}N_2O_5S$, $(M+H)^+$]: 427.13222; found 427.13232.

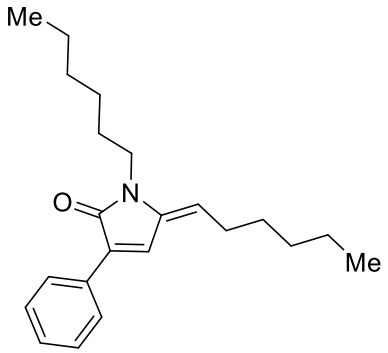
(*E*)-5-Hexylidene-1-(methylsulfonyl)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3g)



Compound **3g** was synthesised according to general procedure C, using *α*-keto amide **1ag** (82 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 9:1) and obtained as a yellow oil (41 mg, 0.13 mmol, 43%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 – 7.85 (2H, m, Ar-*H*), 7.64 (1H, s, C=C*H*), 7.47 – 7.33 (3H, m, Ar-*H*), 6.74 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 3.41 (3H, s, SO_2CH_3), 2.47 – 2.36 (2H, m, C=CHC*H*$_2$), 1.56 – 1.50 (2H, m, C=CHCH$_2$C*H*$_2$), 1.37 – 1.32 (4H, m, C*H*$_2$C*H*$_2$CH$_3$), 0.92 (3H, t, *J* = 7.0 Hz, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 167.7, 134.3, 131.2, 130.0, 129.9, 129.5, 128.8, 127.3, 123.4, 41.9, 31.5, 29.5, 28.5, 22.5, 14.0; **IR (cm^{-1})** $\tilde{\nu}$ = 2929, 2960, 2361, 1714, 1492, 1449, 1355, 1325, 1220, 1165, 1124, 995, 963, 865, 772, 691; **LRMS (ESI) m/z**: 342.0 [$C_{17}H_{21}NO_3SNa$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{17}H_{22}NO_3S$, $(M+H)^+$]: 320.13149; found 320.13137.

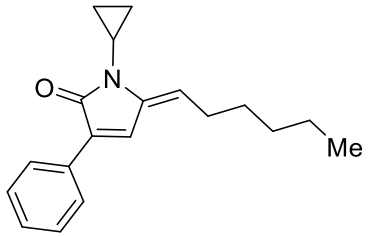
(*E*)-1-Hexyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3h)



Compound **3h** was synthesised according to general procedure C, using *α*-keto amide **1ah** (84 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (51 mg, 0.16 mmol, 52%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (2H, d, *J* = 7.5 Hz, Ar-*H*), 7.44 – 7.30 (4H, m, 3 × Ar-*H*, C=C*H*), 5.45 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 3.66 (2H, t, *J* = 7.5 Hz, NC*H*$_2$), 2.46 – 2.35 (2H, m, C=CHC*H*$_2$), 1.65 – 1.58 (2H, m, NCH$_2$C*H*$_2$), 1.57 – 1.46 (2H, m, C=CHCH$_2$C*H*$_2$), 1.41 – 1.22 (10H, m, N(CH$_2$)$_2$C*H*$_2$C*H*$_2$C*H*$_2$, C*H*$_2$C*H*$_2$CH$_3$), 0.96 – 0.84 (5H, m, N(CH$_2$)$_5$C*H*$_2$, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.7, 138.3, 133.5, 131.9, 128.7, 128.6, 127.4, 124.7, 114.9, 39.3, 31.7, 31.5, 30.2, 29.0, 27.9, 26.7, 22.7, 22.6, 14.2; **IR (cm^{-1})** $\tilde{\nu}$ = 3657, 2981, 2931, 2889, 2349, 1684, 1647, 1461, 1382, 1251, 1153, 1073, 956, 818, 787, 748, 693, 649; **LRMS (ESI) m/z**: 326.2 [$C_{22}H_{32}NO$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{22}H_{32}NO$, $(M+H)^+$]: 326.24784; found 326.24736.

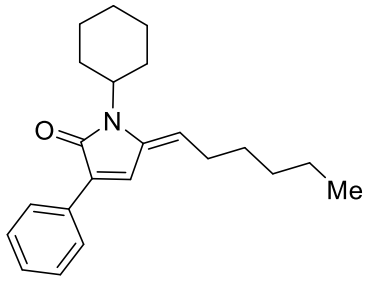
(*E*)-1-Cyclopropyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3i)



Compound **3i** was synthesised according to general procedure C, using *α*-keto amide **1ai** (68 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (56 mg, 0.20 mmol, 69%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93 (2H, d, *J* = 7.5 Hz, Ar-*H*), 7.38 (2H, dd, *J* = 7.5, 7.5 Hz, Ar-*H*), 7.35 – 7.29 (2H, m, Ar-*H*, C=C*H*), 5.83 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 2.54 (1H, tt, *J* = 7.0, 4.0 Hz, NC*H*), 2.44 – 2.34 (2H, m, C=CHCH_2), 1.58 – 1.48 (2H, m, C=CHCH_2CH_2), 1.40 – 1.29 (4H, m, CH_2C$H_2$$CH_3$), 1.06 – 0.98 (2H, m, NCHCH_2), 0.94 – 0.88 (5H, m, CH_3, NCHCH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.4, 139.2, 133.0, 131.9, 128.6, 128.6, 127.4, 124.7, 116.1, 31.5, 30.2, 27.9, 22.6, 21.4, 14.2, 6.4; **IR (cm^{-1})** $\tilde{\nu}$ = 3661, 2981, 2889, 2361, 2341, 1681, 1462, 1421, 1382, 1241, 1152, 1073, 904, 788, 724, 649; **LRMS (ESI) m/z**: 282.2 [$C_{19}H_{24}NO$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{19}H_{24}NO$, $(M+H)^+$]: 282.18524; found 282.18494.

(*E*)-1-Cyclohexyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3j)

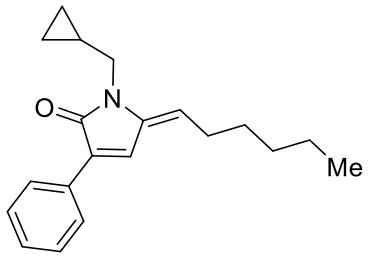


Compound **3j** was synthesised according to general procedure C, using *α*-keto amide **1aj** (83 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (41 mg, 0.12 mmol, 42%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (2H, d, *J* = 7.0 Hz, Ar-*H*), 7.43 – 7.27 (4H, m, 3 × Ar-*H*, C=C*H*), 5.61 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 3.96 (1H, p, *J* = 12.0 Hz, $C_{cy}H$), 2.43 – 2.37 (2H, m, C=CHCH_2), 2.26 – 2.11 (2H, m, $C_{cy}H_2$), 1.92 – 1.82 (2H, m, $C_{cy}H_2$), 1.77 – 1.68 (4H, m, 2 × $C_{cy}H_2$), 1.58 – 1.48 (2H, m, C=CHCH_2CH_2), 1.42 – 1.31 (4H, m, CH_2C$H_2$$CH_3$), 1.31 – 1.15

(2H, m, $C_{cy}H_2$), 0.92 (3H, t, J = 6.5 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.9, 138.0, 133.3, 131.9, 128.6, 128.5, 127.5, 125.1, 115.5, 52.2, 31.6, 30.4, 30.3, 28.2, 26.6, 25.6, 22.6, 14.2, 1.2; **IR (cm^{-1})** $\tilde{\nu}$ = 3661, 2981, 2933, 2361, 2341, 1676, 1640, 1450, 1308, 1347, 1259, 1205, 1152, 1073, 905, 788, 726, 693, 648; **LRMS (ESI) m/z**: 346.2 [$C_{22}H_{29}NNaO$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{22}H_{30}NO$, $(M+H)^+$]: 324.23219; found 324.23199.

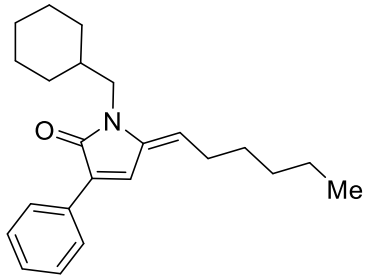
(*E*)-1-(Cyclopropylmethyl)-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3k)



Compound **3k** was synthesised according to general procedure C, using α-keto amide **1ak** (73 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (44 mg, 0.15 mmol, 50%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (2H, d, J = 7.5 Hz, Ar-*H*), 7.42 – 7.37 (3H, m, 2 × Ar-*H*, C=C*H*), 7.33 (1H, t, J = 7.5 Hz, Ar-*H*), 5.54 (1H, t, J = 8.0 Hz, C=C*H*CH_2), 3.58 (2H, d, J = 7.0 Hz, NCH_2), 2.48 – 2.37 (2H, m, C=CHCH_2), 1.60 – 1.46 (2H, m, C=CHCH_2CH_2), 1.40 – 1.30 (4H, m, CH_2CH_2CH_3), 1.15 – 1.01 (1H, m, C*H*$(CH_2)_2$), 0.96 – 0.87 (3H, m, CH_3), 0.54 – 0.44 (2H, m, 1 × CH(CH_2)$_2$), 0.43 – 0.34 (2H, m, 1 × CH(CH_2)$_2$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.8, 138.6, 133.6, 131.9, 128.7, 128.6, 127.4, 124.8, 115.1, 43.3, 31.5, 30.2, 27.9, 22.6, 14.2, 10.9, 3.9; **IR (cm^{-1})** $\tilde{\nu}$ = 3657, 2981, 2889, 2349, 1687, 1491, 1461, 1383, 1252, 1153, 1073, 1021, 955, 789, 749, 694, 650; **LRMS (ESI) m/z**: 296.2 [$C_{20}H_{26}NO$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{20}H_{26}NO$, $(M+H)^+$]: 296.20089; found 296.20062.

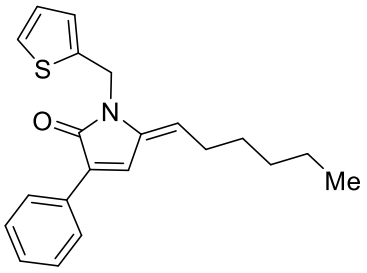
(*E*)-1-(Cyclohexylmethyl)-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3l)



Compound **3l** was synthesised according to general procedure C, using *α*-keto amide **1al** (88 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (46 mg, 0.14 mmol, 45%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (2H, d, *J* = 7.5 Hz, Ar-*H*), 7.43 – 7.35 (3H, m, 2 × Ar-*H*, C=C*H*), 7.32 (1H, t, *J* = 7.0 Hz, Ar-*H*), 5.45 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 3.51 (2H, d, *J* = 7.0 Hz, NCH_2), 2.48 – 2.35 (2H, m, C=CHCH_2), 1.78 – 1.69 (3H, m, $C_{cy}H$, $C_{cy}H_2$), 1.68 – 1.61 (2H, m, $C_{cy}H_2$), 1.56 – 1.47 (2H, m, C=CHCH_2CH_2), 1.40 – 1.30 (4H, m, CH_2C$H_2$$CH_3$), 1.22 – 1.14 (2H, m, $C_{cy}H_2$), 1.08 – 0.95 (2H, m, $C_{cy}H_2$), 0.95 – 0.88 (3H, m, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.1, 138.8, 133.3, 131.9, 128.7, 128.6, 127.4, 124.6, 115.3, 45.5, 37.7, 31.5, 31.1, 30.2, 27.9, 26.5, 26.0, 25.9, 22.6, 14.2; **IR (cm^{-1})** $\tilde{\nu}$ = 3657, 2981, 2928, 2349, 1678, 1646, 1448, 1381, 1345, 1251, 1153, 1073, 956, 906, 838,787, 727, 693, 649; **LRMS (ESI) m/z**: 338.2 [$C_{23}H_{32}NO$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{23}H_{32}NO$, $(M+H)^+$]: 338.24784; found 338.24756.

(*E*)-5-Hexylidene-3-phenyl-1-(thiophen-2-ylmethyl)-1,5-dihydro-2*H*-pyrrol-2-one (3m)

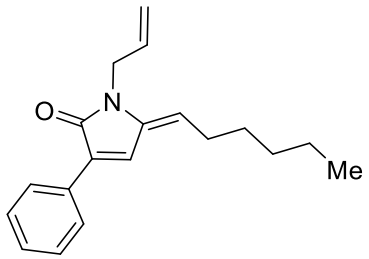


Compound **3m** was synthesised according to general procedure C, using *α*-keto amide **1am** (88 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (54 mg, 0.16 mmol, 53%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (2H, d, *J* = 7.0 Hz, Ar-*H*), 7.39 – 7.31 (3H, m, Ar-*H*), 7.29 (1H, d, *J* = 7.0 Hz, Ar-*H*), 7.12 (1H, d, *J* = 5.0 Hz, Ar-*H*), 6.93 (1H, s, C=C*H*), 6.87 (1H, dd, *J* = 5.0, 3.5 Hz, Ar-*H*), 5.51 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.99 (2H, s, NCH_2), 2.32 (2H, q, *J* = 8.0 Hz, C=CHCH_2), 1.48 – 1.36 (2H, m, C$H_2$$CH_2$$CH_2$$CH_3$), 1.32 – 1.17 (4H, m, C$H_2CH_2$$CH_3$), 0.84 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.3, 140.2, 137.5, 133.3, 131.6, 128.8, 128.6, 127.4, 126.8, 125.9, 125.3, 125.0, 116.0, 37.8, 31.3, 30.0, 27.8, 22.6, 14.1; **IR (cm^{-1})** $\tilde{\nu}$ = 3369, 3069, 2955, 2927, 2857, 2360, 1685, 1491, 1431, 1410, 1340, 1238, 1180,

1128, 1074, 924, 852, 789, 747, 694, 649; **MS (ESI) m/z**: 338.2 [$C_{21}H_{24}NOS$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{21}H_{24}NOS$, $(M+H)^+$]: 338.15731; found 338.15689.

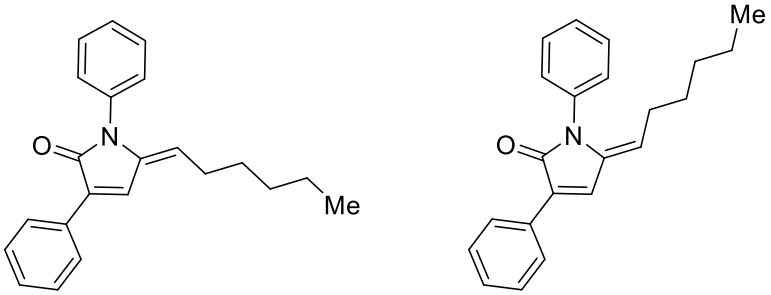
(*E*)-1-Allyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3n)



Compound **3n** was synthesised according to general procedure C, using α-keto amide **1an** (68 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (43 mg, 0.15 mmol, 51%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (2H, d, *J* = 7.0 Hz, Ar-*H*), 7.43 – 7.30 (4H, m, 3 × Ar-*H*, C=C*H*), 5.90 – 5.78 (1H, m, NCH_2CH=CH_2), 5.46 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 5.19 – 5.08 (2H, m, NCH_2CH=CH_2), 4.35 – 4.27 (2H, m, NCH_2), 2.44 – 2.34 (2H, m, C=CHCH_2), 1.55 – 1.45 (2H, m, C=$CHCH_2CH_2$), 1.41 – 1.28 (4H, m, $CH_2CH_2CH_3$), 0.91 (3H, t, *J* = 6.5 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.5, 138.0, 133.3, 131.8, 128.8, 128.6, 127.4, 125.1, 116.4, 116.0, 100.1, 41.6, 31.5, 30.1, 27.9, 22.6, 14.2; **IR (cm^{-1})** $\tilde{\nu}$ = 3661, 2981, 2889, 2361, 2341, 1681, 1647, 1382, 1251, 1153, 1073, 942, 905, 727, 693, 648; **LRMS (ESI) m/z**: 304.2 [$C_{19}H_{23}NNaO$, $(M+Na)^+$]; **HRMS (ESI)**: calcd for [$C_{19}H_{23}NNaO$, $(M+Na)^+$]: 304.16719; found 304.16727.

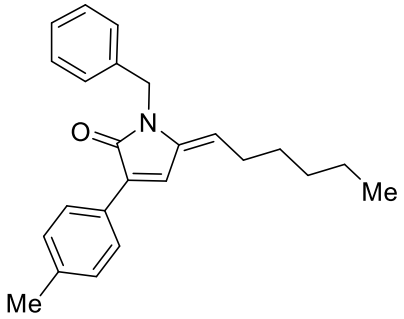
(*E*)-5-Hexylidene-1,3-diphenyl-1,5-dihydro-2*H*-pyrrol-2-one and
(*Z*)-5-Hexylidene-1,3-diphenyl-1,5-dihydro-2*H*-pyrrol-2-one (3o)



Compound **3o** was synthesised according to general procedure C, using α-keto amide **1ao** (81 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil containing an inseparable mixture of (*E*) and (*Z*) isomers (56 mg, 0.18 mmol, 59%), *E*/*Z* ratio 3:1.

Major **(*E*)-isomer: ^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.12 (2H, d, *J* = 7.0 Hz, Ar-*H*), 7.65 (1H, s, C=C*H*), 7.59 – 7.36 (8H, m, Ar-*H*), 5.50 (1H, t, *J* = 8.5 Hz, C=C*H*CH_2), 2.53 – 2.42 (2H, m, C=CHC*H*$_2$), 1.59 – 1.48 (2H, m, C=CHCH_2C*H*$_2$), 1.46 – 1.36 (4H, m, C*H*$_2$C*H*$_2$$CH_3$), 1.05 – 0.94 (3H, m, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** 168.3, 139.4, 134.8, 132.97, 131.7, 129.3, 128.9, 128.64, 128.4, 127.8, 127.51, 125.3, 117.0, 31.5, 29.9, 27.9, 22.6, 14.1; Minor **(*Z*)-isomer: ^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.08 – 7.98 (2H, m, Ar-*H*), 7.76 – 7.67 (1H, m, Ar-*H*), 7.65 – 7.34 (7H, m, Ar-*H*), 7.25 (1H, s, C=C*H*), 5.38 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 1.83 – 1.72 (2H, m, C=CHC*H*$_2$), 1.46 – 1.26 (4H, m, C=$CH_2$$CH_2$C*H*$_2$C*H*$_2$), 1.28 – 1.10 (2H, m, C*H*$_2$$CH_3$), 0.94 – 0.86 (3H, m, 3H, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** 170.2, 138.1, 137.1, 133.04, 131.6, 129.2, 128.7, 128.60, 128.56, 128.2, 127.50, 127.2, 119.7, 31.4, 29.3, 27.4, 22.4, 14.0; **IR (cm^{-1})** $\tilde{\nu}$ = 3065, 2955, 2927, 2856, 1693, 1597, 1500, 1449, 1404, 1352, 1224, 1159, 1120, 1073, 1027, 964, 909, 851, 785, 749, 730, 693, 651; **LRMS (ESI) m/z**: 318.2 [$C_{22}H_{24}NO$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{22}H_{24}NO$, $(M+H)^+$]: 318.18524; found 318.18493.

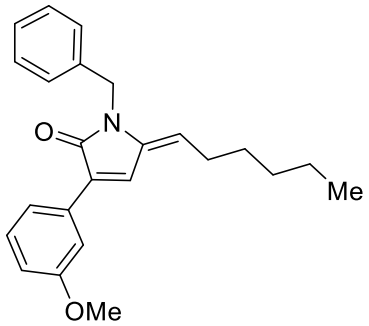
(*E*)-1-Benzyl-5-hexylidene-3-(*p*-tolyl)-1,5-dihydro-2*H*-pyrrol-2-one (4a)



Compound **4a** was synthesised according to general procedure C, using *α*-keto amide **1ba** (91 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (42 mg, 0.12 mmol, 41%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.50 (1H, s, C=C*H*), 7.45 – 7.40 (2H, m, Ar-*H*), 7.38 – 7.31 (5H, m, Ar-*H*), 5.48 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 5.03 (2H, s, NCH_2), 2.50 (3H, s, Ar-CH_3), 2.47 – 2.40 (2H, m, C=CHCH_2), 1.55 – 1.48 (2H, m, C$H_2$$CH_2$$CH_2$$CH_3$), 1.42 – 1.32 (4H, m, C$H_2CH_2$$CH_3$), 0.98 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.0, 138.8, 138.0, 137.7, 133.3, 129.4, 128.9, 128.7, 127.8, 127.2, 127.0, 124.3, 115.9, 42.9, 31.3, 30.0, 27.7, 22.5, 21.5, 14.1; **IR (cm^{-1})** $\tilde{\nu}$ = 2981, 2930, 2889, 2349, 1699, 1512, 1495, 1458, 1393, 1252, 1153, 1077, 954, 823, 748, 701, 648; **LRMS (ESI) m/z**: 346.2 [$C_{24}H_{28}NO$, $(M+H)^+$]; **HRMS (ESI)**: calcd for [$C_{24}H_{28}NO$, $(M+H)^+$]: 346.21654; found 346.21634.

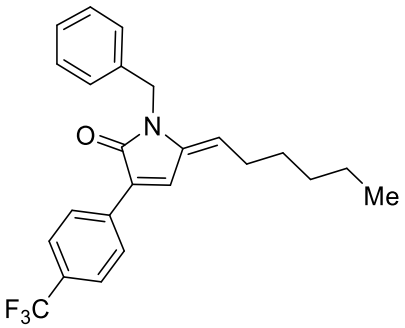
(*E*)-1-Benzyl-5-hexylidene-3-(3-methoxyphenyl)-1,5-dihydro-2*H*-pyrrol-2-one (4b)



Compound **4b** was synthesised according to general procedure C, using *α*-keto amide **1bb** (97 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow oil (64 mg, 0.18 mmol, 59%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (1H, s, Ar-*H*), 7.55 (1H, d, *J* = 7.5 Hz, Ar-*H*), 7.41 (1H, s, C=C*H*), 7.34 – 7.25 (3H, m, Ar-*H*), 7.25 – 7.17 (3H, m, Ar-*H*), 6.90 (1H, d, *J* = 8.0 Hz, Ar-*H*), 5.38 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.90 (2H, s, NCH_2), 3.84 (3H, s, OCH_3), 2.30 (2H, q, *J* = 8.0 Hz, C=CHCH_2), 1.44 – 1.32 (2H, m, C$H_2$$CH_2CH_2CH_3$), 1.32 – 1.13 (4H, m, C$H_2CH_2$$CH_3$), 0.84 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.8, 159.8, 137.9, 137.6, 133.1, 133.0, 129.6, 128.7, 127.3, 127.0, 125.5, 119.8, 116.6, 115.1, 112.3, 55.4, 42.9, 31.3, 29.9, 27.8, 22.5, 14.1; **IR (cm^{-1})** $\tilde{\nu}$ = 2928, 2857, 2361, 2012, 1722, 1683, 1575, 1534, 1488, 1455, 1434, 1412, 1371, 1336, 1287, 1252, 1207, 1180, 1153, 1112, 1044, 1012, 963, 842, 790, 729, 695, 649; **LRMS (ESI) m/z**: 362.2 [$C_{24}H_{28}NO_2$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{24}H_{28}NO_2$, $(M+H)^+$]: 362.21146; found 362.21149.

(*E*)-1-Benzyl-5-hexylidene-3-(4-(trifluoromethyl)phenyl)-1,5-dihydro-2*H*-pyrrol-2-one (4c)

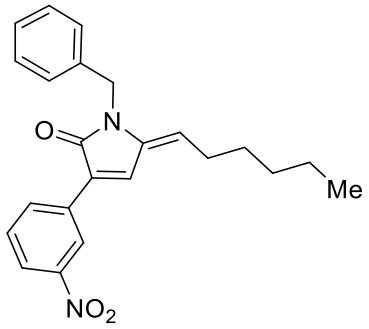


Compound **4c** was synthesised according to general procedure C, using *α*-keto amide **1bc** (111 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a brown oil (85 mg, 0.21 mmol, 71%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.59 (2H, d, *J* = 8.0 Hz, Ar-*H*), 7.45 (1H, s, C=C*H*), 7.28 – 7.20 (2H, m, Ar-*H*), 7.21 – 7.12 (3H, m, Ar-*H*), 5.40 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.85 (2H, s, NCH_2), 2.28 (2H, q, *J* = 8.0 Hz, C=CHCH_2), 1.40 – 1.29 (2H, m, C$H_2$$CH_2CH_2CH_3$), 1.28 – 1.08 (4H, m, C$H_2CH_2$$CH_3$), 0.79 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.4, 137.7, 137.4, 135.2, 132.0, 130.4 (q, *J* = 32.0 Hz), 128.8, 127.6, 127.4, 127.0, 126.9, 125.5 (q, *J* = 4.0 Hz), 124.2 (q, *J* = 273.0 Hz), 118.1, 43.0, 31.3, 29.9, 27.9, 22.6, 14.1; **^{19}F NMR (377 MHz, $CDCl_3$)** -62.7; **IR (cm^{-1})** $\tilde{\nu}$ = 2980, 2889, 1684, 1616, 1461, 1382, 1324, 1251, 1164, 1126, 1070, 1018, 954, 842, 757, 729, 698, 612; **LRMS (ESI) m/z**:

400.2 [$C_{24}H_{25}F_3NO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{24}H_{25}F_3NO$, $(M+H)^+$]: 400.18828; found 400.18787.

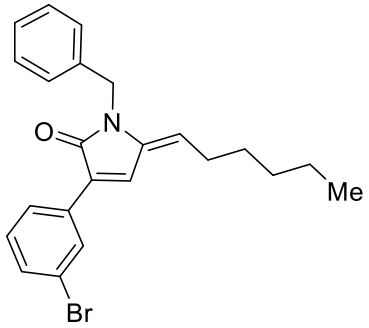
(*E*)-1-Benzyl-5-hexylidene-3-(3-nitrophenyl)-1,5-dihydro-2*H*-pyrrol-2-one (4d)



Compound **4d** was synthesised according to general procedure C, using α-keto amide **1bd** (102 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 9:1) and obtained as a light yellow solid (86 mg, 0.23 mmol, 76%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.80 (1H, s, Ar-*H*), 8.49 (1H, d, *J* = 8.0 Hz, Ar-*H*), 8.19 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.65 – 7.57 (2H, m, Ar-*H*, C=CH), 7.36 – 7.20 (5H, m, Ar-*H*), 5.52 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.93 (2H, s, NCH_2), 2.37 (2H, q, *J* = 8.0 Hz, C=CHCH_2), 1.48 – 1.38 (2H, m, C$H_2CH_2CH_2CH_3$), 1.34 – 1.18 (4H, m, C$H_2CH_2CH_3$), 0.86 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.1, 148.5, 137.6, 137.2, 133.4, 133.3, 131.0, 129.7, 128.8, 127.5, 127.1, 127.0, 123.2, 122.0, 118.8, 43.0, 31.3, 29.9, 28.0, 22.5, 14.1; **mp (Petrol/Et_2O)**: 80 – 82 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 2980, 2889, 2360, 2341, 1724, 1686, 1529, 1473, 1462, 1382, 1350, 1252, 1152, 1073, 955, 810, 732, 701; **LRMS (ESI) m/z**: 377.2 [$C_{23}H_{25}N_2O_3$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{23}H_{25}N_2O_3$, $(M+H)^+$]: 377.18597; found 377.18582.

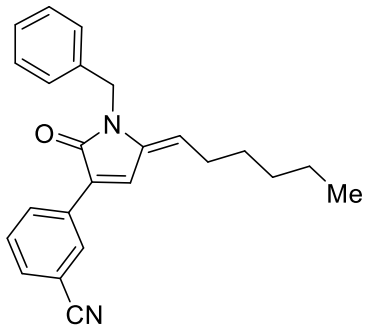
(*E*)-1-Benzyl-3-(3-bromophenyl)-5-hexylidene-1,5-dihydro-2*H*-pyrrol-2-one (4e)



Compound **4e** was synthesised according to general procedure C, using α-keto amide **1be** (115 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a brown oil (80 mg, 0.20 mmol, 65%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (1H, s, Ar-*H*), 7.90 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.41 – 7.33 (2H, m, Ar-*H*), 7.25 – 7.09 (6H, m, Ar-*H*), 5.34 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.81 (2H, s, NC*H*$_2$), 2.29 – 2.16 (2H, m, C=CHC*H*$_2$), 1.37 – 1.25 (2H, m, C*H*$_2$$CH_2CH_2CH_3$), 1.25 – 1.05 (4H, m, C*H*$_2$C*H*$_2$$CH_3$), 0.77 (3H, t, *J* = 7.0 Hz, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.3, 137.7, 137.4, 133.7, 131.8, 131.6, 130.14, 130.13, 128.7, 127.3, 127.0, 126.1, 126.0, 122.8, 117.5, 42.9, 31.3, 29.9, 27.8, 22.5, 14.1; **mp (Petrol/Et_2O)**: 65 – 67 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 2980, 2889, 1724, 1683, 1556, 1473, 1462, 1382, 1252, 1152, 1074, 954, 790, 729, 696; **LRMS (ESI) m/z**: 410.0 [$C_{23}H_{25}{}^{79}BrNO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{23}H_{25}{}^{79}BrNO$, $(M+H)^+$]: 410.11140; found 410.11127.

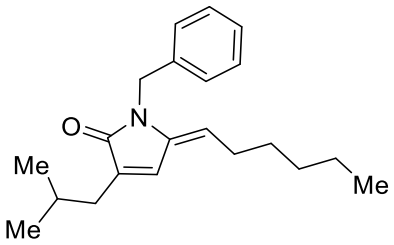
(*E*)-3-(1-Benzyl-5-hexylidene-2-oxo-2,5-dihydro-1*H*-pyrrol-3-yl)benzonitrile (4f)



Compound **4f** was synthesised according to general procedure C, using α-keto amide **1bf** (95 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 9:1) and obtained as a yellow solid (79 mg, 0.22 mmol, 74%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (1H, s, Ar-*H*), 8.25 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.59 (1H, d, *J* = 8.0 Hz, Ar-*H*), 7.54 – 7.45 (2H, m, Ar-*H*, C=C*H*), 7.36 – 7.16 (5H, m, Ar-*H*), 5.49 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.90 (2H, s, NCH_2), 2.34 (2H, q, *J* = 8.0 Hz, C=CHCH_2), 1.48 – 1.34 (2H, m, C$H_2CH_2CH_2CH_3$), 1.29 – 1.17 (4H, m, C$H_2CH_2CH_3$), 0.84 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.1, 137.5, 137.2, 132.9, 131.8, 131.5, 131.0, 130.8, 129.4, 128.7, 127.4, 127.0, 126.7, 118.7, 118.5, 112.8, 42.9, 31.2, 29.8, 27.9, 22.5, 14.0; **mp (Petrol/Et_2O)**: 72 – 74 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 2981, 2889, 2361, 2341, 2230, 1683, 1649, 1473, 1461, 1382, 1252, 1154, 1073, 955, 803, 729, 687, 655; **LRMS (ESI) m/z**: 357.2 [$C_{24}H_{25}N_2O$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{24}H_{25}N_2O$, $(M+H)^+$]: 357.19614; found 357.19608.

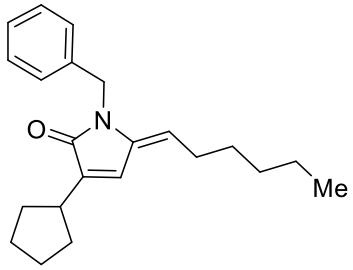
(*E*)-1-Benzyl-5-hexylidene-3-isobutyl-1,5-dihydro-2*H*-pyrrol-2-one (4g)



Compound **4g** was synthesised according to general procedure C, using *α*-keto amide **1bg** (79 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a brown oil (18 mg, 0.06 mmol, 19%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 – 7.11 (3H, m, Ar-*H*), 7.11 – 7.06 (2H, m, Ar-*H*), 6.82 (1H, s, C=C*H*), 5.13 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.75 (2H, s, NCH_2), 2.23 (2H, d, *J* = 7.0 Hz, CHCH_2), 2.15 (2H, q, *J* = 8.0 Hz, C=CHCH_2), 2.00 – 1.85 (1H, m, C*H*CH_2), 1.34 – 1.05 (6H, m, C$H_2CH_2CH_2CH_3$), 0.89 (6H, d, *J* = 6.5 Hz, 2 × CH_3), 0.77 (3H, t, *J* = 7.0 Hz, CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 170.6, 138.3, 137.9, 136.8, 128.6, 127.2, 127.0, 126.9, 114.1, 42.9, 34.9, 31.3, 30.0, 27.50, 27.48, 22.7, 22.5, 14.1; **IR (cm^{-1})** $\tilde{\nu}$ = 2980, 2889, 2361, 2341, 1690, 1473, 1462, 1383, 1252, 1153, 1074, 954, 819, 728, 697; **LRMS (ESI) m/z**: 312.2 [$C_{21}H_{30}NO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{21}H_{30}NO$, $(M+H)^+$]: 312.23219; found 312.23163.

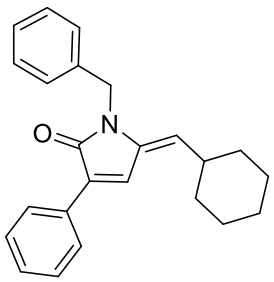
(*E*)-1-Benzyl-3-cyclopentyl-5-hexylidene-1,5-dihydro-2*H*-pyrrol-2-one (4h)



Compound **4h** was synthesised according to general procedure C, using *α*-keto amide **1bh** (83 mg, 0.36 mmol), 1-octyne (44 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 95:5) and obtained as a yellow oil (39 mg, 0.12 mmol, 40%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 – 7.07 (5H, m, Ar-*H*), 6.78 (1H, s, C=C*H*), 5.12 (1H, t, *J* = 8.0 Hz, C=C*H*CH_2), 4.75 (2H s, NC*H*$_2$), 2.93 – 2.80 (1H, m, $C_{cyclopentane}$*H*), 2.22 – 2.08 (2H, m, C=CHC*H*$_2$), 2.06 – 1.91 (2H, m, $C_{cyclopentane}$*H*$_2$), 1.75 – 1.43 (6H, m, 2 × $C_{cyclopentane}H_2$, C*H*$_2$$CH_2CH_2CH_3$), 1.34 – 1.07 (6H, m, $C_{cyclopentane}H_2$, C*H*$_2$C*H*$_2$$CH_3$), 0.78 (3H, t, *J* = 7.0 Hz, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 170.2, 142.1, 138.3, 137.9, 128.6, 127.2, 127.0, 124.1, 114.0, 42.8, 37.0, 32.2, 31.3, 30.0, 27.5, 25.4, 22.6, 14.1; **IR (cm^{-1})** $\tilde{\nu}$ = 2981, 2889, 2361, 2341, 1704, 1679, 1456, 1393, 1252, 1152, 1072, 955, 817, 700; **LRMS (ESI) m/z**: 324.2 [$C_{22}H_{30}NO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{22}H_{30}NO$, $(M+H)^+$]: 324.23219; found 324.23224.

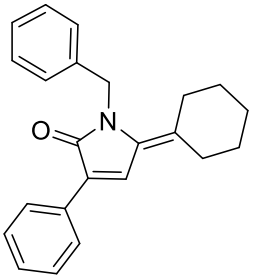
(*E*)-1-Benzyl-5-(cyclohexylmethylene)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (5a)



Compound **5a** was synthesised according to general procedure C using *α*-keto amide **1aa** (86 mg, 0.36 mmol) and 3-cyclohexyl-1-propyne (43 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 9:1) and obtained as a yellow oil (52 mg, 0.15 mmol, 50%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 – 7.98 (2H, m, Ar-*H*), 7.45 – 7.39 (3H, m, 2 × Ar-*H*, C=C*H*), 7.38 – 7.27 (3H, m, Ar-*H*), 7.25 – 7.20 (3H, m, Ar-*H*), 5.27 (1H, d, *J* = 10.0 Hz, C=C*H*CH), 4.90 (2H, s, NCH_2), 2.57 – 2.43 (1H, m, C=CHC*H*), 1.78 – 1.61 (5H, m, 2 × CH_2, CH_AH$_B$), 1.40 – 1.24 (2H, m, CH_2), 1.24 – 1.05 (3H, m, CH_2, CH_AH_B); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.9, 137.6, 136.7, 133.5, 128.8, 128.70, 128.65, 127.4, 127.3, 127.1, 125.5, 122.0, 42.9, 37.3, 34.1, 25.8, 25.7; **IR (cm^{-1})** $\tilde{\nu}$ = 2981, 2889, 1685, 1473, 1462, 1383, 1252, 1153, 1073, 954, 816, 695; **LRMS (ESI) m/z**: 344.2 [$C_{24}H_{26}NO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{22}H_{24}NO$, $(M+H)^+$]: 344.20089; found 344.20094.

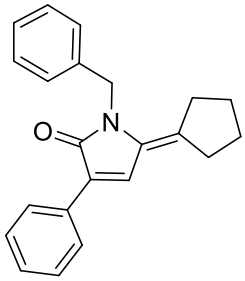
1-Benzyl-5-cyclohexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (5b)



Compound **5b** was synthesised according to general procedure C using *α*-keto amide **1aa** (86 mg, 0.36 mmol) and cyclohexylacetylene (39 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 95:5) and obtained as a yellow solid (45 mg, 0.14 mmol, 46%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 – 8.00 (2H, m, Ar-*H*), 7.63 (1H, s, C=C*H*), 7.46 – 7.38 (2H, m, Ar-*H*), 7.37 – 7.28 (3H, m, Ar-*H*), 7.27 – 7.18 (1H, m, Ar-*H*), 7.12 (2H, d, *J* = 7.5 Hz, Ar-*H*), 5.18 (2H, s, CH_2), 2.53 – 2.45 (2H, m, CH_2), 2.44 – 2.34 (2H, m, CH_2), 1.70 – 1.60 (2H, m, CH_2), 1.59 – 1.48 (2H, m, CH_2), 1.31 – 1.19 (2H, m, CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 170.9, 138.4, 132.6, 132.1, 131.8, 130.3, 128.7, 128.6, 128.3, 128.2, 127.2, 126.9, 126.0, 45.9, 33.0, 31.0, 29.1, 28.0, 26.5; **mp (Petrol/Et_2O)**: 117 – 119 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 2981, 2930, 2889, 2854, 2361, 2341, 1673, 1492, 1449, 1381, 1352, 1327, 1251, 1224, 1168, 1074, 1028, 997, 947, 892, 854, 787, 749, 725, 694, 652; **LRMS (ESI) m/z**: 330.2 [$C_{23}H_{24}NO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{23}H_{24}NO$, $(M+H)^+$]: 330.18524; found 330.18503.

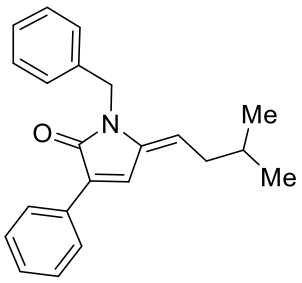
1-Benzyl-5-cyclopentylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (5c)



Compound **5c** was synthesised according to general procedure C using *α*-keto amide **1aa** (86 mg, 0.36 mmol) and cyclopentylacetylene (35 µL, 0.30 mmol), purified by column chromatography (Petrol/Acetone = 95:5) and obtained as a white solid (46 mg, 0.15 mmol, 48%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (2H, d, *J* = 7.0 Hz, Ar-*H*), 7.46 – 7.18 (7H, m, Ar-*H*), 7.13 (2H, d, *J* = 7.0 Hz, Ar-*H*), 5.13 (2H, s, NCH_2), 2.72 (2H, tp, *J* = 5.0, 2.0 Hz, CH_2), 2.51 (2H, tp, *J* = 5.0, 2.0 Hz, CH_2), 1.75 – 1.61 (4H, m, 2 × CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.9, 138.8, 133.9, 132.2, 131.7, 130.5, 128.8, 128.7, 128.6, 128.4, 127.2, 127.0, 125.9, 44.4, 33.0, 30.9, 27.2, 25.8; **mp (Petrol/Et_2O)**: 143 – 146 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 2981, 2888, 2361, 2341, 1674, 1490, 1473, 1462, 1383, 1252, 1152, 1073, 954, 816, 787, 748, 725, 694, 669, 652; **LRMS (ESI) m/z**: 316.2 [$C_{22}H_{22}NO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{22}H_{22}NO$, $(M+H)^+$]: 316.16959; found 316.16968.

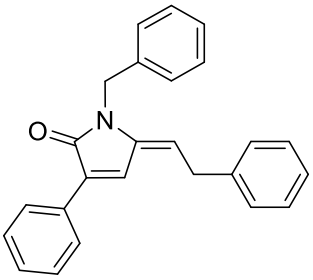
(*E*)-1-Benzyl-5-(3-methylbutylidene)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (5d)



Compound **5d** was synthesised according to general procedure C using *α*-keto amide **1aa** (86 mg, 0.36 mmol) and 5-methyl-1-hexyne (40 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 95:5) and obtained as a yellow solid (52 mg, 0.16 mmol, 55%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (2H, d, *J* = 7.0 Hz, Ar-*H*), 7.45 – 7.40 (3H, m, Ar-*H*), 7.37 – 7.28 (3H, m, 2 × Ar-*H*, C=C*H*), 7.26 – 7.20 (3H, m, Ar-*H*), 5.39 (1H, t, *J* = 8.5 Hz, C=C*H*CH_2), 4.93 (2H, s, NCH_2), 2.22 (2H, dd, *J* = 8.5, 7.0 Hz, C=CHCH_2), 1.73 – 1.59 (1H, m, C*H*$(CH_3)_2$), 0.84 (6H, d, *J* = 7.0 Hz, 2 × CH_3); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.9, 138.5, 137.6, 133.5, 131.8, 128.8, 128.71, 128.67, 127.5, 127.3, 127.0, 125.4, 115.2, 43.0, 36.7, 29.4, 22.3; **mp (Petrol/Et_2O)**: 81 – 82 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 2981, 2889, 2361, 2341, 1683, 1648, 1490, 1462, 1383, 1296, 1252, 1153, 1073, 953, 854, 786, 749, 730, 694, 649; **LRMS (ESI) m/z**: 318.2 [$C_{22}H_{24}NO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{22}H_{24}NO$, $(M+H)^+$]: 318.18524; found 318.18530.

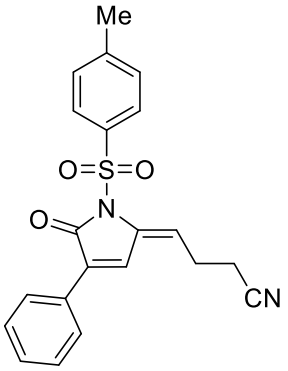
(*E*)-1-Benzyl-3-phenyl-5-(2-phenylethylidene)-1,5-dihydro-2*H*-pyrrol-2-one (5e)



Compound **5e** was synthesised according to general procedure C using *α*-keto amide **1aa** (86 mg, 0.36 mmol) and 4-phenyl-1-butyne (42 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 95:5) and obtained as an off-white solid (48 mg, 0.14 mmol, 46%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (2H, d, *J* = 7.0 Hz, Ar-*H*), 7.50 (1H, s, Ar-*H*), 7.42 (2H, t, *J* = 7.0 Hz, Ar-*H*), 7.38 – 7.33 (1H, m, Ar-*H*), 7.31 – 7.18 (8H, m, Ar-*H*), 7.06 (2H, d, *J* = 7.0 Hz, Ar-*H*), 5.52 (1H, t, *J* = 8.5 Hz, C*H*CH_2), 4.92 (2H, s, CH_2), 3.67 (2H, d, *J* = 8.5 Hz, CHCH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 169.0, 139.4, 138.7, 137.5, 134.3, 131.6, 129.1, 128.8, 128.7, 128.7, 128.4, 127.5, 127.4, 127.1, 126.7, 125.1, 113.4, 43.0, 33.6; **mp (Petrol/EtOAc)**: 116 – 118 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3085, 3062, 3029, 2918, 2850, 2359, 2324, 2166, 2038, 1979, 1683, 1648, 1603, 1585, 1524, 1494, 1453, 1435, 1412, 1384, 1345, 1298, 1279, 1239, 1172, 1128, 1098, 1075, 1029, 1001, 974, 947, 906, 856, 786, 729, 695, 649, 609; **LRMS (ESI) m/z**: 352.2 [$C_{25}H_{22}NO$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{25}H_{22}NO$, $(M+H)^+$]: 352.16959; found 352.16971.

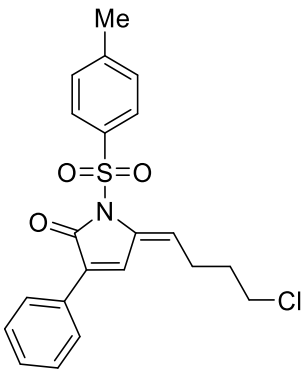
(*E*)-4-(5-oxo-4-phenyl-1-tosyl-1,5-dihydro-2*H*-pyrrol-2-ylidene)butanenitrile (5f)



Compound **5f** was synthesised according to general procedure C using *α*-keto amide **1ab** (109 mg, 0.36 mmol) and hex-5-ynenitrile (32 µL, 0.30 mmol), purified by column chromatography (Petrol/EtOAc = 7:3) and obtained as a yellow solid (31 mg, 0.08 mmol, 27%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (2H, d, *J* = 8.5 Hz, Ar-*H*), 7.84 – 7.74 (2H, m, Ar-*H*), 7.54 (1H, s, C=C*H*), 7.39 – 7.34 (3H, m, Ar-*H*), 7.34 – 7.30 (2H, m, Ar-*H*), 6.80 (1H, t, *J* = 8.5 Hz, C=C*H*CH_2), 2.85 – 2.74 (2H, m, C=CHC*H*$_2$), 2.63 (2H, t, *J* = 7.0 Hz, C*H*$_2$CN), 2.40 (3H, s, C*H*$_3$); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.7, 145.6, 136.8, 135.5, 132.9, 129.94, 129.90, 129.5, 129.0, 128.8, 128.1, 127.6, 118.6, 115.7, 24.5, 21.8, 18.1; **mp (Petrol/EtOAc)**: 120 – 122 °C; **IR (cm^{-1})** $\tilde{\nu}$ = 3090, 2981, 2929, 2889, 2361, 2341, 2246, 1725, 1540, 1492, 1389, 1364, 1307, 1190, 1176, 1135, 1092, 1006, 994, 814, 785, 692, 660; **LRMS (ESI) m/z**: 379.1 [$C_{21}H_{19}N_2O_3S$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{21}H_{19}N_2O_3S$, $(M+H)^+$]: 379.11109; found 379.11096.

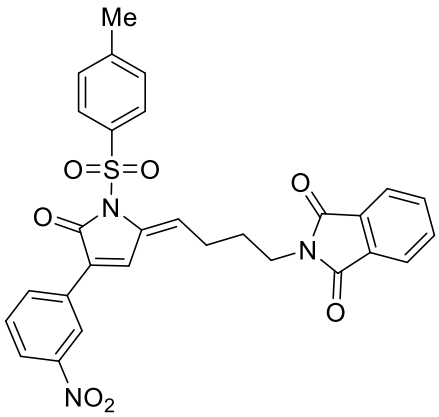
(*E*)-5-(4-chlorobutylidene)-3-phenyl-1-tosyl-1,5-dihydro-2*H*-pyrrol-2-one (5g)



Compound **5g** was synthesised according to general procedure C using *α*-keto amide **1ab** (109 mg, 0.36 mmol) and 6-chlorohex-1-yne (36 µL, 0.30 mmol), purified by column chromatography (Petrol/Et_2O = 4:1) and obtained as a light yellow oil (30 mg, 0.07 mmol, 25%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (2H, d, *J* = 8.5 Hz, Ar-*H*), 7.86 – 7.76 (2H, m, Ar-*H*), 7.63 (1H, s, C=C*H*), 7.42 – 7.26 (5H, m, Ar-*H*), 6.80 (1H, t, *J* = 8.5 Hz, C=C*H*CH_2), 3.60 (2H, t, *J* = 6.0 Hz, CH_2Cl), 2.64 (2H, dt, *J* = 8.5, 7.0 Hz, C=CHCH_2), 2.41 (3H, s, CH_3), 2.10 – 1.97 (2H, m, CH_2CH_2Cl); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 166.8, 145.3, 135.8, 135.6, 131.9, 129.8, 129.75, 129.73, 129.5, 128.7, 128.0, 127.3, 119.6, 44.0, 32.0, 25.2, 21.70 (d); **IR (cm^{-1})** $\tilde{\nu}$ = 2981, 2889, 2361, 2341, 1723, 1492, 1473, 1387, 1366, 1306, 1250, 1188, 1175, 1135, 1092, 1006, 994, 870, 785, 750, 711, 692, 660; **LRMS (ESI) m/z**: 402.1 [$C_{21}H_{21}ClNO_3S$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{21}H_{21}ClNO_3S$, $(M+H)^+$]: 402.09252; found 402.09244.

(*E*)-2-(4-(4-(3-nitrophenyl)-5-oxo-1-tosyl-1,5-dihydro-2*H*-pyrrol-2-ylidene)butyl)isoindoline-1,3-dione (5h)

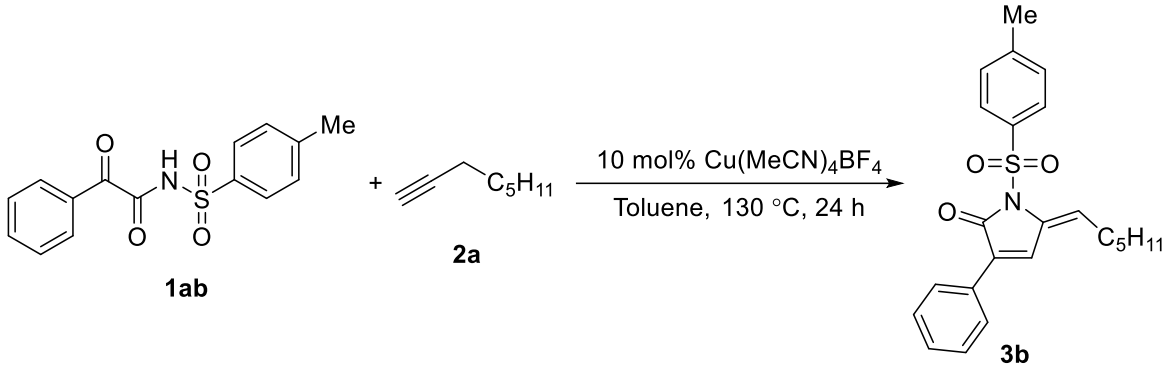


Compound **5h** was synthesised according to general procedure C using *α*-keto amide **1bg** (125 mg, 0.36 mmol) and *N*-(5-hexynyl)phthalimide (68 mg, 0.30 mmol), purified by column chromatography (Petrol/Et_2OAc = 1:1) and obtained as a white solid (135 mg, 0.24 mmol, 81%).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.67 (1H, t, *J* = 2.0 Hz, Ar-*H*), 8.27 – 8.23 (1H, m, Ar-*H*), 8.20 – 8.16 (1H, m, Ar-*H*), 7.99 – 7.91 (2H, m, Ar-*H*), 7.86 – 7.84 (2H, m, Ar-*H*), 7.80 (1H, s, Ar-

H), 7.74 – 7.22 (2H, m, Ar-*H*), 7.56 (1H, t, *J* = 8.0 Hz, Ar-*H*), 7.33 (1H, d, *J* = 8.0 Hz, Ar-*H*), 6.95 (1H, t, *J* = 8.2 Hz, C=C*H*CH_2), 3.79 (2H, t, *J* = 7.0 Hz, CH_2N), 2.60 – 2.48 (2H, m, C=CHCH_2), 2.41 (3H, s, CH_3), 2.02 (2H, p, *J* = 7.0 Hz, C=CHCH_2CH_2); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 168.6, 166.2, 148.5, 145.6, 135.6, 134.9, 134.3, 133.3, 132.1, 131.9, 131.7, 130.0, 129.9, 129.4, 128.2, 123.9, 123.5, 123.1, 122.3, 37.3, 28.7, 26.2, 21.9; **IR (cm^{-1})** $\tilde{\nu}$ = 3660, 2981, 2888, 2361, 2341, 1770, 1709, 1529, 1395, 1351, 1251, 1152, 1090, 1023, 955, 893, 774, 720, 699; **LRMS (ESI) m/z**: 580.2 [$C_{29}H_{23}NaN_3O_7S$, $(M+H)^+$]; **HRMS (ESI) m/z**: calcd for [$C_{29}H_{23}NaN_3O_7S$, $(M+H)^+$]: 580.11489; found 580.11481.

V. Gram-scale Synthesis of Pyrrolinone 3b



Commercially purchased 1-octyne was purified prior to use by distillation. α-Keto amide **1ab** was synthesised and purified as before. An oven-dried round bottom flask (100 mL) was charged with *N*-tosyl-2-oxo-2-phenylacetamide **1ab** (1.31 g, 4.32 mmol, 1.2 equiv.) and $[Cu(MeCN)_4]BF_4$ (113 mg, 0.36 mmol, 0.10 equiv.). The flask was then evacuated under vacuum and back-filled with nitrogen three times. Degassed dry toluene (6 mL) and degassed 1-octyne (531 µL, 3.6 mmol, 1.0 equiv.) were added subsequently under nitrogen atmosphere, and the mixture was refluxed at 130 °C for 20 h under nitrogen. It was then cooled to room temperature, filtered through silica (washed down with CH_2Cl_2), concentrated in vacuo, and purified by column chromatography (5% Et_2O/Petrol to 10% Et_2O/Petrol) to give pyrrolinone **3b** (1.18 g, 83%) as a yellow oil. The data is consistent as obtained for the small-scale reaction.

VI. References

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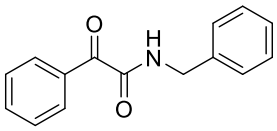
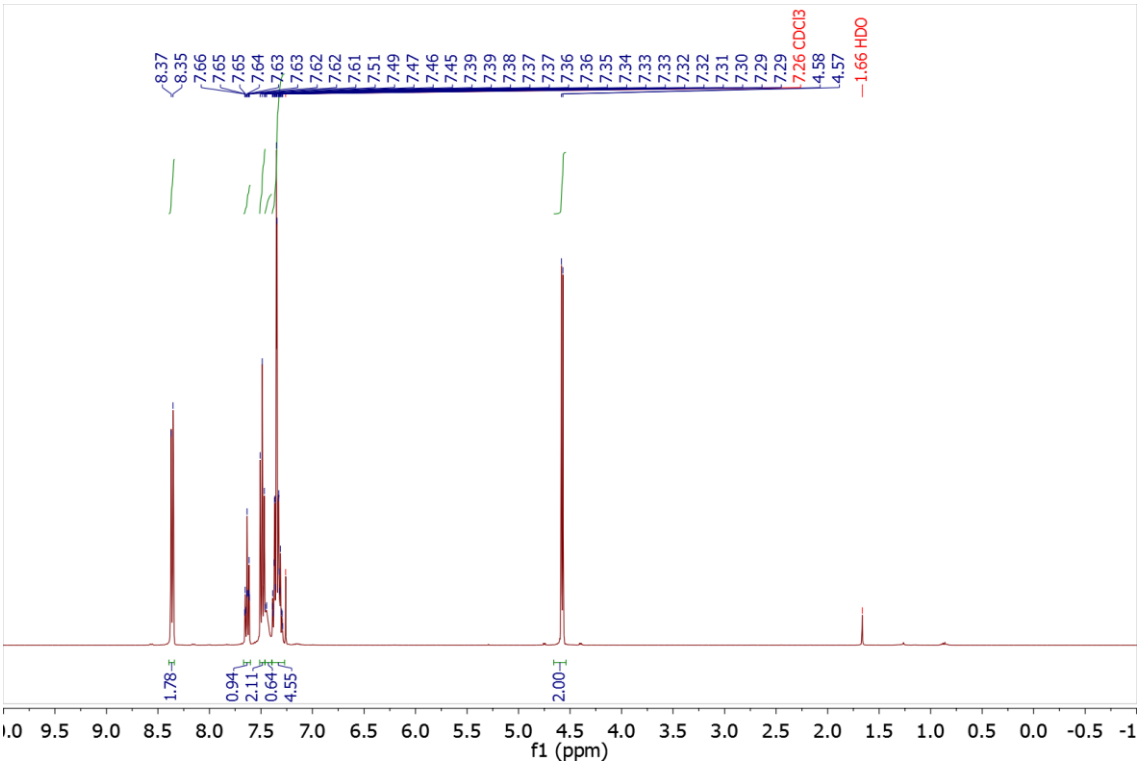
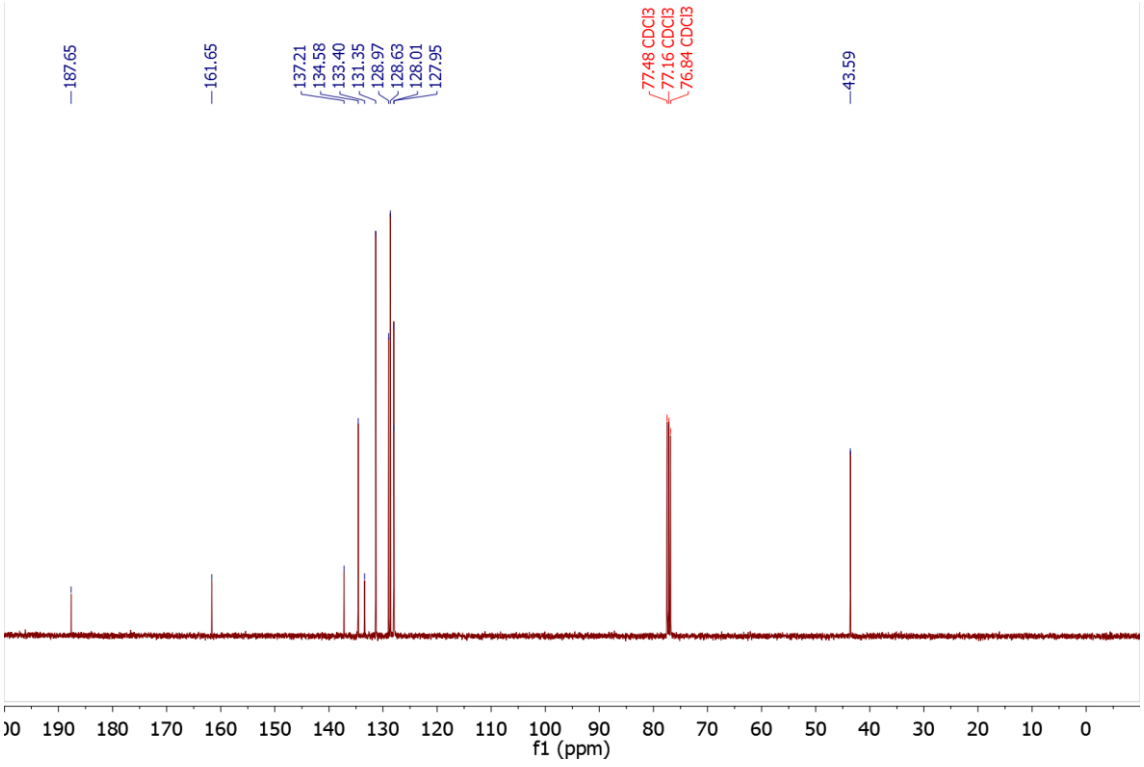
N-Benzyl-2-oxo-2-phenylacetamide (1a)



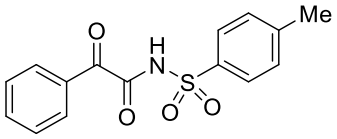
^{1}H NMR (400 MHz, $CDCl_3$)



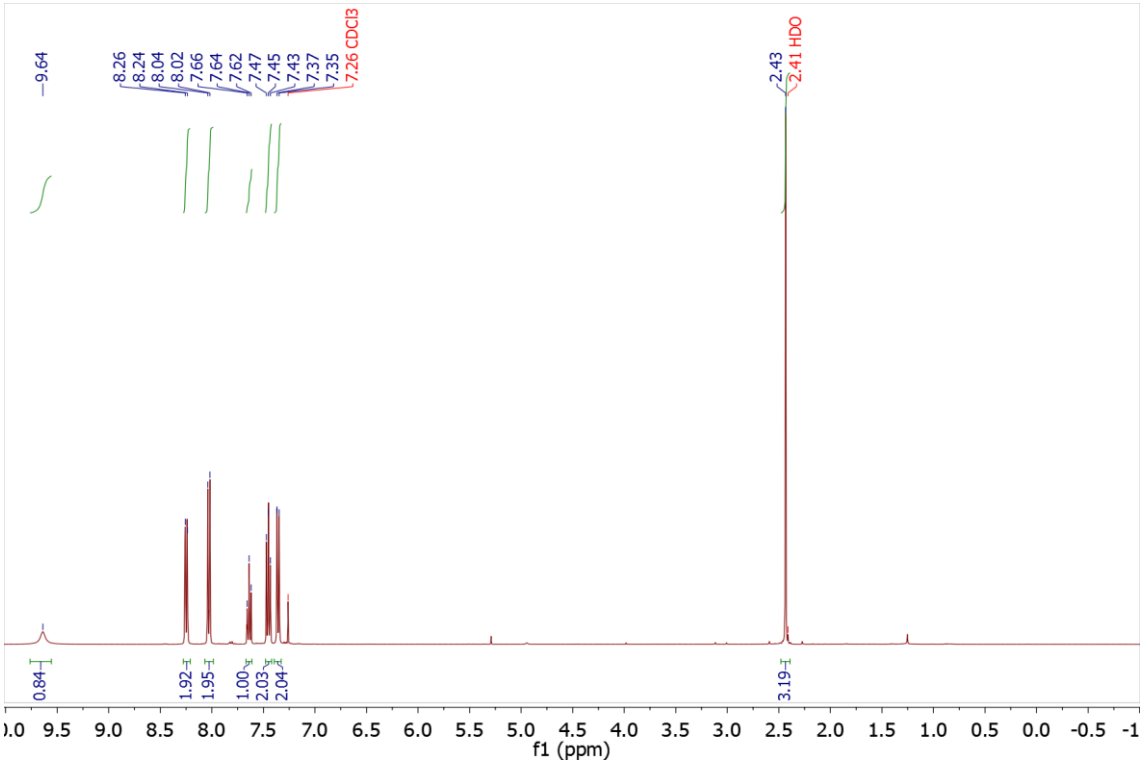
^{13}C NMR (101 MHz, $CDCl_3$)



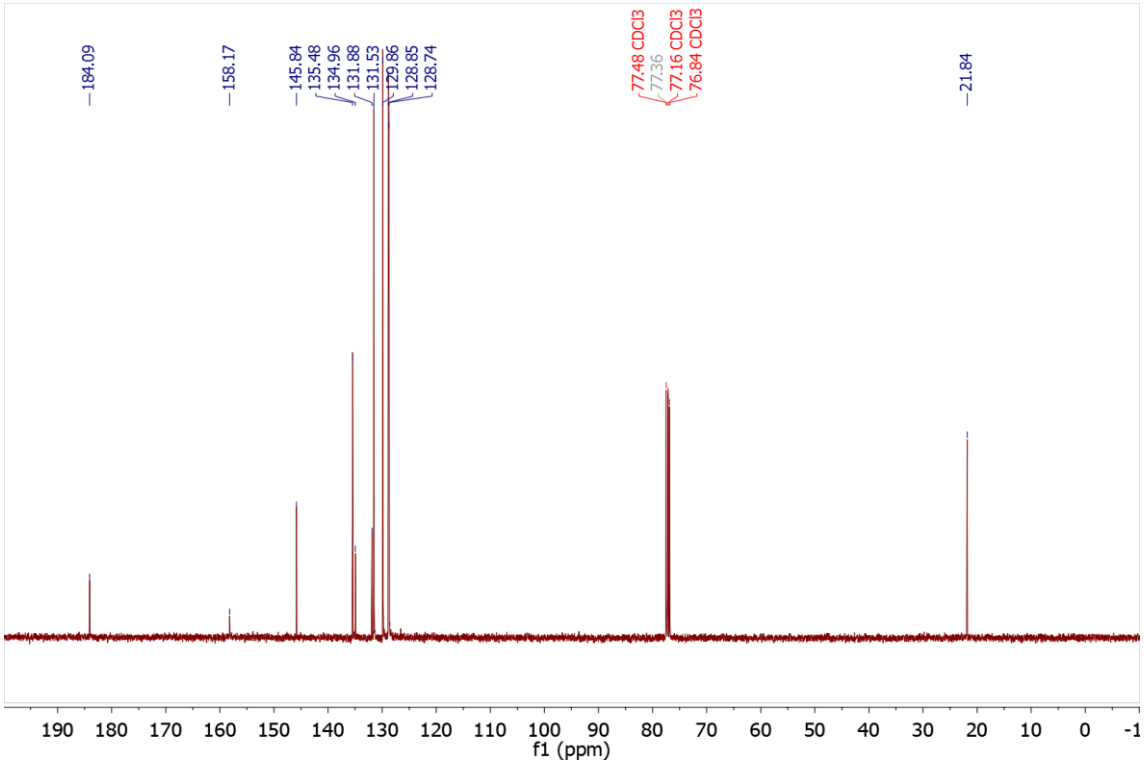
N-Tosyl-2-oxo-2-phenylacetamide (1b)



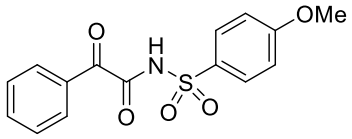
^{1}H NMR (400 MHz, $CDCl_3$)



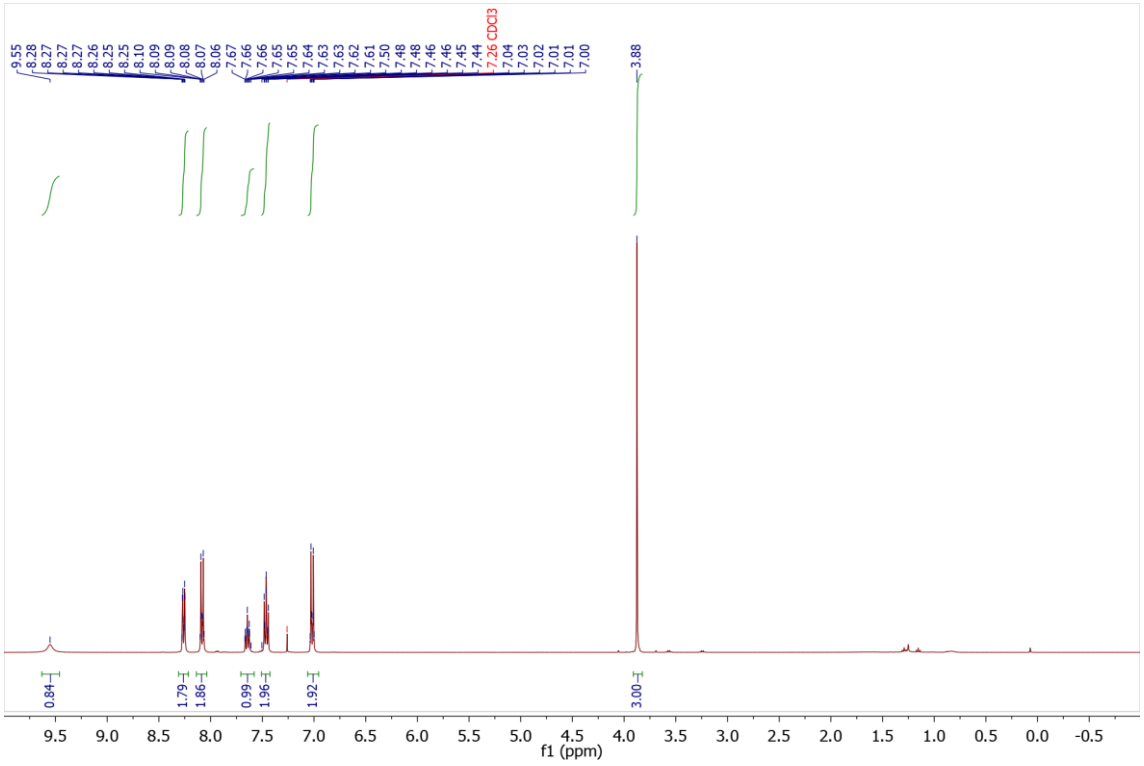
^{13}C NMR (101 MHz, $CDCl_3$)



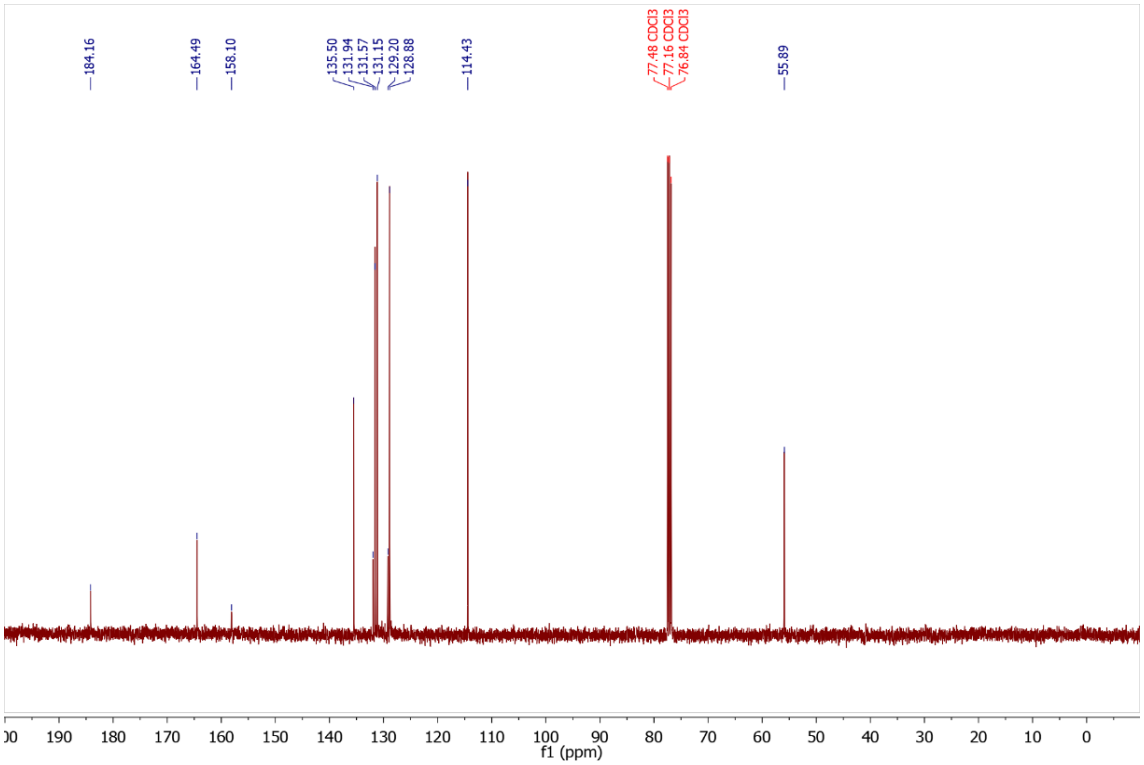
N-((4-Methoxyphenyl)sulfonyl)-2-oxo-2-phenylacetamide (1c)



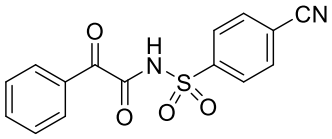
^{1}H NMR (400 MHz, $CDCl_3$)



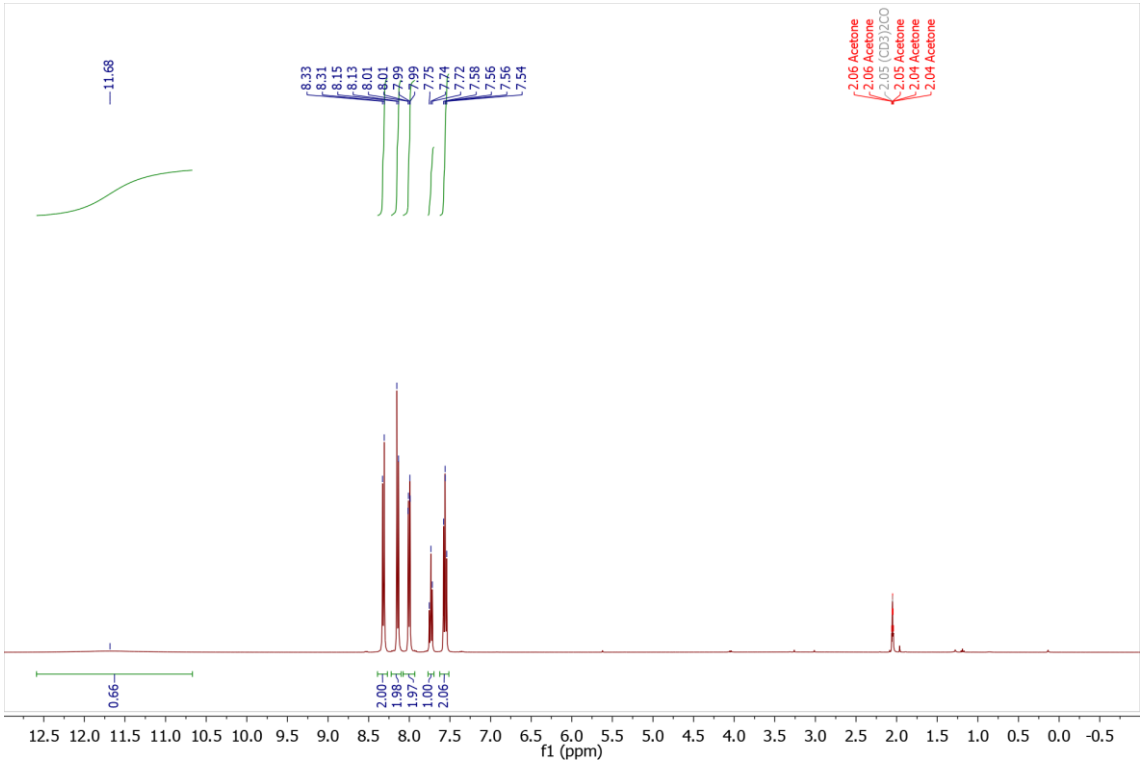
^{13}C NMR (101 MHz, $CDCl_3$)



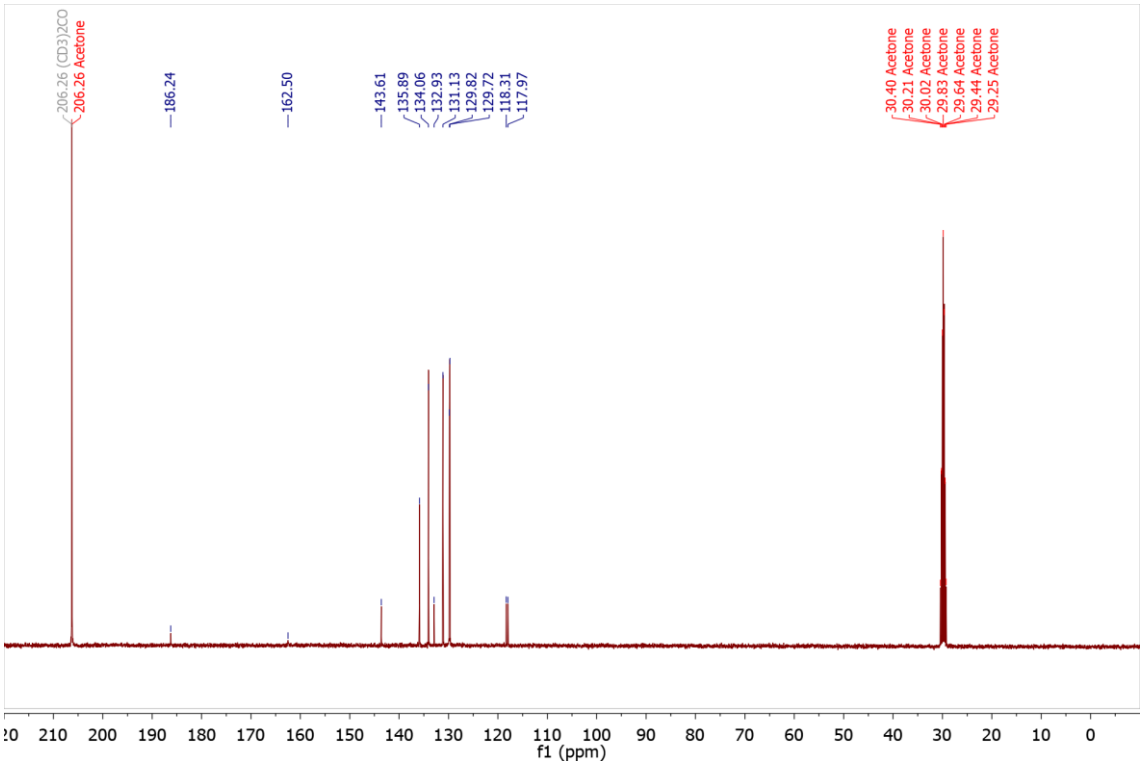
N-((4-Cyanophenyl)sulfonyl)-2-oxo-2-phenylacetamide (1d)



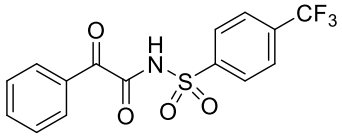
^{1}H NMR (400 MHz, d_6-acetone)



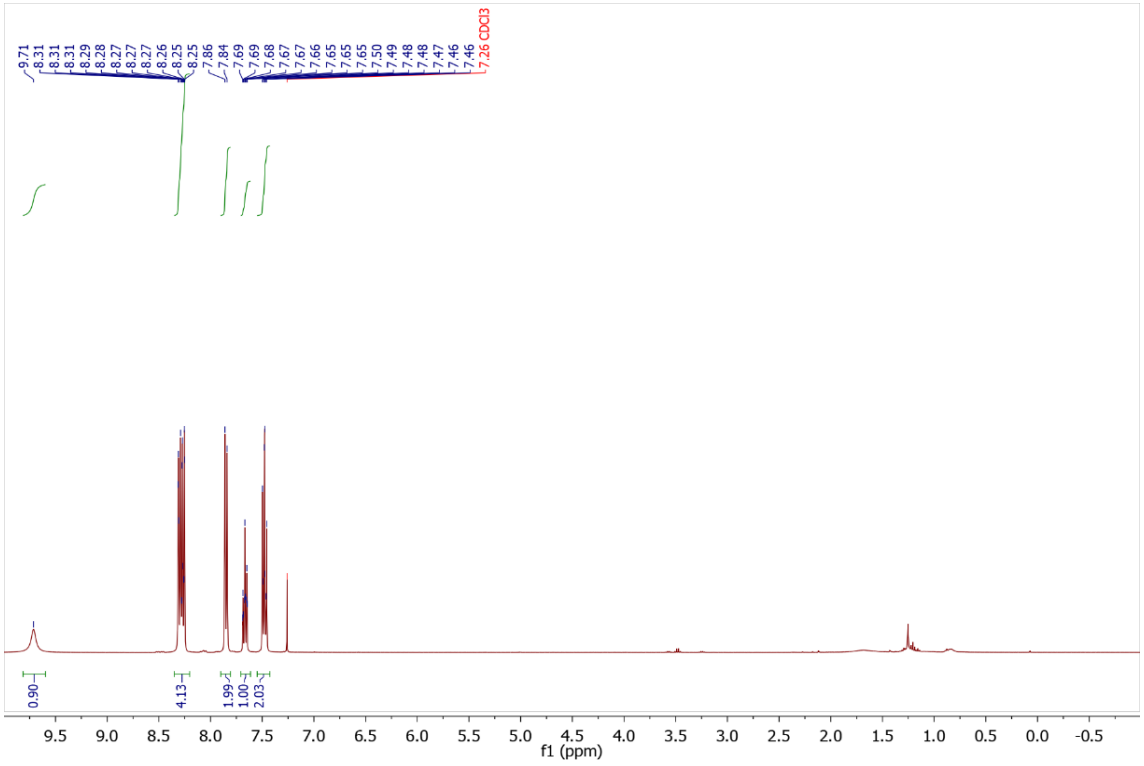
^{13}C NMR (101 MHz, d_6-acetone)



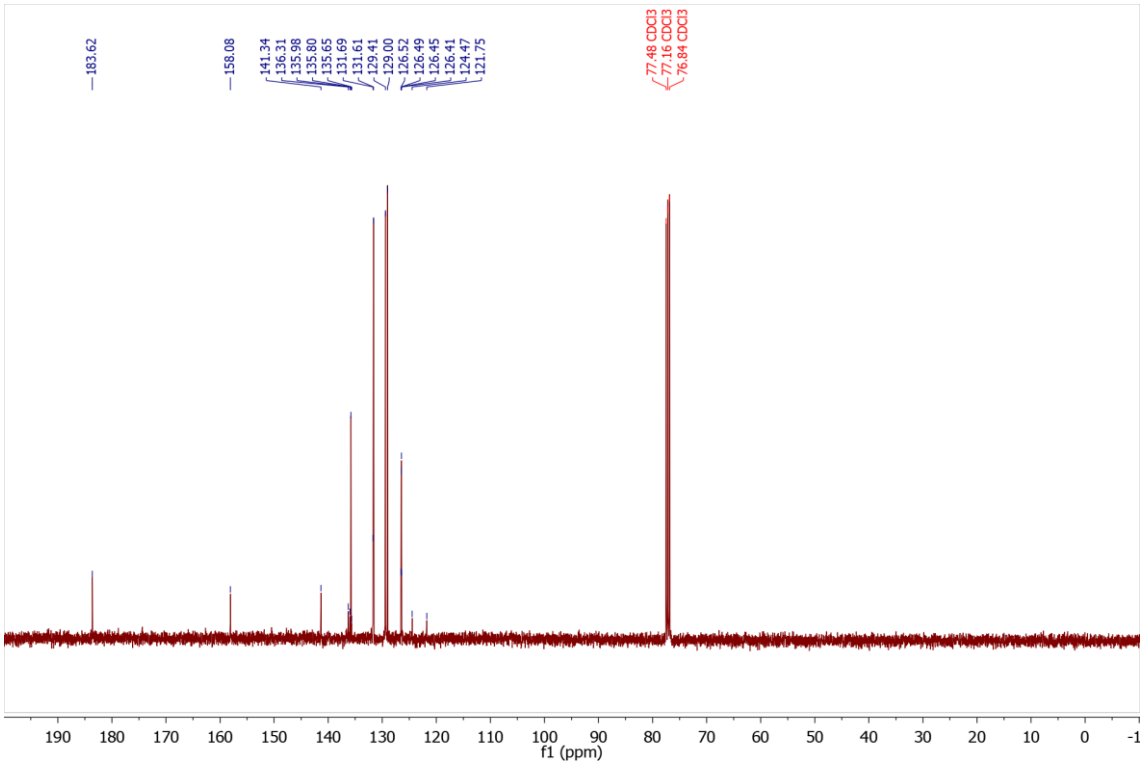
N-((4-(Trifluoromethyl)phenyl)sulfonyl)-2-oxo-2-phenylacetamide (1e)



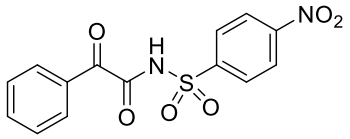
^{1}H NMR (400 MHz, $CDCl_3$)



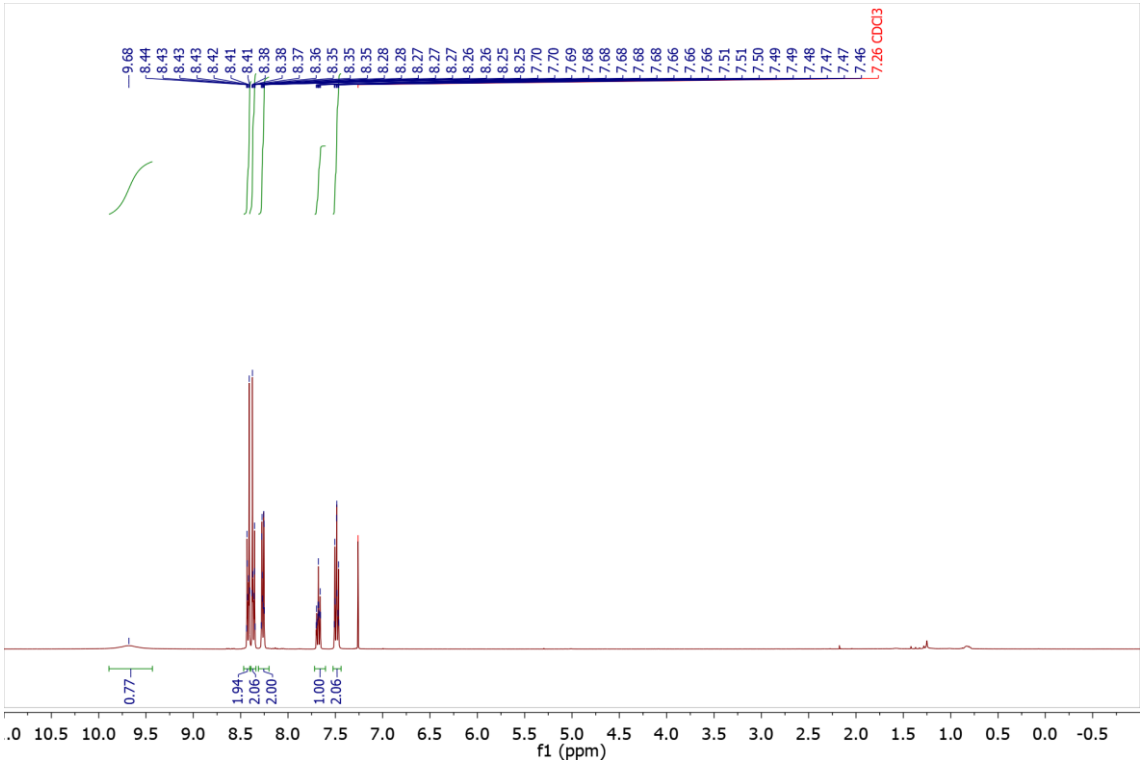
^{13}C NMR (101 MHz, $CDCl_3$)



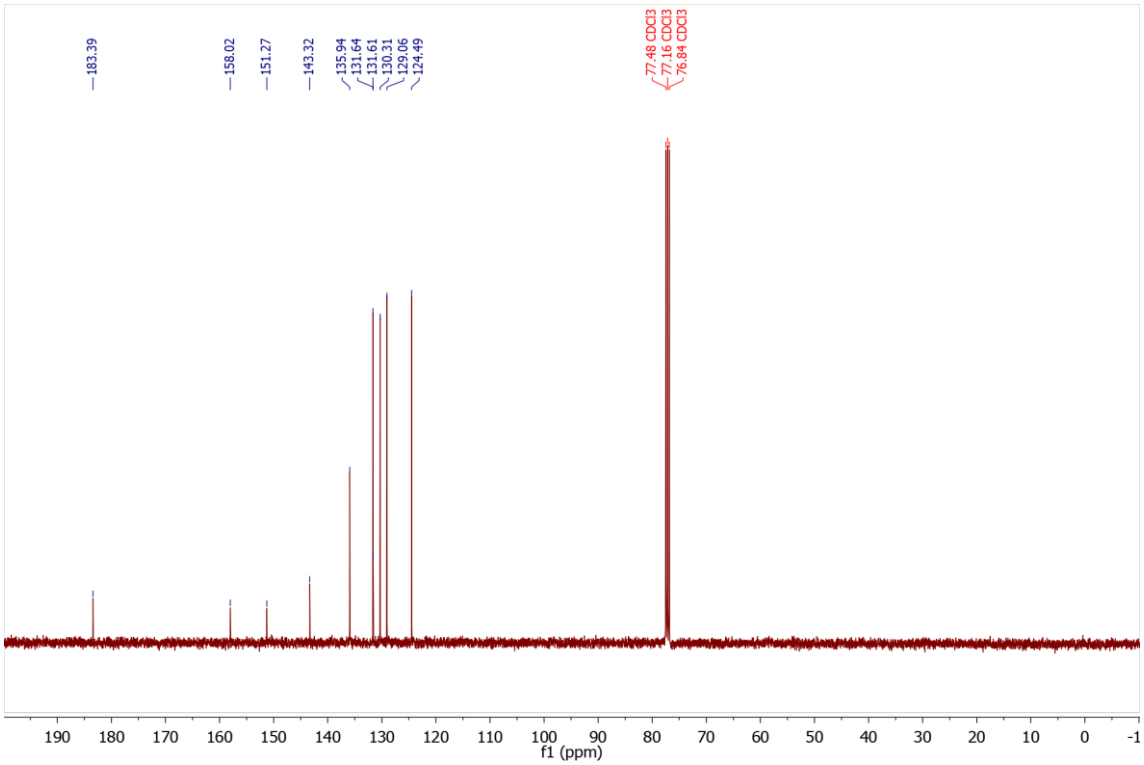
N-((4-Nitrophenyl)sulfonyl)-2-oxo-2-phenylacetamide (1f)



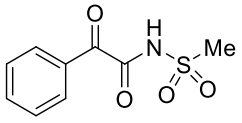
^{1}H NMR (400 MHz, $CDCl_3$)



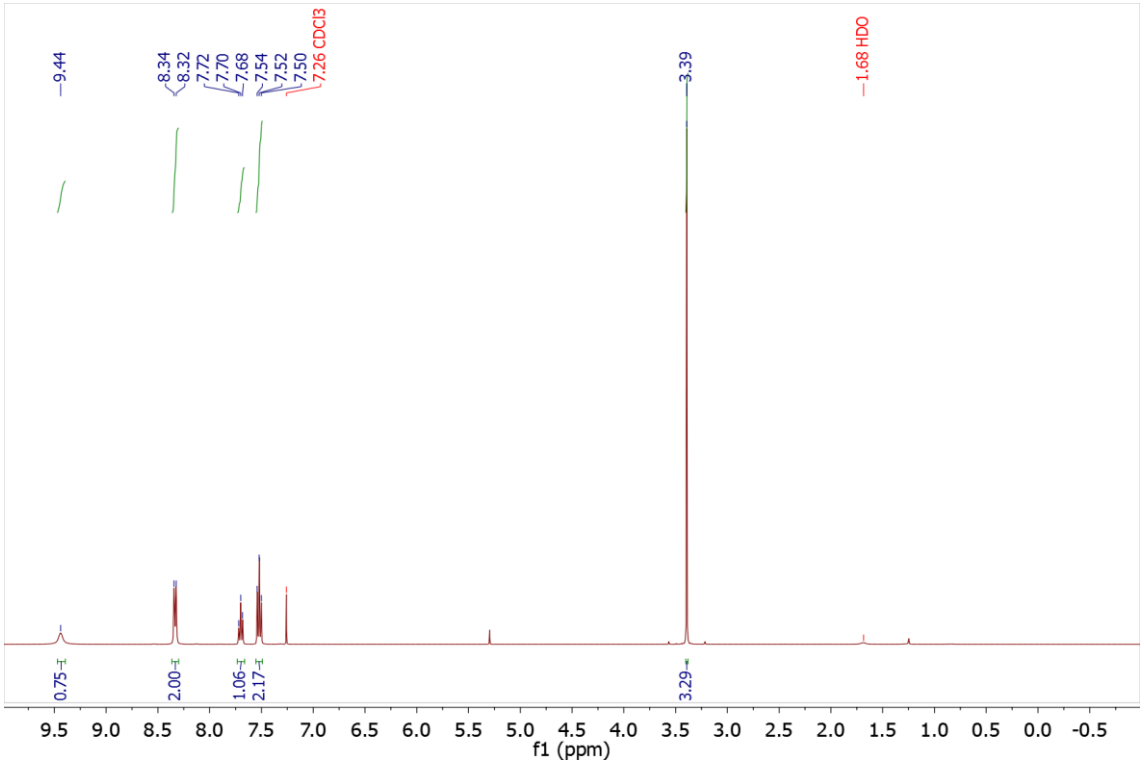
^{13}C NMR (101 MHz, $CDCl_3$)



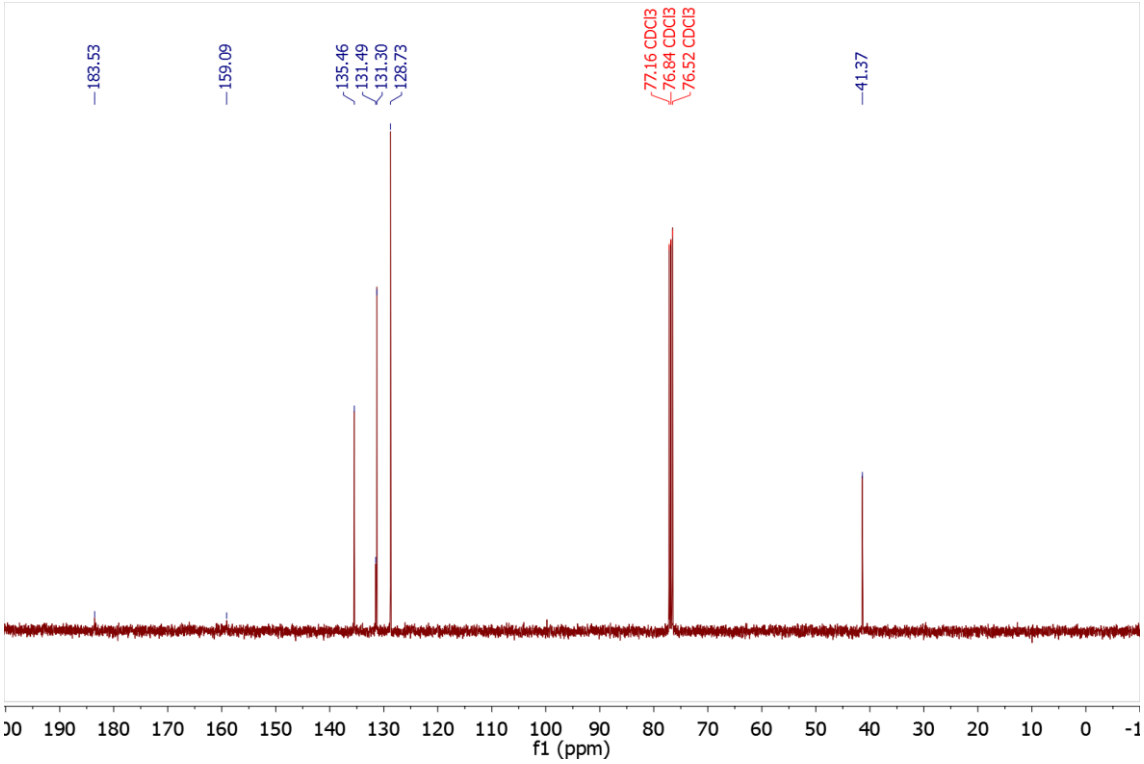
N-(Methylsulfonyl)-2-oxo-2-phenylacetamide (1g)



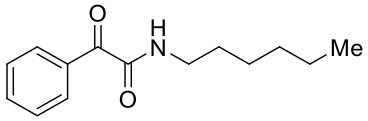
^{1}H NMR (400 MHz, $CDCl_3$)



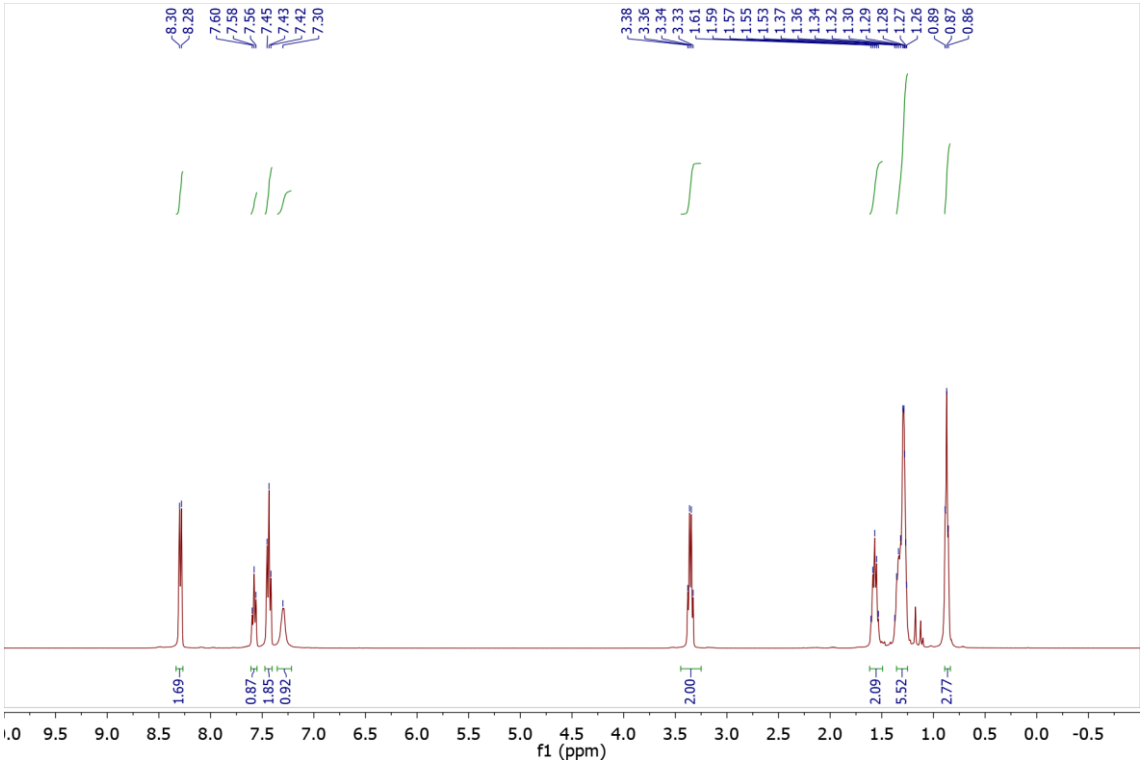
^{13}C NMR (101 MHz, $CDCl_3$)



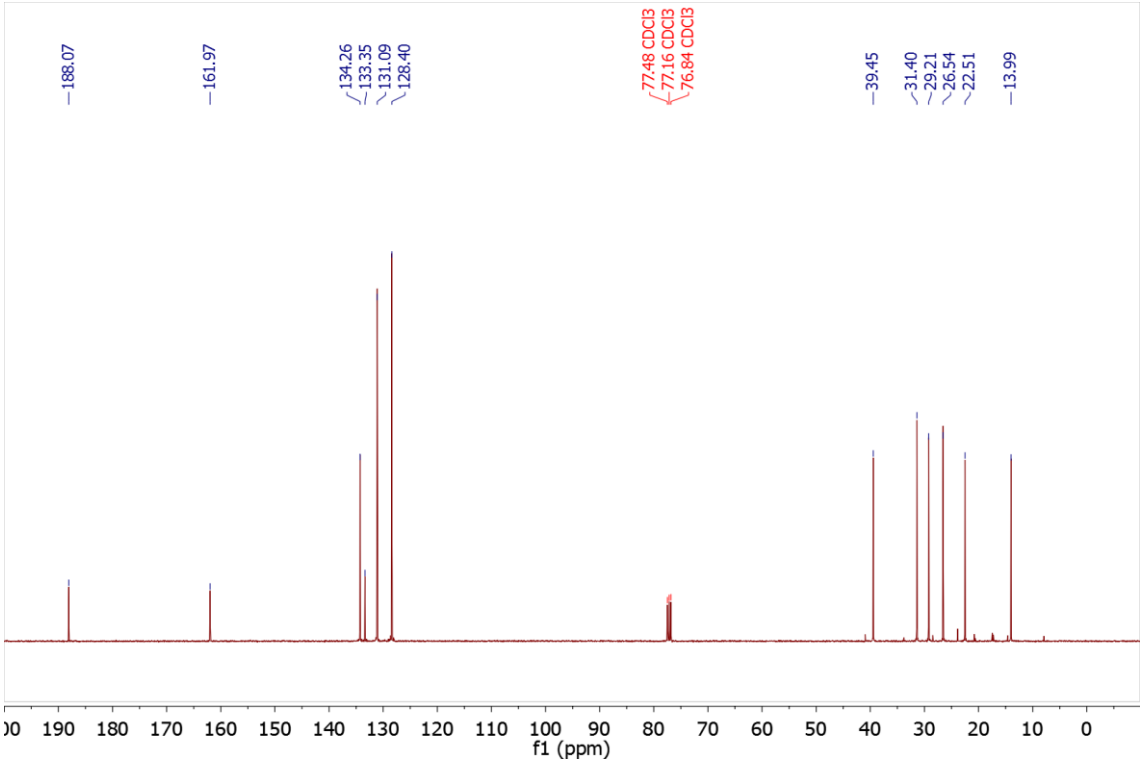
N-Hexyl-2-oxo-2-phenylacetamide (1h)



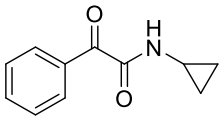
^{1}H NMR (400 MHz, $CDCl_3$)



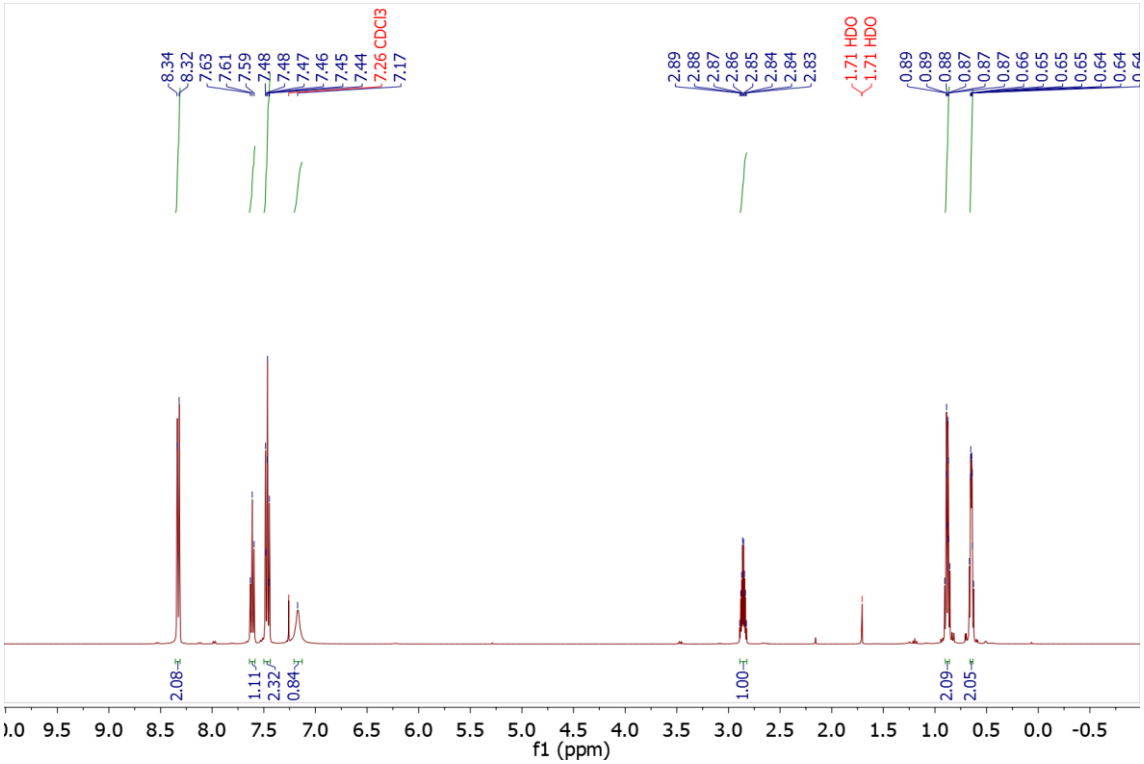
^{13}C NMR (101 MHz, $CDCl_3$)



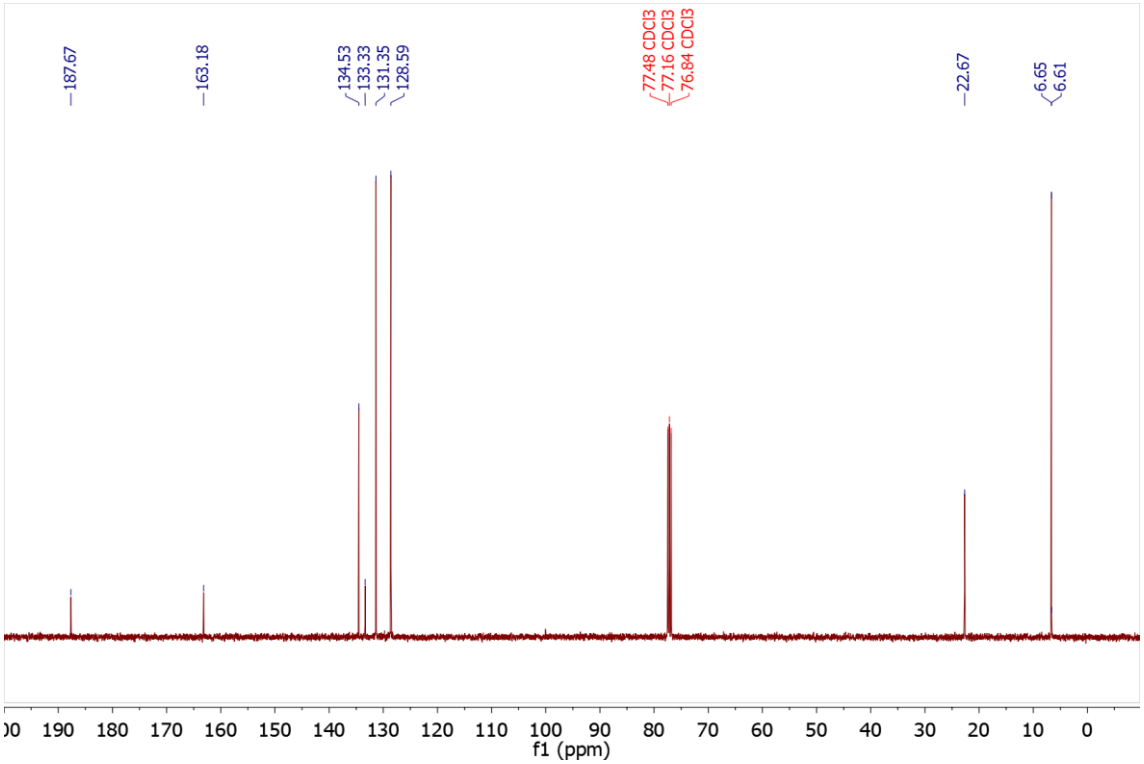
N-Cyclopropyl-2-oxo-2-phenylacetamide (1i)



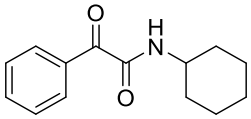
^{1}H NMR (400 MHz, $CDCl_3$)



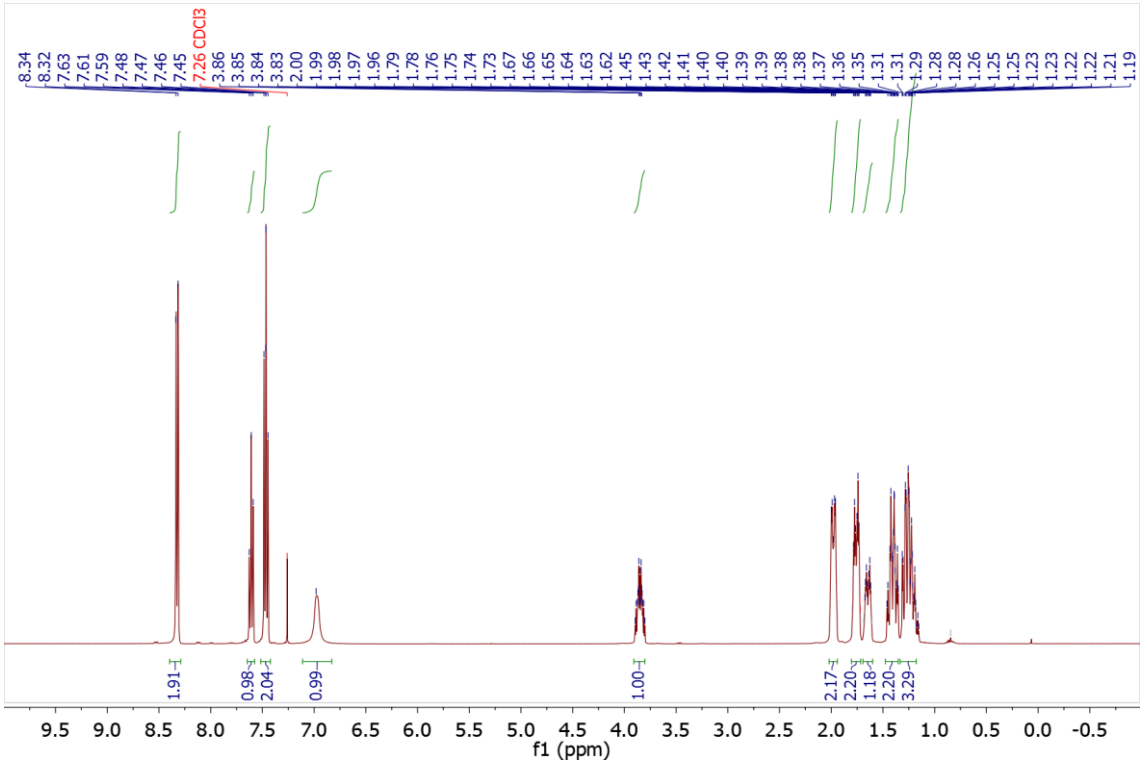
^{13}C NMR (101 MHz, $CDCl_3$)



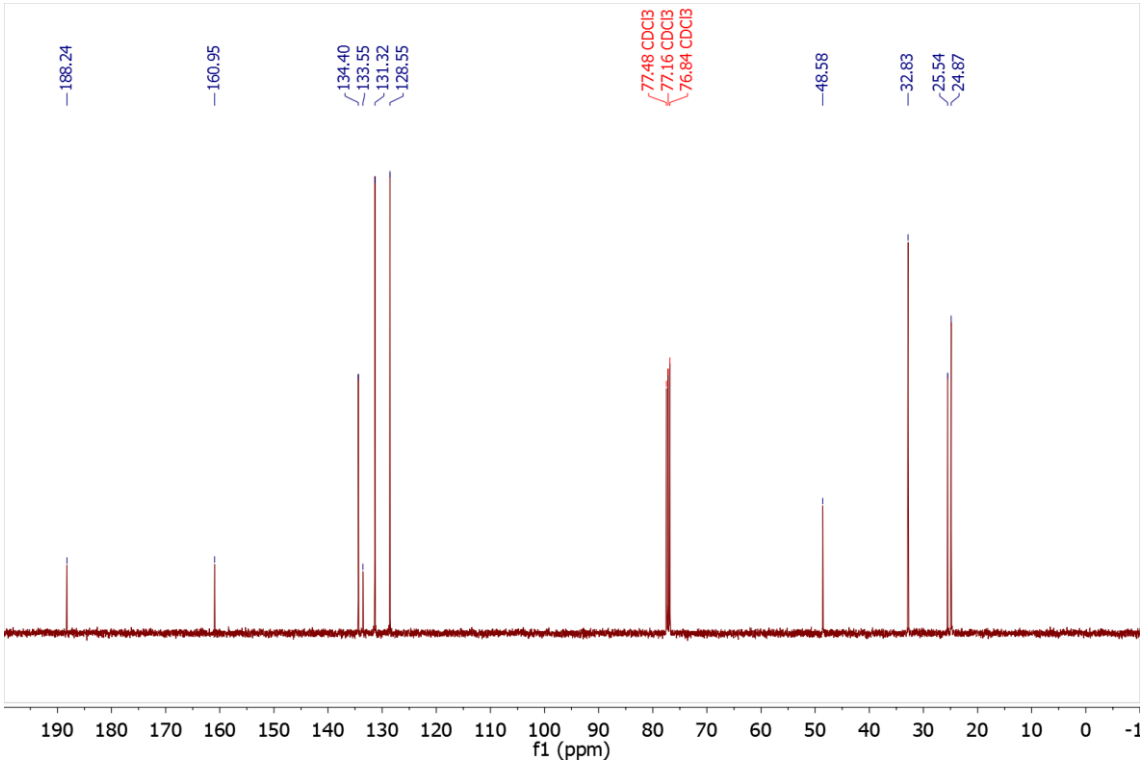
N-Cyclohexyl-2-oxo-2-phenylacetamide (1j)



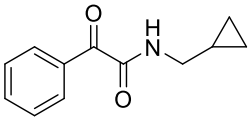
^{1}H NMR (400 MHz, $CDCl_3$)



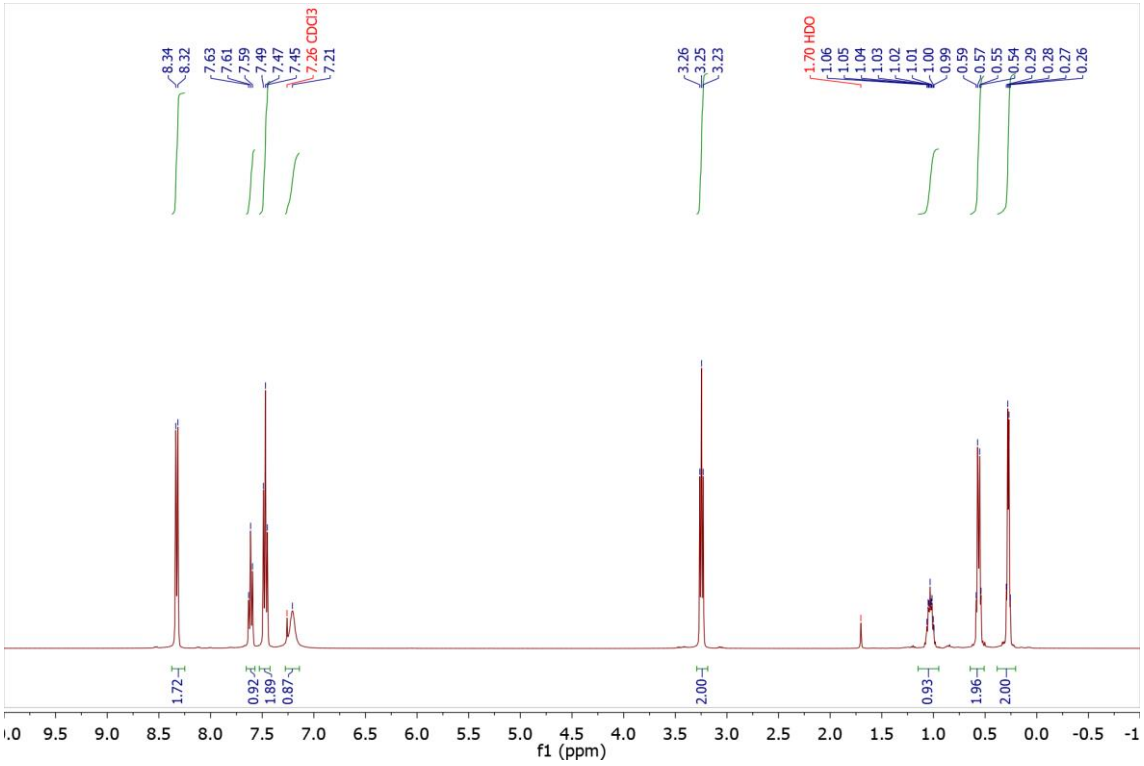
^{13}C NMR (101 MHz, $CDCl_3$)



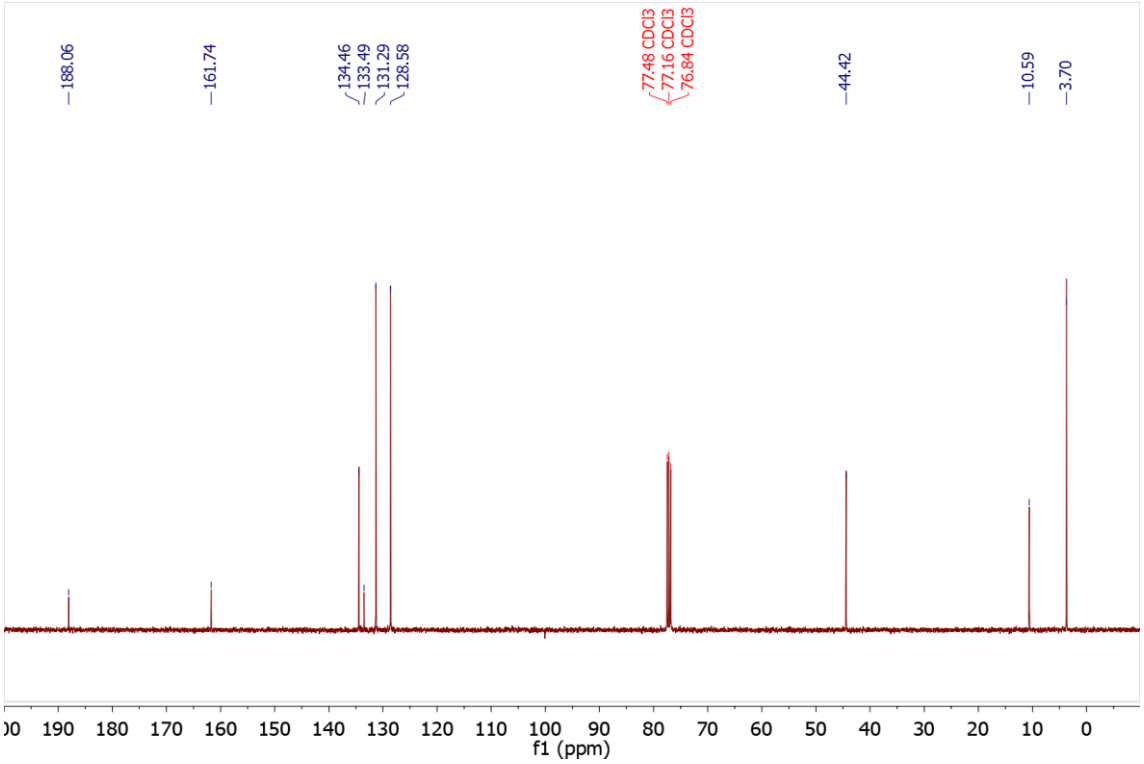
N-(Cyclopropylmethyl)-2-oxo-2-phenylacetamide (1k)



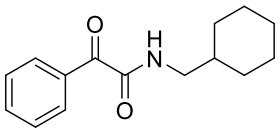
^{1}H NMR (400 MHz, $CDCl_3$)



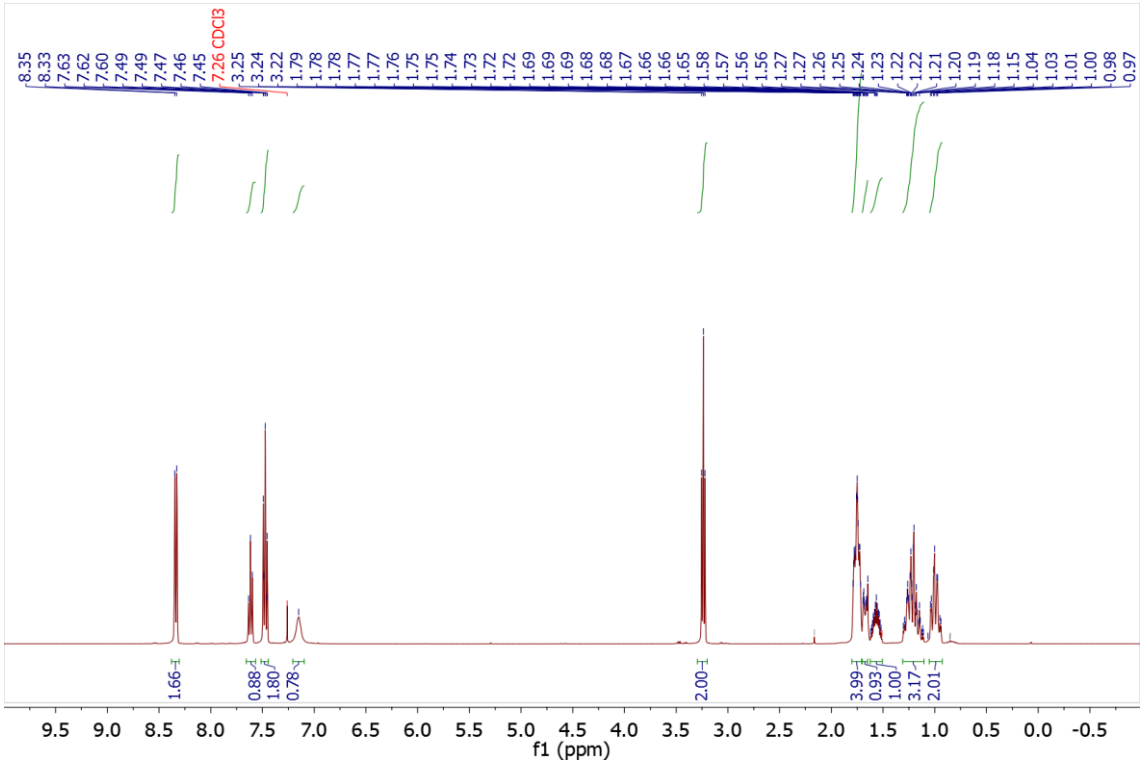
^{13}C NMR (101 MHz, $CDCl_3$)



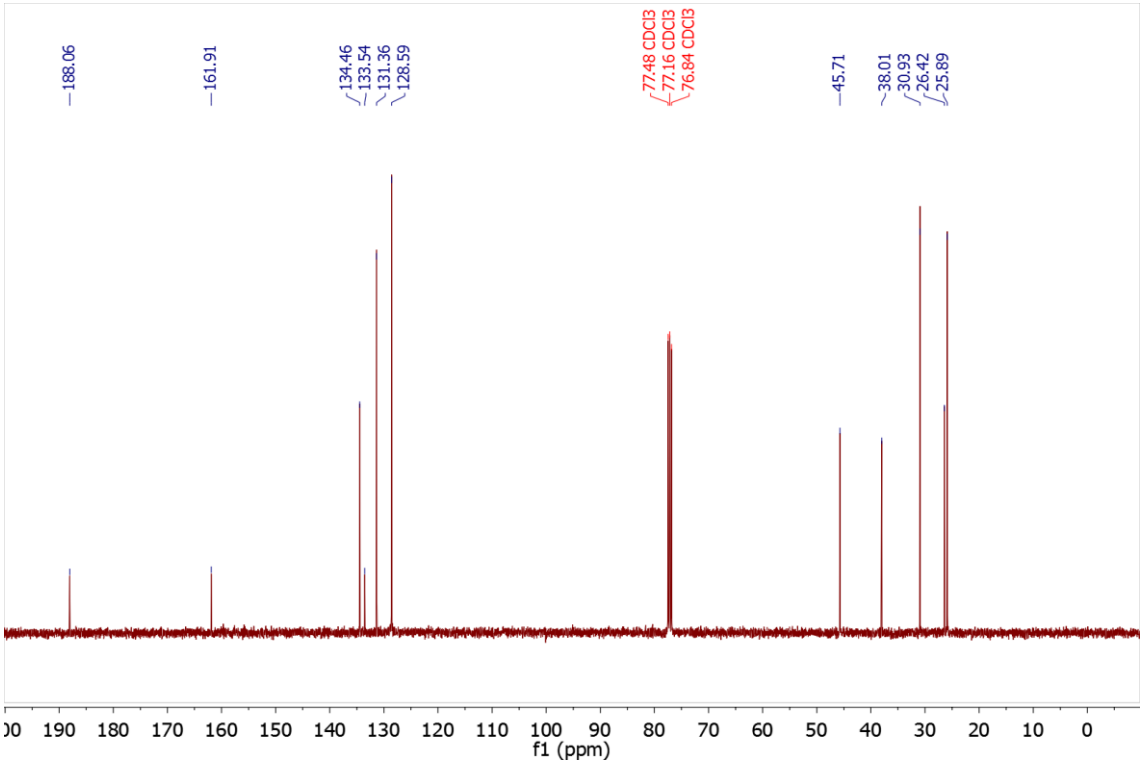
N-(Cyclohexylmethyl)-2-oxo-2-phenylacetamide (1l)



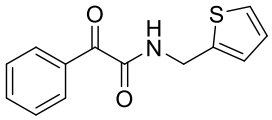
^{1}H NMR (400 MHz, $CDCl_3$)



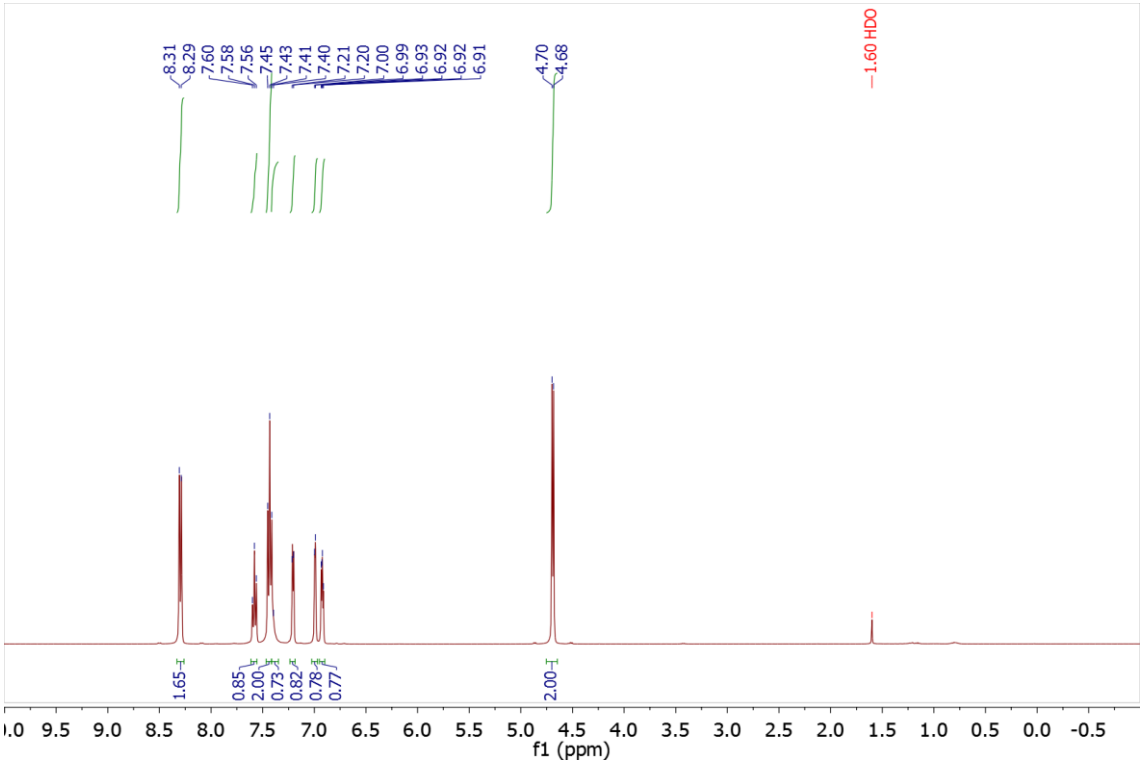
^{13}C NMR (101 MHz, $CDCl_3$)



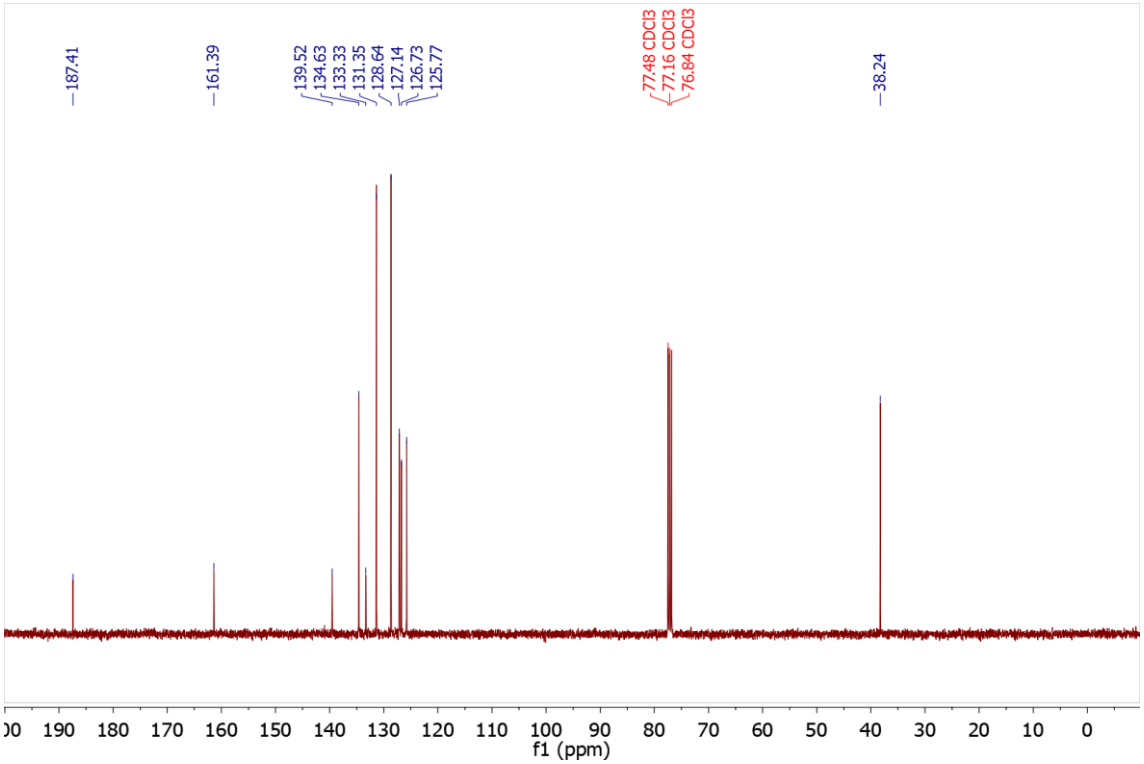
N-(Thiophen-2-ylmethyl)-2-oxo-2-phenylacetamide (1m)



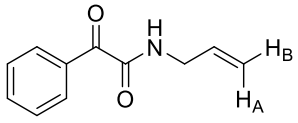
^{1}H NMR (400 MHz, $CDCl_3$)



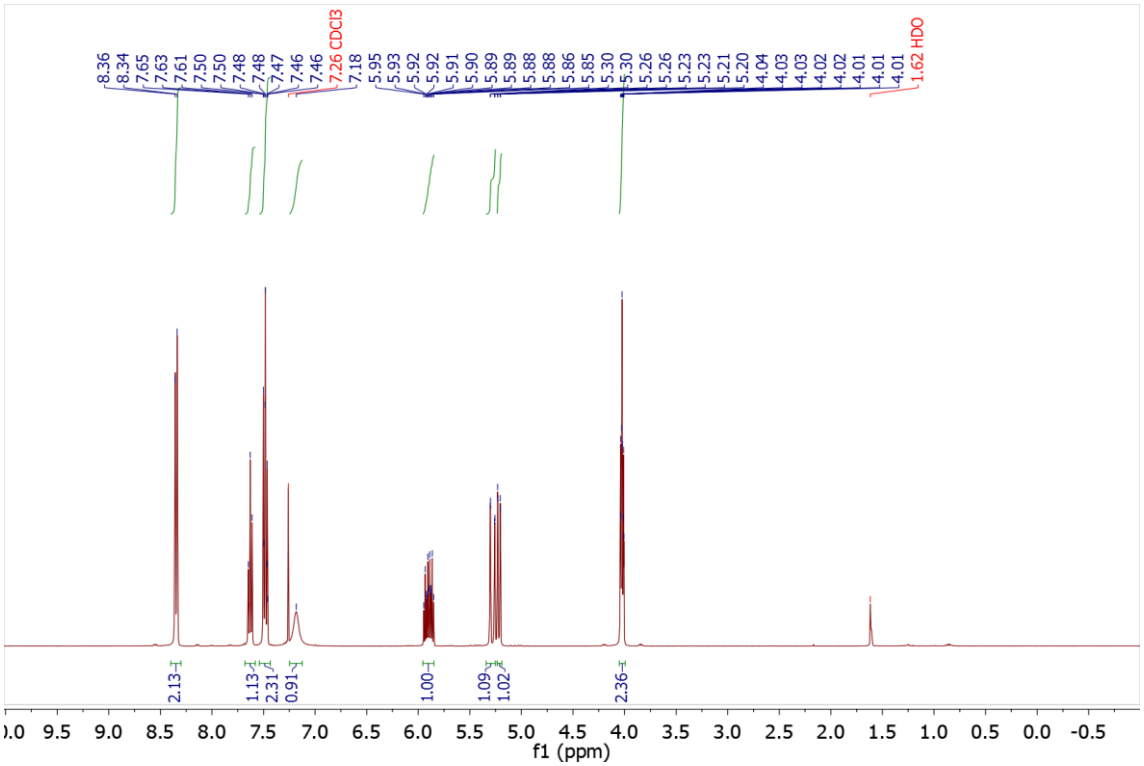
^{13}C NMR (101 MHz, $CDCl_3$)



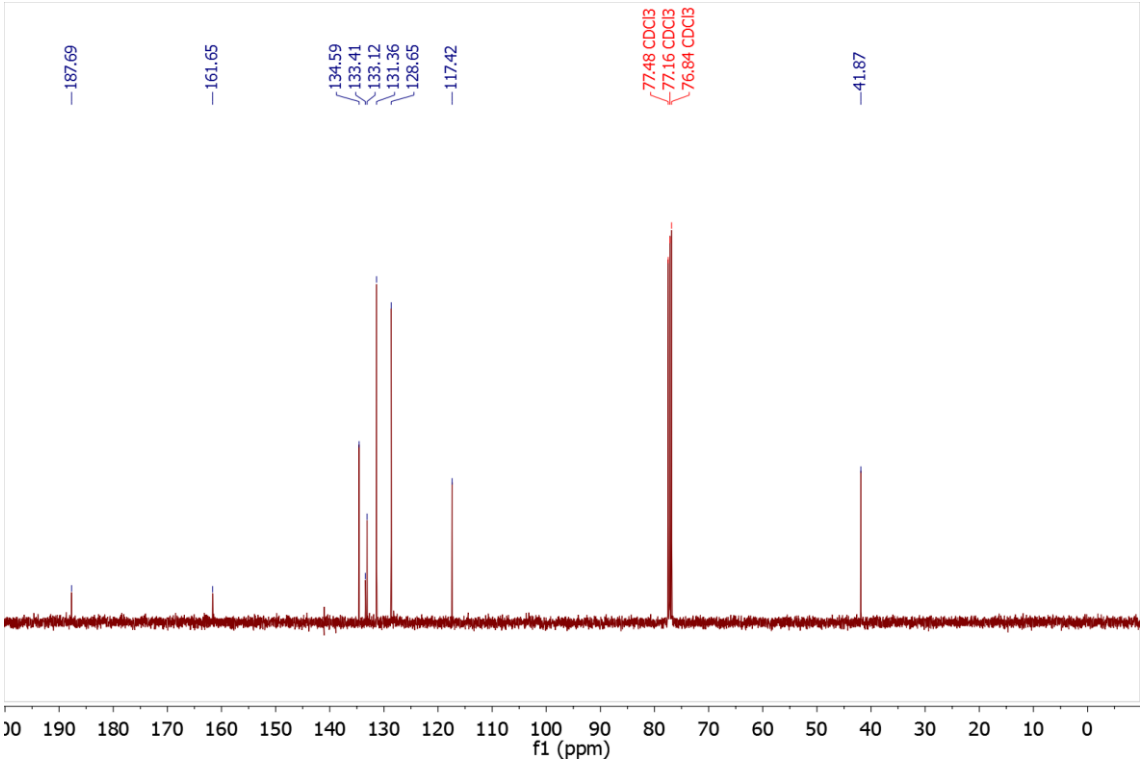
N-Allyl-2-oxo-2-phenylacetamide (1n)



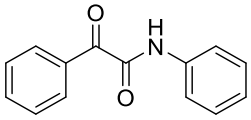
^{1}H NMR (400 MHz, $CDCl_3$)



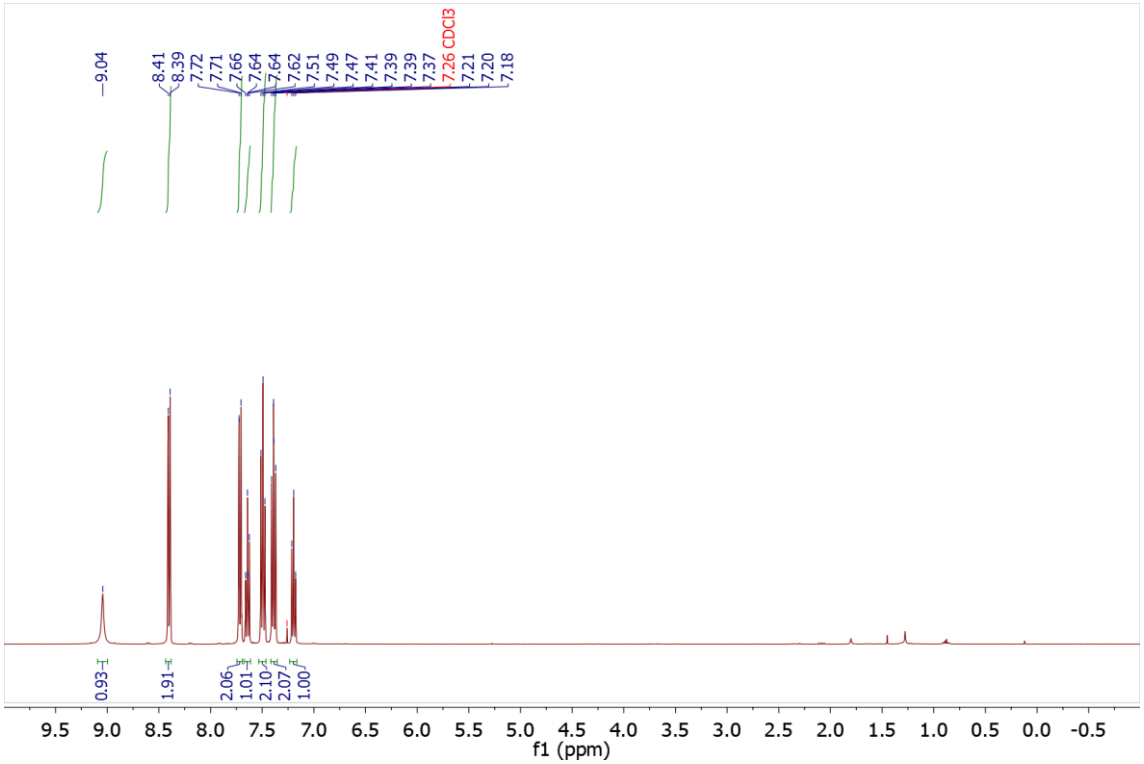
^{13}C NMR (101 MHz, $CDCl_3$)



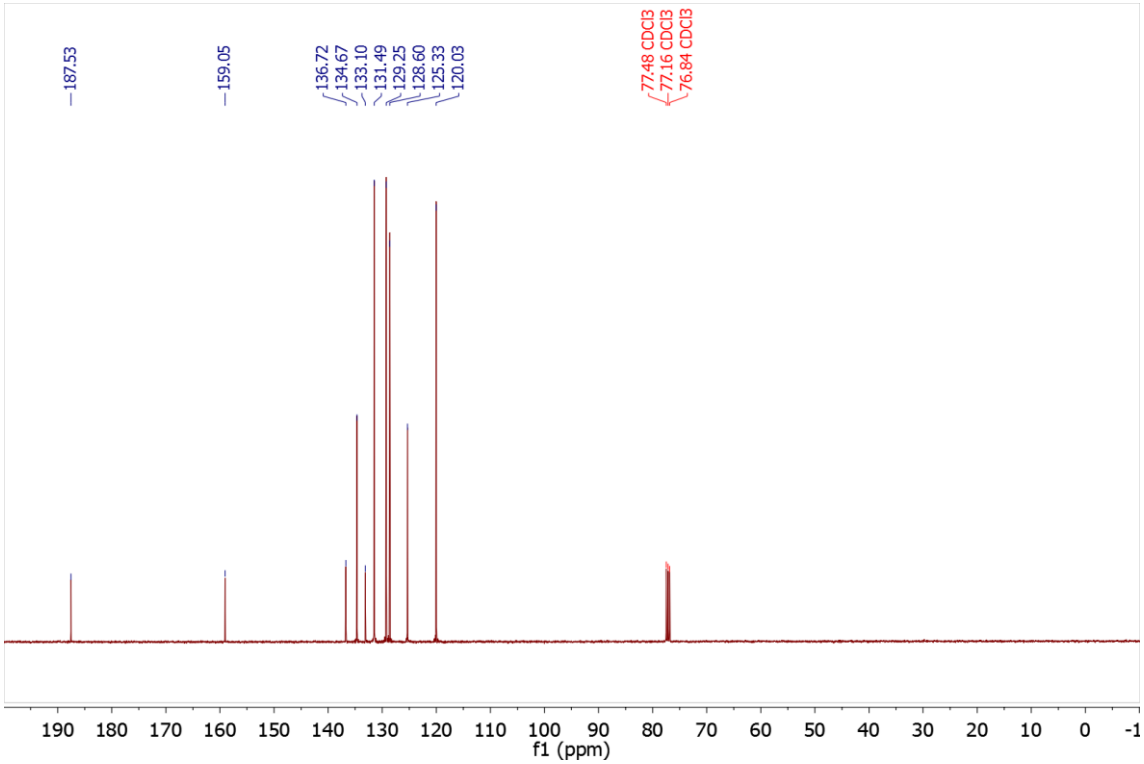
N-Phenyl-2-oxo-2-phenylacetamide (1o)



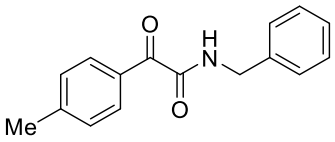
^{1}H NMR (400 MHz, $CDCl_3$)



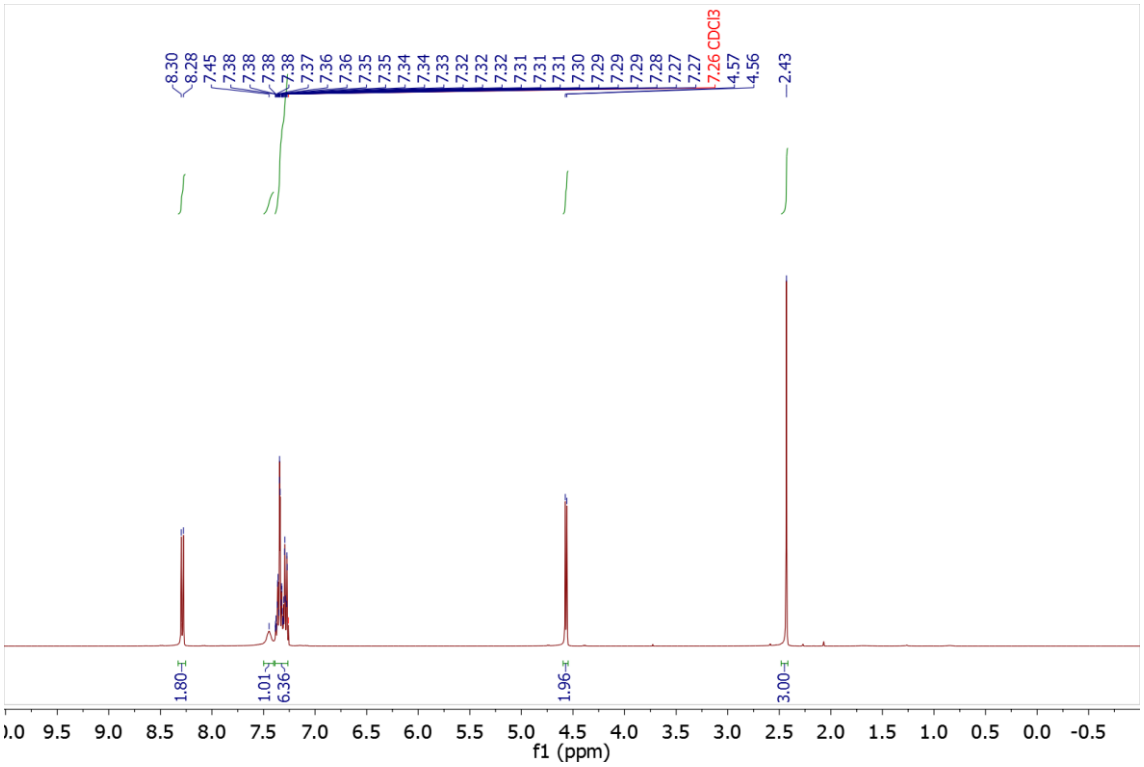
^{13}C NMR (101 MHz, $CDCl_3$)



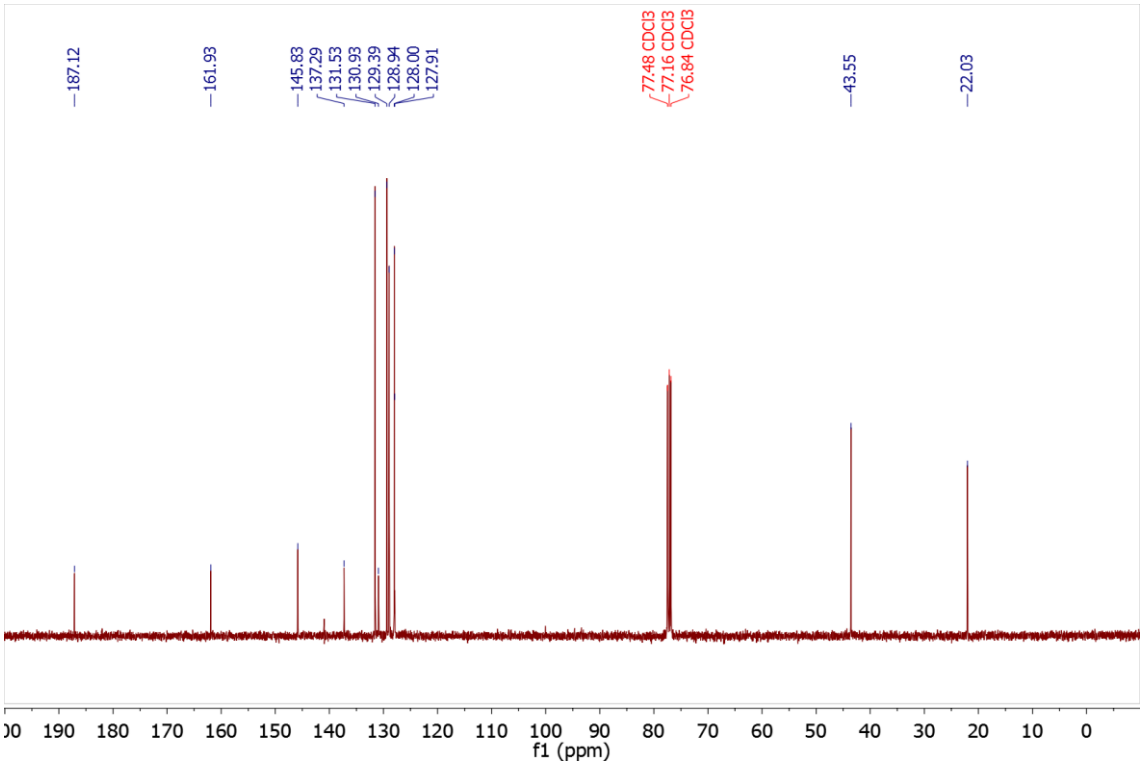
_N_-Benzyl-2-oxo-2-(_p_-tolyl)acetamide (1p)



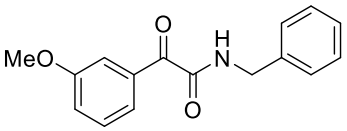
^{1}H NMR (400 MHz, $CDCl_3$)



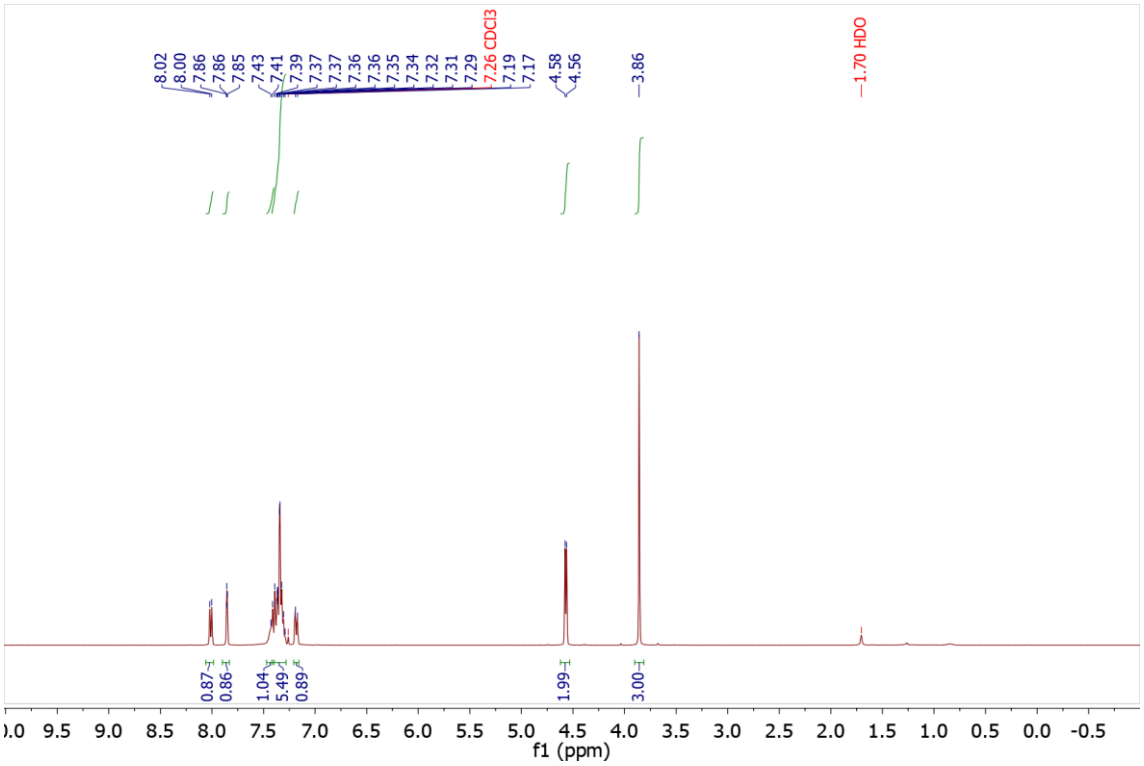
^{13}C NMR (101 MHz, $CDCl_3$)



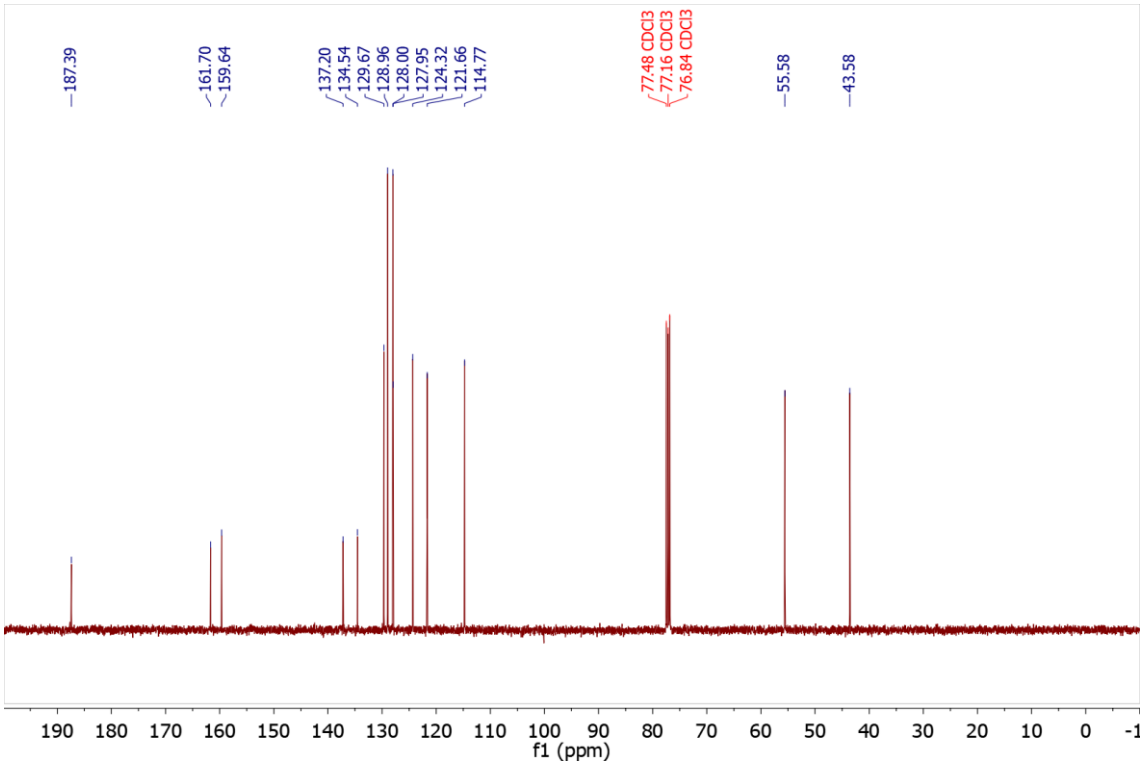
N-Benzyl-2-oxo-2-(3-methoxyphenyl)acetamide (1q)



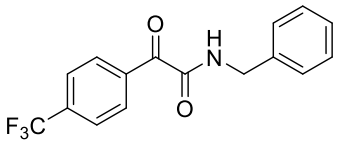
^{1}H NMR (400 MHz, $CDCl_3$)



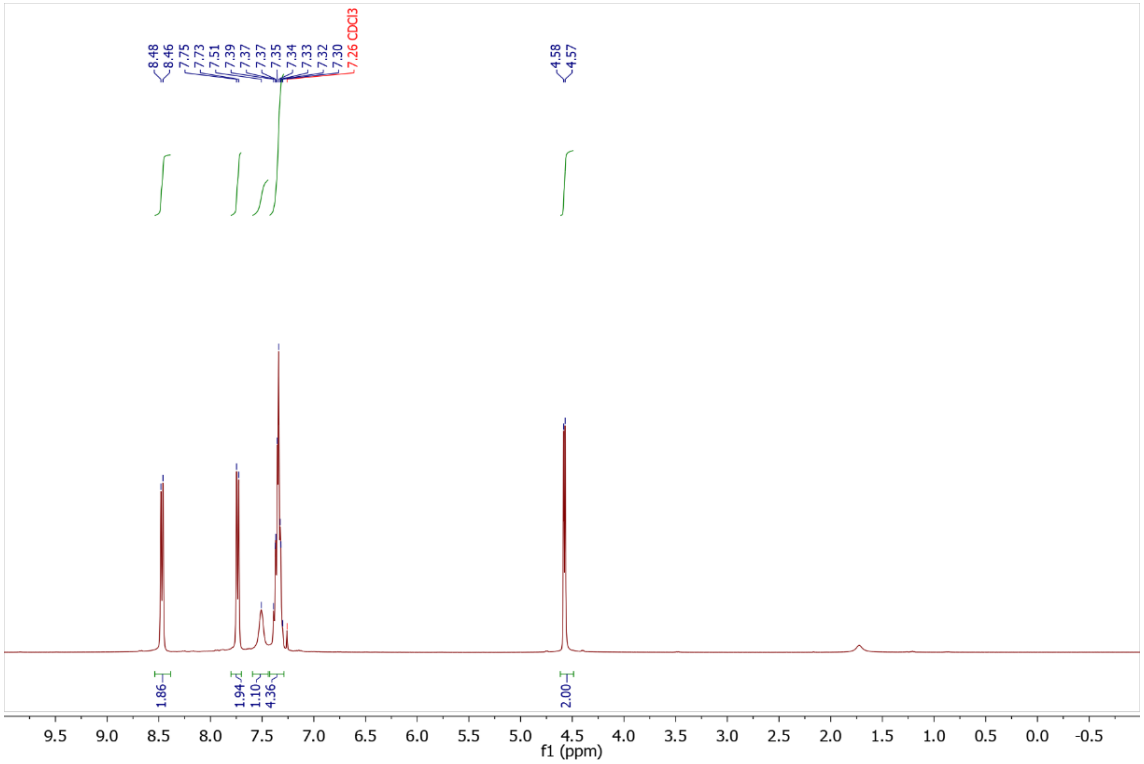
^{13}C NMR (101 MHz, $CDCl_3$)



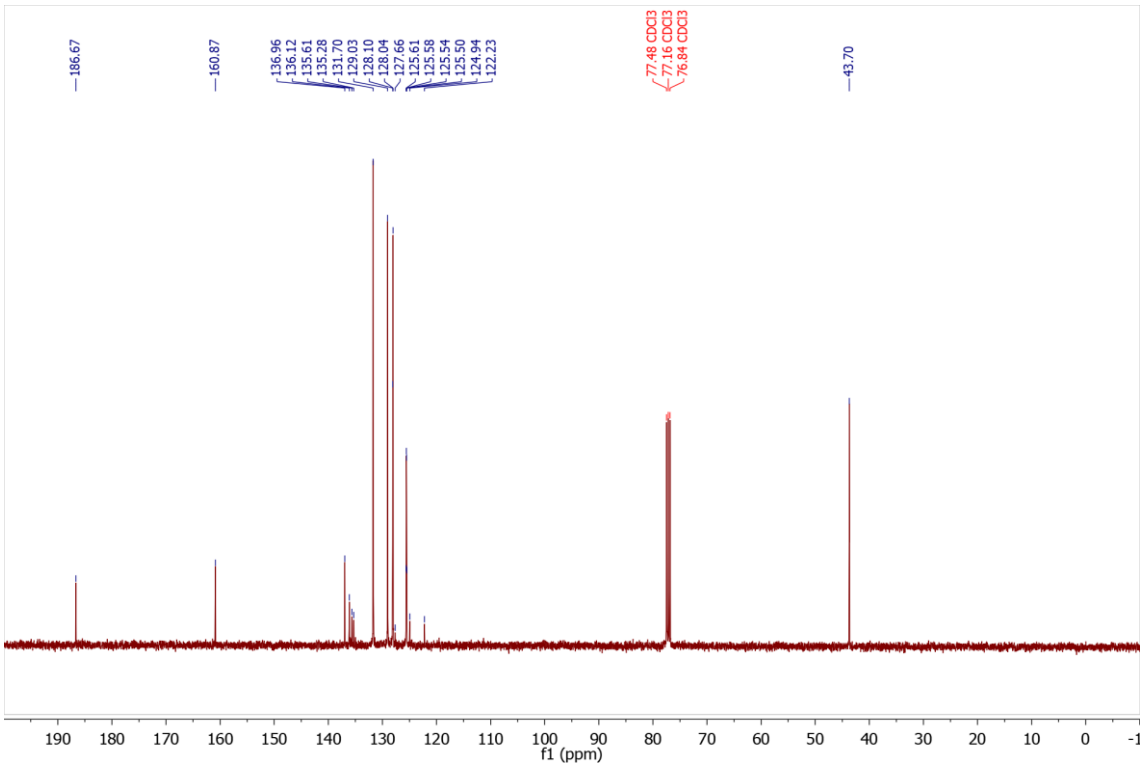
N-Benzyl-2-oxo-2-(4-(trifluoromethyl)phenyl)acetamide (1r)



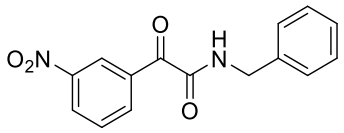
^{1}H NMR (400 MHz, $CDCl_3$)



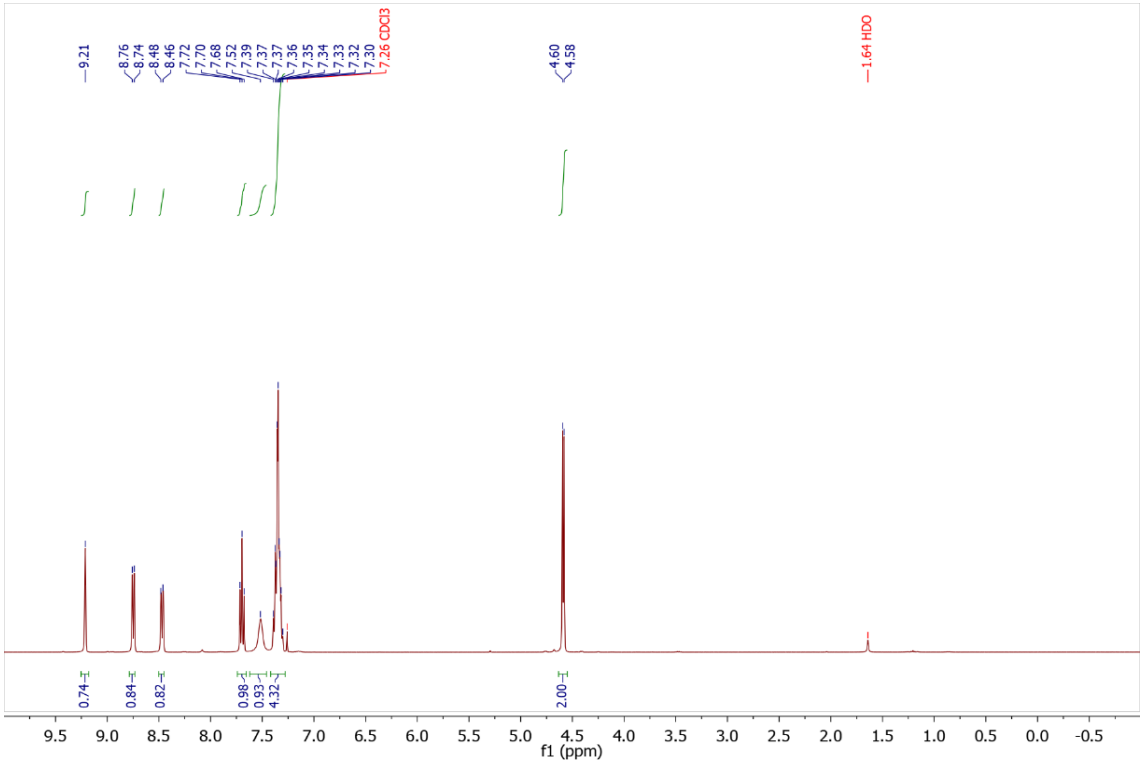
^{13}C NMR (101 MHz, $CDCl_3$)



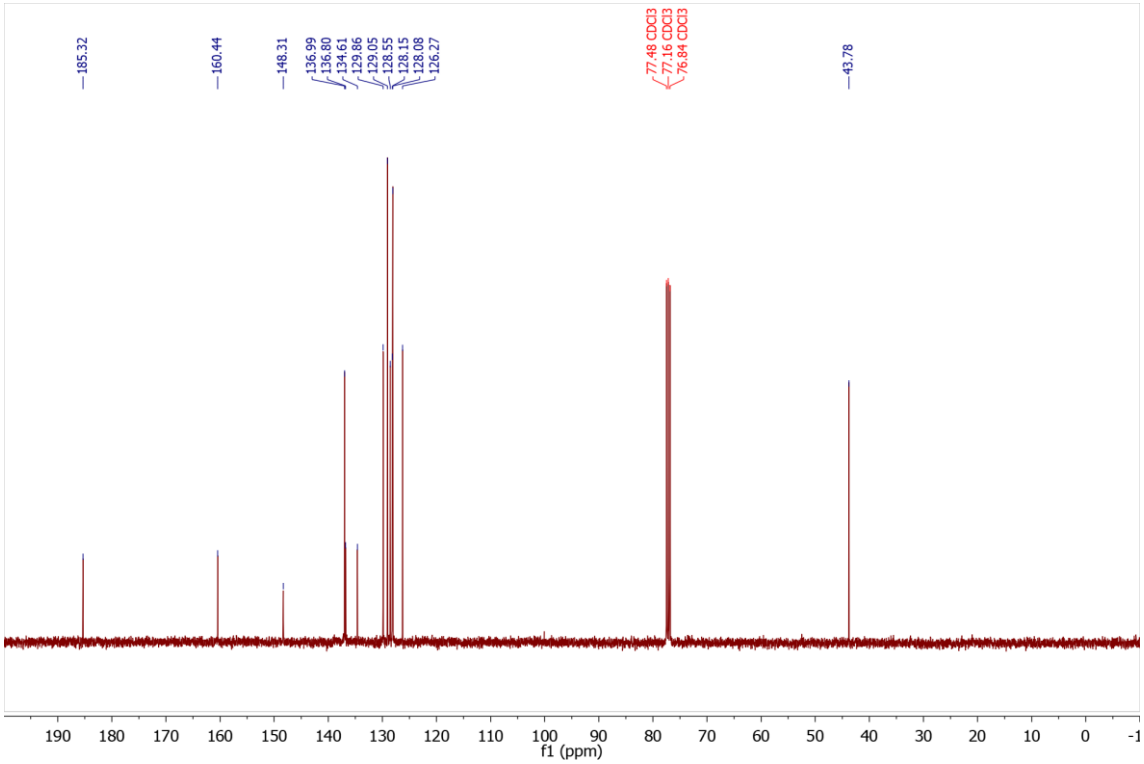
N-Benzyl-2-oxo-2-(3-nitrophenyl)acetamide (1s)



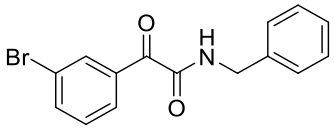
^{1}H NMR (400 MHz, $CDCl_3$)



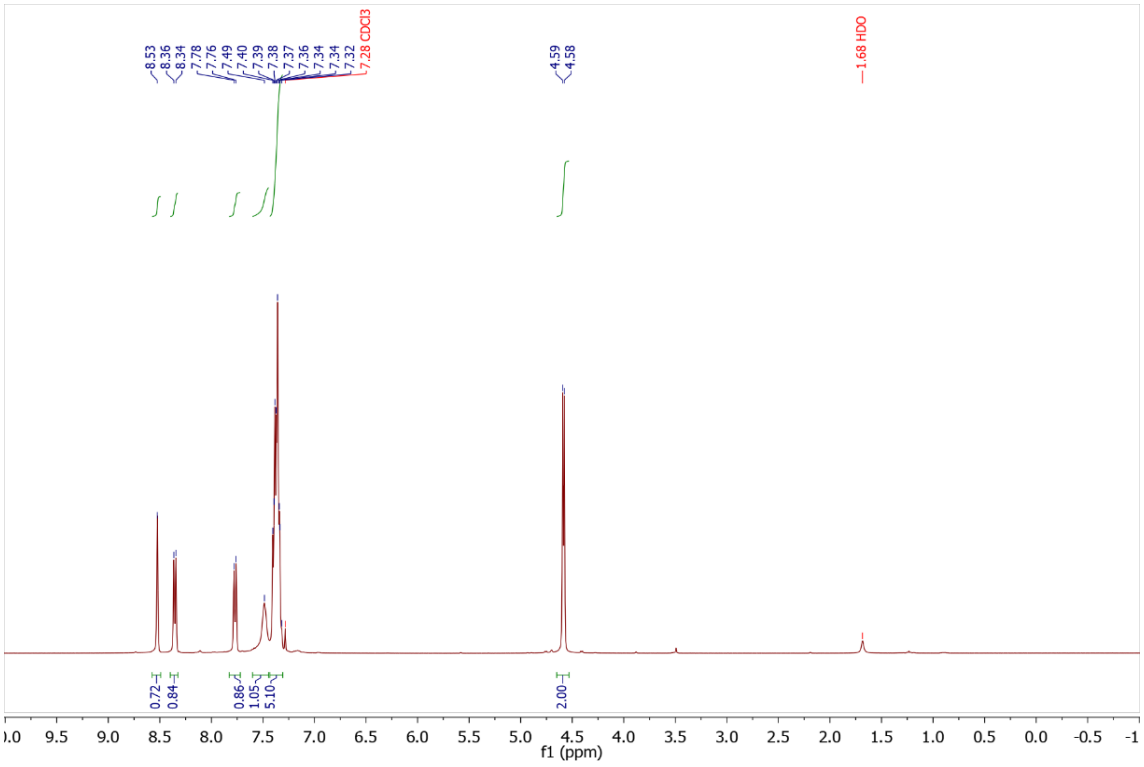
^{13}C NMR (101 MHz, $CDCl_3$)



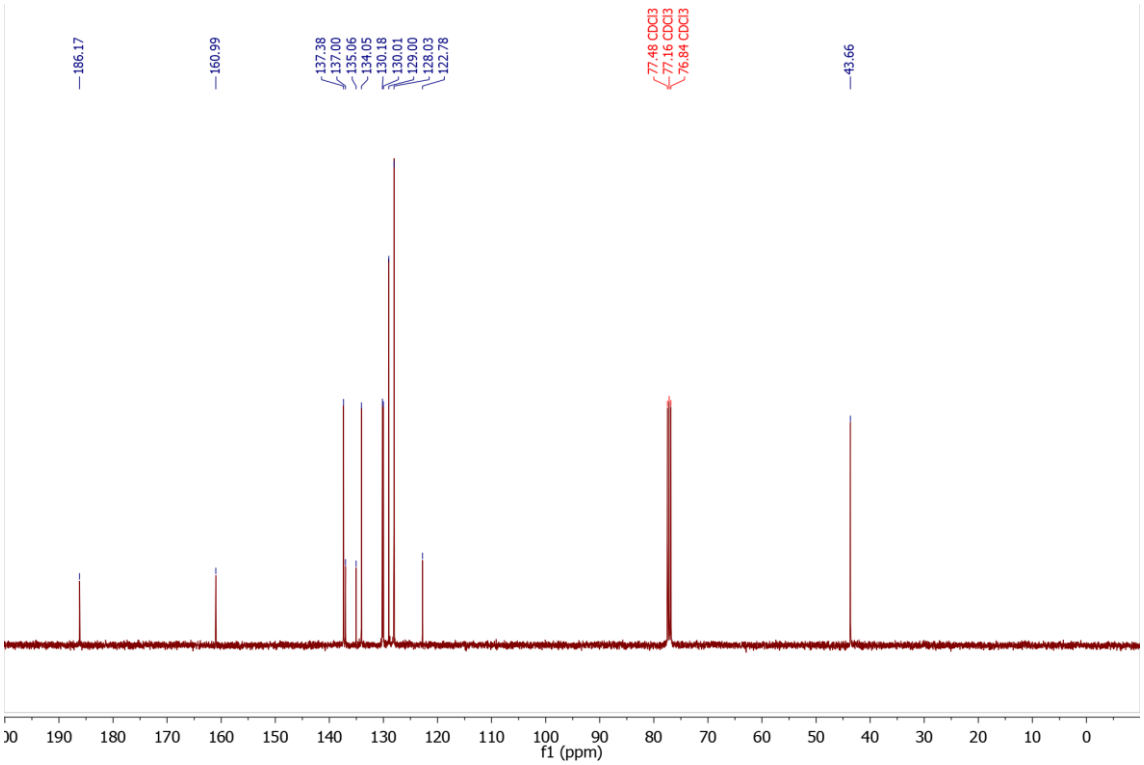
N-Benzyl-2-oxo-2-(3-bromophenyl)acetamide (1t)



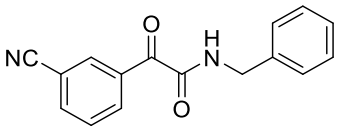
^{1}H NMR (400 MHz, $CDCl_3$)



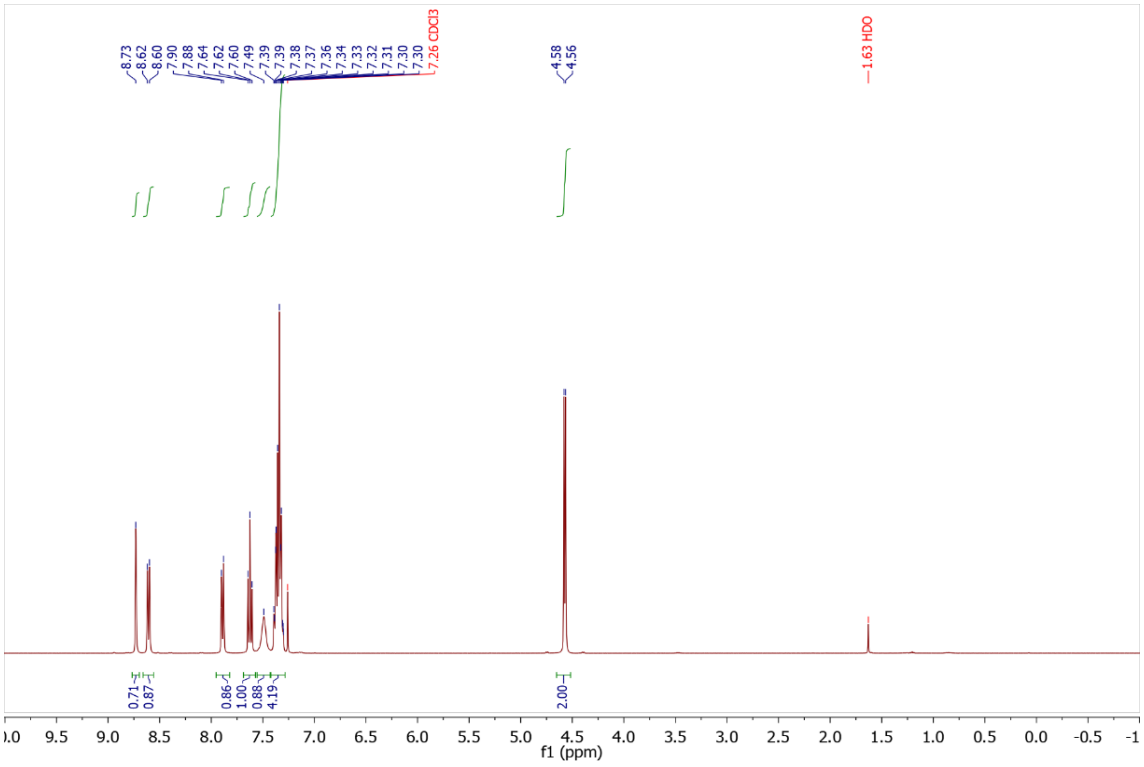
^{13}C NMR (101 MHz, $CDCl_3$)



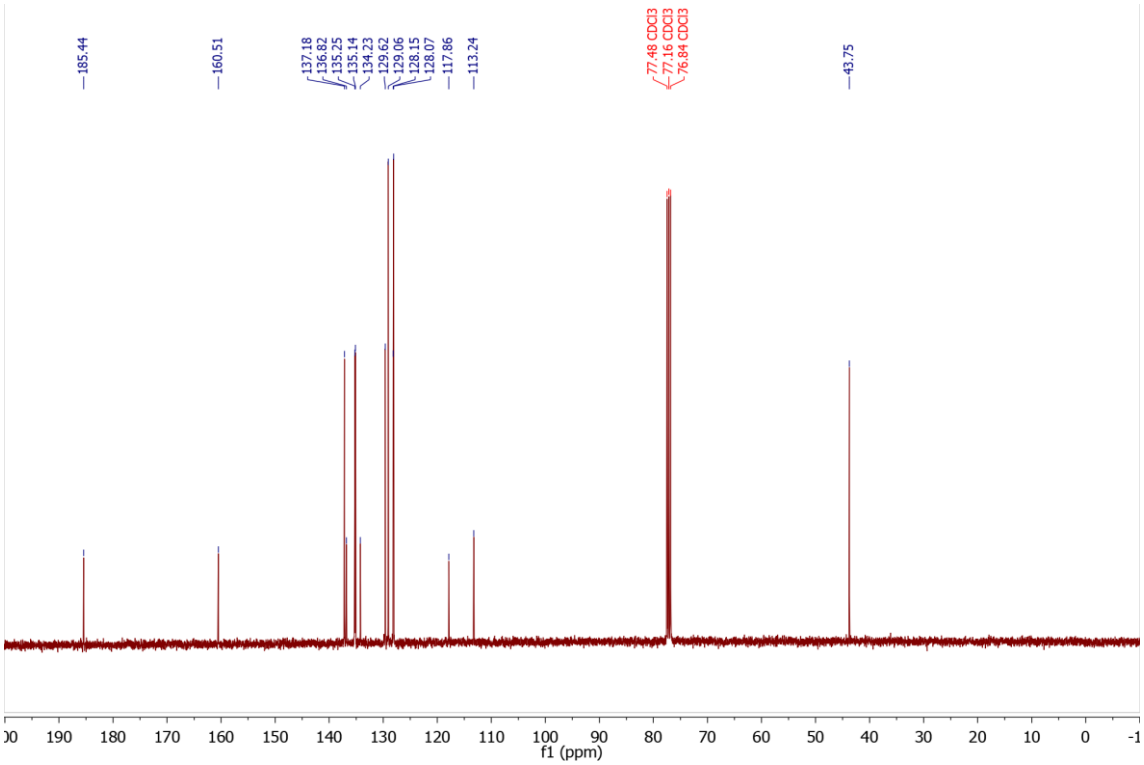
N-Benzyl-2-oxo-2-(3-cyanophenyl)acetamide (1u)



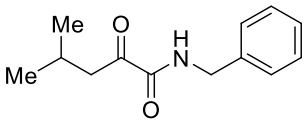
^{1}H NMR (400 MHz, $CDCl_3$)



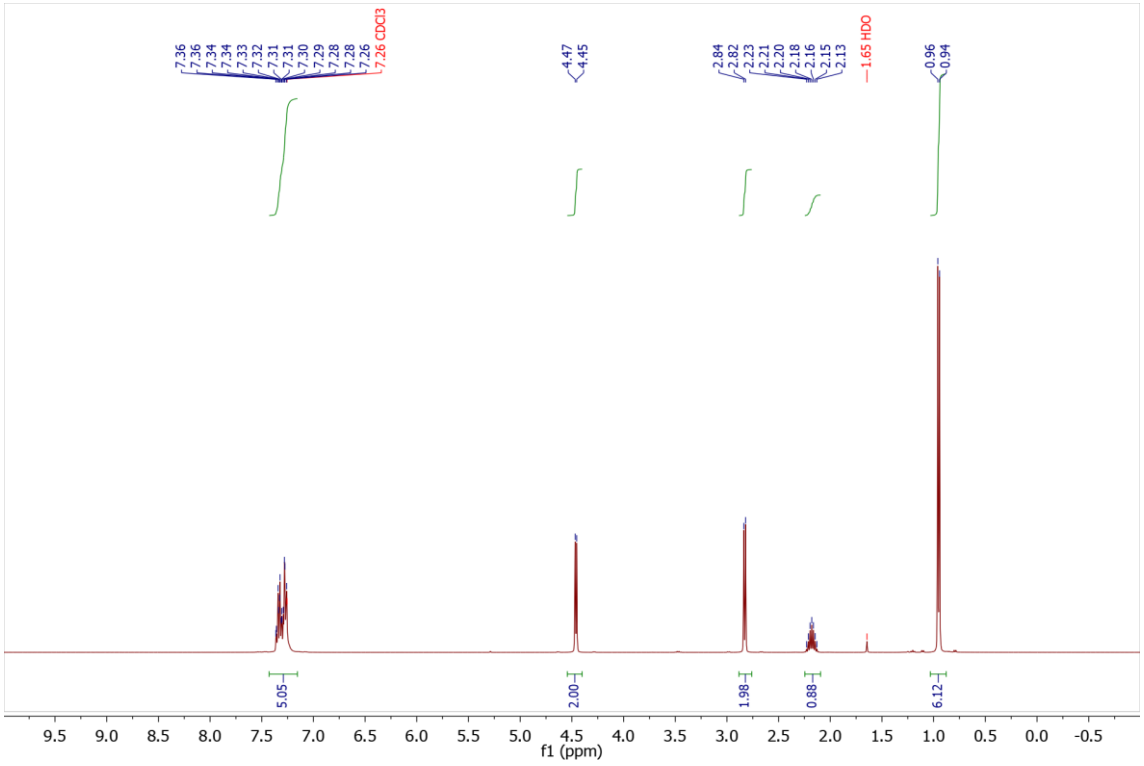
^{13}C NMR (101 MHz, $CDCl_3$)



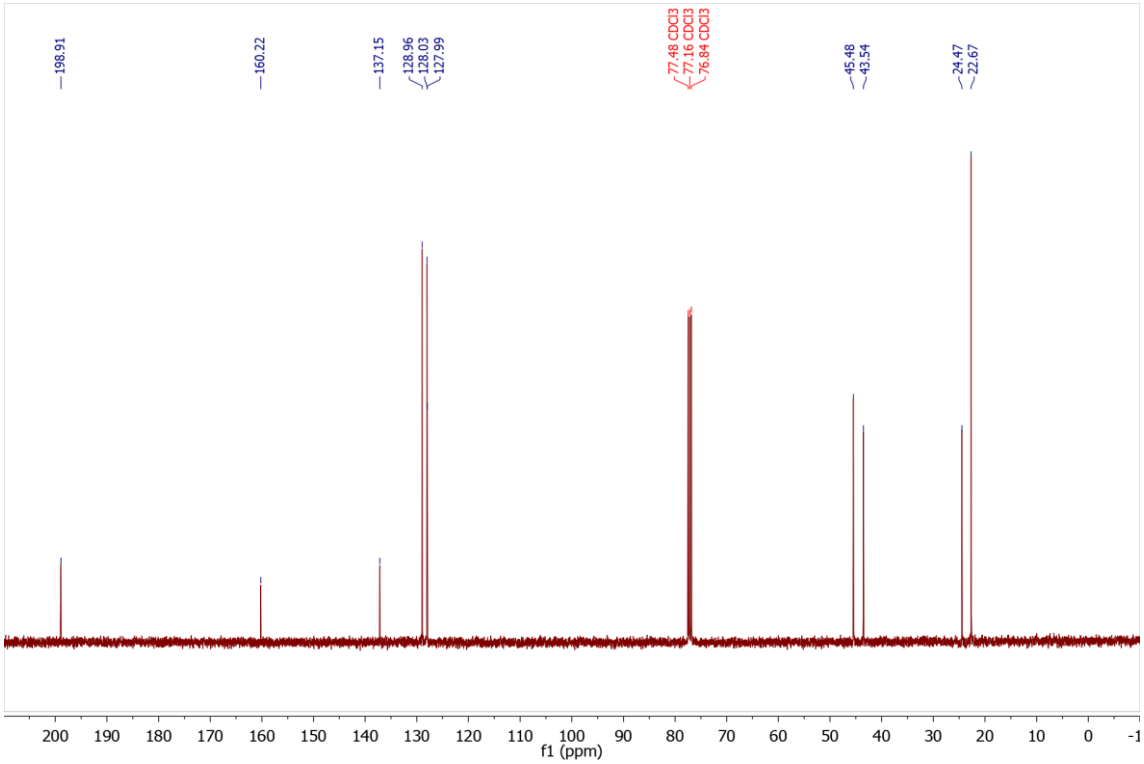
N-Benzyl-4-methyl-2-oxopentanamide (1v)



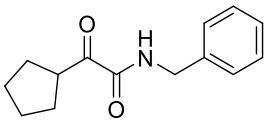
^{1}H NMR (400 MHz, $CDCl_3$)



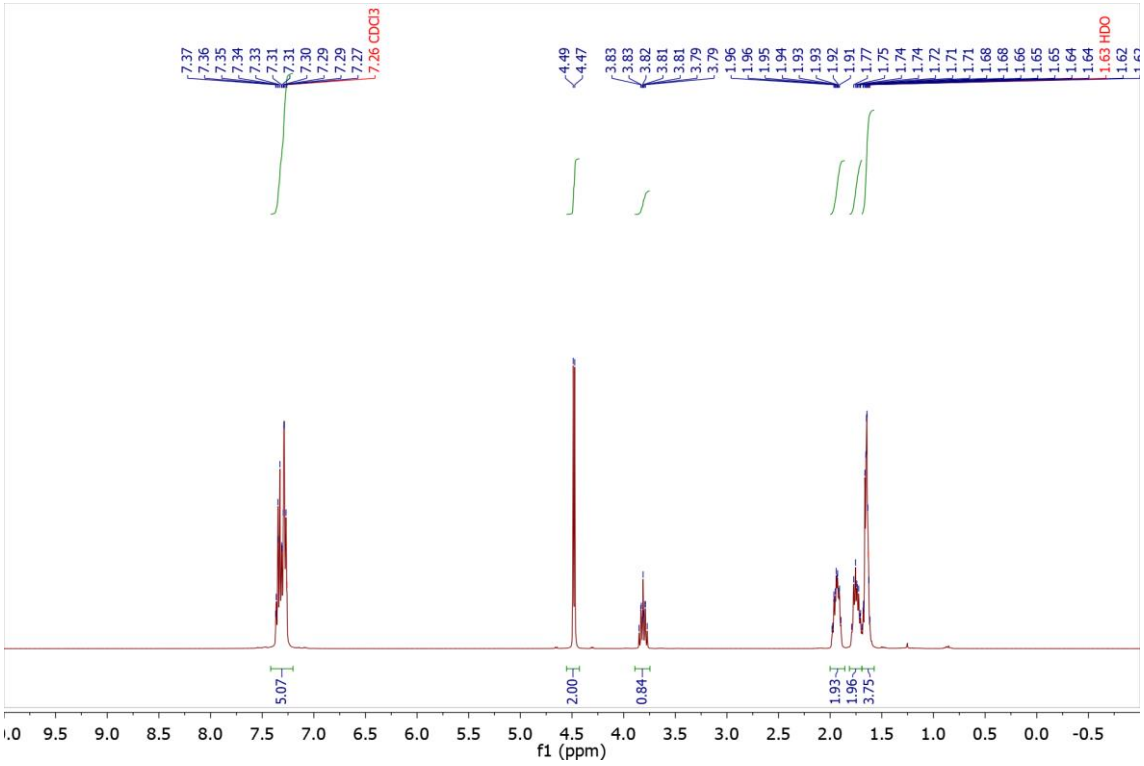
^{13}C NMR (101 MHz, $CDCl_3$)



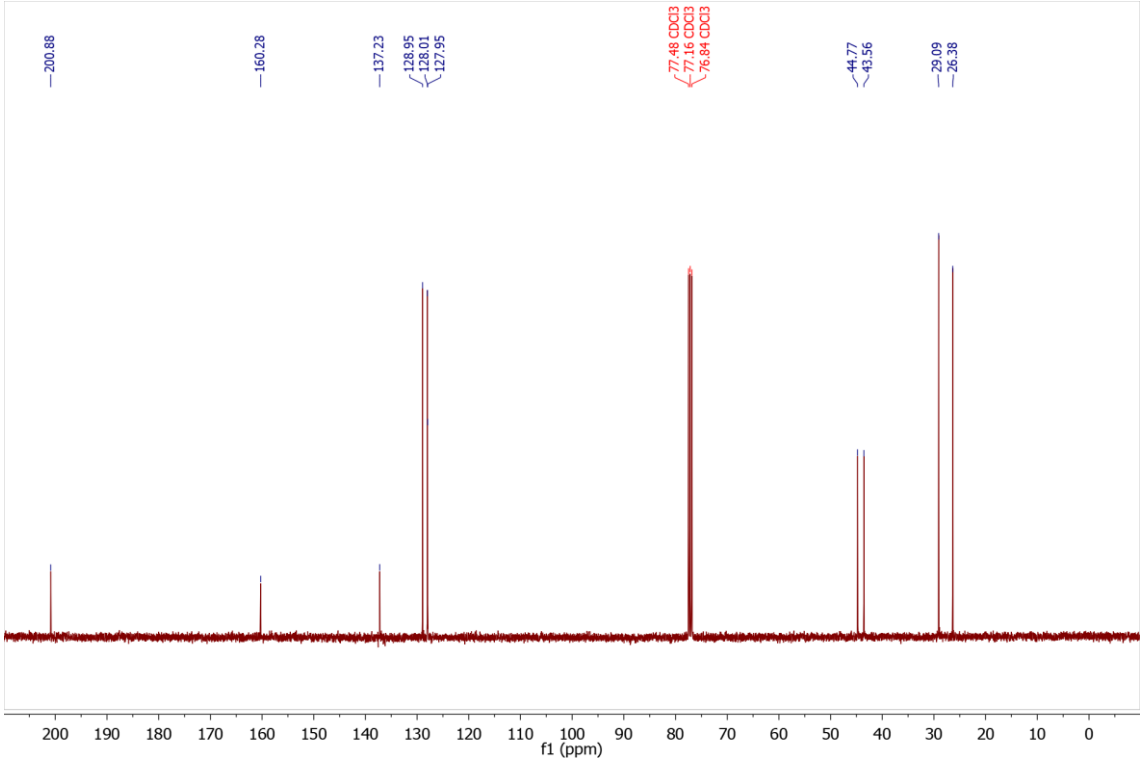
N-Benzyl-2-cyclopentyl-2-oxoacetamide (1w)



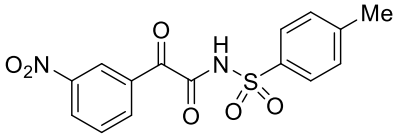
^{1}H NMR (400 MHz, $CDCl_3$)



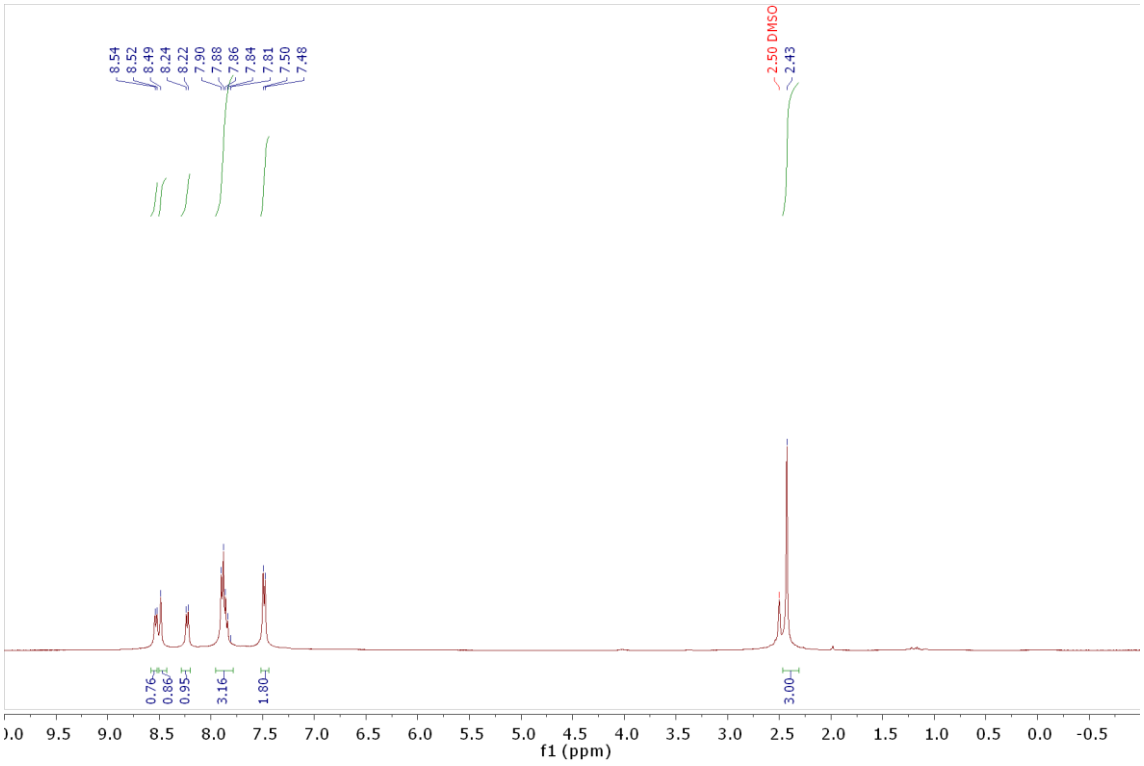
^{13}C NMR (101 MHz, $CDCl_3$)



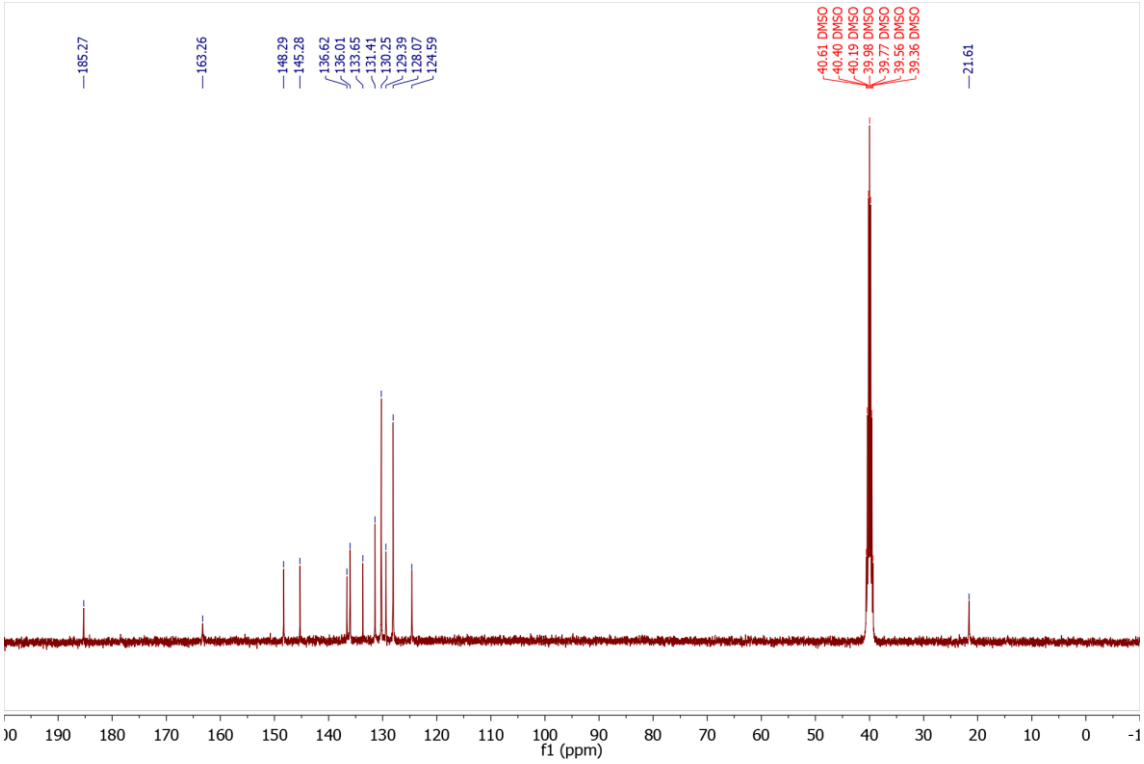
N-Tosyl-2-(3-nitrophenyl)-2-oxo-acetamide (1x)



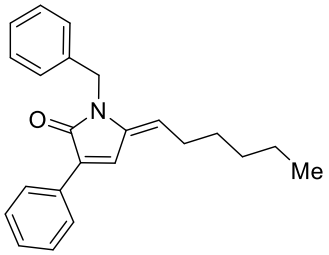
^{1}H NMR (400 MHz, d_6-DMSO)



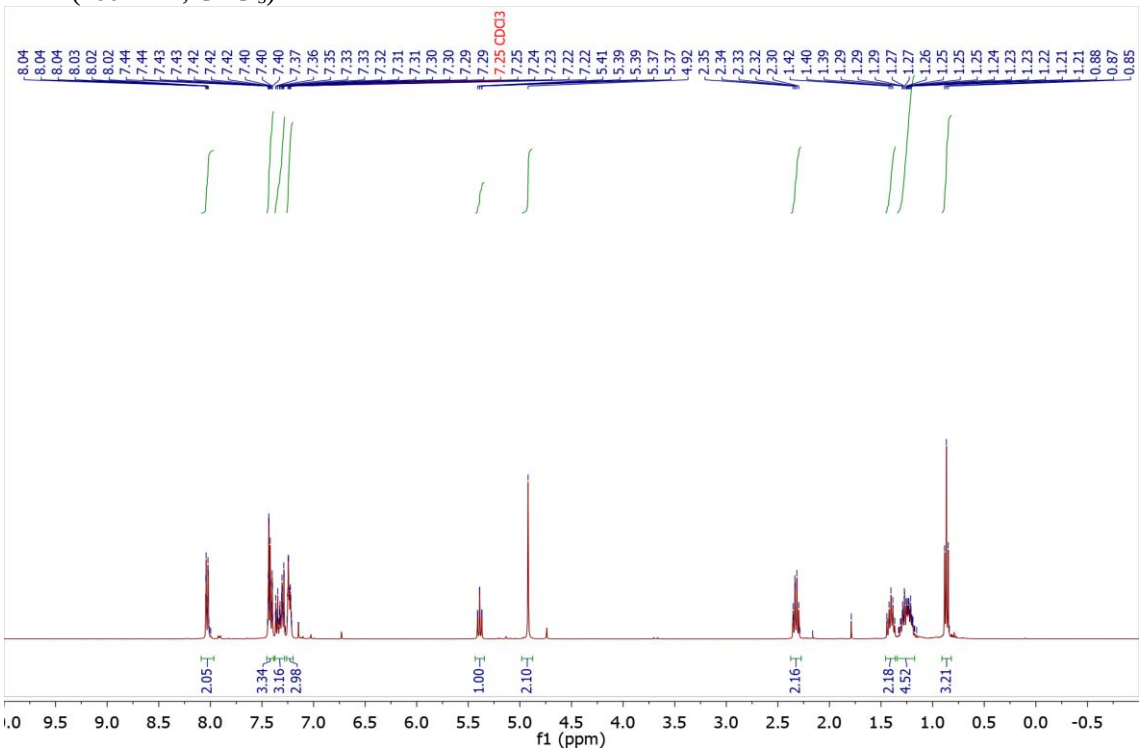
^{13}C NMR (101 MHz, d_6-DMSO)



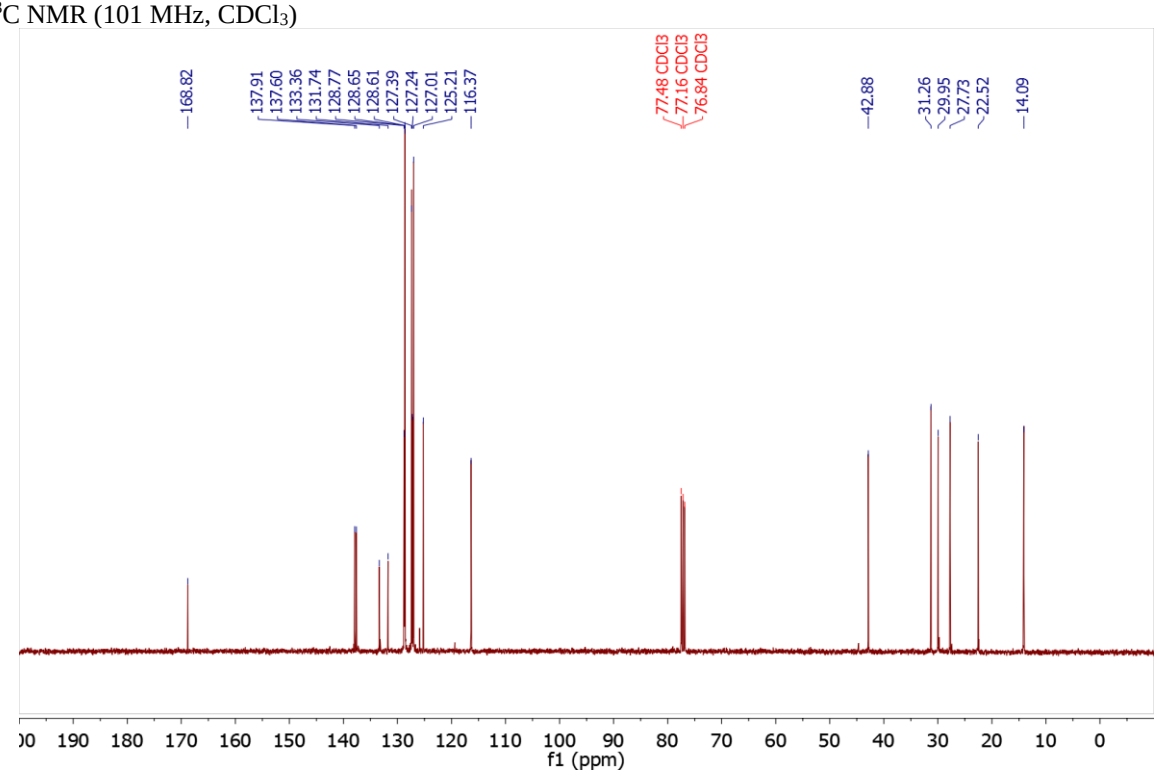
(*E*)-1-Benzyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3a)



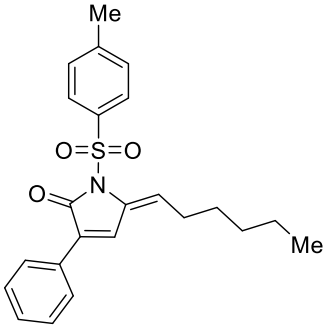
^{1}H NMR (400 MHz, $CDCl_3$)



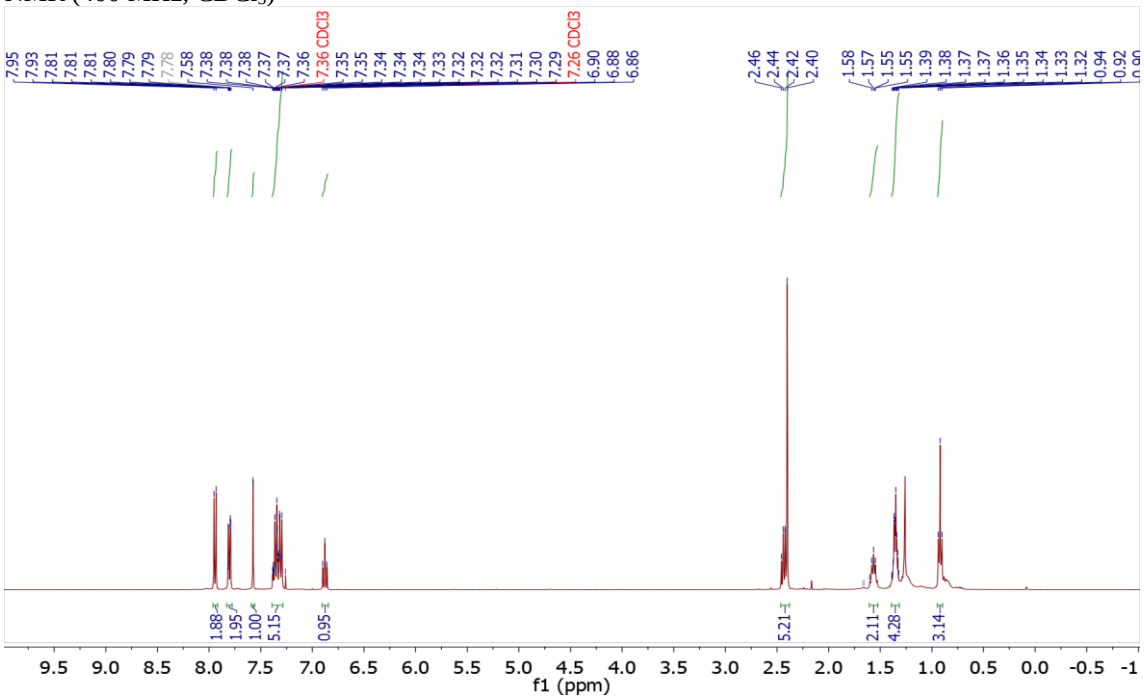
^{13}C NMR (101 MHz, $CDCl_3$)



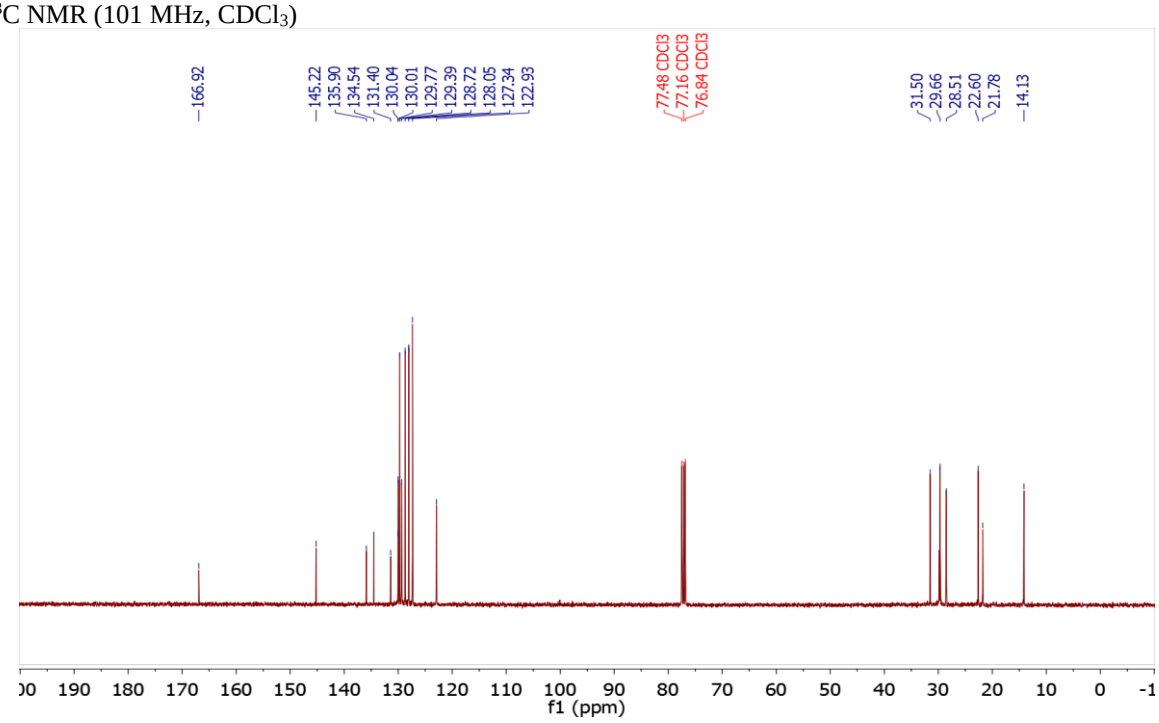
(*E*)-5-Hexylidene-3-phenyl-1-tosyl-1,5-dihydro-2*H*-pyrrol-2-one (3b)



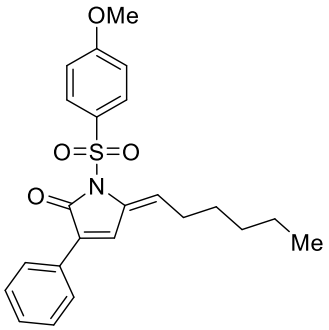
^{1}H NMR (400 MHz, $CDCl_3$)



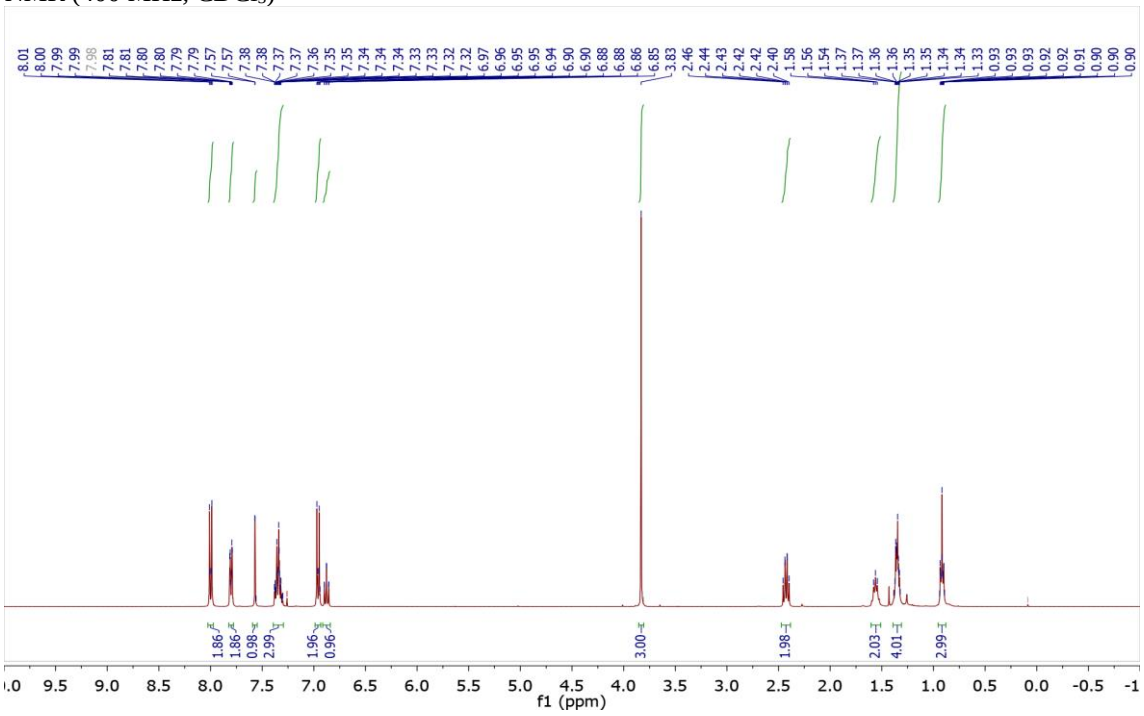
^{13}C NMR (101 MHz, $CDCl_3$)



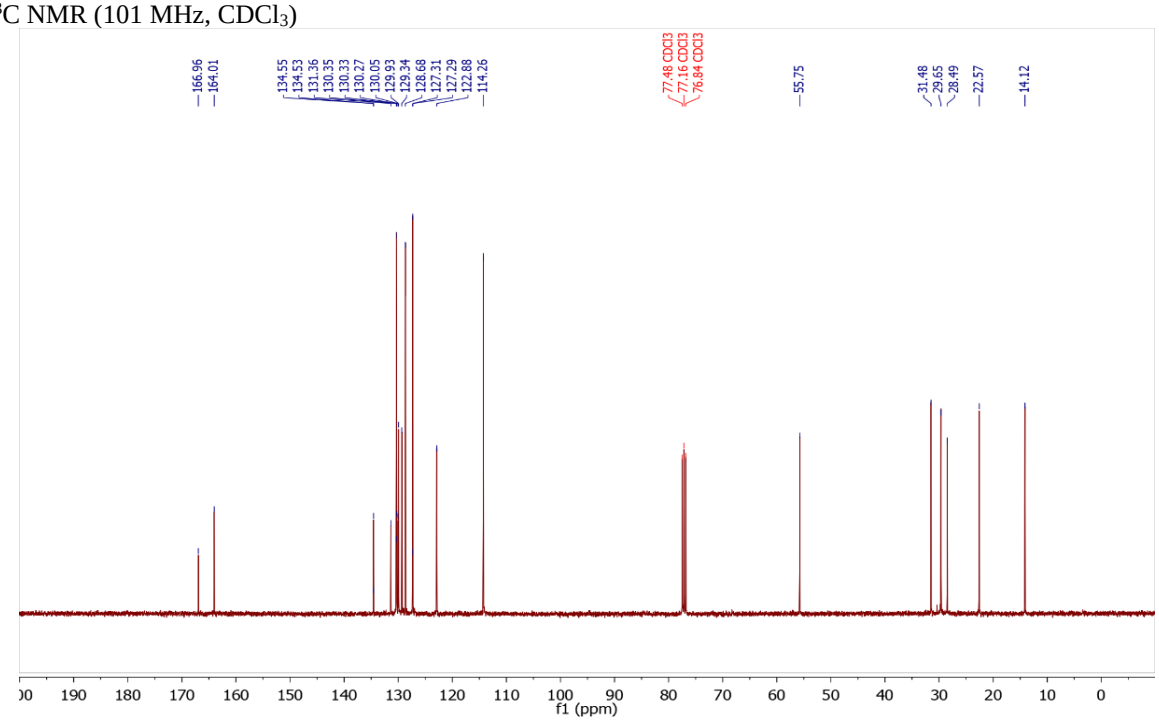
(*E*)-5-Hexylidene-1-((4-methoxyphenyl)sulfonyl)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3c)



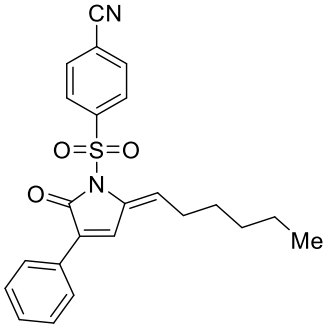
^{1}H NMR (400 MHz, $CDCl_3$)



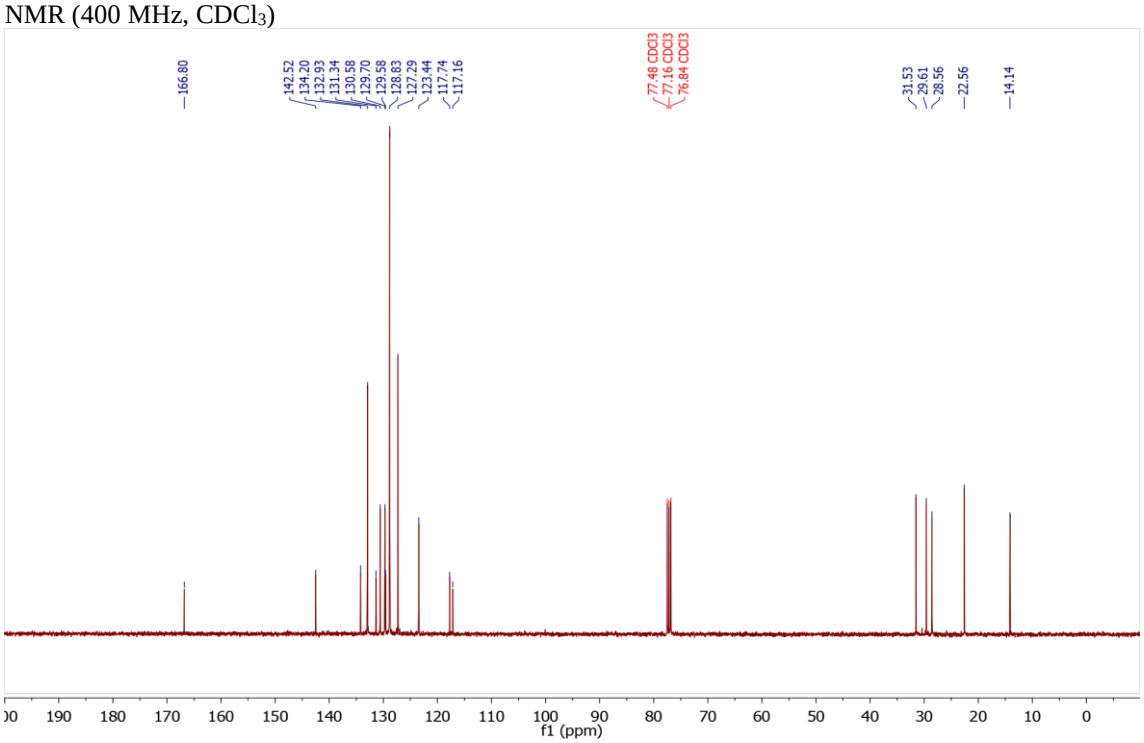
^{13}C NMR (101 MHz, $CDCl_3$)



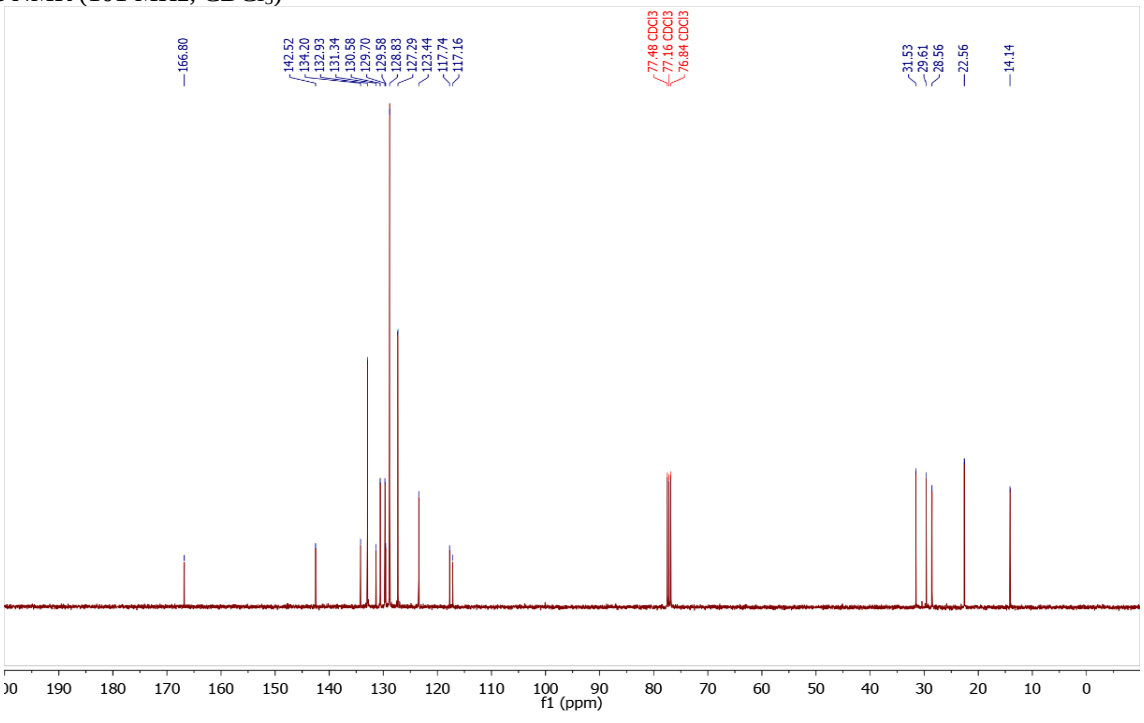
(*E*)-5-Hexylidene-1-((4-cyano)sulfonyl)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3d)



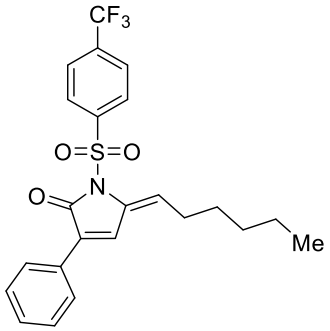
^{1}H NMR (400 MHz, $CDCl_3$)



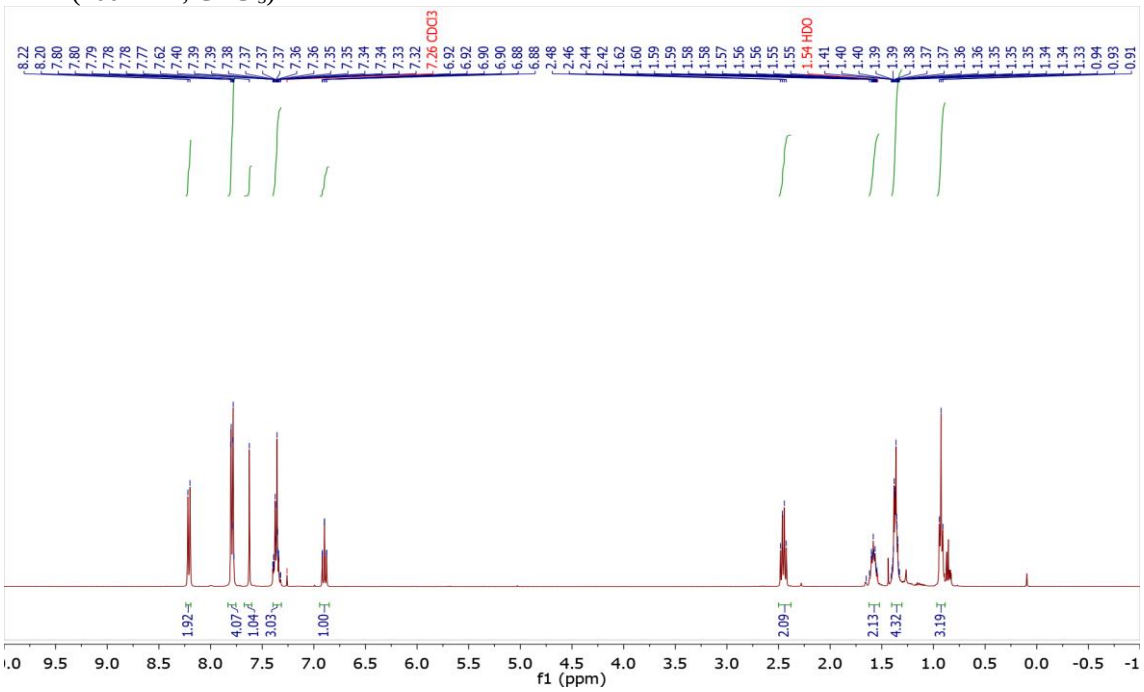
^{13}C NMR (101 MHz, $CDCl_3$)



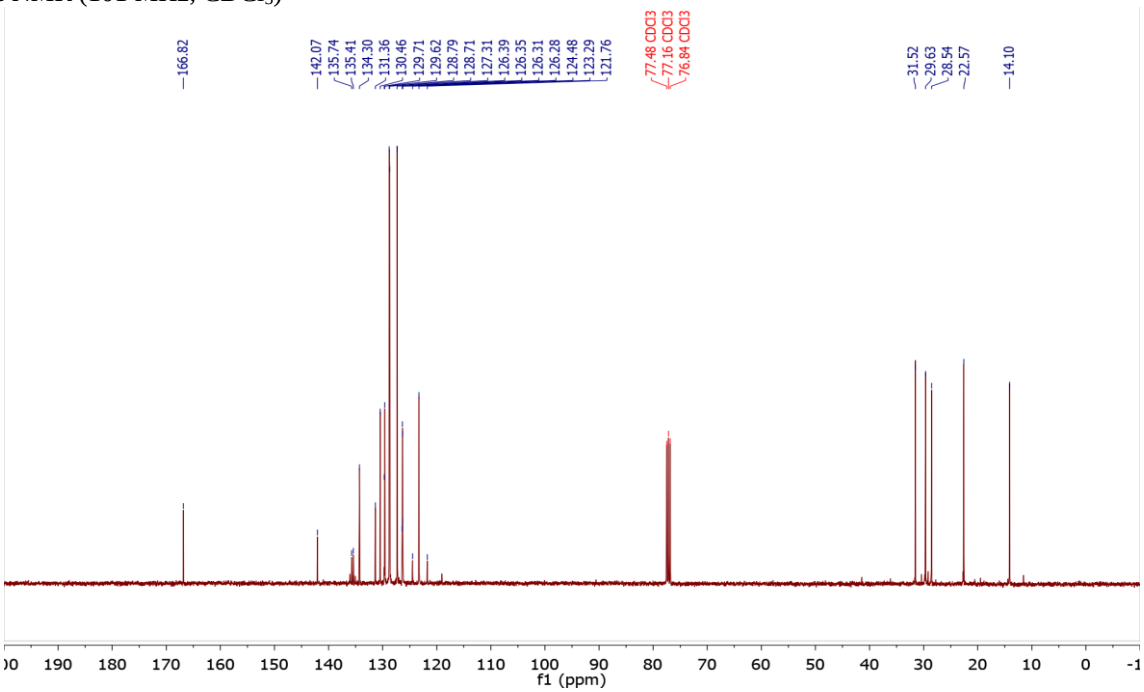
(*E*)-5-Hexylidene-3-phenyl-1-((4-(trifluoromethyl)phenyl)sulfonyl)-1,5-dihydro-2*H*-pyrrol-2-one (3e)



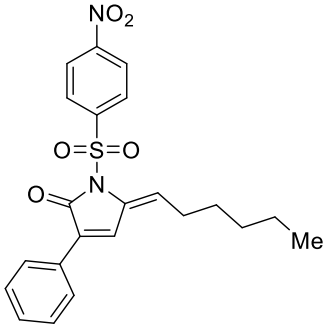
^{1}H NMR (400 MHz, $CDCl_3$)



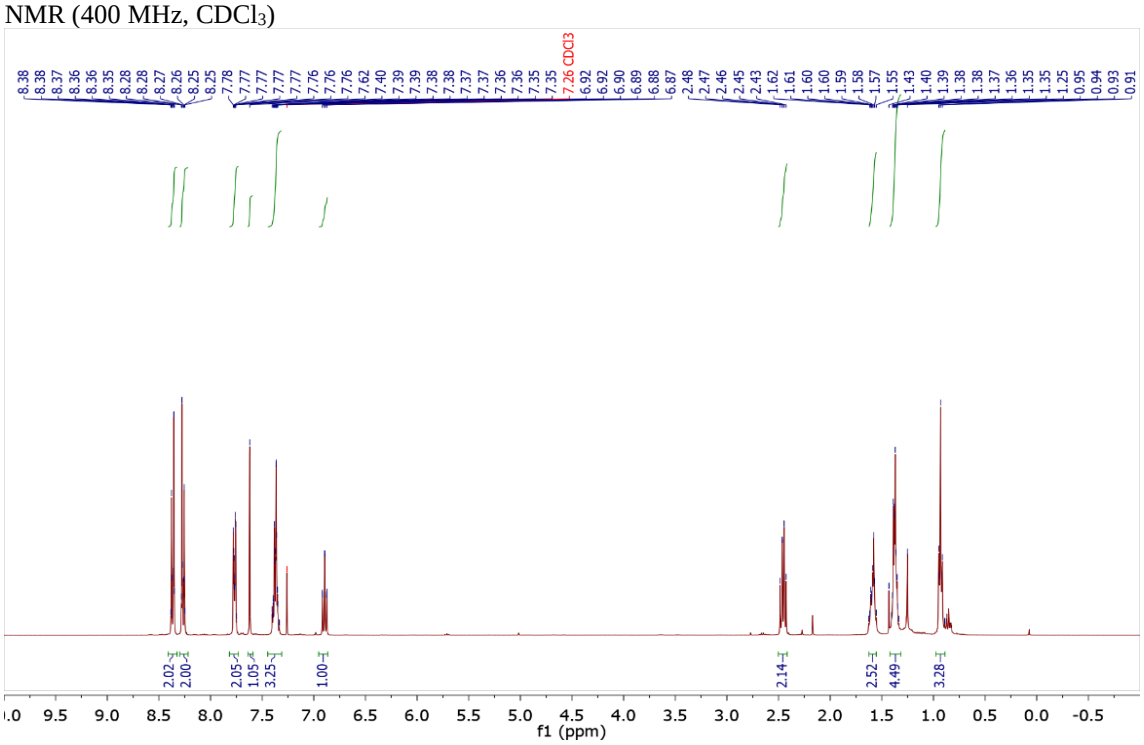
^{13}C NMR (101 MHz, $CDCl_3$)



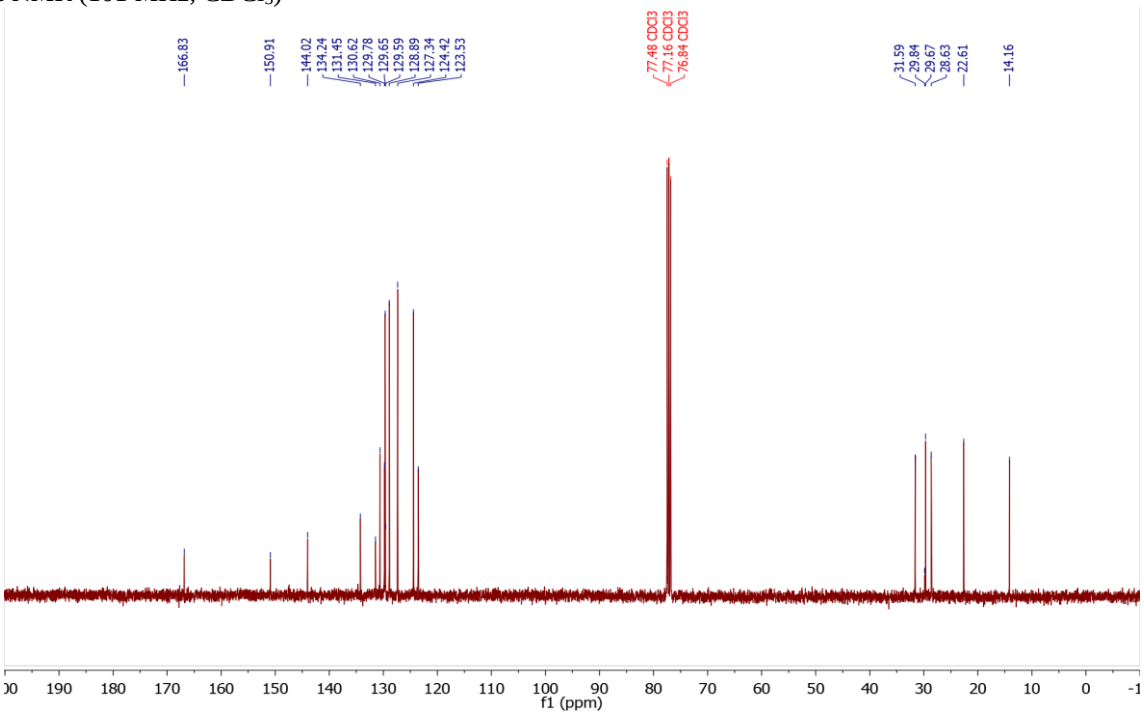
(*E*)-5-Hexylidene-1-((4-nitrophenyl)sulfonyl)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3f)



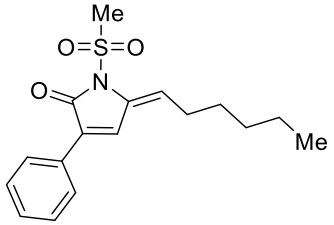
^{1}H NMR (400 MHz, $CDCl_3$)



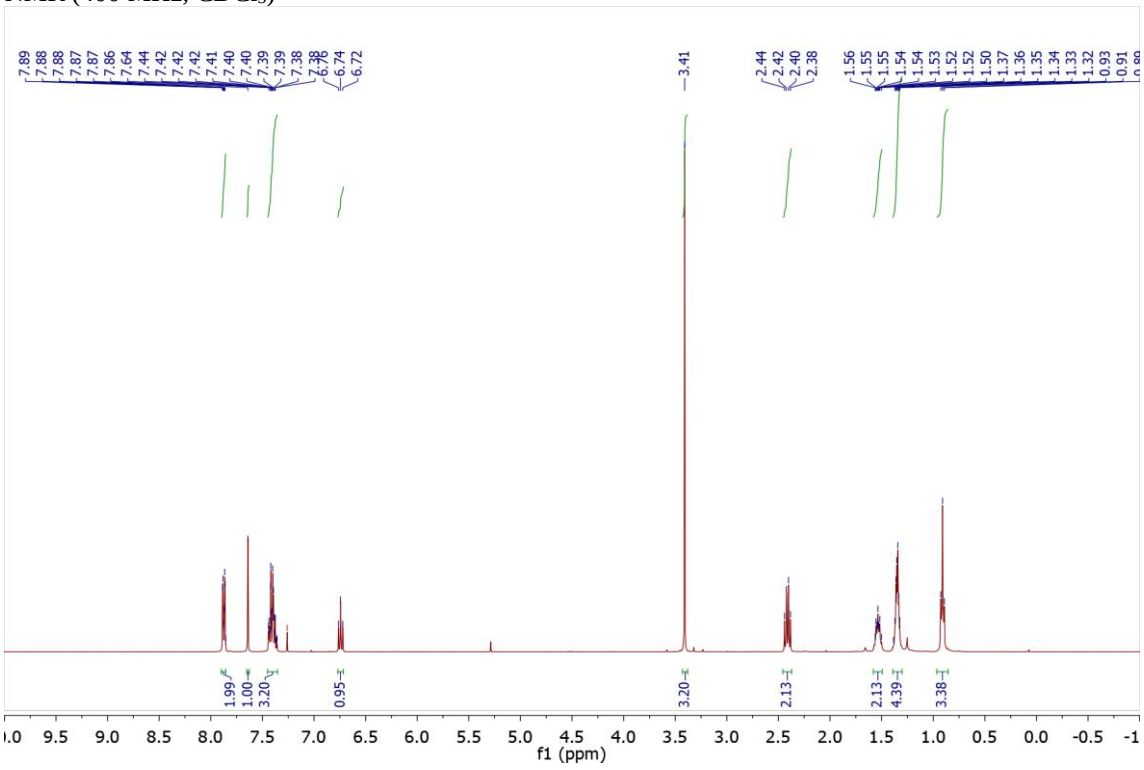
^{13}C NMR (101 MHz, $CDCl_3$)



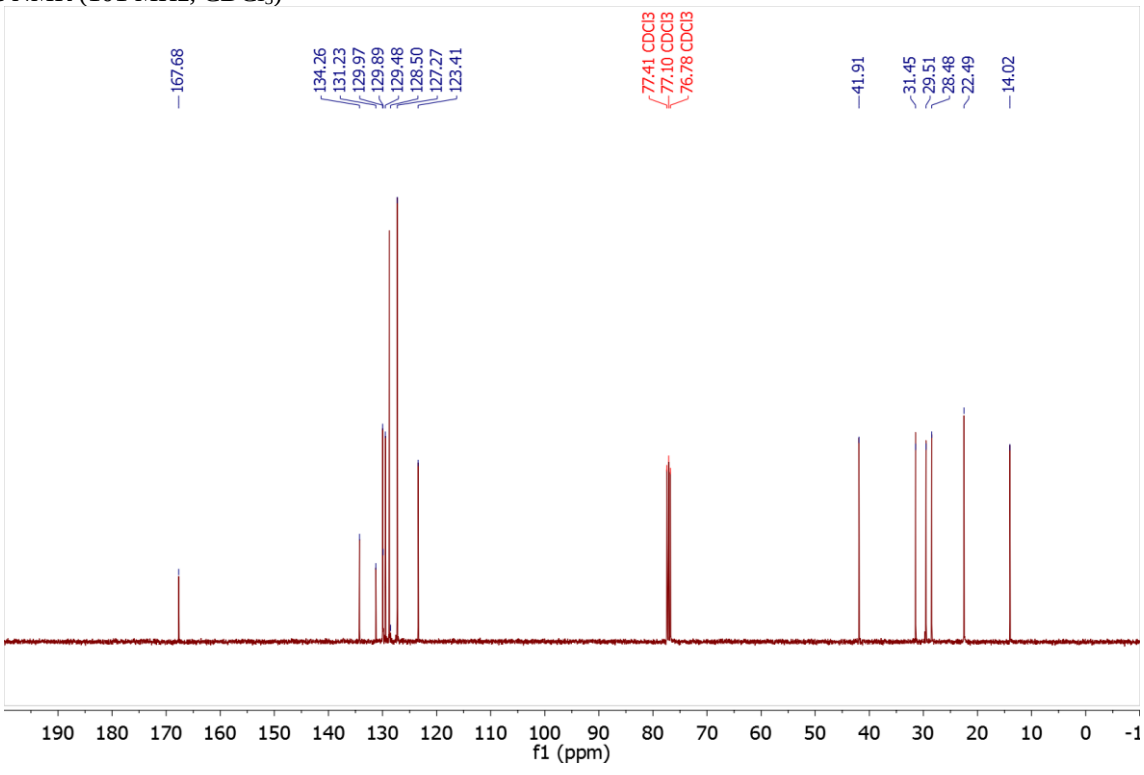
(*E*)-5-Hexylidene-1-(methylsulfonyl)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3g)



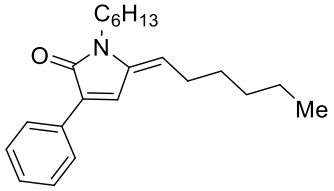
^{1}H NMR (400 MHz, $CDCl_3$)



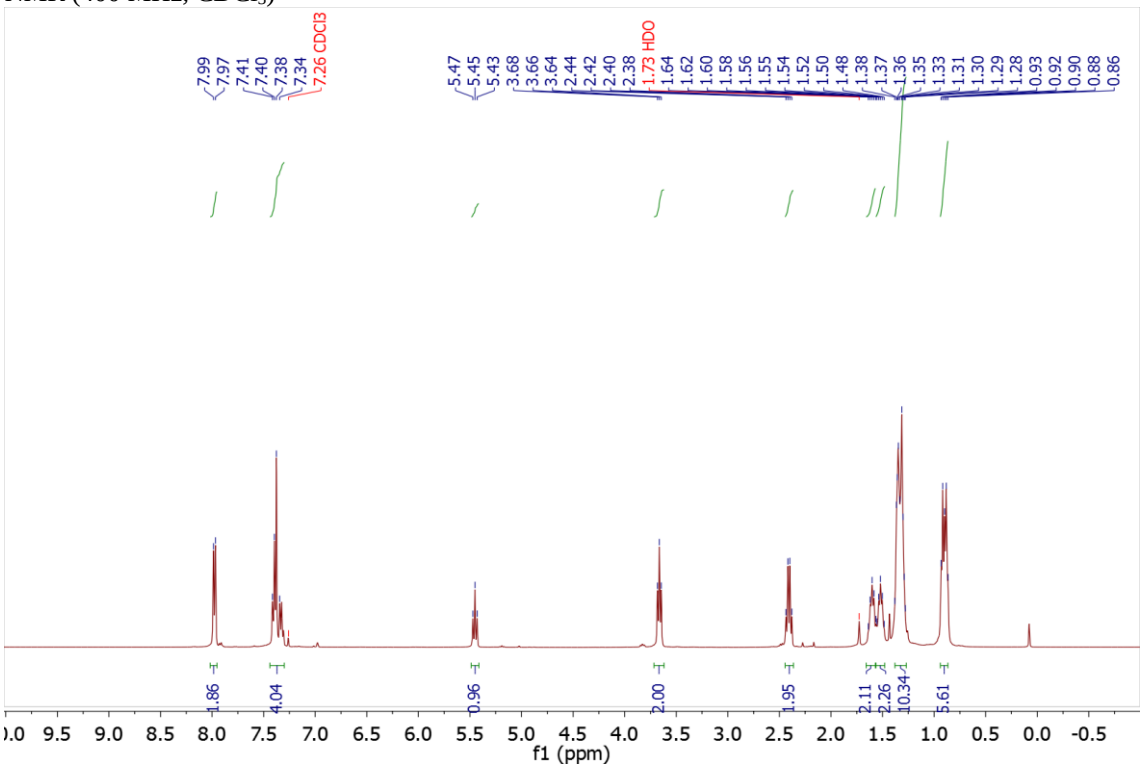
^{13}C NMR (101 MHz, $CDCl_3$)



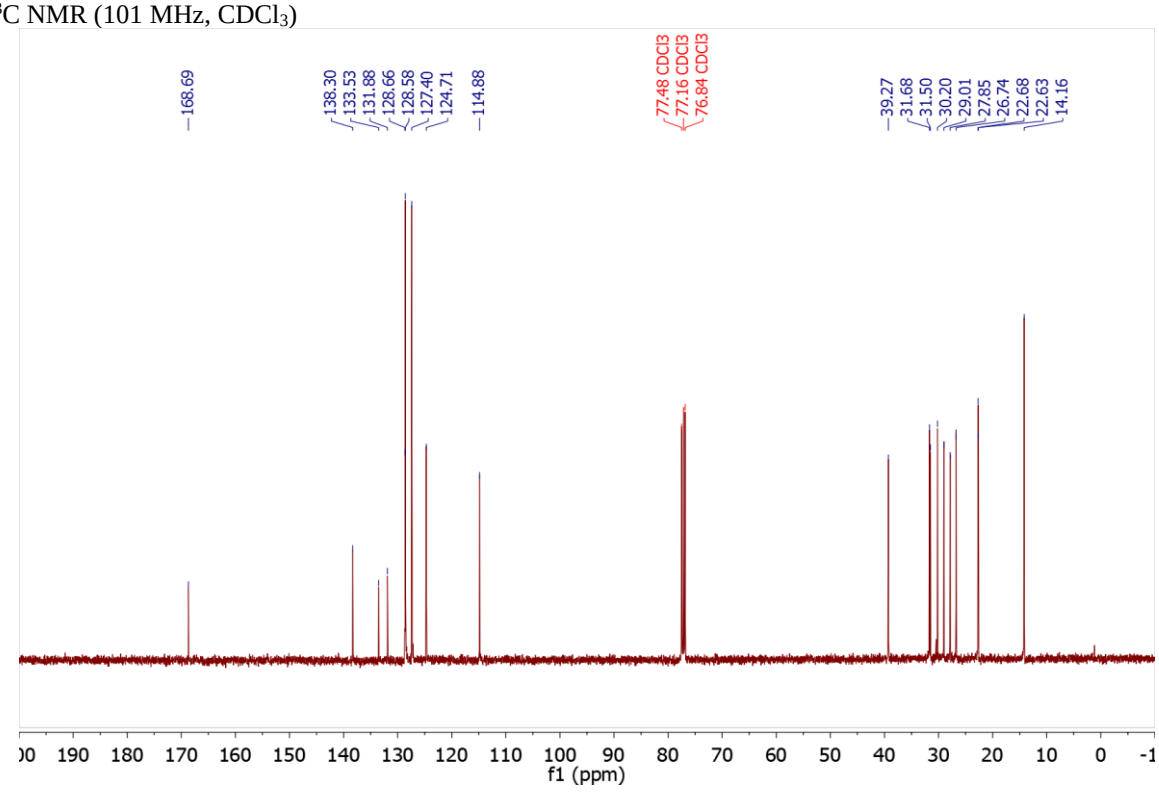
(*E*)-1-Hexyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3h)



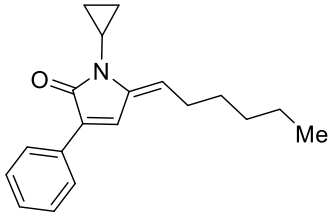
^{1}H NMR (400 MHz, $CDCl_3$)



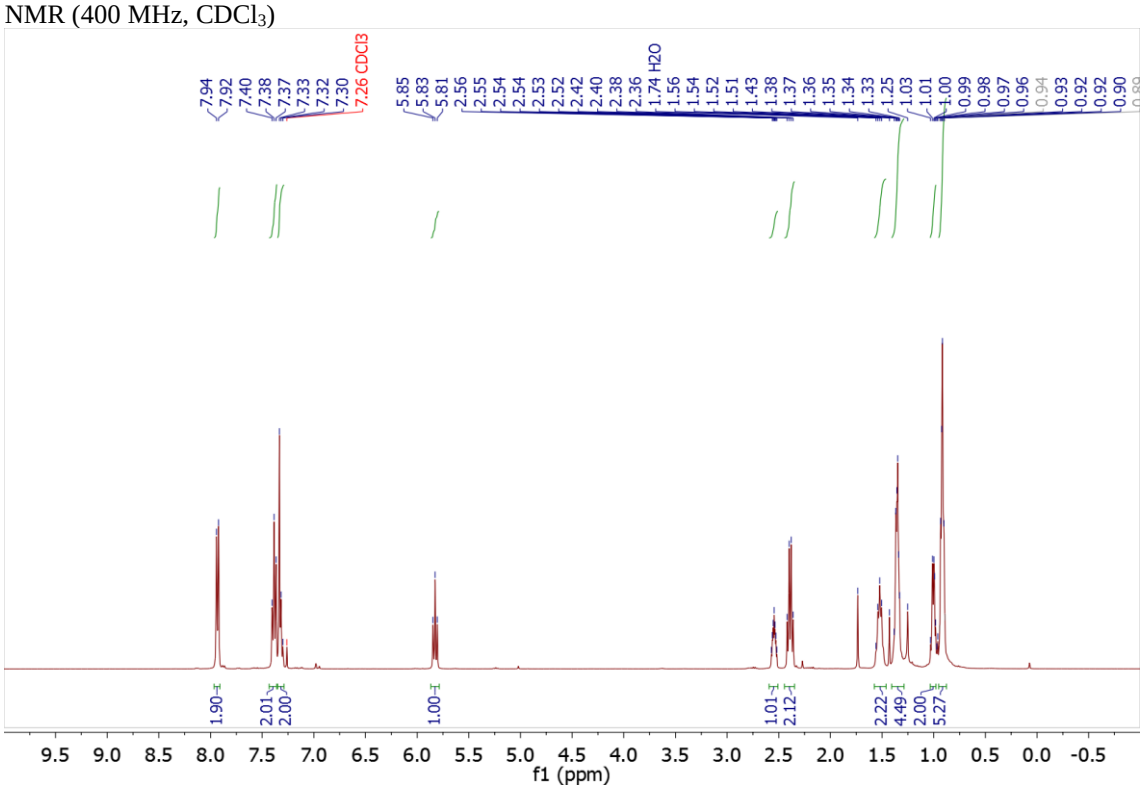
^{13}C NMR (101 MHz, $CDCl_3$)



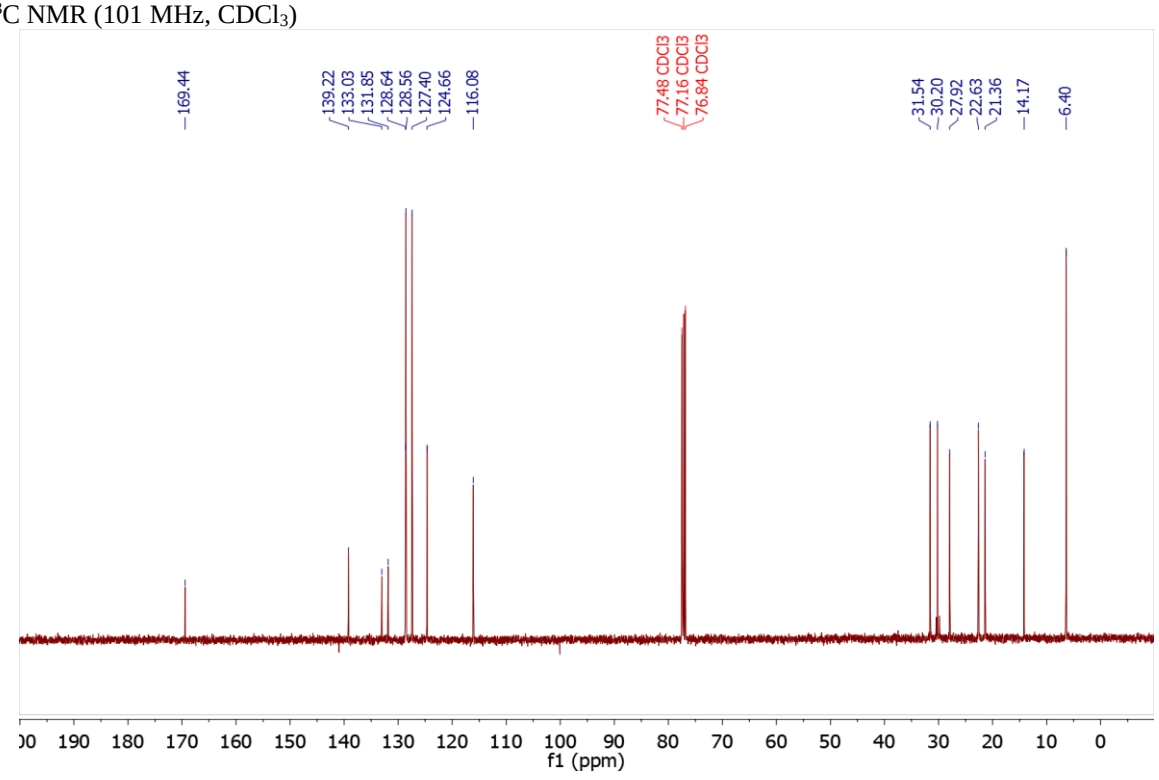
(*E*)-1-Cyclopropyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3i)



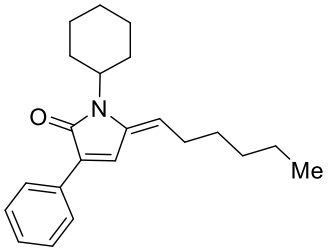
^{1}H NMR (400 MHz, $CDCl_3$)



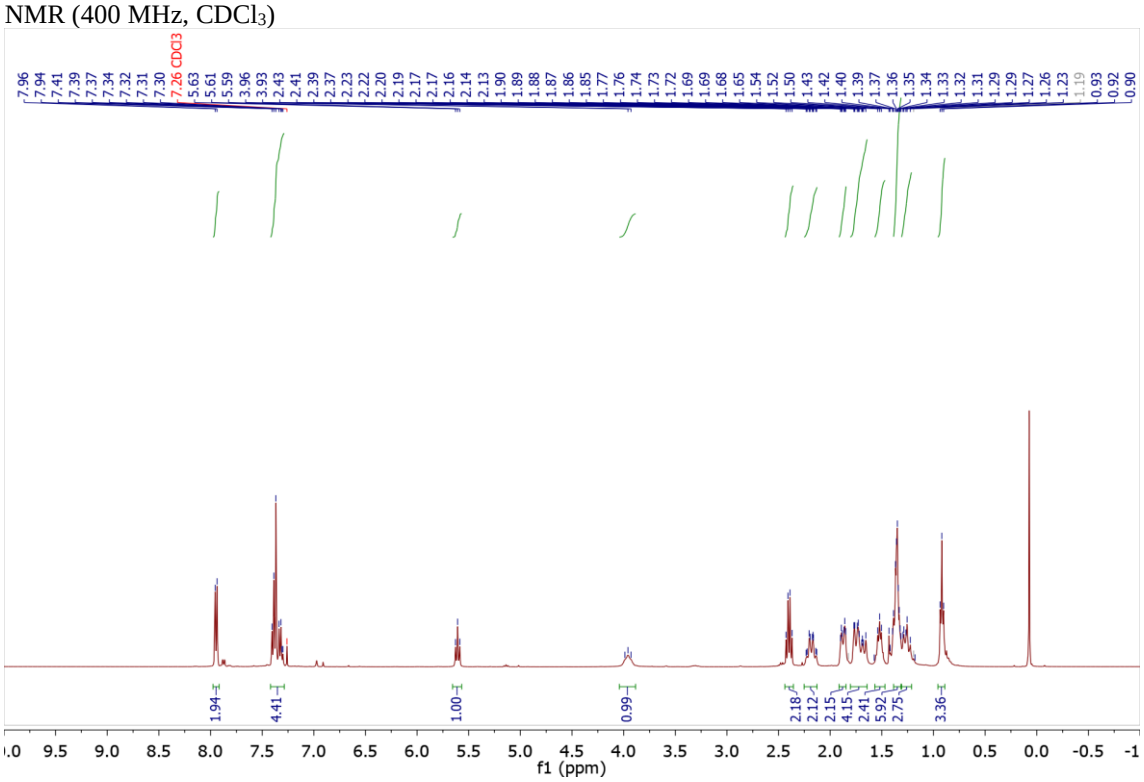
^{13}C NMR (101 MHz, $CDCl_3$)



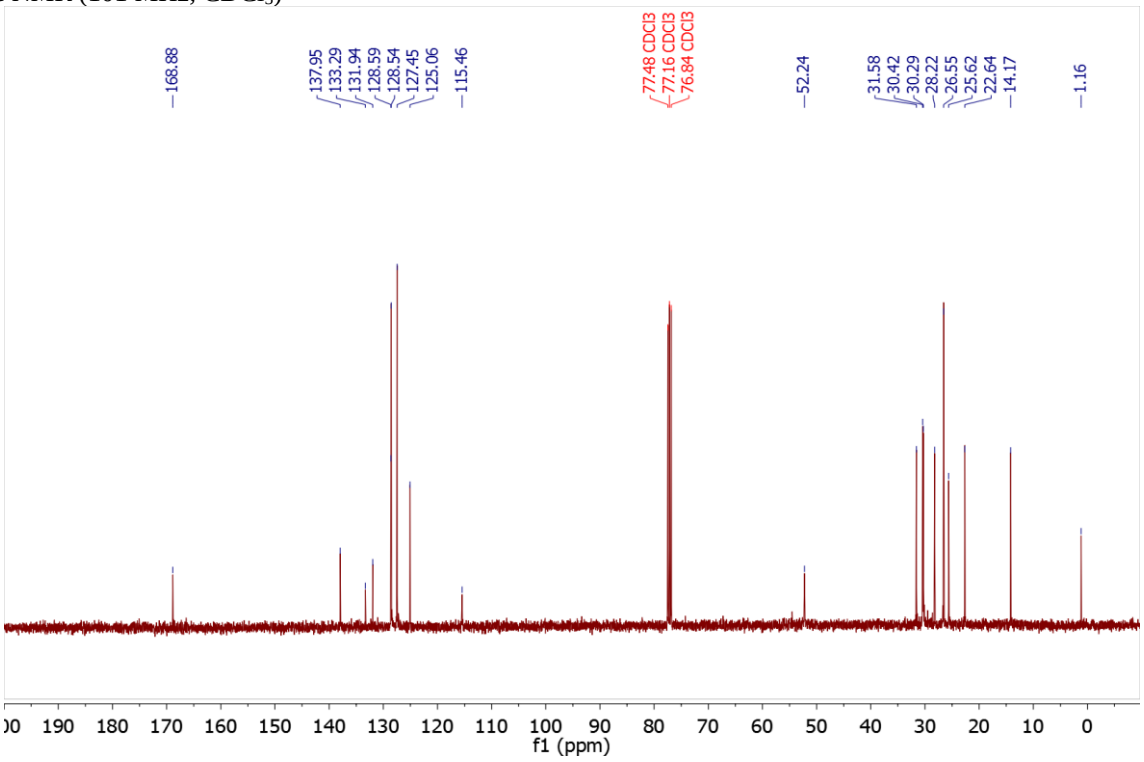
(*E*)-1-Cyclohexyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3j)



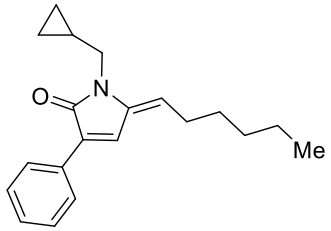
^{1}H NMR (400 MHz, $CDCl_3$)



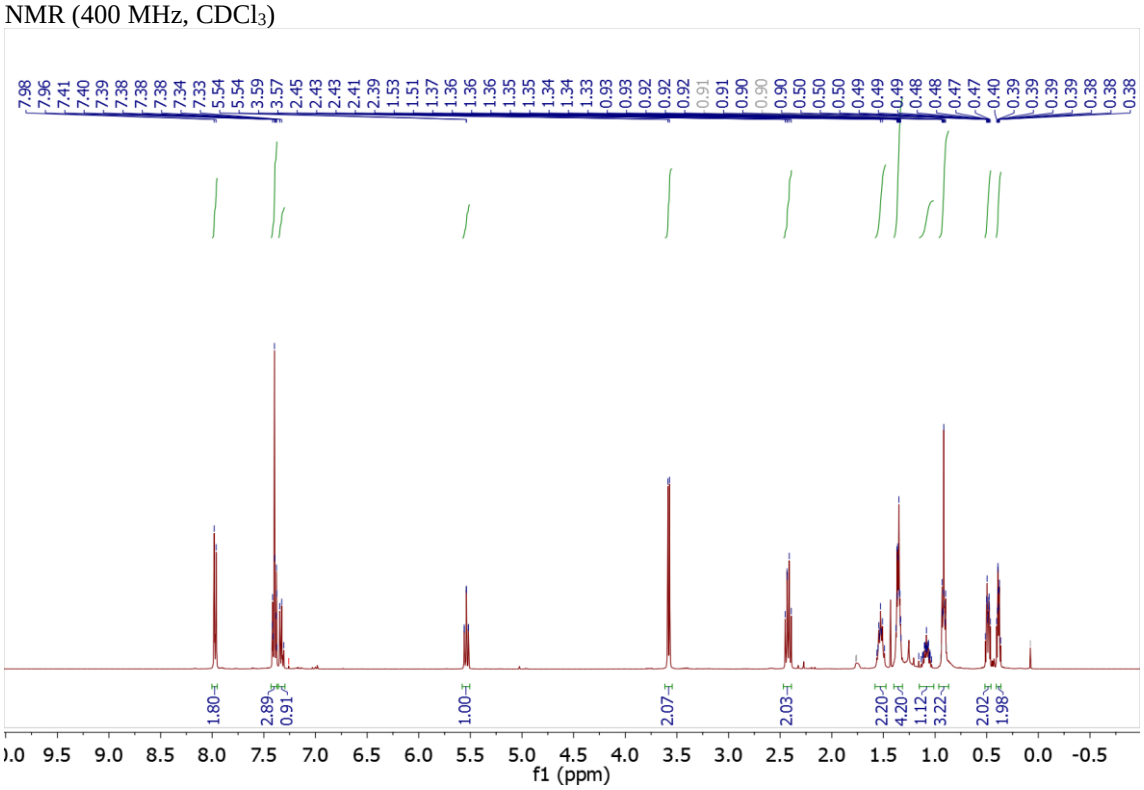
^{13}C NMR (101 MHz, $CDCl_3$)



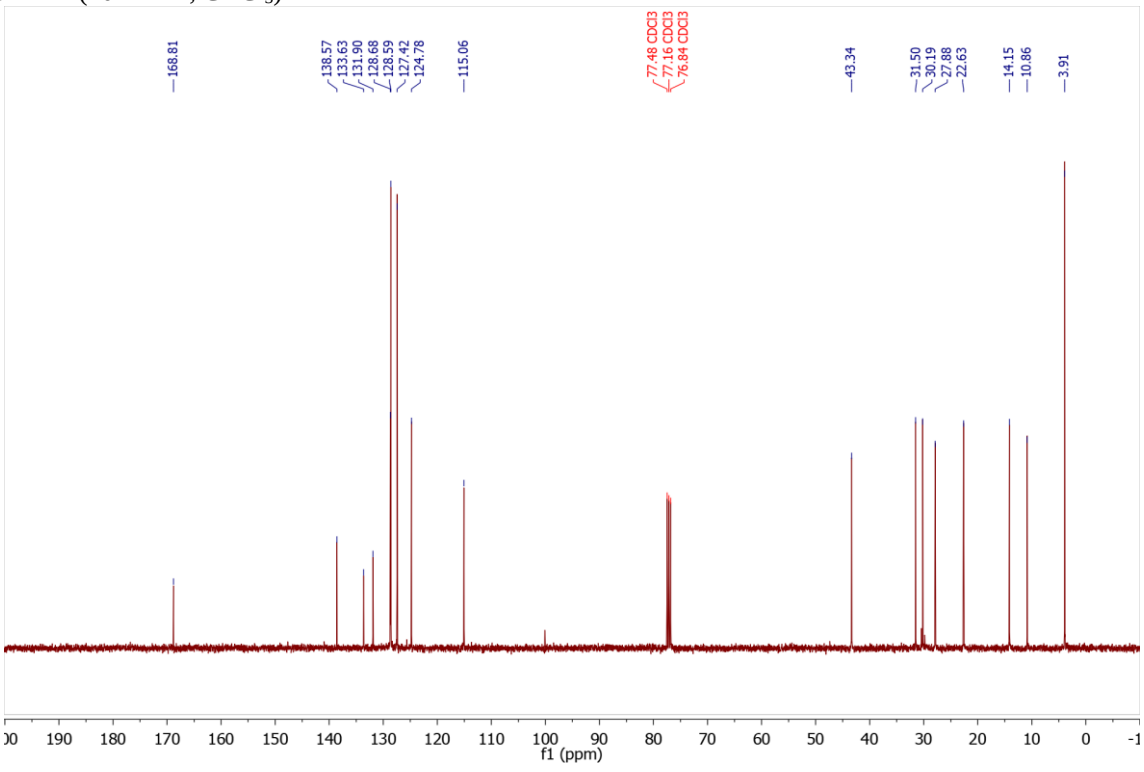
(*E*)-1-(Cyclopropylmethyl)-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3k)



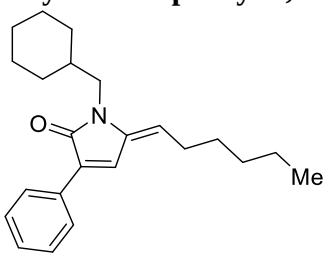
^{1}H NMR (400 MHz, $CDCl_3$)



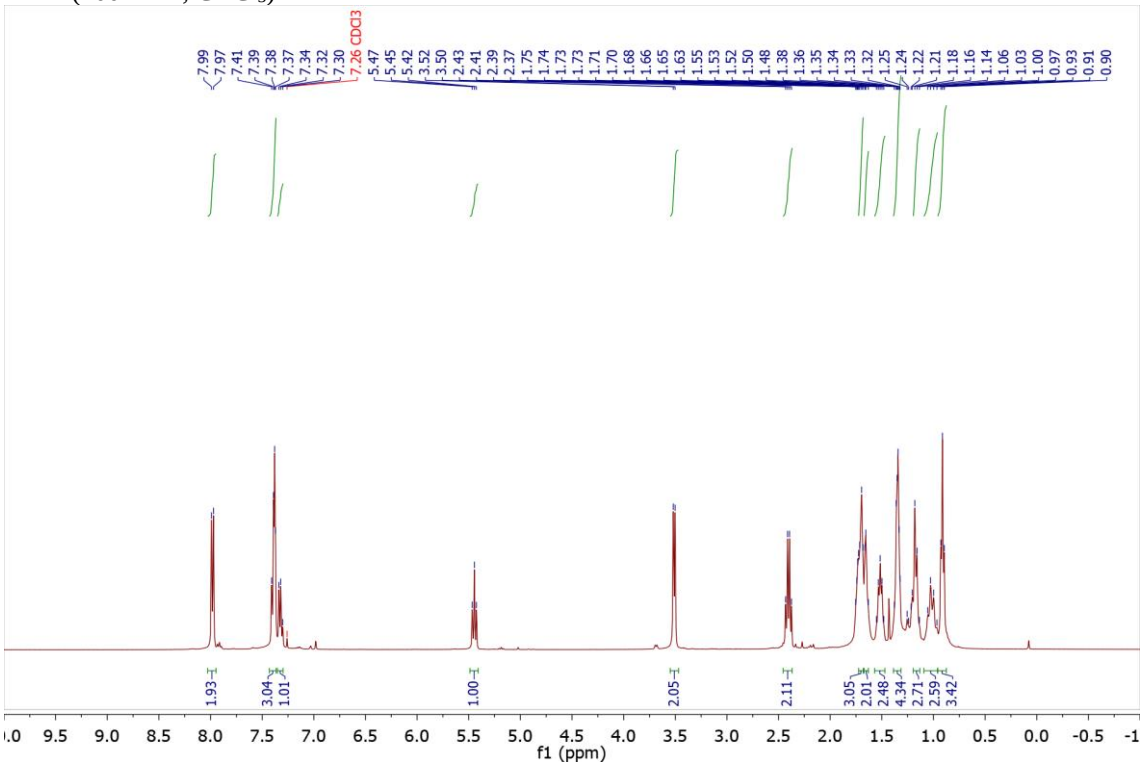
^{13}C NMR (101 MHz, $CDCl_3$)



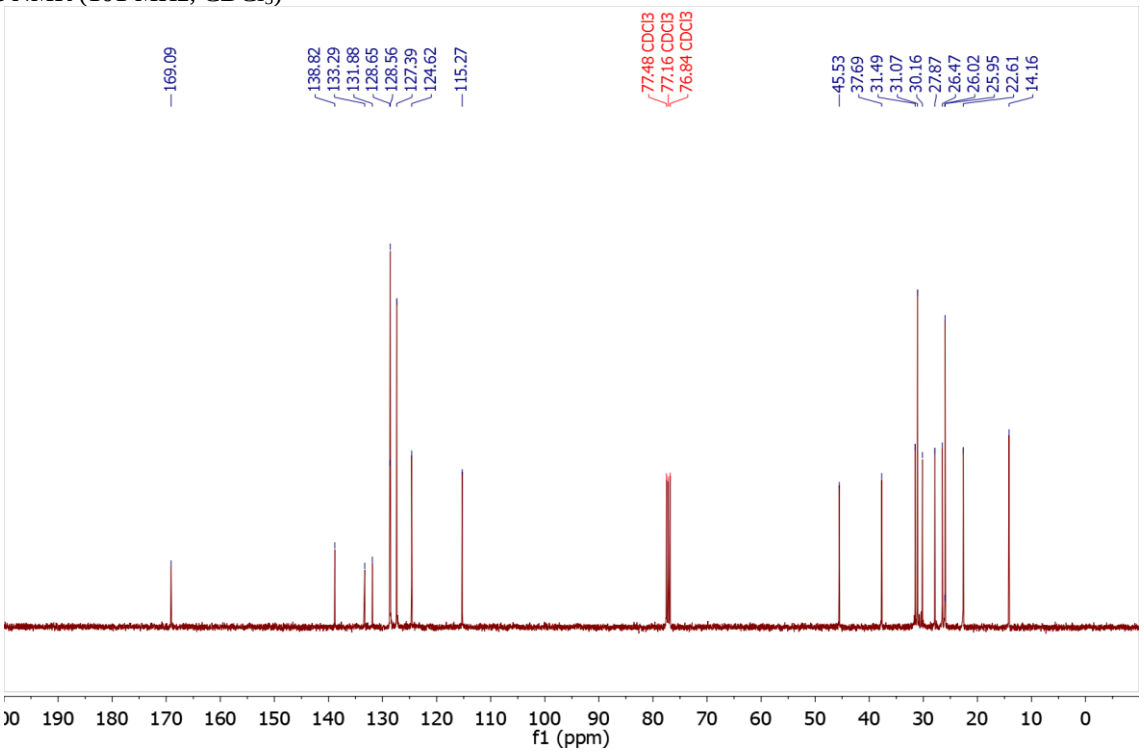
(*E*)-1-(Cyclohexylmethyl)-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3l)



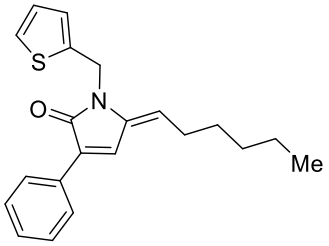
^{1}H NMR (400 MHz, $CDCl_3$)



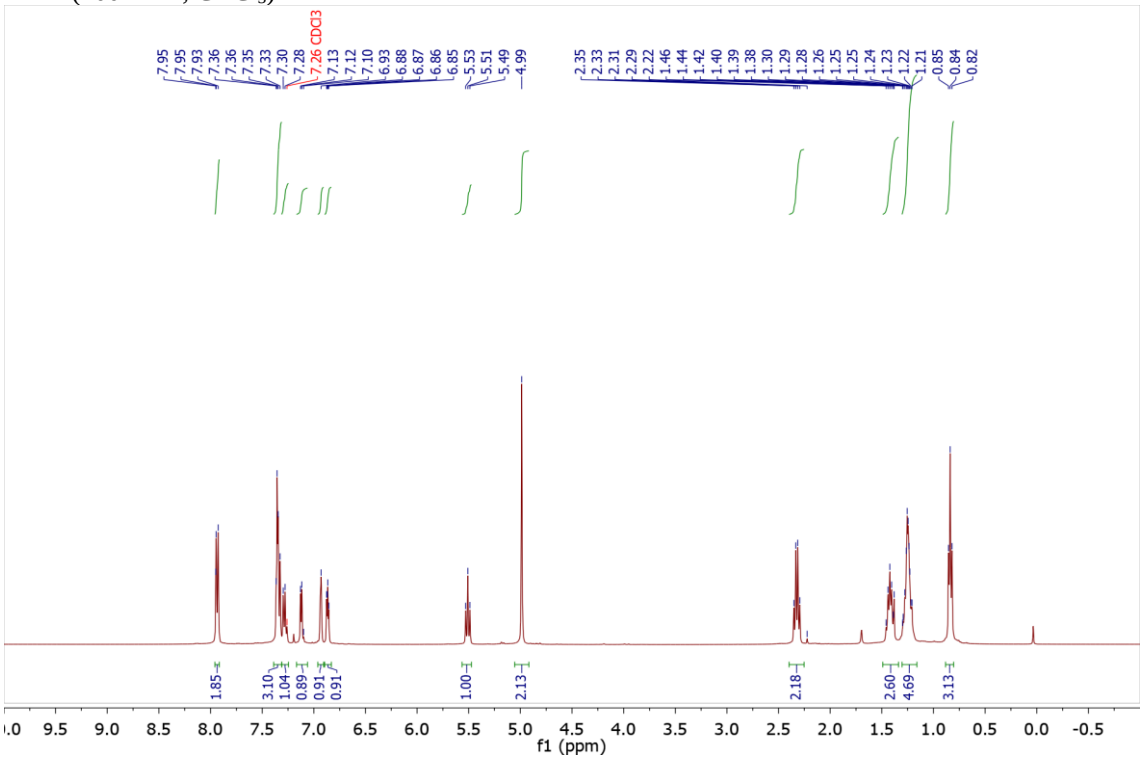
^{13}C NMR (101 MHz, $CDCl_3$)



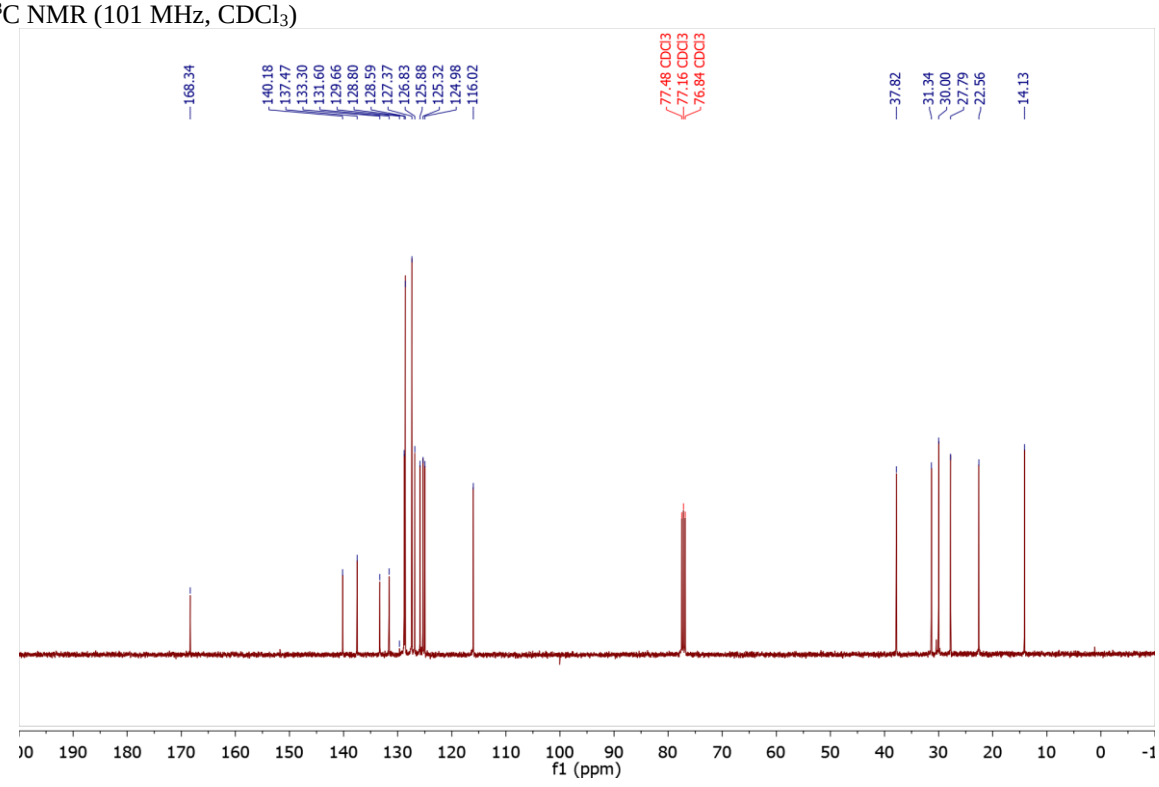
(*E*)-5-Hexylidene-3-phenyl-1-(thiophen-2-ylmethyl)-1,5-dihydro-2*H*-pyrrol-2-one (3m)



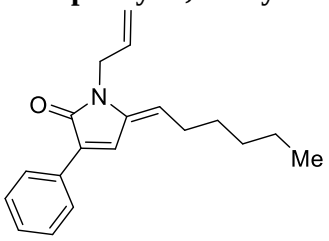
^{1}H NMR (400 MHz, $CDCl_3$)



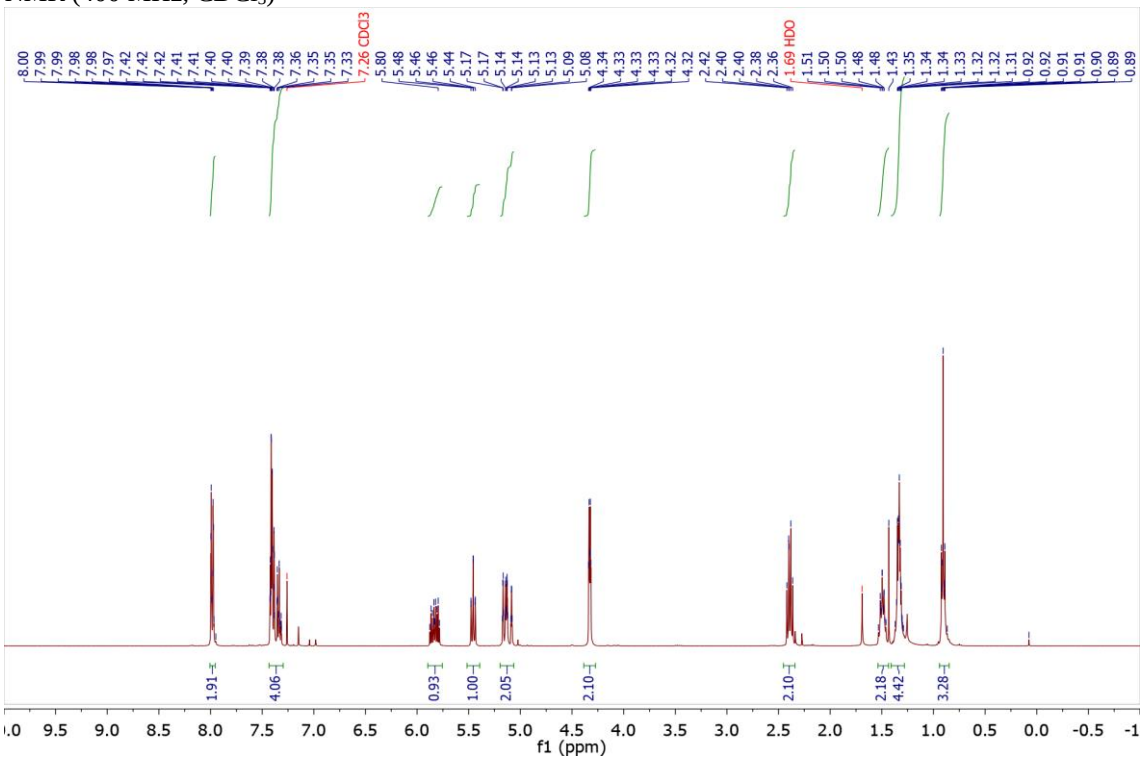
^{13}C NMR (101 MHz, $CDCl_3$)



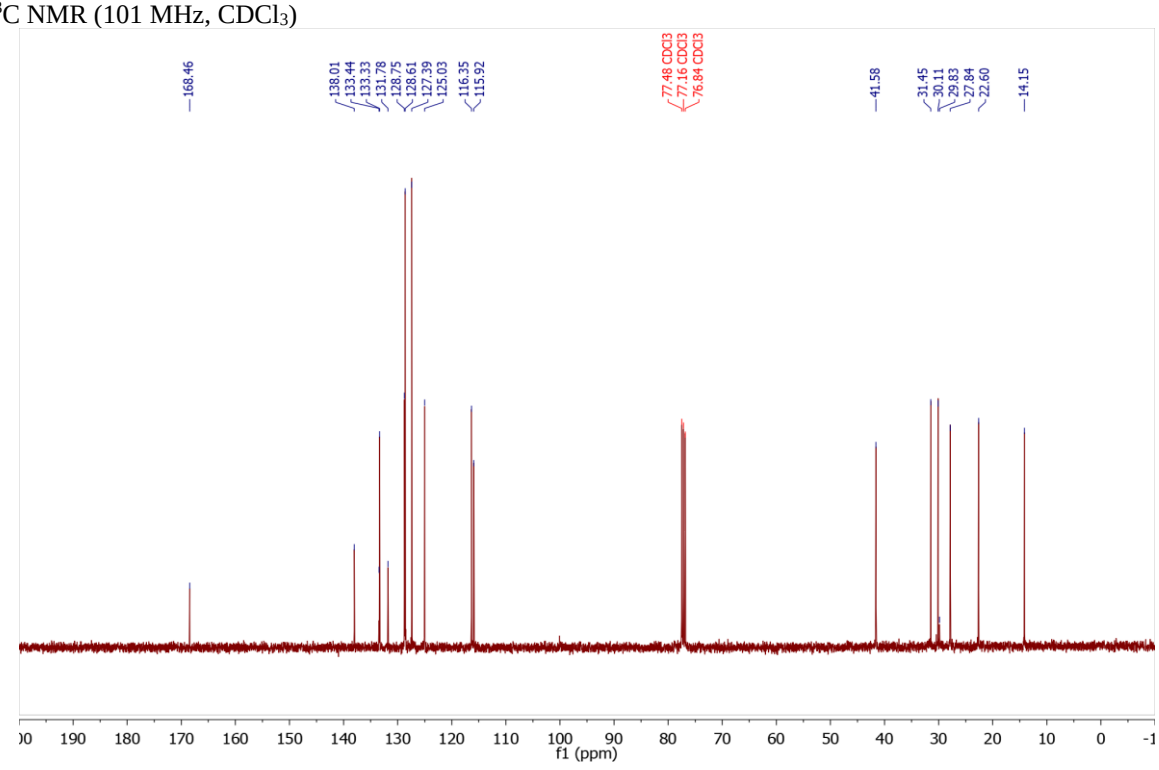
(*E*)-1-Allyl-5-hexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (3n)



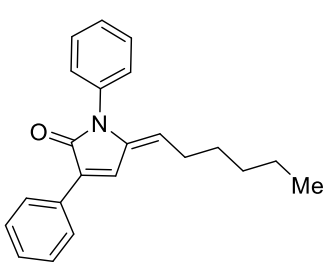
^{1}H NMR (400 MHz, $CDCl_3$)

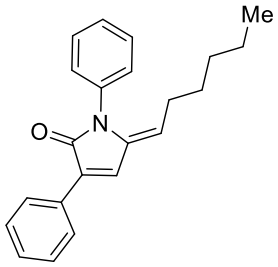


^{13}C NMR (101 MHz, $CDCl_3$)

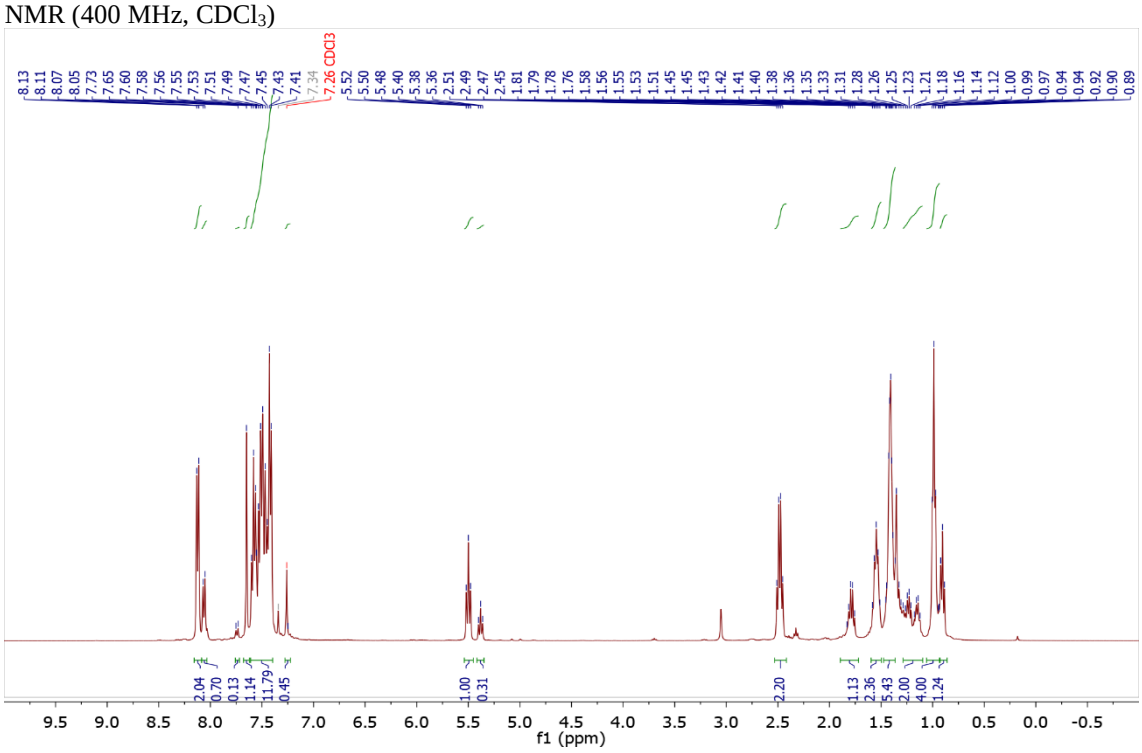


(*E*)-5-Hexylidene-1,3-diphenyl-1,5-dihydro-2*H*-pyrrol-2-one and
(*Z*)-5-Hexylidene-1,3-diphenyl-1,5-dihydro-2*H*-pyrrol-2-one (3o)

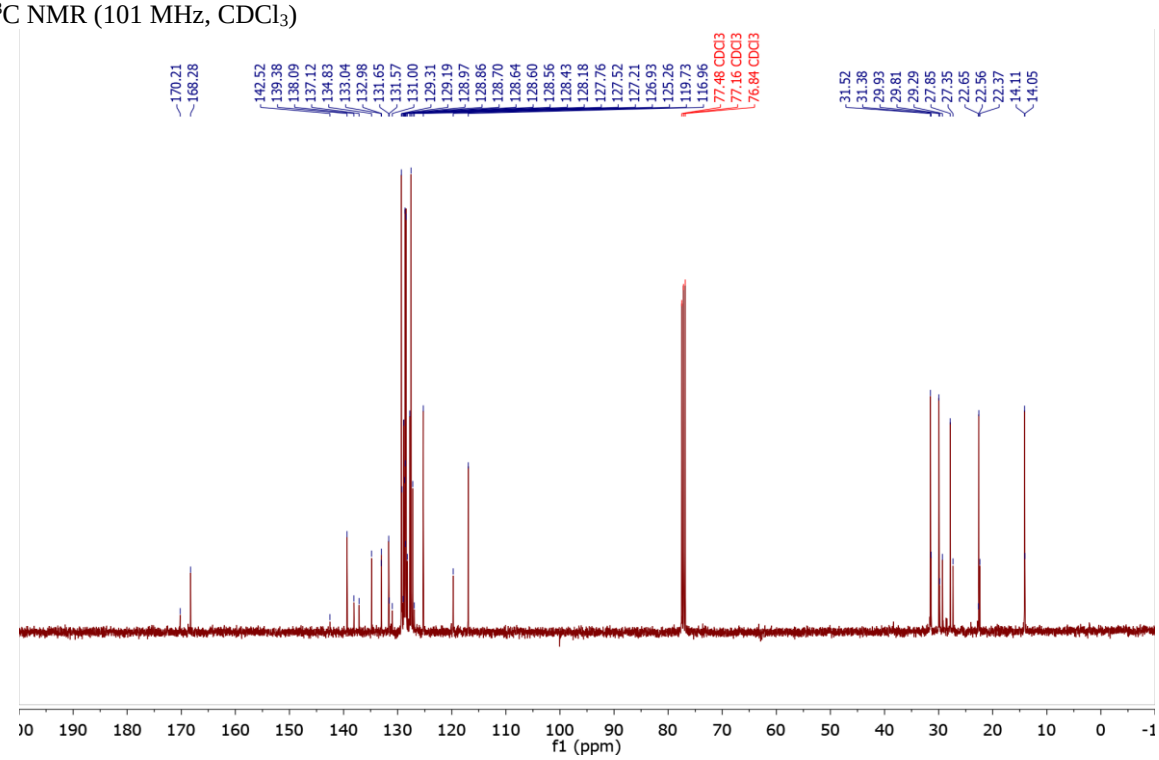




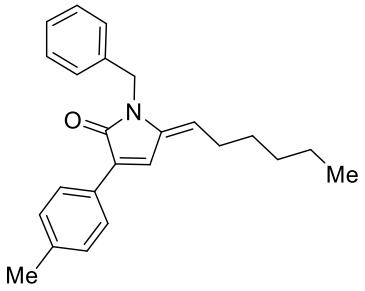
^{1}H NMR (400 MHz, $CDCl_3$)



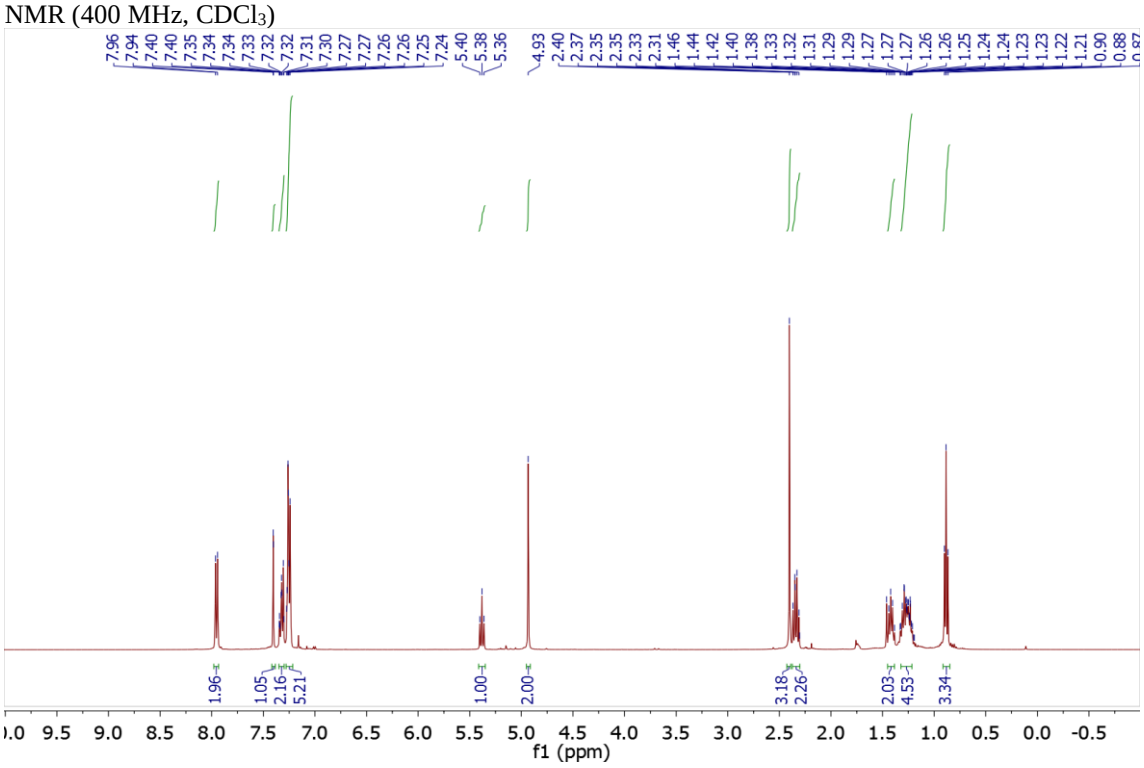
^{13}C NMR (101 MHz, $CDCl_3$)



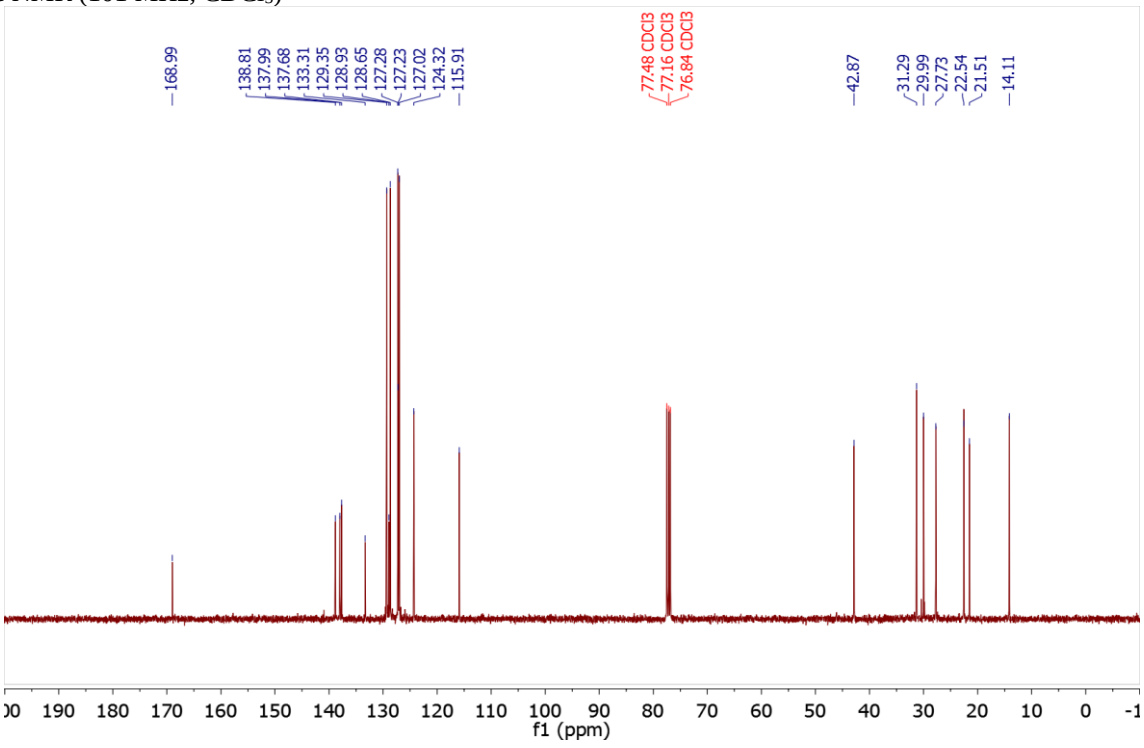
(*E*)-1-Benzyl-5-hexylidene-3-(*p*-tolyl)-1,5-dihydro-2*H*-pyrrol-2-one (4a)



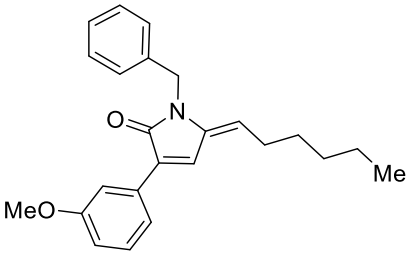
^{1}H NMR (400 MHz, $CDCl_3$)



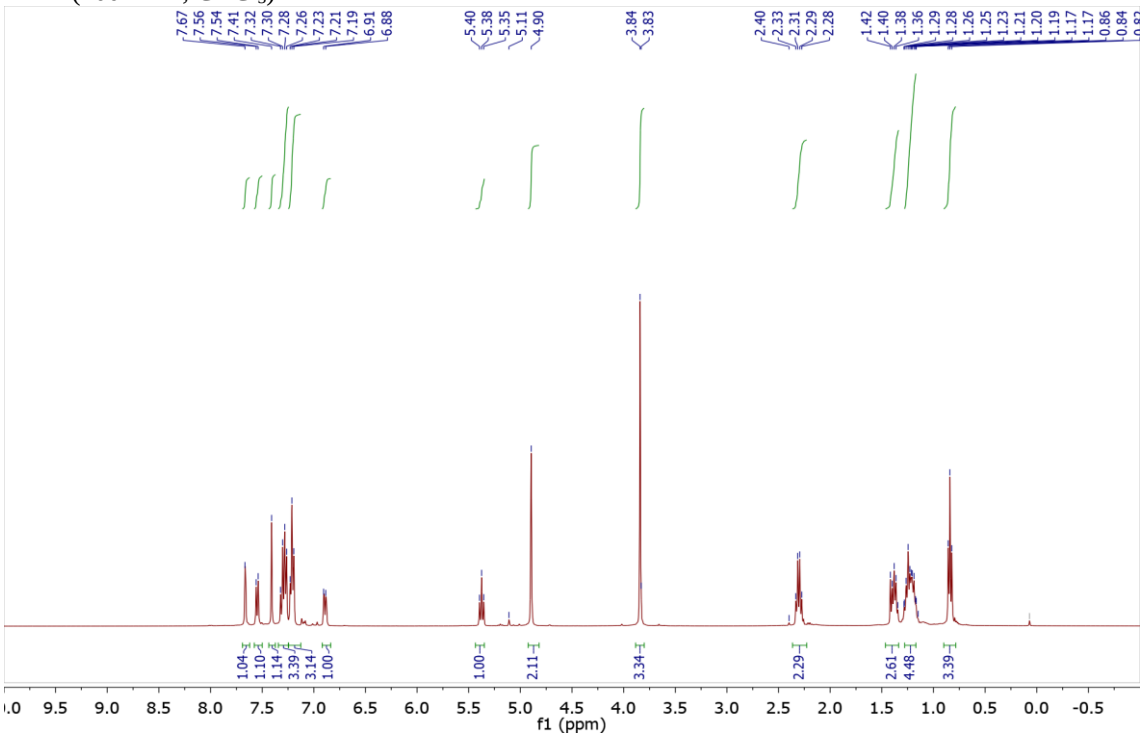
^{13}C NMR (101 MHz, $CDCl_3$)



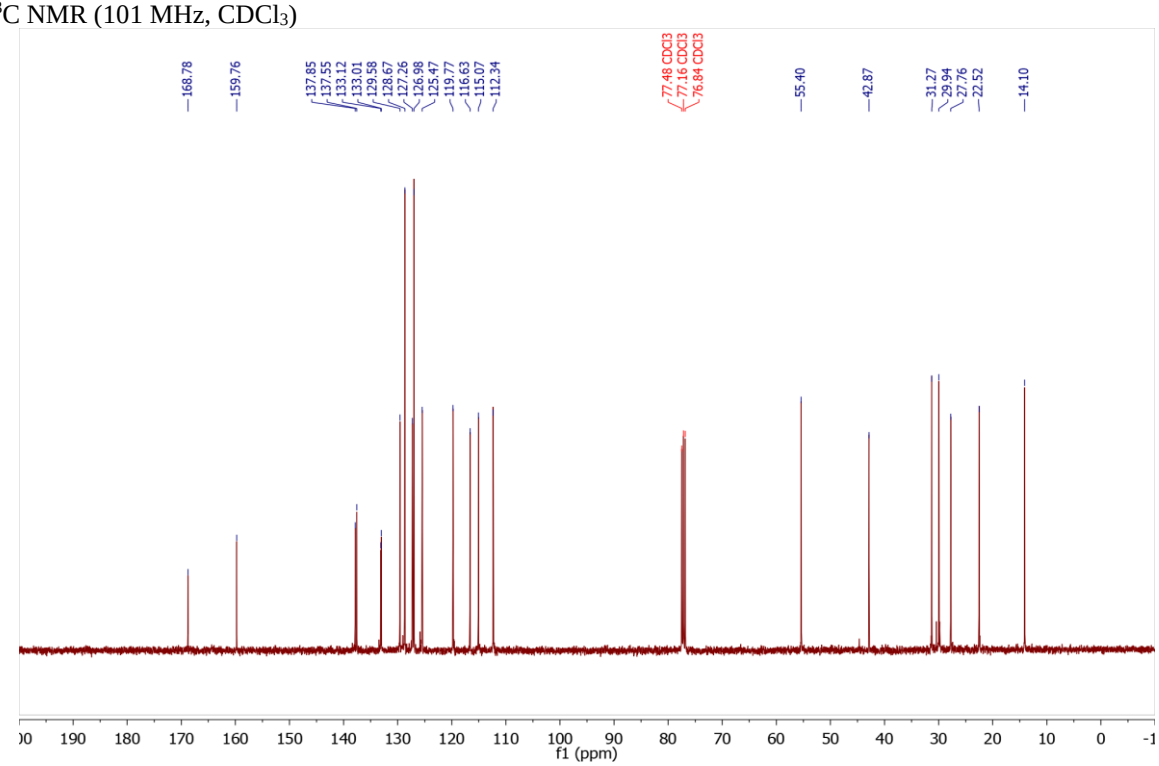
(*E*)-1-Benzyl-5-hexylidene-3-(3-methoxyphenyl)-1,5-dihydro-2*H*-pyrrol-2-one (4b)



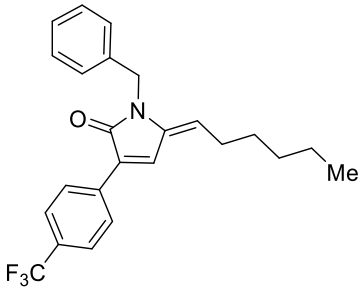
^{1}H NMR (400 MHz, $CDCl_3$)



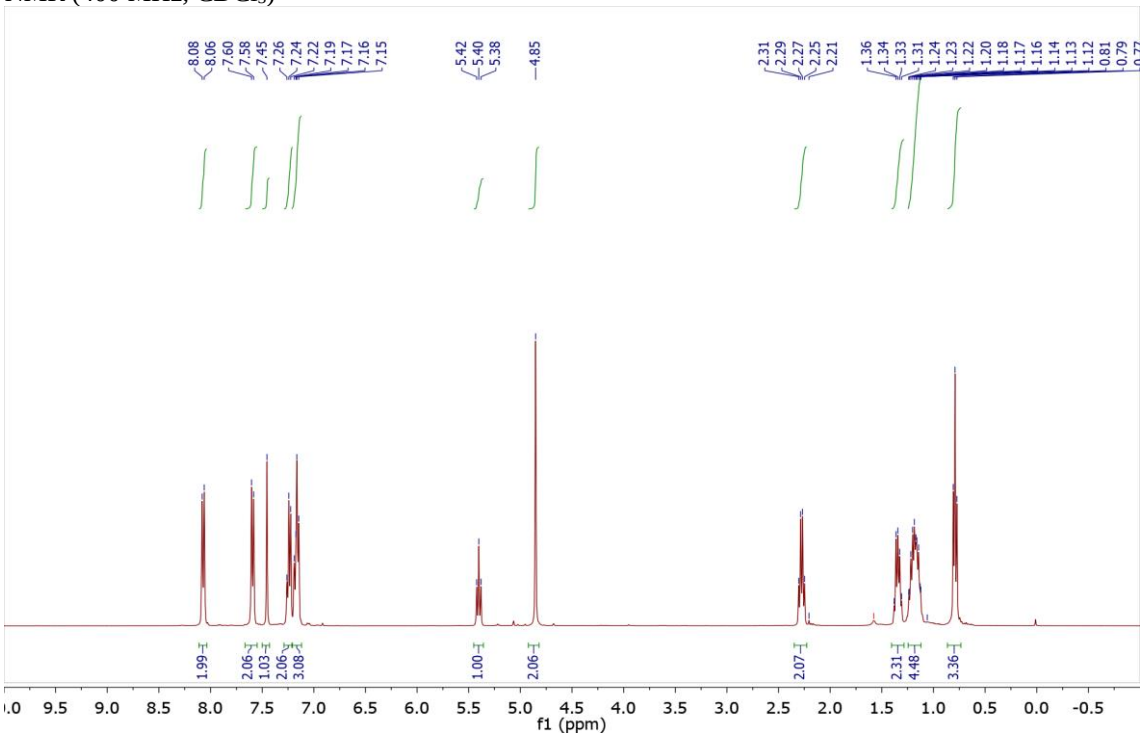
^{13}C NMR (101 MHz, $CDCl_3$)



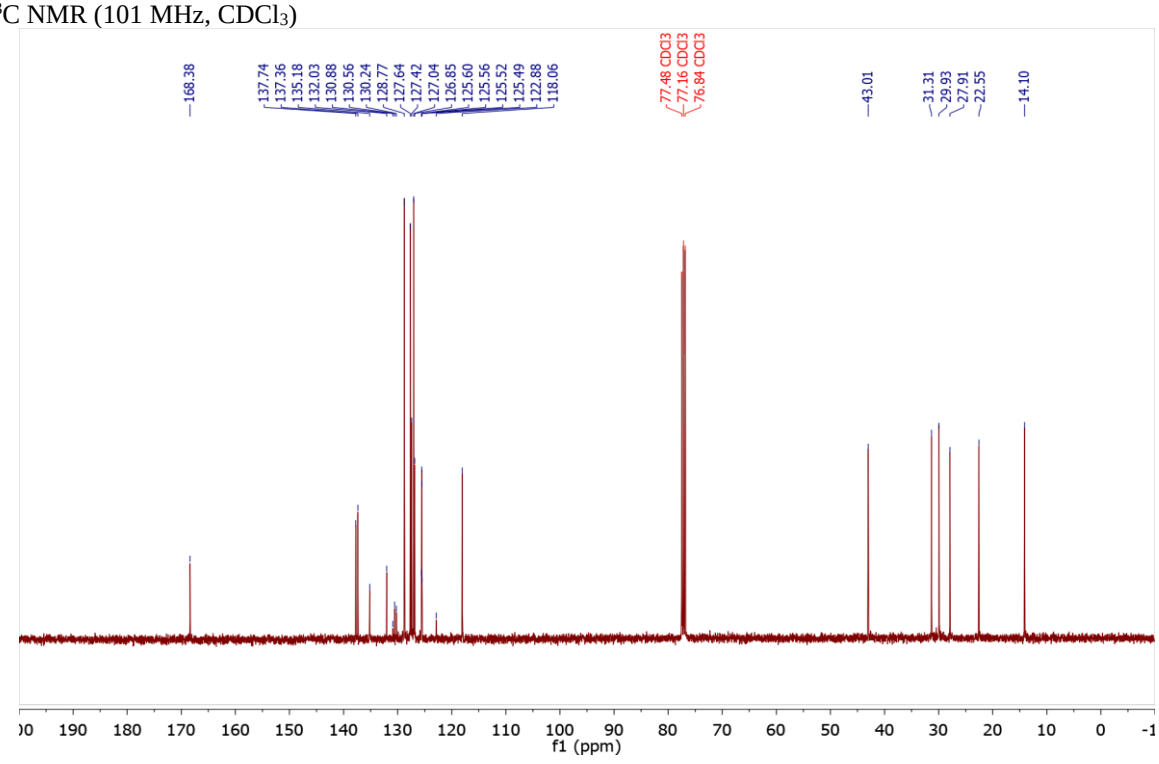
(*E*)-1-Benzyl-5-hexylidene-3-(4-(trifluoromethyl)phenyl)-1,5-dihydro-2*H*-pyrrol-2-one (4c)



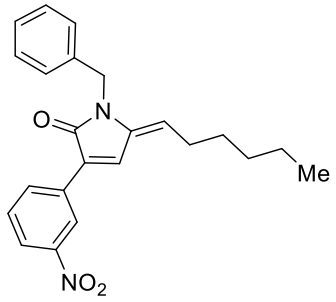
^{1}H NMR (400 MHz, $CDCl_3$)



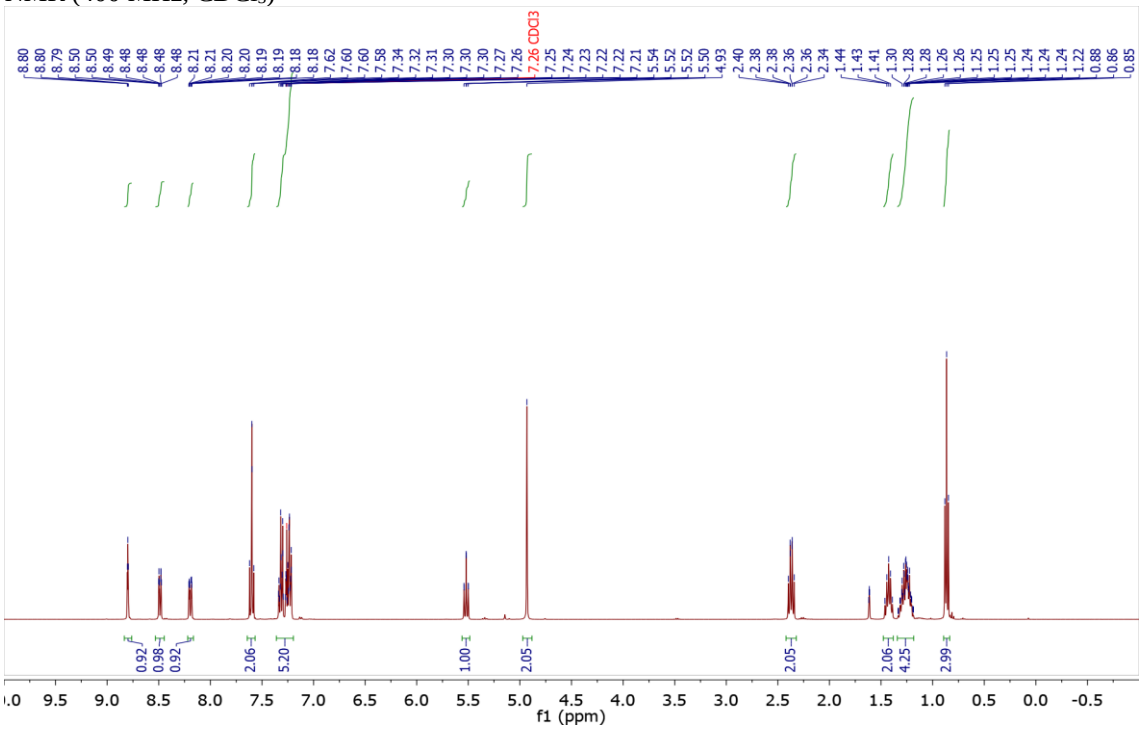
^{13}C NMR (101 MHz, $CDCl_3$)



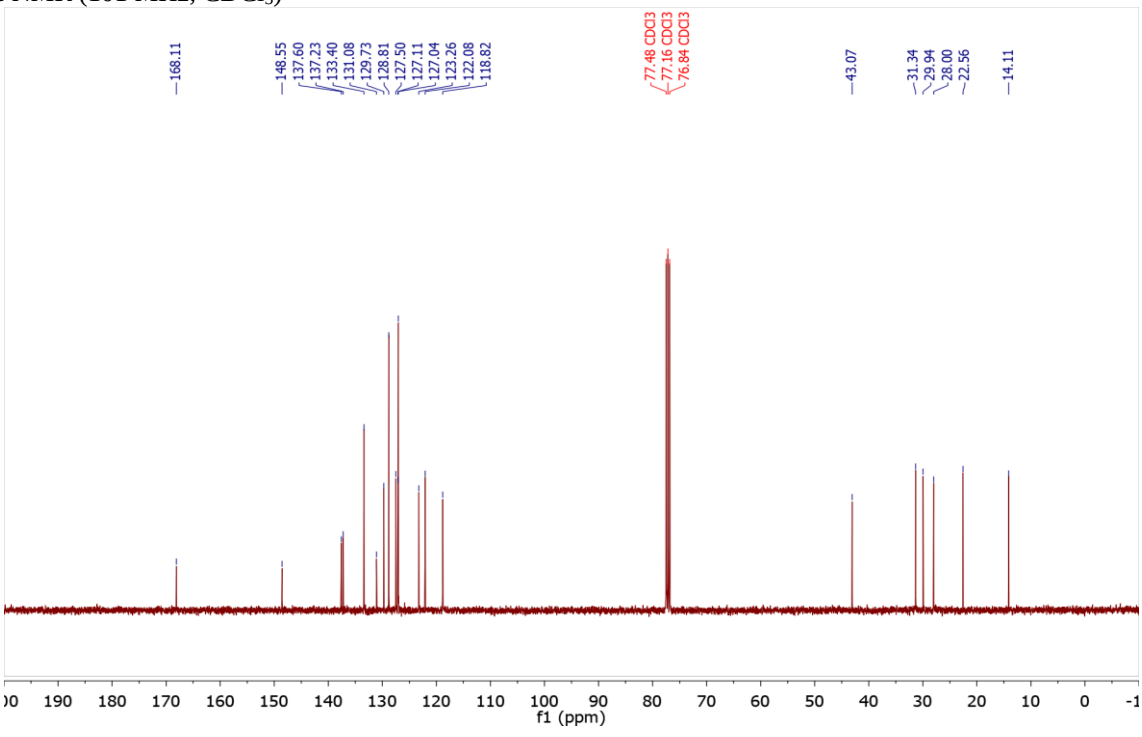
(*E*)-1-Benzyl-5-hexylidene-3-(3-nitrophenyl)-1,5-dihydro-2*H*-pyrrol-2-one (4d)



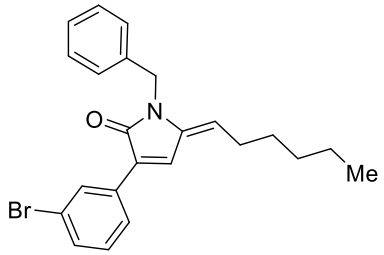
^{1}H NMR (400 MHz, $CDCl_3$)



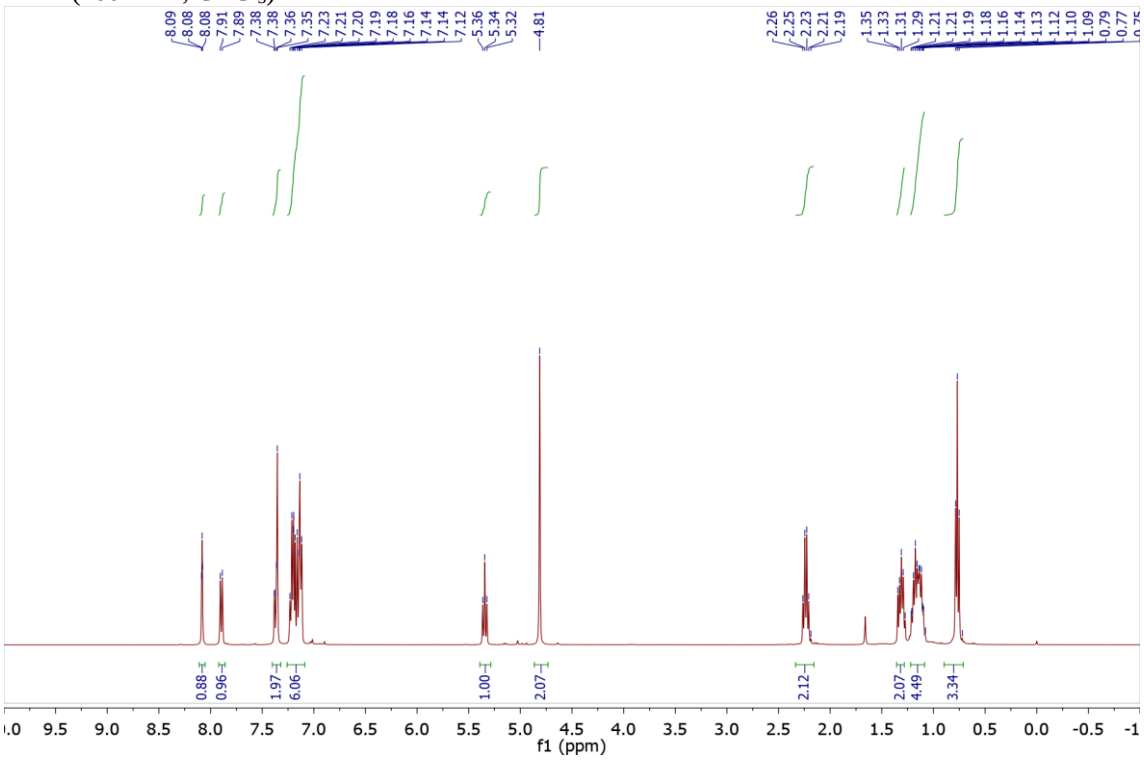
^{13}C NMR (101 MHz, $CDCl_3$)



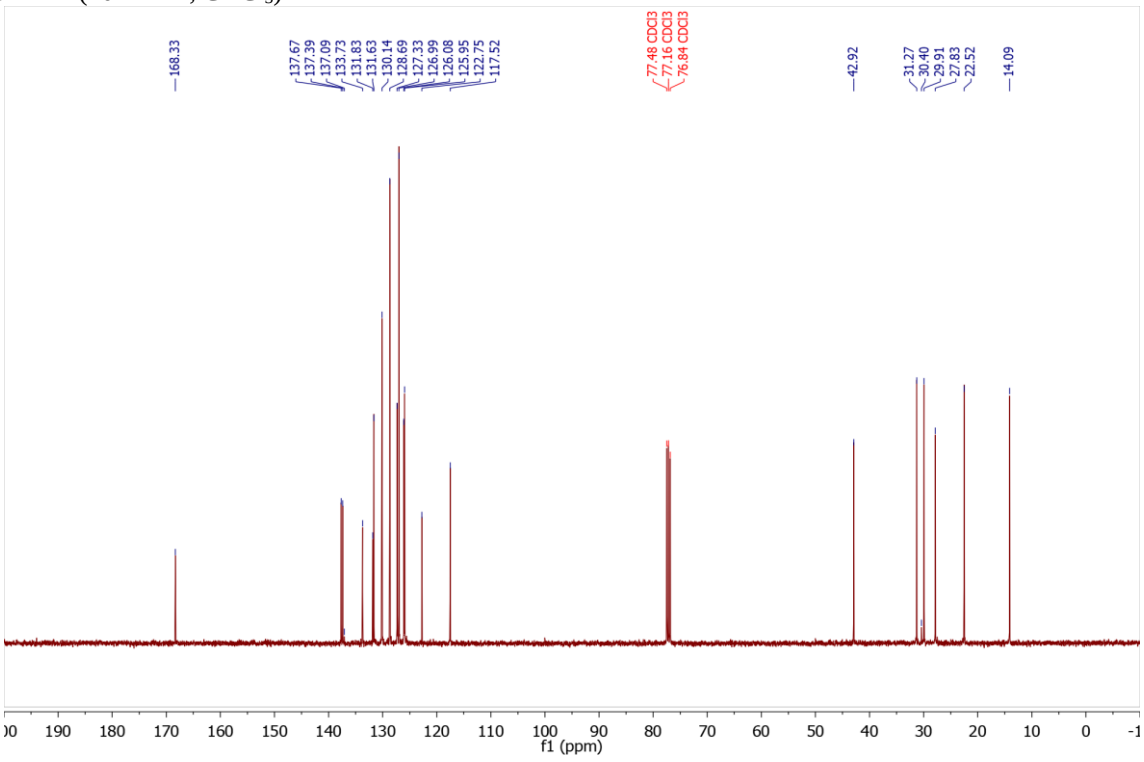
(*E*)-1-Benzyl-3-(3-bromophenyl)-5-hexylidene-1,5-dihydro-2*H*-pyrrol-2-one (4e)



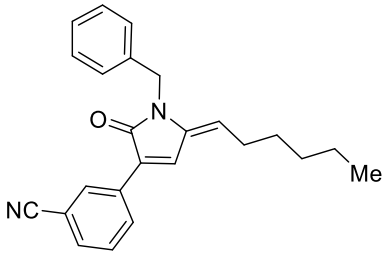
^{1}H NMR (400 MHz, $CDCl_3$)



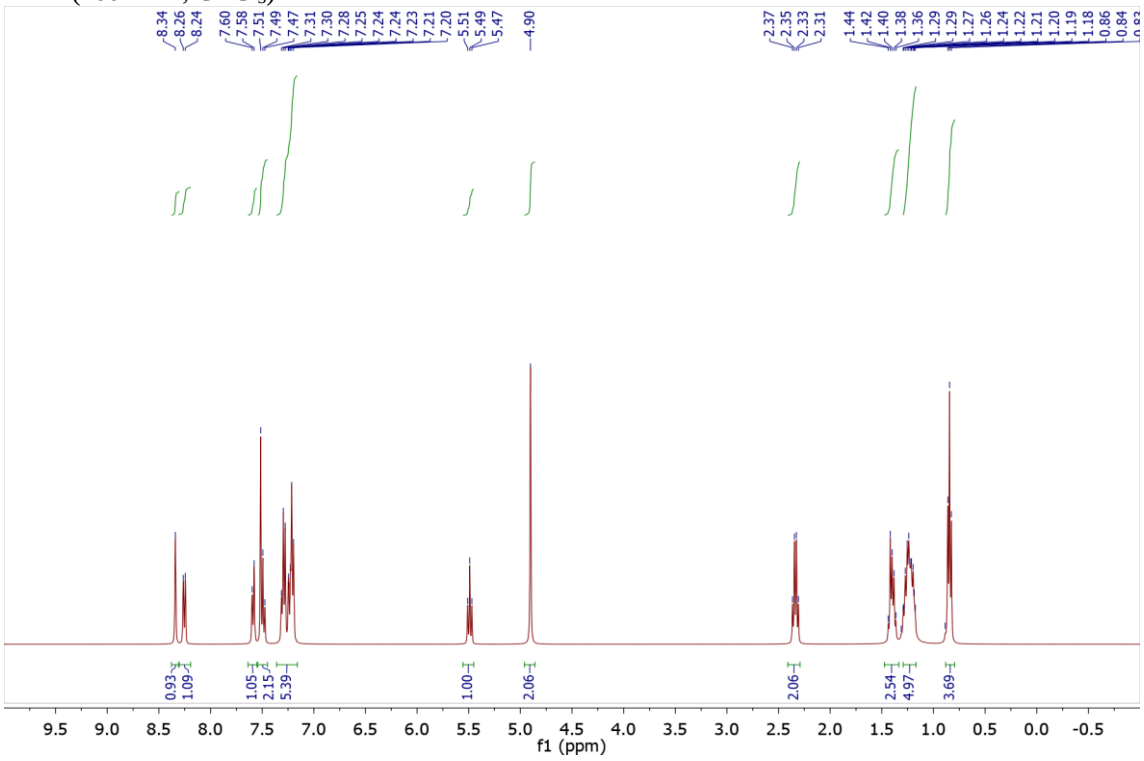
^{13}C NMR (101 MHz, $CDCl_3$)



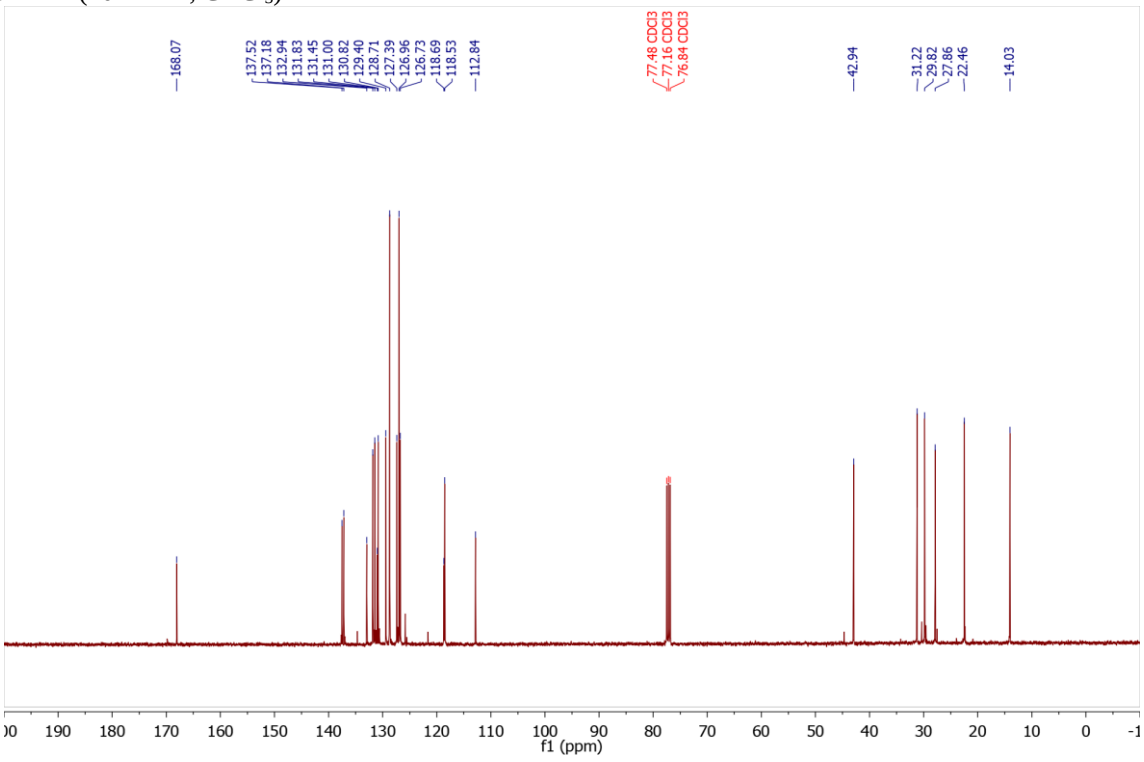
(*E*)-3-(1-Benzyl-5-hexylidene-2-oxo-2,5-dihydro-1*H*-pyrrol-3-yl)benzonitrile (4f)



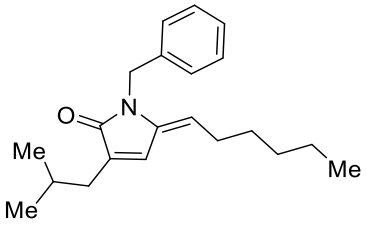
^{1}H NMR (400 MHz, $CDCl_3$)



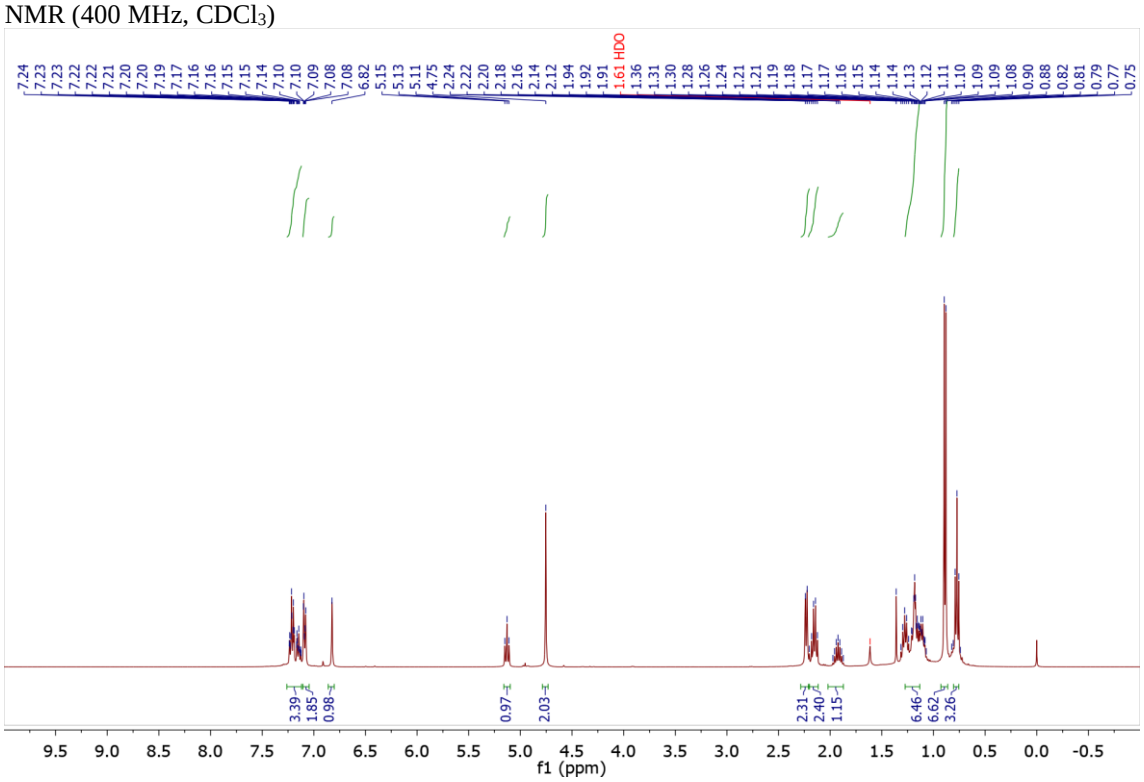
^{13}C NMR (101 MHz, $CDCl_3$)



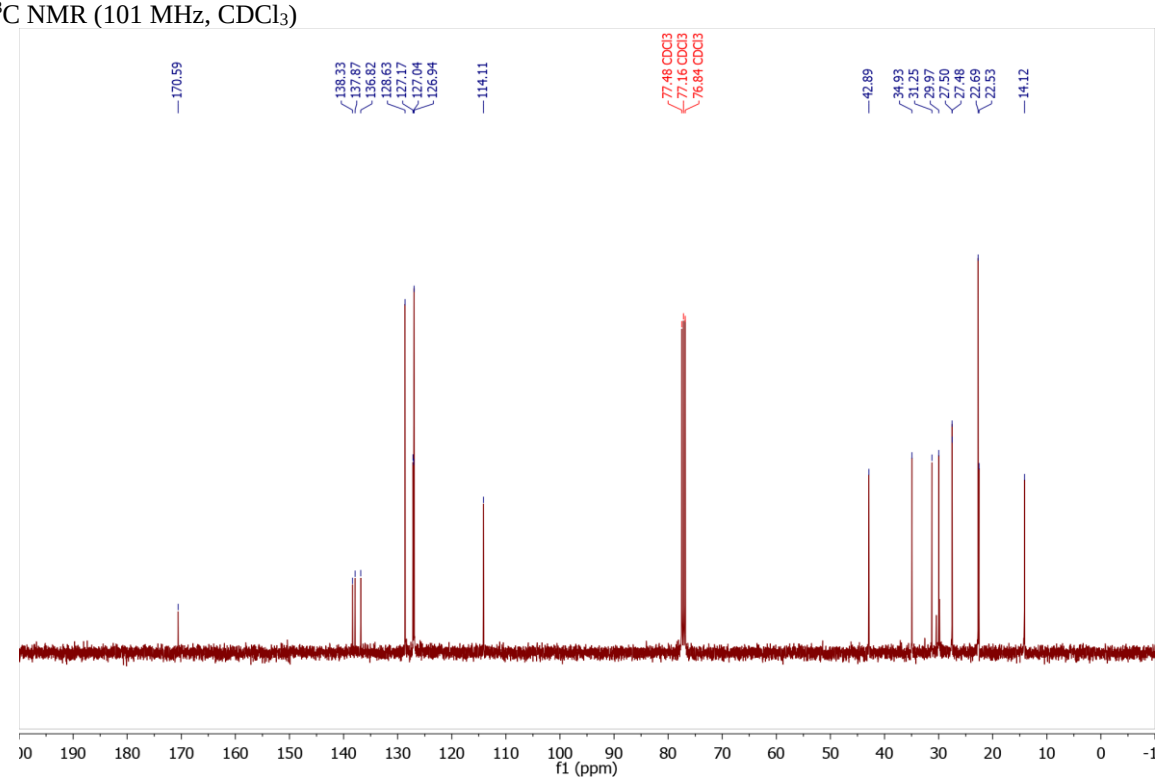
(*E*)-1-Benzyl-5-hexylidene-3-isobutyl-1,5-dihydro-2*H*-pyrrol-2-one (4g)



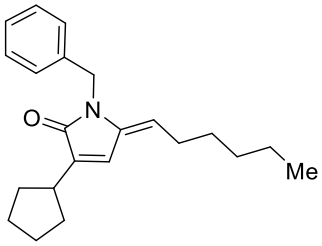
^{1}H NMR (400 MHz, $CDCl_3$)



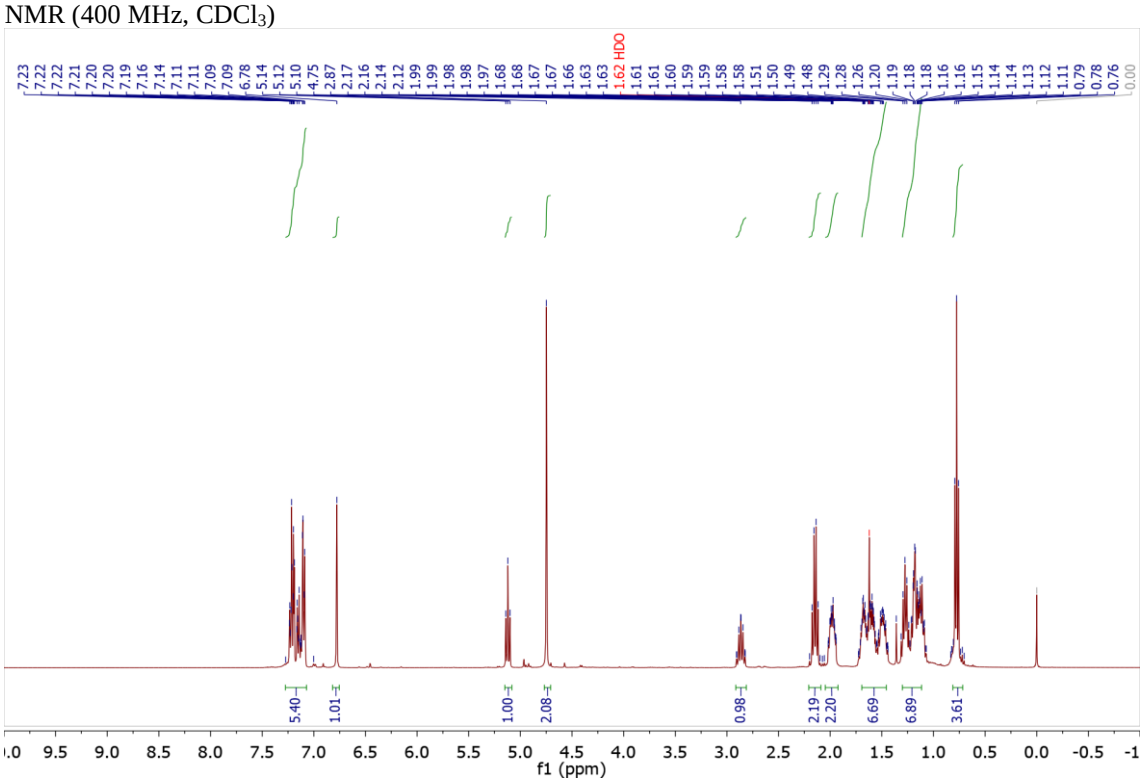
^{13}C NMR (101 MHz, $CDCl_3$)



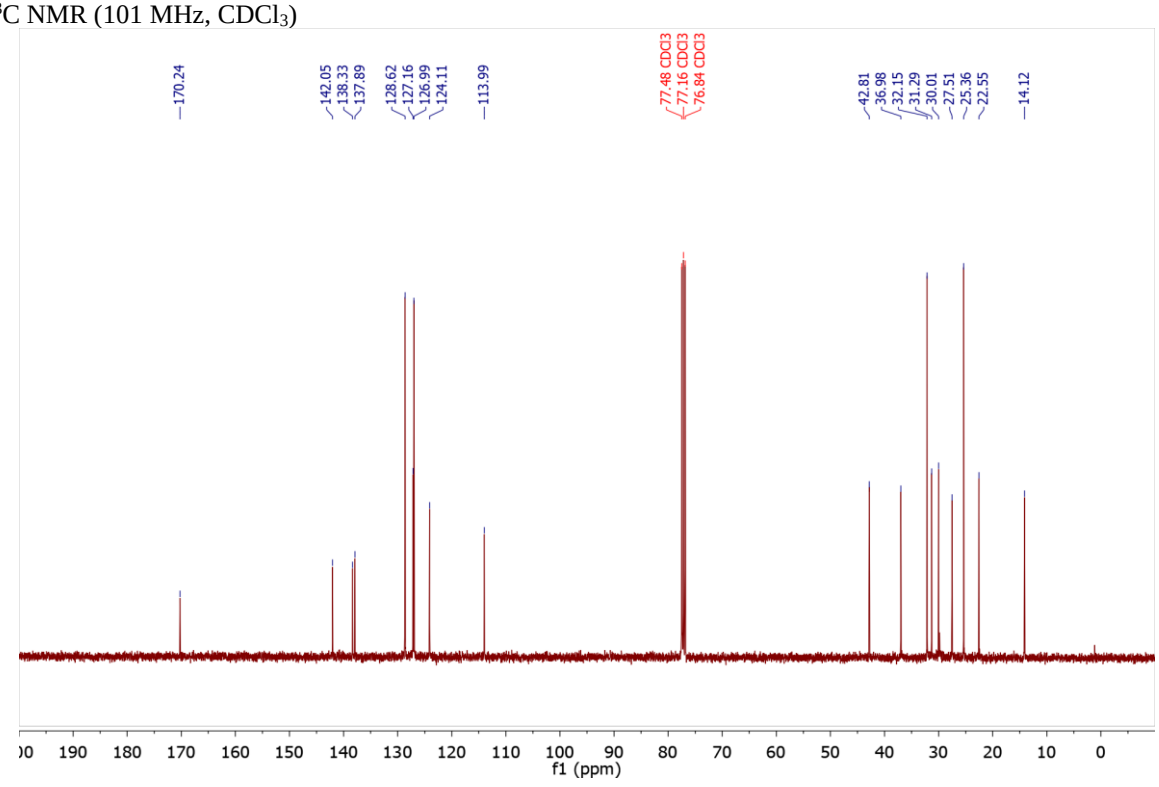
(*E*)-1-Benzyl-3-cyclopentyl-5-hexylidene-1,5-dihydro-2*H*-pyrrol-2-one (4h)



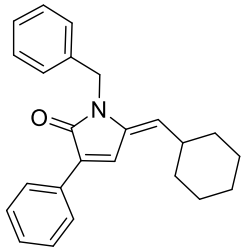
^{1}H NMR (400 MHz, $CDCl_3$)



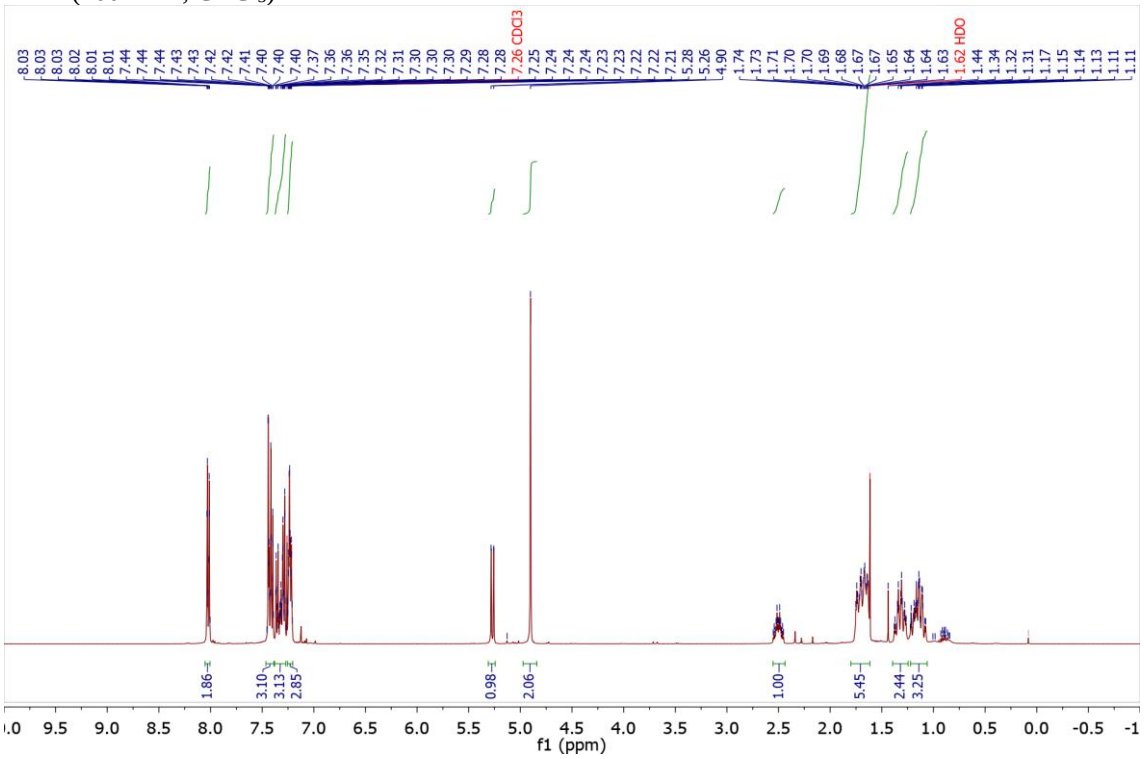
^{13}C NMR (101 MHz, $CDCl_3$)



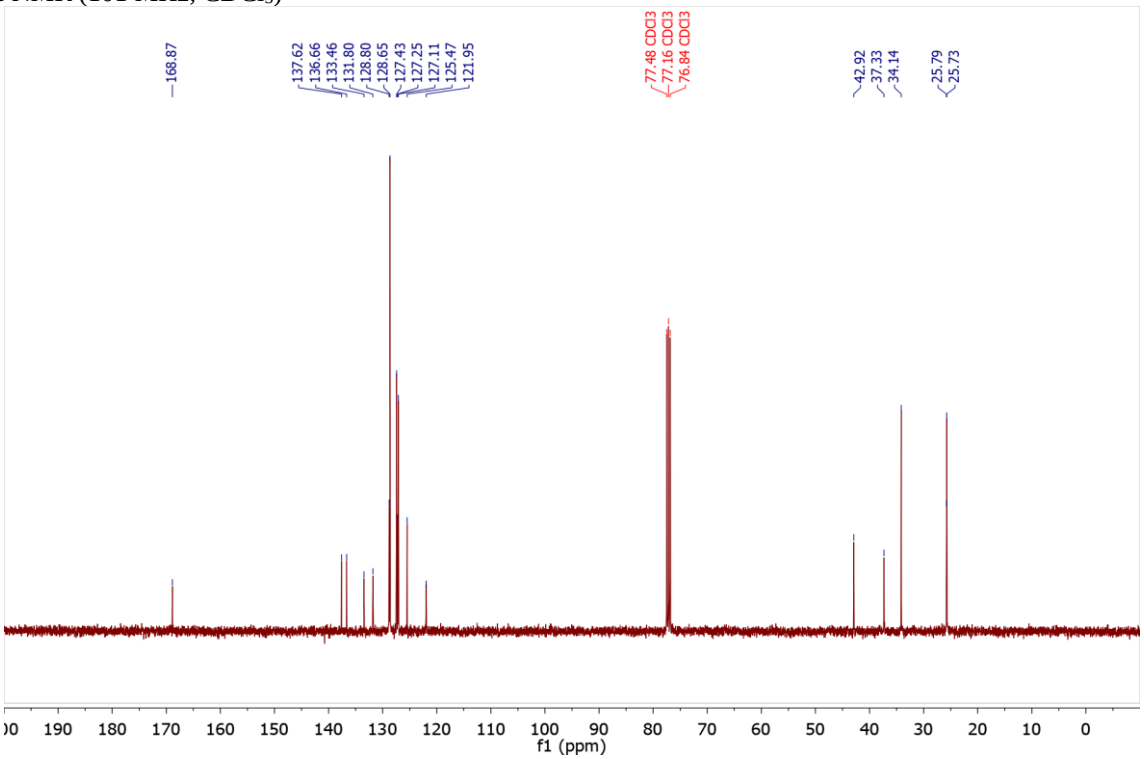
(*E*)-1-Benzyl-5-(cyclohexylmethylene)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (5a)



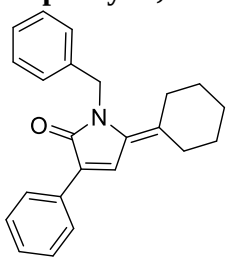
^{1}H NMR (400 MHz, $CDCl_3$)



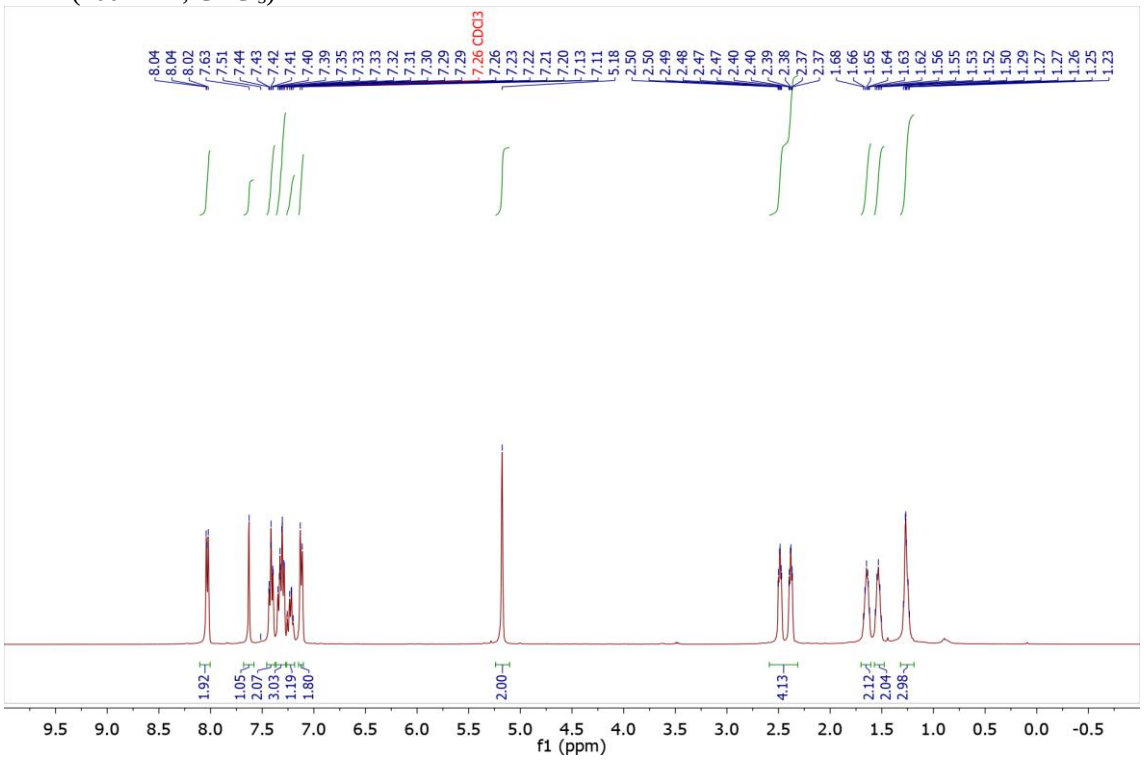
^{13}C NMR (101 MHz, $CDCl_3$)



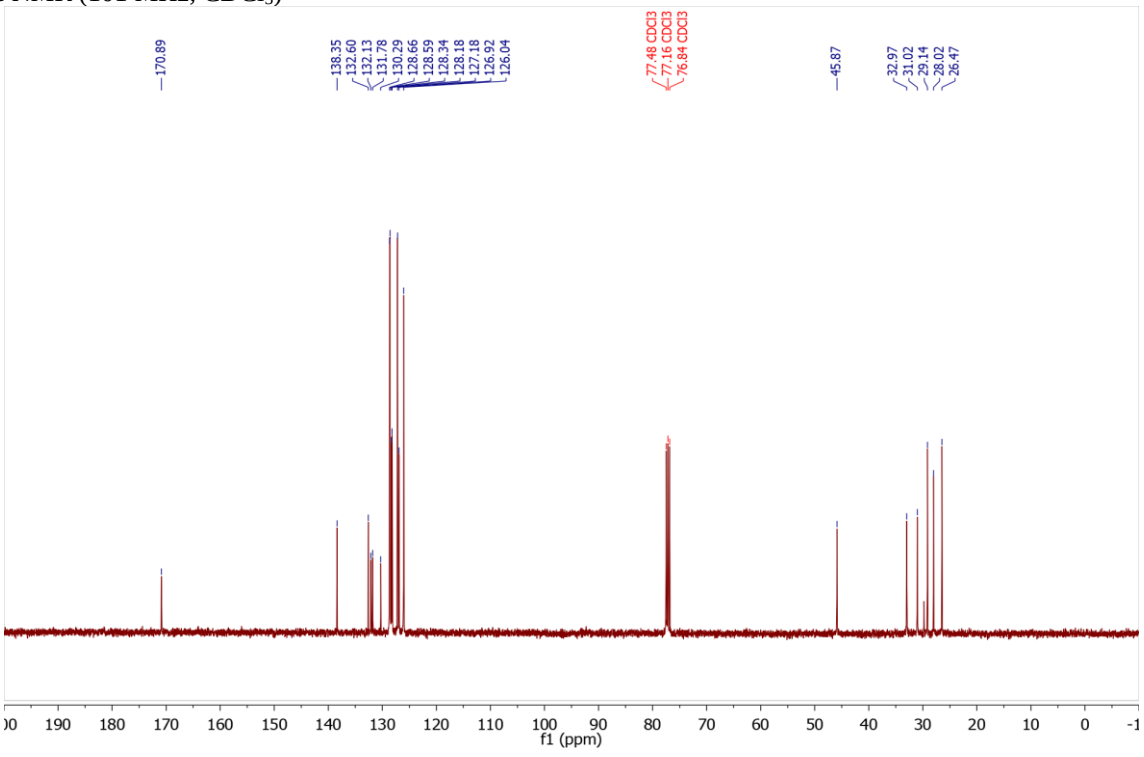
1-Benzyl-5-cyclohexylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (5b)



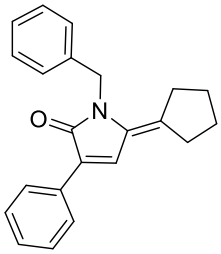
^{1}H NMR (400 MHz, $CDCl_3$)



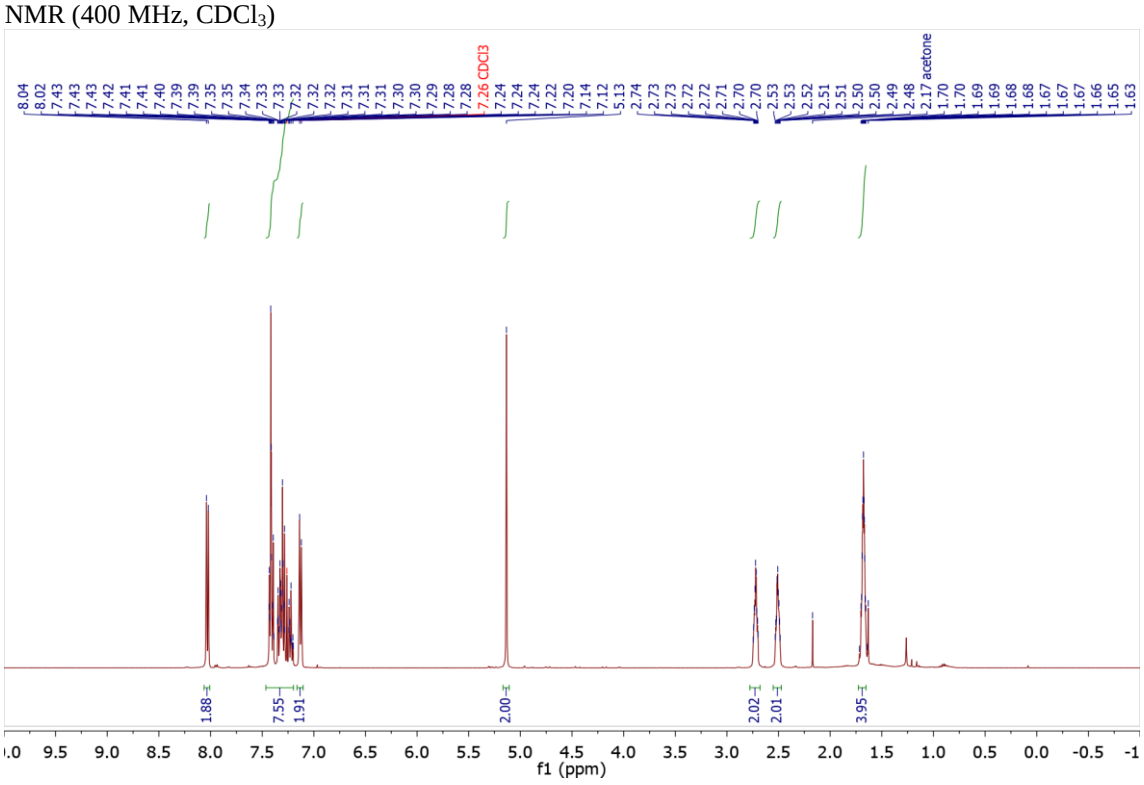
^{13}C NMR (101 MHz, $CDCl_3$)



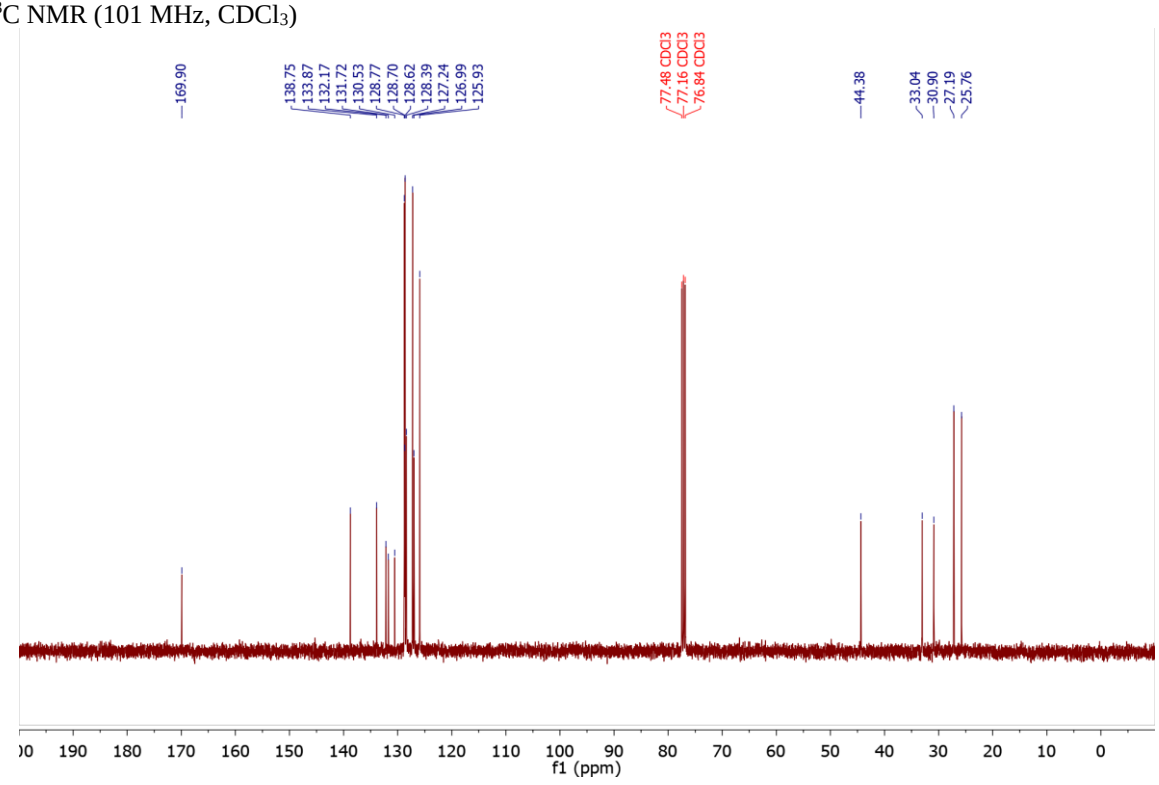
1-Benzyl-5-cyclopentylidene-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (5c)



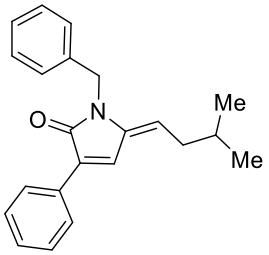
^{1}H NMR (400 MHz, $CDCl_3$)



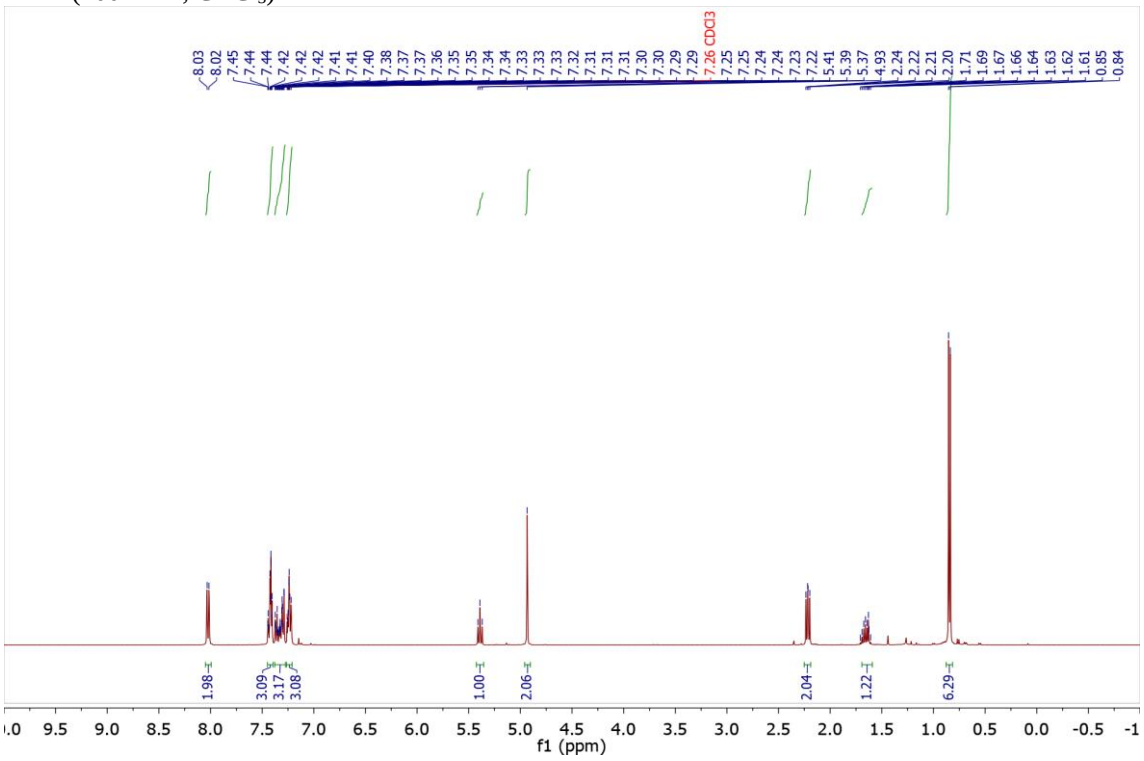
^{13}C NMR (101 MHz, $CDCl_3$)



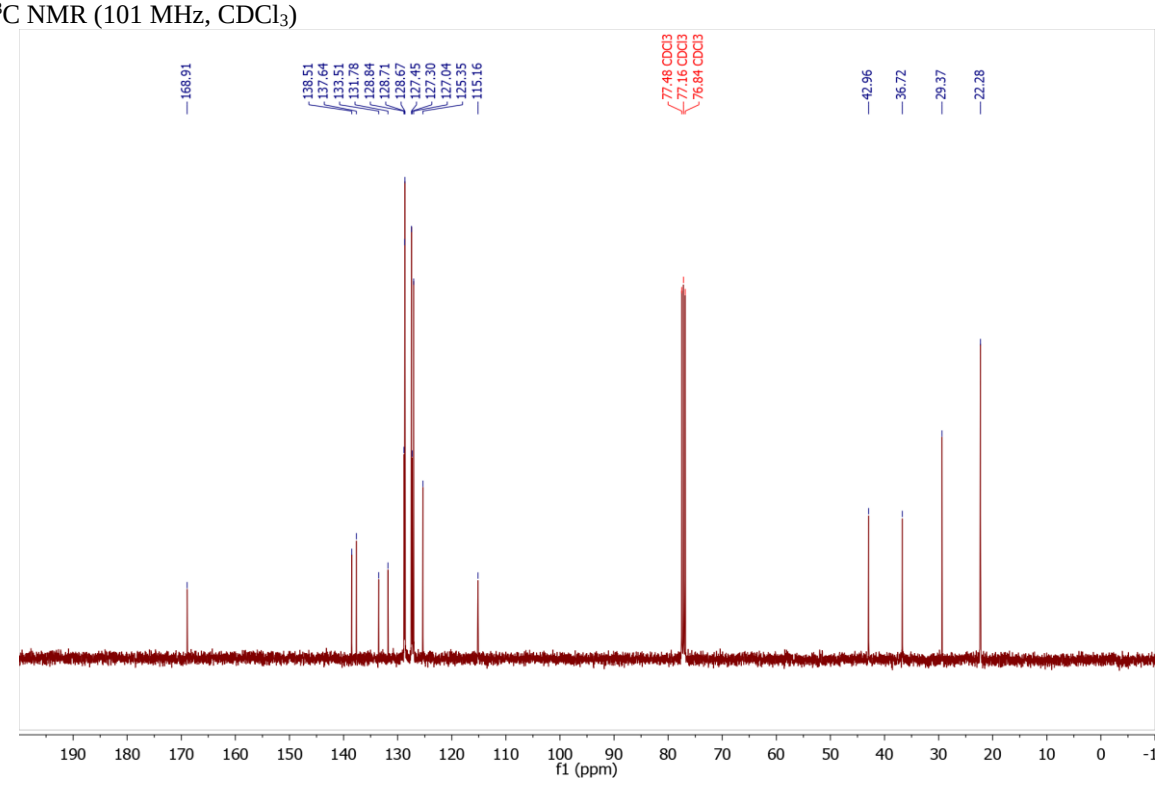
(*E*)-1-Benzyl-5-(3-methylbutylidene)-3-phenyl-1,5-dihydro-2*H*-pyrrol-2-one (5d)



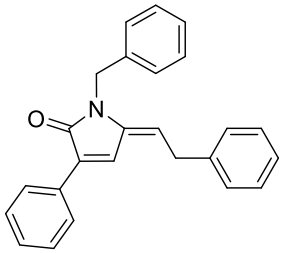
^{1}H NMR (400 MHz, $CDCl_3$)



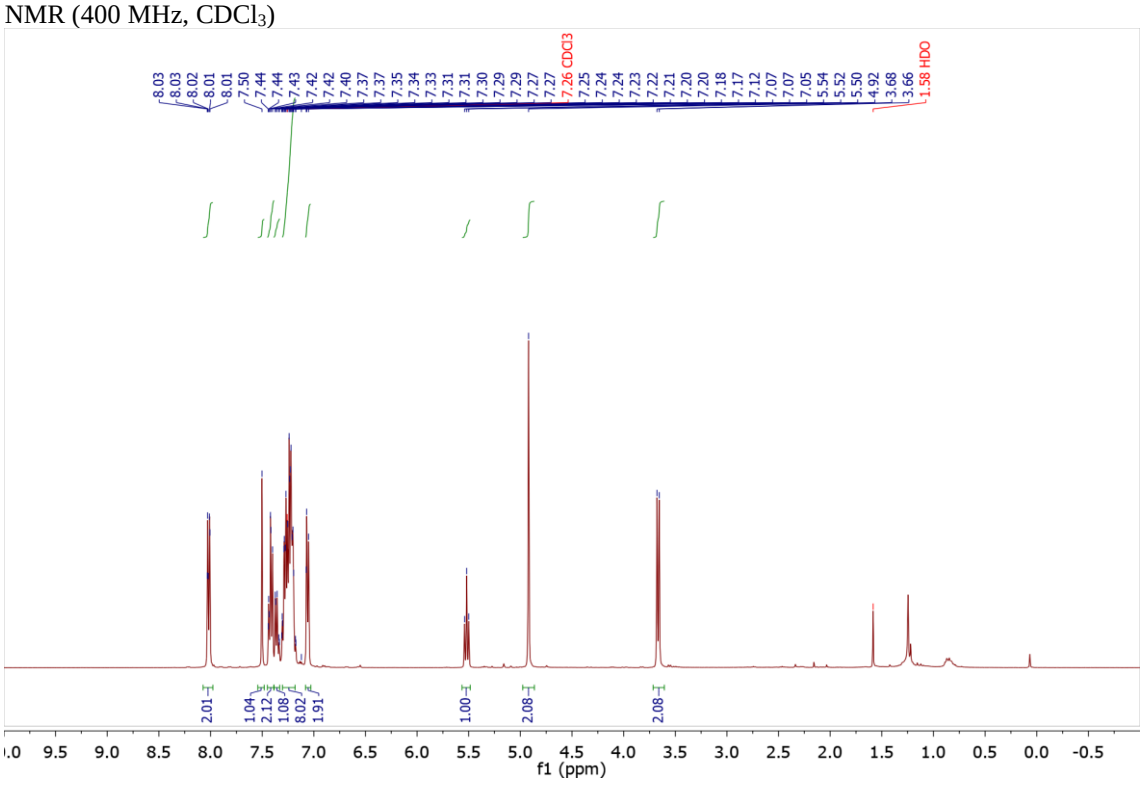
^{13}C NMR (101 MHz, $CDCl_3$)



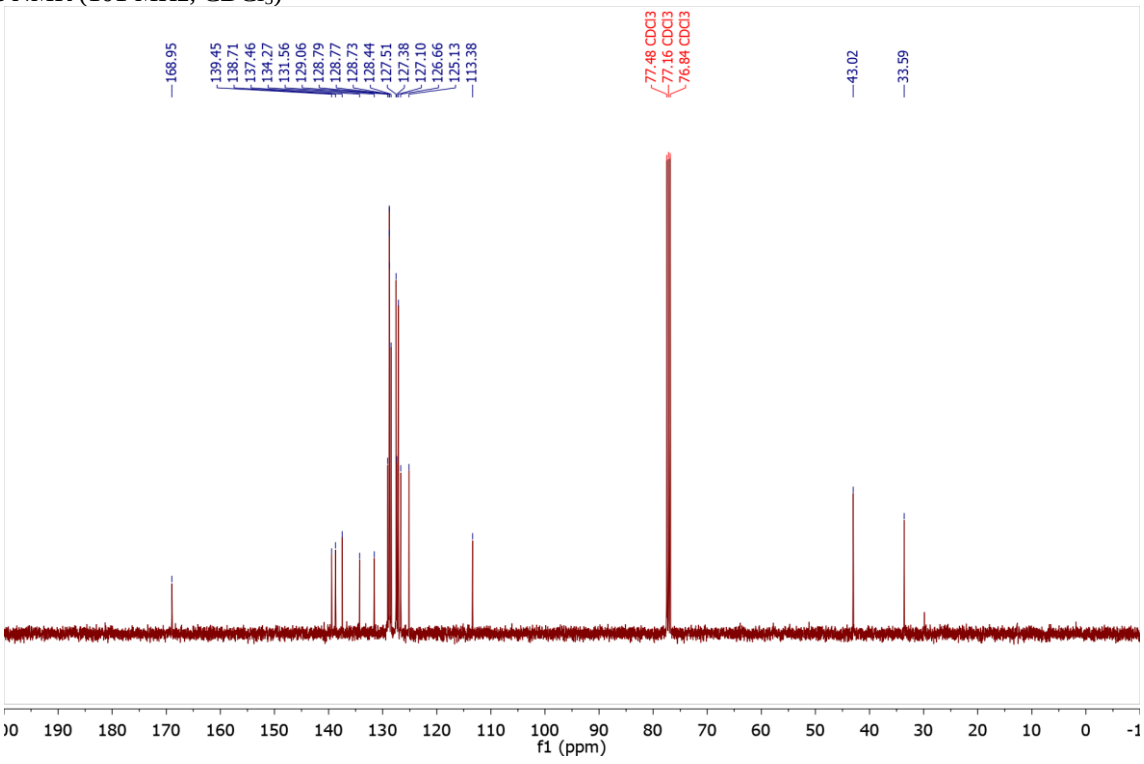
(*E*)-1-Benzyl-3-phenyl-5-(2-phenylethylidene)-1,5-dihydro-2*H*-pyrrol-2-one (5e)



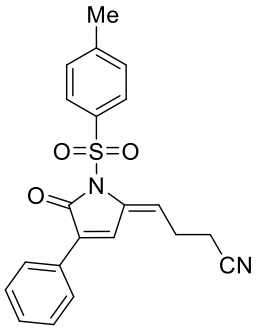
^{1}H NMR (400 MHz, $CDCl_3$)



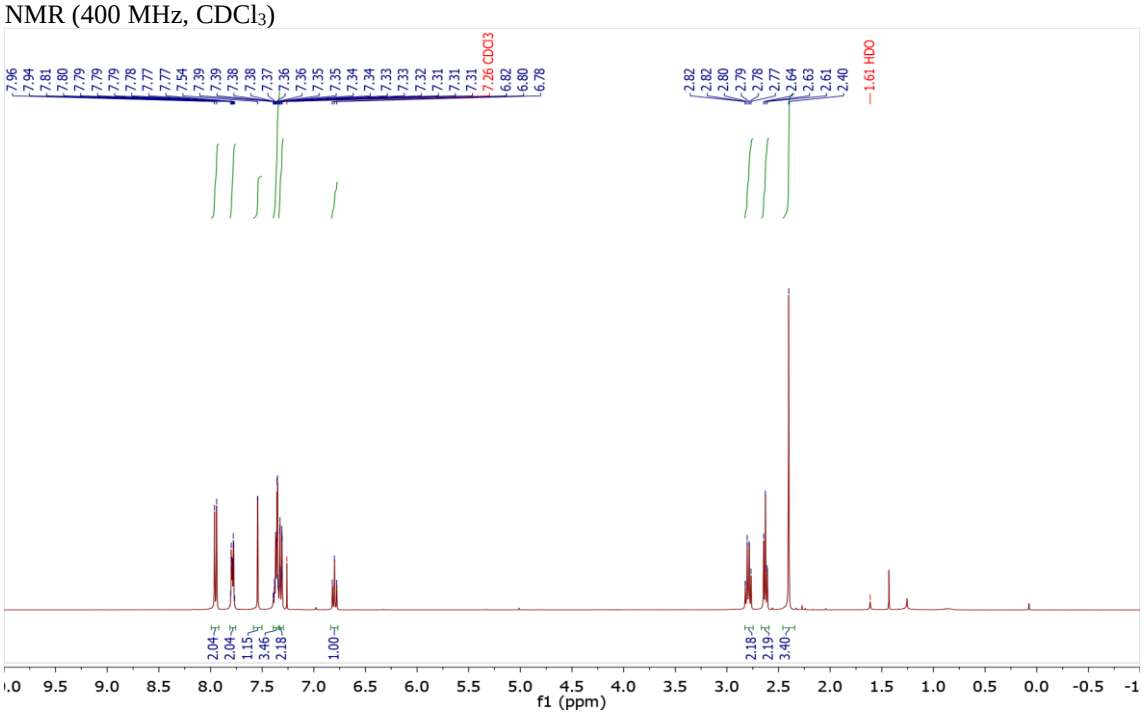
^{13}C NMR (101 MHz, $CDCl_3$)



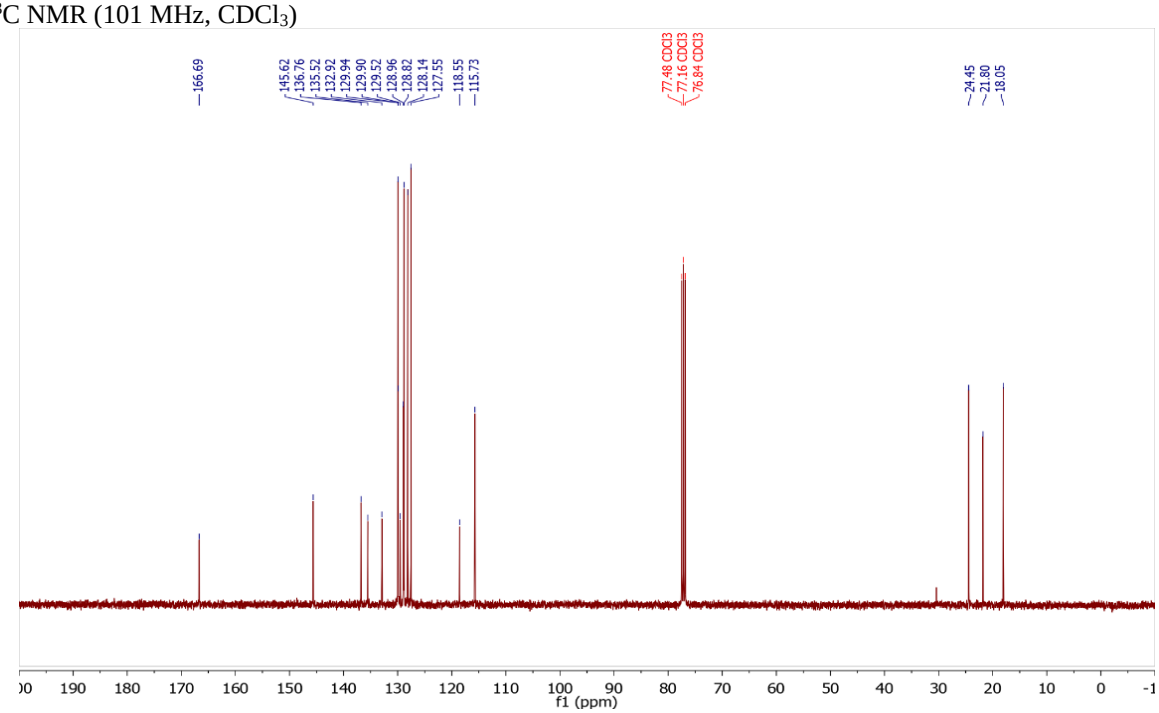
(*E*)-4-(5-oxo-4-phenyl-1-tosyl-1,5-dihydro-2*H*-pyrrol-2-ylidene)butanenitrile (5f)



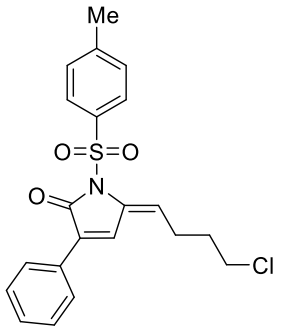
^{1}H NMR (400 MHz, $CDCl_3$)



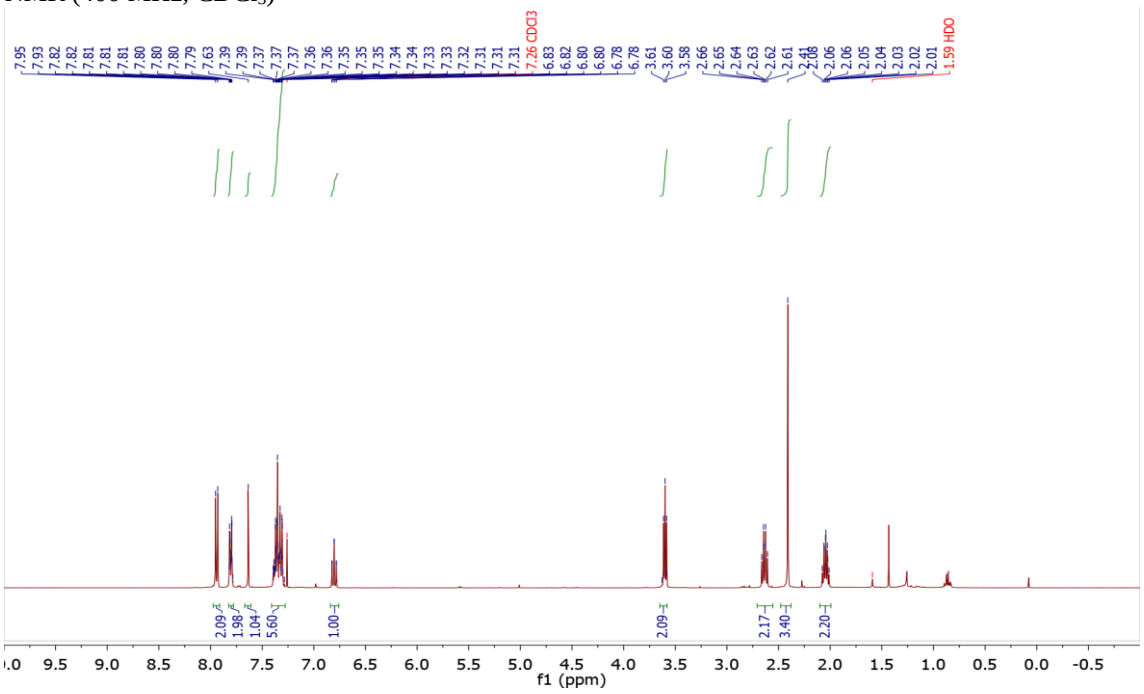
^{13}C NMR (101 MHz, $CDCl_3$)



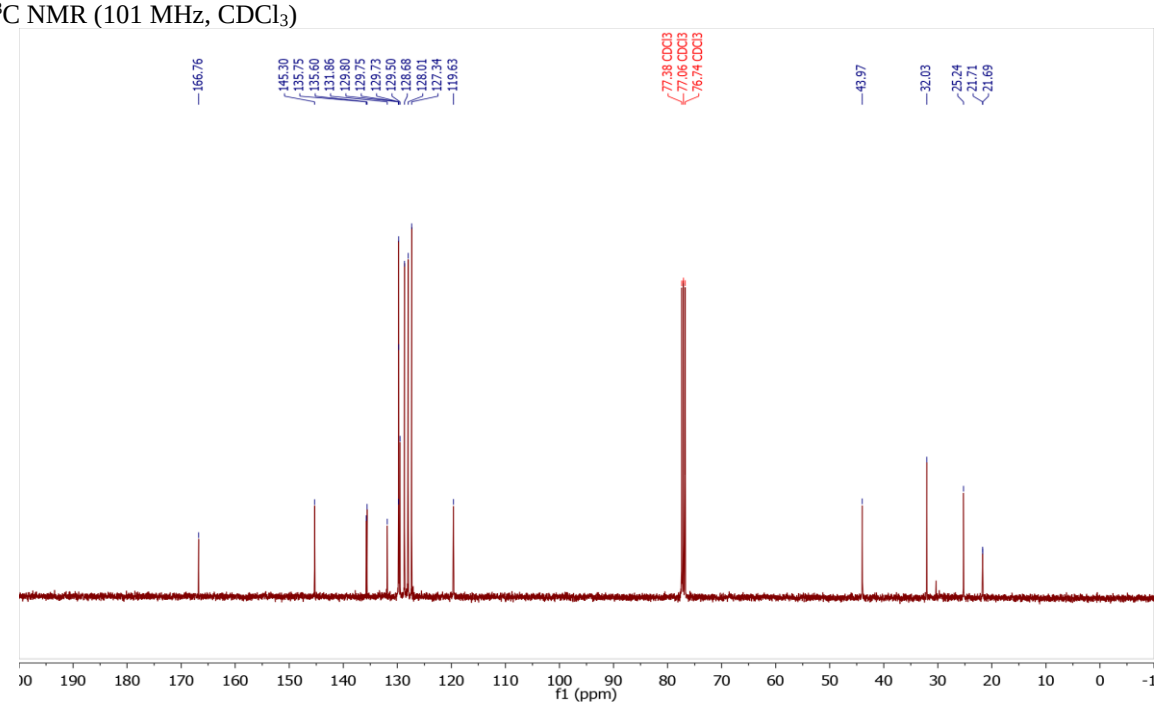
(*E*)-5-(4-chlorobutylidene)-3-phenyl-1-tosyl-1,5-dihydro-2*H*-pyrrol-2-one (5g)



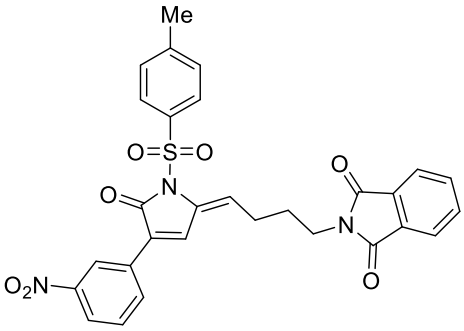
^{1}H NMR (400 MHz, $CDCl_3$)



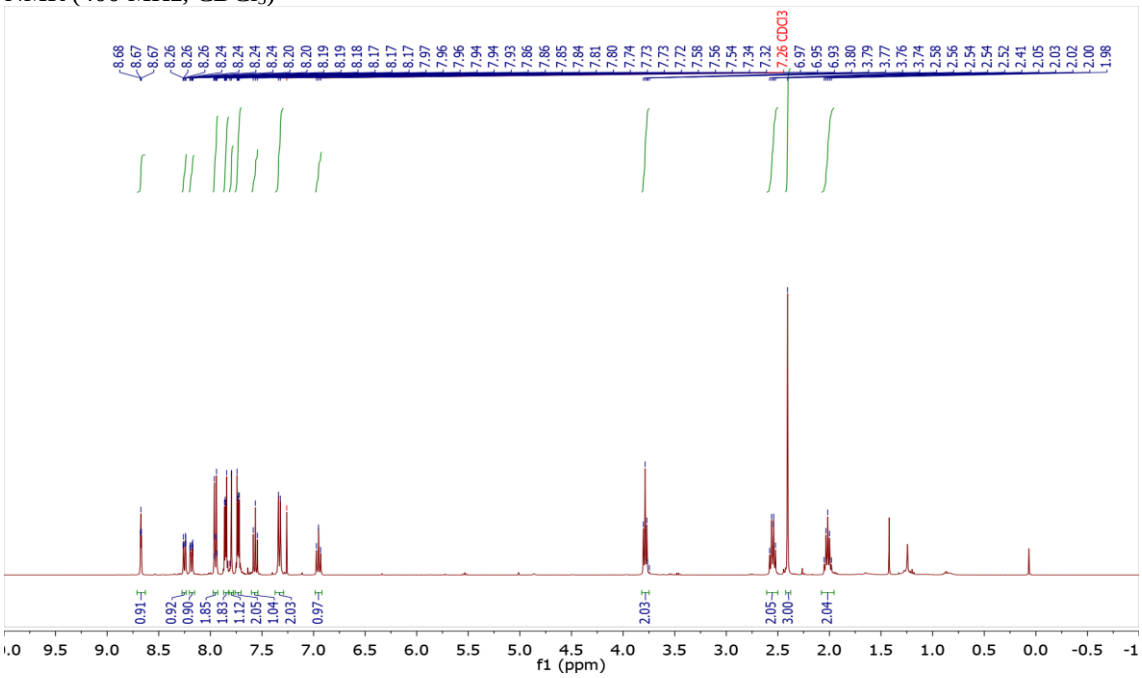
^{13}C NMR (101 MHz, $CDCl_3$)



(*E*)-2-(4-(4-(3-nitrophenyl)-5-oxo-1-tosyl-1,5-dihydro-2*H*-pyrrol-2-ylidene)butyl)isoindoline-1,3-dione (5h)



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



^{13}C NMR (101 MHz, $CDCl_3$)