Electronic Supplementary Information (ESI)

An expedient and facile route for the general synthesis of 3-aryl substituted 1,2,3-triazolo[1,5-*a*][1,4]benzodiazepin-6-ones and 1,2,3-triazolo[1,5-*a*][1,5]benzodiazocin-7-ones

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1. General:

The reactions catalysed by palladium and reductions using lithium aluminium hydride were carried out under argon atmosphere using dry solvents; otherwise all the reactions were run under open atmosphere using commercial grade solvents. Petroleum ether refers to fraction boiling in the range 60-80 ^{o}C. DMF was dried over CaH_2, distilled, and stored over 3A^{o} molecular sieves in sealed container. THF was distilled over sodium and benzophenone. Analytical thin-layer chromatography (TLC) was performed on silica gel G coated aluminium sheets. Visualization of the developed chromatogram was done by UV absorbance. For purification, column chromatography was performed using silica gel (60-120 or 100- 200 mesh).

^{1}H and ^{13}C NMR spectra were recorded using 300 or 600 MHz NMR instrument using tetramethylsilane (TMS) as internal standard. Chemical shifts (δ) are given from TMS (δ=0.00) in parts per million (ppm) with the residual signals of deuterated solvent used as standards [$CDCl_3$: ^{1}H NMR δ = 7.26 ppm (s); ^{13}C NMR δ = 77.0 ppm (t)]. Coupling constants (*J*) are expressed in hertz (Hz) and spin multiplicities are given as s (singlet), d (doublet), dd (double doublet), ddd (doublet of double doublet), t (triplet), m (multiplet) and br (broad). All ^{13}C NMR spectra were obtained with complete proton decoupling. Mass spectra were performed using ESI-TOF, EI or FAB ionization mode. Infrared spectra were obtained on FT-IR spectrometer in neat condition or as KBr plate.

2. X-Ray crystallographic information of products 5a and 6a:

Single crystals of products **5a** and **6a** were obtained through slow evaporation at room temperature of a solution in ethyl acetate - petroleum ether. A single crystal of **5a** (or **6a)** was attached to a glass fiber with epoxy glue and transferred to X-ray diffractometer equipped with a graphite-monochromator. Diffraction data of products **5a** and **6a** were measured with MoKα radiation (λ = 0.71073 Å) at 296(2)K. The structures were solved by direct methods using the SHELXS-97 program.[1] Refinements

were carried out with a full matrix least squares method against F^2 using SHELXL-97.[2] The non-hydrogen atoms were refined with anisotropic thermal parameters. The hydrogen atoms were included in geometric positions and given thermal parameters equivalent to 1.2 times those of the atoms to which they were attached. The important crystal data of products **5a** and **6a** are given below.

Table 1: Crystallographic data of product 5a

Empirical Formula:	$C_{17}H_{14}N_4O$
Formula Weight:	290.32
Crystal System:	Monoclinic
Space group	P21/n
Crystal Size	0.40 x 0.08 x 0.05 mm^3
Unit Cell Dimensions	a = 13.2985(12)Å, b = 7.5621(7)Å, c = 14.0449(11) Å
	$\alpha = 90.00^o$, $\beta = 96.240(4)^o$, $\gamma = 90.00^o$
Volume	1404.1(2) $Å^3$
Z	4
Density (Calculated)	1.373 Mg m^{-3}
Temperature	296(2) K
Wavelength	0.71073Å
μ	0.090 mm^{-1}
Reflections Collected	23805
Unique reflections	6221
R_{int}	0.0265
θ Range for Data Collection	2.00^o to 35.22^o
F (000)	608
Final R Indices [I >2σ(I)]	R1 = 0.0508, wR2= 0.1389
R Indices (all data)	R1 = 0.0803, wR2= 0.1747
Goodness-of-Fit on F^2	0.845

For more details please see the CIF file attached with supporting information. The crystal data of the product has already been deposited at Cambridge Crystallographic Data Center, UK, and the CCDC reference number is 774490.

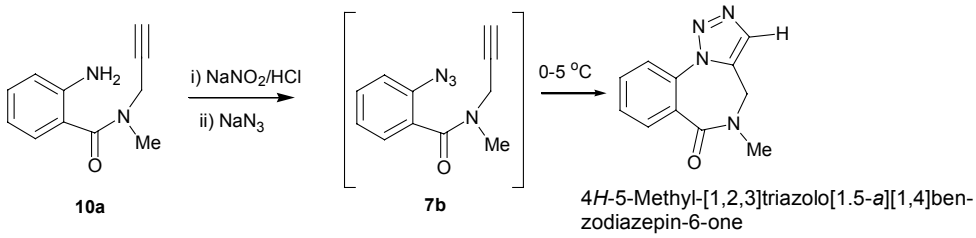
Table 2: Crystallographic data of product 6a

Empirical Formula:	$C_{18}H_{16}N_4O$
Formula Weight:	304.35
Crystal System:	Orthorhombic
Space group	P212121
Crystal Size	0.35 x 0.08 x 0.06 mm^3
Unit Cell Dimensions	a = 8.459(4) Å, b = 9.484(4) Å, c = 18.978(8) Å
	$\alpha = 90.00^o$, $\beta = 90.00^o$, $\gamma = 90.00^o$
Volume	1522.4(11) $Å^3$
Z	4
Density (Calculated)	1.328 Mg m^{-3}
Temperature	296(2) K
Wavelength	0.71073Å
μ	0.086 mm^{-1}
Reflections Collected	2156
Unique reflections	1901
R_{int}	0.0362
θ Range for Data Collection	3.40^o to 25.00^o
F (000)	640
Final R Indices [I >2σ(I)]	R1 = 0.0439, wR2= 0.1203
R Indices (all data)	R1 = 0.0494, wR2= 0.1274
Goodness-of-Fit on F^2	0.782

For more details please see the CIF file attached with supporting information. The crystal data of product has already been deposited at Cambridge Crystallographic data Centre, UK. The CCDC reference number is 775332.

3. Preparation of starting materials:

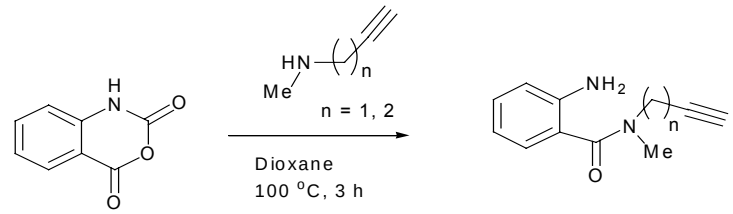
Attempted synthesis of 2-azido-*N*-methyl-*N*-(prop-2-ynyl)benzamide (7b): formation of 4*H*-5-methyl-[1,2,3]triazolo[1,5-*a*][1,4]benzodiazepin-6-one



To a well stirred and cooled (0-3 °C) solution of **10a** (170 mg, 0.90 mmol) in 2N HCl (12.0 mL) was added a solution of $NaNO_2$ (88 mg, 1.26 mmol) in 3.0 mL H_2O dropwise during 35 min and the mixture was stirred for another 30 min at the same temperature. A solution of NaN_3 (82 mg, 1.26 mmol) in 3 mL H_2O was added dropwise during 40 min under ice-cooled condition and stirring continued for another 30 min. The reaction mixture was allowed to come to room temperature during about 45 min. and extracted with chloroform (2 × 30 mL). The combined extracts were washed with brine (20 mL) followed by water (20 mL) and dried over Na_2SO_4. The solvent was evaporated under reduced pressure and the crude product was purified by column chromatography over silica gel (60-120 mesh). The spectral and analytical data confirmed the formation of 4*H*-5-methyl-[l,2,3]triazolo[l,5-*a*][1,4]benzodiazepin-6-one.[3]

4*H*-5-Methyl-[1,2,3]triazolo[1,5-*a*][1,4]benzodiazepin-6-one: Yield 74%; Solid, mp: 170-172 °C (reported[3] mp: 169-171 °C); ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.24 (s, 3H), 4.45 (s, 2H), 7.58 (t, *J* = 7.5 Hz, 1H), 7.70 (td, *J* = 7.5 Hz, 1.2, 1H), 7.76 (s, 1H), 8.01 (d, *J* = 7.8 Hz, 1H), 8.09 (d, *J* = 7.8 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 35.9, 41.4, 122.2, 127.0, 128.8, 130.4, 131.9, 132.3, 132.5, 134.2, 166.0; IR (KBr, cm^{-1}) 3013, 2915, 1641, 1485, 1391, 1239, 1134 ;MS (ESI) (*m*/*z*) 215.07 ($M+H^+$), 237.04 ($M+Na^+$).

General procedure for the preparation 2-amino-*N*-methyl-*N*-(prop-2-ynyl)-benzamide (10a)[3,4]and 2-amino-*N*-methyl-*N*-(but-3-ynyl)benzamide (10b):



Isatoic anhydride

10a: n=1
10b: n=2

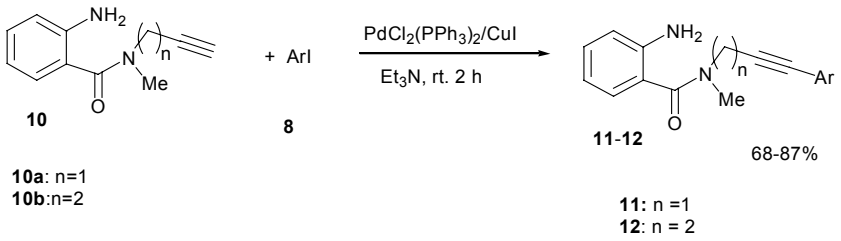
N-Methylpropargylamine or *N*-methylhomopropargylamine (2.75 mmol) was added to a solution of isatoic anhydride (1.84 mmol) in dioxane (10 mL) and the mixture was heated under reflux for 3 h. It was then poured into ice/water (50 mL), adjusted to pH 9 with 5% NaOH, and extracted with ethyl acetate (3 × 150 mL). The organic layer was washed with water, dried over Na_2SO_4, filtered, and evaporated under reduced pressure. The crude product was purified through silica gel (60-120 mesh) column chromatography to furnish the product **10a** or **10b**.

2-Amino-*N*-methyl-*N*-(prop-2-ynyl)benzamide (10a)[3]: Yield 81%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.30 (br s, 1H), 3.12 (s, 3H), 4.22 (br s, 2H), 4.38 (br s, 2H), 6.70-6.73 (m, 2H), 7.15-7.20 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 34.6, 38.4, 72.4, 78.4, 116.5, 117.0, 118.7, 127.77, 130.7, 145.7, 170.7; IR (neat, cm^{-1}) 3455, 3356, 3285, 3027, 2924, 2117, 1620, 1490, 1397, 1261, 1068; MS (ESI) (*m*/*z*) 211.09 ($M + Na^+$) .

2-Amino-*N*-methyl-*N*-(but-3-ynyl)-benzamide (10b): Yield 62% ; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.02 (t, *J* = 2.6 Hz, 1H), 2.53(br s, 2H), 3.08 (s, 3H), 3.62 (br s, 2H), 4.28 (br s, 2H), 6.69-6.73 (m, 2H), 7.10-7.18 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ

17.4, 38.3, 46.5, 70.1, 81.3, 116.4, 117.3, 120.1, 127.7, 130.4, 145.0, 171.0; IR (neat, cm^{-1}) 3453, 3352, 3288, 2930, 2115, 1619, 1488, 1400; MS (ESI) (*m*/*z*) 225.01 (M + Na^+) ; Anal. Calcd. for $C_{12}H_{14}N_2O$: C, 71.26; H, 6.98; N, 13.85; Found C, 71.19; H, 6.95; N, 13.88.

4. General procedure for the preparation of 2-amino-*N*-methyl-*N*-(3-aryl-prop-2-ynyl)benzamides (11) and 2-amino-*N*-methyl-*N*-(4-aryl-but-3-ynyl)benzamides (12) through Sonogashira coupling[5] :



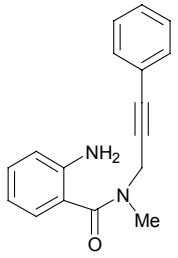
To a well stirred solution of aryl iodide **8** (1.45 mmol) and Et_3N (10.15 mmol) in DMF (3 mL), $PdCl_2(PPh_3)_2$ (41 mg, 0.058 mmol) was added. The whole reaction mixture was then allowed to stir at room temperature for 10 min under argon atmosphere. Next, CuI (16 mg, 0.087 mmol) was added to the reaction mixture followed by dropwise addition of a solution of **10** (1.52 mmol) in DMF (1.0 mL). The resulting reaction mixture was allowed to stir at room temperature for 2 h. The reaction was monitored through TLC to ensure complete consumption of the starting materials. It was then extracted with ethyl acetate (3 × 50 mL). The combined ethyl acetate extracts were washed successively with brine (50 mL) and water (50 mL), dried over Na_2SO_4, and filtered. The solvent was evaporated under reduced pressure and the product **11**/**12** was purified by column chromatography over silica gel (100-200 mesh) using 20-30% ethyl acetate in hexane (v/v).

References

1. G. M. Sheldrick, *Acta Crystallogr., Sect. A,* 1990**, 46**, 467.
2. G. M. Sheldrick, *SHELX - 97, Program for Crystallography Refinement,* University of Gottingen: Gottingen, Germany, 1997.
3. G. Broggini, G. Molteni, A. Terraneo and G. Zecchi, *Tetrahedron,* 1999, **55**, 14803.
4. M. C. Venuti, *Synthesis*, 1982, 266.
5. K. Sonograshira, Y. Tohda and N. Haghihara, *Tetrahedron Lett.,* 1975, **16**, 4467.

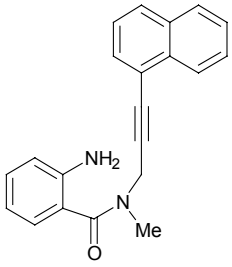
8. Spectral data of the products (11-12):

2-Amino-*N*-methyl-*N*-(3-phenylprop-2-ynyl)benzamide (11a): Yield 85%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.18 (s, 3H), 4.43 (br s, 4H), 6.71-6.73 (m, 2H), 7.16-7.33 (m, 5H), 7.43-7.44 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 34.7 (br), 39.2 (br), 83.6, 83.9, 116.3, 116.7, 118.6, 122.1, 127.5, 127.9, 128.1, 130.4, 131.3, 145.5, 170.5; IR (neat, cm^{-1}) 3453, 3353, 3058, 2924, 1622, 1490, 1394, 1259, 1066; MS (ESI) (*m*/*z*) 265.13 ($M+H^+$), 287.11 ($M+Na^+$). Anal. Calcd for $C_{17}H_{16}N_2O$: C, 77.25; H, 6.10; N, 10.60; Found: C, 77.28; H, 6.14; N, 10.54.



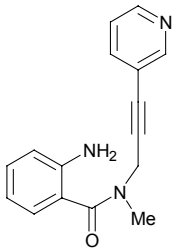
11a

2-Amino-*N*-methyl-*N*-[3-(1-naphthyl)prop-2-ynyl)benzamide (11b): Yield 87%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.26 (s, 3H), 4.43 (s, 2H), 4.59 (s, 2H), 6.73-6.75 (m, 2H), 7.20 (t, *J* = 7.5 Hz, 1 H), 7.31 (m, 1H), 7.43 (t, *J* = 7.5 Hz, 1H), 7.52-7.59 (m, 2H), 7.69 (d, *J* = 6.6 Hz, 1H), 7.85 (br, 2H), 8.30 (d, *J* = 7.8 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 34.2 (br), 40.0 (br), 82.4, 88.7, 116.7, 117.3, 119.0, 120.0, 125.0, 125.8, 126.3, 126.8, 127.9, 128.2, 128.9, 130.6, 130.8, 133.0, 133.2, 145.8, 170.9; IR (neat, cm^{-1}) 3457, 3355, 3056, 2921, 1620, 1491, 1394, 1257, 1064; MS (ESI) (*m*/*z*) 337.14 ($M+Na^+$). Anal. Calcd for $C_{21}H_{18}N_2O$: C, 80.23; H, 5.77; N, 8.91; Found: C, 80.18; H, 5.78; N, 8.95.



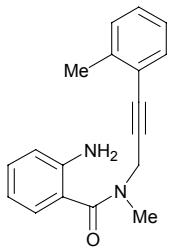
11b

2-Amino-*N*-methyl-*N*-[3-(3-pyridyl)prop-2-ynyl]benzamide (11c): Yield 85%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.18 (s, 3H), 4.42 (br s, 2H), 4.47 (br s, 2H), 6.71-6.76 (m, 2H), 7.16-7.28 (m, 3H), 7.73 (d, J = 7.8 Hz, 1H), 8.54 (d, J = 2.7 Hz, 1H), 8.68 (s, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 35.9 (br), 39.9 (br), 81.0, 87.4, 116.8, 117.3, 118.8, 119.6, 123.0, 127.9, 131.0, 138.7, 145.9, 148.7, 152.3, 171.0; IR (neat, cm^{-1}) 3451, 3351, 3031, 2923, 1627, 1481, 1396, 1260, 1066; MS (ESI) (*m*/*z*) 288.06 ($M+Na^+$). Anal. Calcd for $C_{16}H_{15}N_3O$: C, 72.43; H, 5.70; N, 15.84; Found: C, 72.36; H, 5.67; N, 15.88.



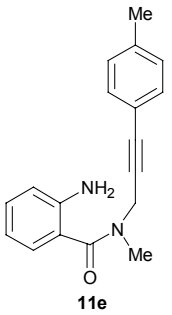
11c

2-Amino-*N*-methyl-*N*-[3-(2-methylphenyl)prop-2-ynyl]benzamide (11d): Yield 71%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.44 (s, 3H), 3.19 (s, 3H), 4.40 (s, 2H), 4.46 (s, 2H), 6.71-6.75 (m, 2H), 7.14-7.26 (m, 5H), 7.41 (d, J = 7.5 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 20.5, 34.7 (br), 39.2 (br), 83.1, 87.6, 116.6, 117.0, 118.9, 122.1, 125.4, 127.8, 128.3, 129.3, 130.7, 131.9, 140.0, 145.7, 170.7; IR (neat, cm^{-1}) 3456, 3353, 3023, 2920, 1623, 1487, 1395, 1259, 1064; MS (ESI) (*m*/*z*) 301.22 ($M+Na^+$). Anal. Calcd for $C_{18}H_{18}N_2O$: C, 77.67; H, 6.52; N, 10.06; Found: C, 77.65; H, 6.59; N, 10.02.



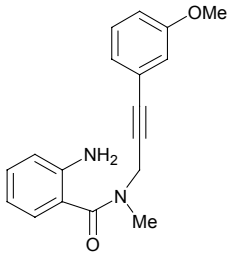
11d

2-Amino-*N*-methyl-*N*-[3-(4-methylphenyl)prop-2-ynyl]benzamide (11e): Yield 82%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.35 (s, 3H), 3.17 (s, 3H), 4.41 (br s, 4H), 6.71-6.75 (m, 2H), 7.11-7.26 (m, 4H), 7.34 (d, *J* = 7.8 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 21.2, 35.0 (br), 41.1 (br), 82.9, 84.2, 116.5, 117.0, 118.9, 119.2, 127.7, 128.8, 130.6, 131.4, 138.4, 145.6, 170.6; IR (neat, cm^{-1}) 3459, 3354, 3029, 2921, 1625, 1489, 1395, 1261, 1064 ; MS (ESI) (*m*/*z*) 301.10 (M+Na$^+$). Anal. Calcd for $C_{18}H_{18}N_2O$: C, 77.67; H, 6.52; N, 10.06; Found: C, 77.71; H, 6.49; N, 10.09.



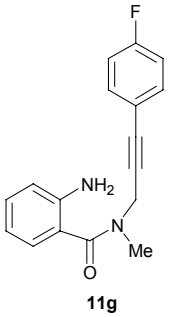
11e

2-Amino-*N*-methyl-*N*-[3-(3-methoxyphenyl)prop-2-ynyl]benzamide (11f): Yield 72%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.18 (s, 3H), 3.81 (s, 3H), 4.43 (br s, 4H), 6.71-6.73 (m, 2H), 6.89 (d, *J* = 8.1 Hz, 1H), 6.97 (s, 1H), 7.04 (d, *J* = 7.5 Hz, 1H), 7.16-7.26 (m, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 34.9 (br), 38.4 (br), 55.1, 83.6, 84.1, 114.9, 116.5, 116.6, 117.1, 118.9, 123.3, 124.1, 127.9, 129.3, 130.8, 145.8, 159.1, 170.8; IR (neat, cm^{-1}) 3452, 3360, 2937, 1625, 1485, 1395; MS (ESI) (*m*/*z*) 317.01 (M+Na$^+$). Anal. Calcd for $C_{18}H_{18}N_2O_2$: C, 73.45; H, 6.16; N, 9.52; Found: C, 73.39; H, 6.19; N, 9.54.



11f

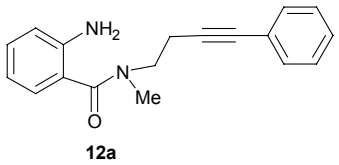
2-Amino-*N*-methyl-*N*-[3-(4-fluorophenyl)prop-2-ynyl]benzamide (11g): Yield 72%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 3.17 (s, 3H), 4.43 (br s, 4H), 6.71-6.76 (m, 2H), 7.01 (t, *J* = 8.3 Hz, 2H), 7.16-7.26 (m, 2H), 7.40-7.45 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 33.9 (br), 40.6 (br), 83.3, 83.5, 115.5 (d, *J* = 21.8 Hz), 116.8, 117.3, 118.5, 119.0, 127.9, 130.9, 133.6 (d, *J* = 8.3 Hz), 145.8, 162.5(d, *J* = 248.3 Hz), 170.9; IR (neat, cm^{-1}) 3458, 3354, 3064, 2923, 1624, 1502, 1396, 1226, 1157, 1065; MS (ESI) (*m*/*z*) 305.07 (M+Na$^+$). Anal. Calcd for $C_{17}H_{15}FN_2O$: C, 72.32; H, 5.36; N, 9.92; Found:



11g

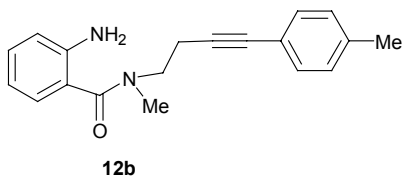
C, 72.36; H, 5.41; N, 9.88.

2-Amino-*N*-methyl-*N*-(4-phenyl-but-3-ynyl)benzamide (12a): Yield 81%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.77 (br s, 2H), 3.14 (s, 3H), 3.71 (br s, 2H), 4.24 (br s, 2H), 6.68-6.73 (m,, 2H), 7.16 (t, *J* = 7.2 Hz, 2H), 7.26-7.38 (m, 5H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 18.5, 37.9 (br), 46.9 (br), 82.1, 86.8, 116.4, 117.4, 120.4, 123.2, 127.7, 127.8, 128.2, 130.4, 131.4, 144.9, 171.1; IR (neat, cm^{-1}) 3454, 3350, 3024, 2926, 1619,1489, 1399, 1071; MS (EI) (*m*/*z*) 278, 120; Anal. Calcd. for $C_{18}H_{18}N_2O$: C, 77.67; H, 6.52; N, 10.06; Found C, 77.71; H, 6.56; N, 10.11.



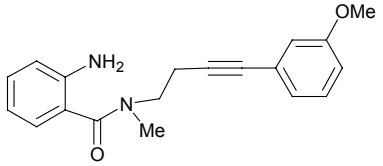
12a

2-Amino-*N*-methyl-*N*-[4-(4-methylphenyl)-but-3-ynyl]benzamide (12b): Yield 79%; Solid, mp 99-100 °C; ^{1}H NMR (600MHz, $CDCl_3$) δ 2.32 (s, 3H), 2.76 (br s, 2H), 3.13 (s, 3H), 3.73 (br s, 2H), 4.25 (br s, 2H), 6.68-6.72 (m, 2H), 7.08 (d, *J* = 7.8 Hz, 2H), 7.13-7.16 (m, 2H), 7.27 (d, *J* = 7.8 Hz, 2H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 18.1, 21.3, 37.3 (br), 46.3 (br), 81.8, 85.8, 116.5, 117.4, 120.1, 120.5, 127.8, 129.0, 130.4, 131.3, 137.9, 144.9, 170.7; IR (KBr, cm^{-1}) 3454, 3351, 3027, 2923, 1620, 1490, 1399, 1071; MS (EI) (*m*/*z*) 292, 120; Anal. Calcd. for $C_{19}H_{20}N_2O$: C, 78.05; H, 6.89; N, 9.58; Found C, 78.02; H, 6.93; N, 9.54.



12b

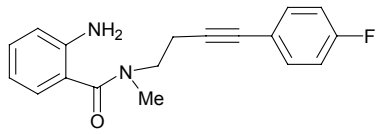
2-Amino-*N*-[4-(3-methoxy-phenyl)-but-3-ynyl]-*N*-methyl-benzamide (12c): Yield 75%; Oil; ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.76 (br s, 2H), 3.13 (s, 3H), 3.71 (br s, 2H), 3.78 (s, 3H), 4.26 (br s, 2H), 6.68-6.73 (m, 2H), 6.84 (dd, *J* = 8.3, 1.7 Hz, 1H), 6.92 (s, 1H), 6.98 (d, *J* = 7.5 Hz, 1H), 7.13-7.22 (m, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 18.4, 38.1 (br), 46.5 (br), 55.0, 81.9, 86.6, 114.3, 116.3, 116.4, 117.3, 120.2, 123.9,



12c

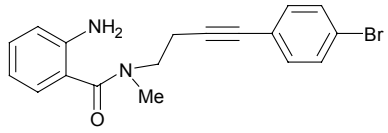
124.1, 127.7, 129.2, 130.3, 144.9, 159.1, 171.0; IR (neat, cm^{-1}) 3453, 3352, 3237, 2934, 1622, 1486, 1399; MS (FAB^+) (*m*/*z*) 309 ($M + H^+$), 120; Anal. Calcd. for $C_{19}H_{20}N_2O_2$: C, 74.00; H, 6.54; N, 9.08; Found C, 74.06; H, 6.51; N, 9.11.

2-Amino-*N*-methyl-*N*-[4-(4-fluoro-phenyl)-but-3-ynyl]benzamide (12d): Yield 68 %; Oil; ^1H NMR (300 MHz, $CDCl_3$) δ 2.75 (br s, 2H), 3.12 (s, 3H), 3.70 (br s, 2H), 4.25 (br s, 2H), 6.68-6.73 (m, 2H), 6.97 (t, *J* = 8.55 Hz, 2H), 7.12-7.18 (m, 2H), 7.33-7.38 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 18.3, 37.9 (br), 46.6 (br), 81.0, 86.4, 115.3 (d, *J* = 21.8 Hz), 116.4, 117.3, 119.2 (d, *J* = 3.0 Hz), 120.2, 127.7, 130.4, 133.2 (d, *J* = 8.3 Hz), 144.9, 162.1(d, *J* = 246.8 Hz), 171.0; IR (neat, cm^{-1}) 3437, 3351, 3064, 2926, 1608, 1502, 1402, 1220, 1078; MS (ESI) (*m*/*z*) 319.12 ($M + Na^+$) ; Anal. Calcd. for $C_{18}H_{17}FN_2O$: C, 72.95; H, 5.78; N, 9.45; Found C, 72.91; H, 5.80; N, 9.39.



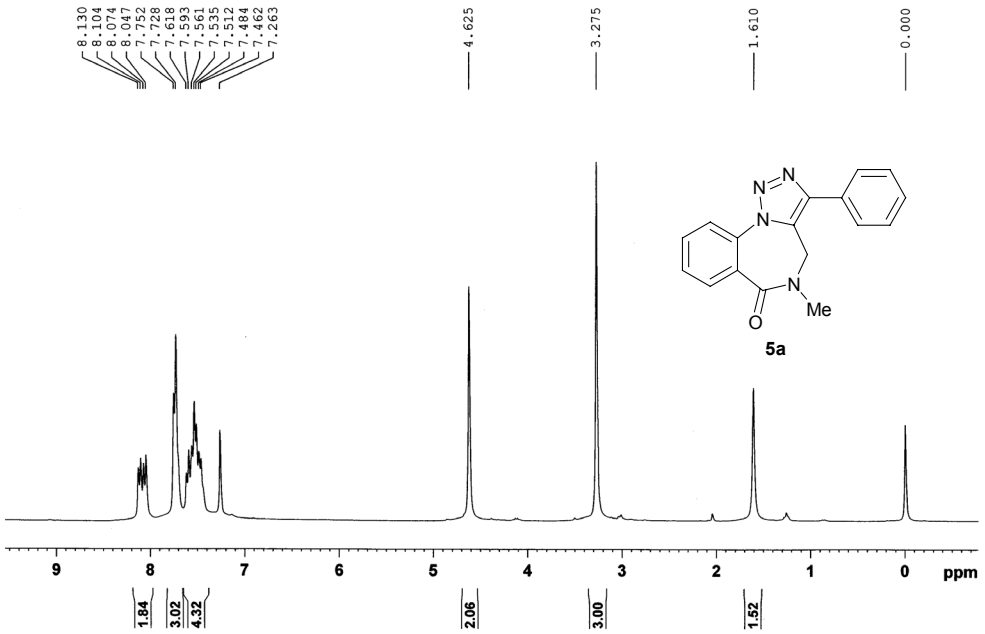
12d

2-Amino-*N*-methyl-*N*-[4-(4-bromo-phenyl)-but-3-ynyl]benzamide (12e): Yield 76 %; Solid, mp 80-82 °C; ^1H NMR (300 MHz, $CDCl_3$) δ 2.75 (br s, 2H), 3.12 (s, 3H), 3.70 (br s, 2H), 4.24 (br s, 2H), 6.68-6.73 (m , 2H), 7.11-7.25 (m, 4H), 7.41 (d, *J* = 7.8 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 18.4, 37.7 (br), 46.4 (br), 81.0, 88.0, 116.4, 117.2, 120.1, 121.9, 122.1, 127.6, 130.3, 131.3, 132.8, 144.9, 171.0; IR (KBr, cm^{-1}) 3441, 3350, 3024, 2926, 1619, 1486, 1398, 1070; MS (FAB+) (*m*/*z*) 357 ($M + H^+$); Anal. Calcd. for $C_{18}H_{17}BrN_2O$: C, 60.52; H, 4.80; N, 7.84; Found C, 60.49; H, 4.84; N, 7.78.

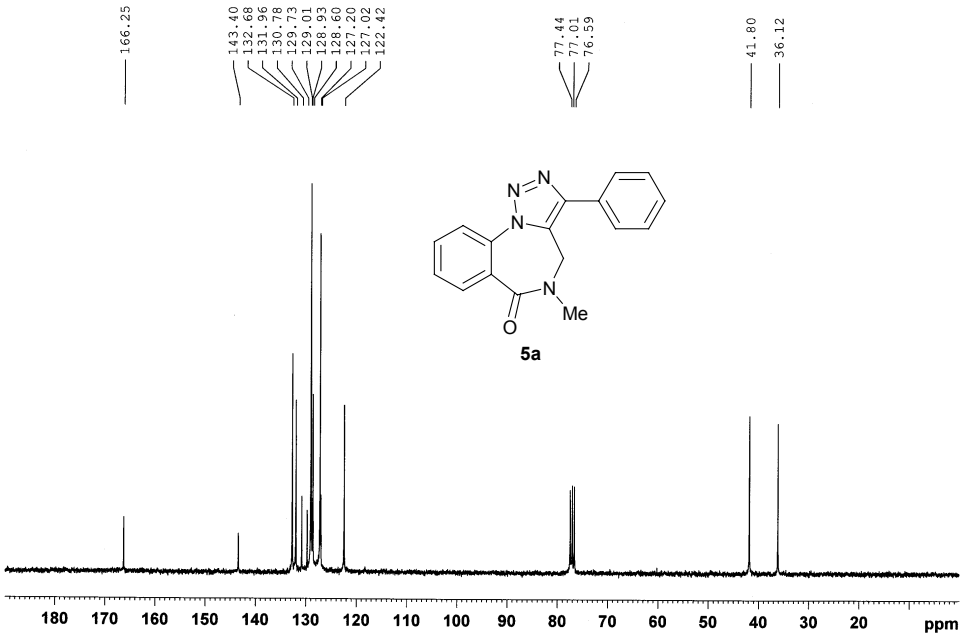


12e

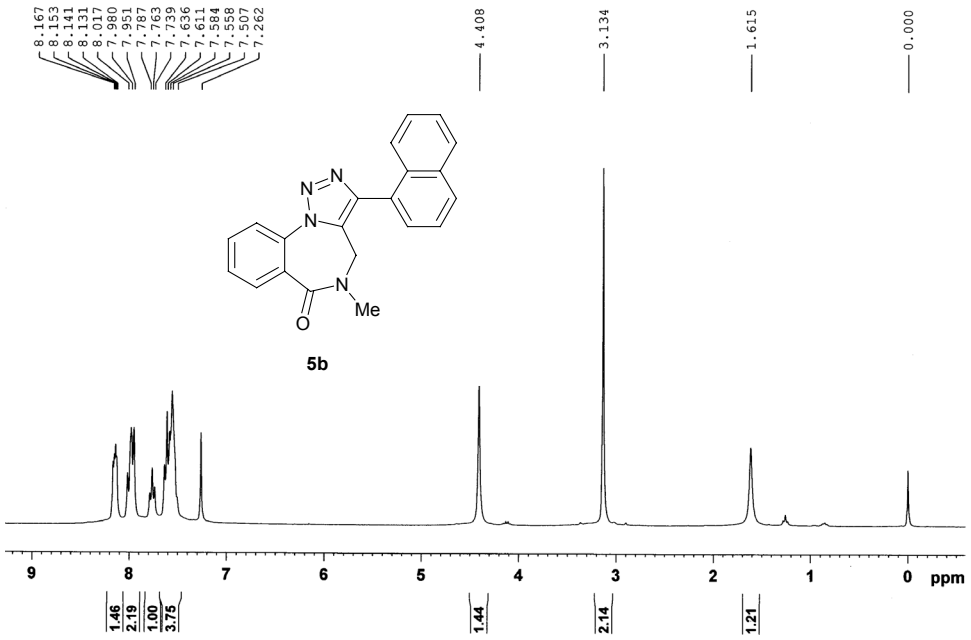
^{1}H NMR (300 MHz, $CDCl_3$) of **5a**



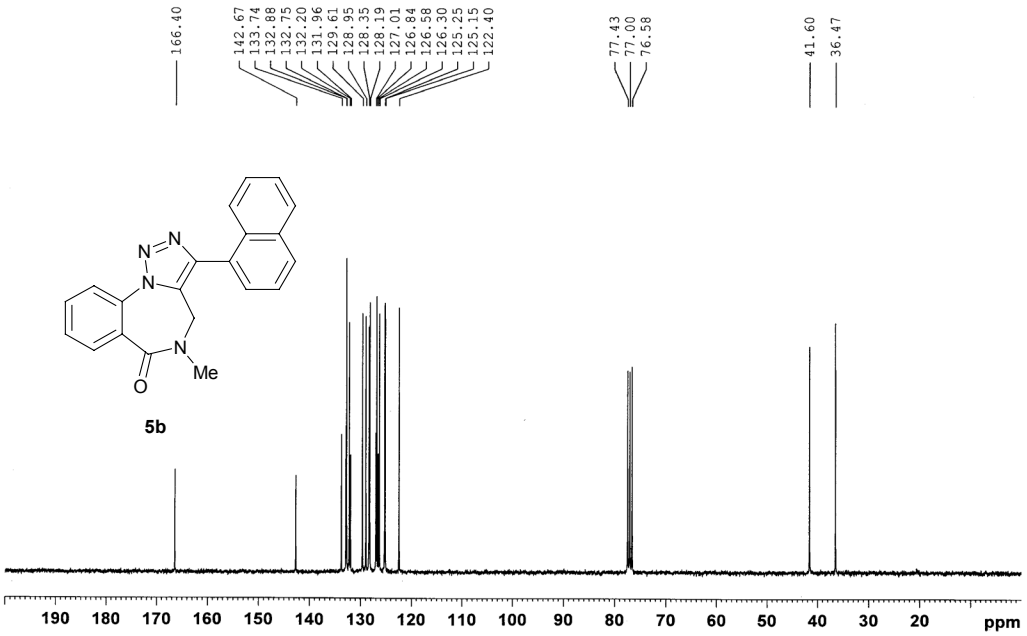
^{13}C NMR (75 MHz, $CDCl_3$) of **5a**



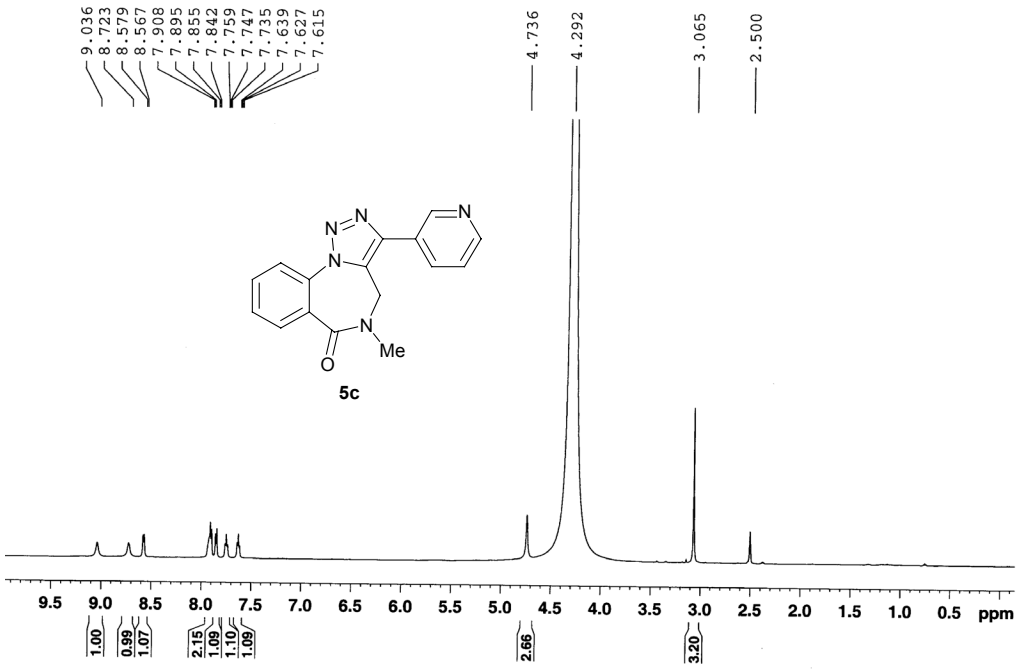
^{1}H NMR (300 MHz, $CDCl_3$) of **5b**



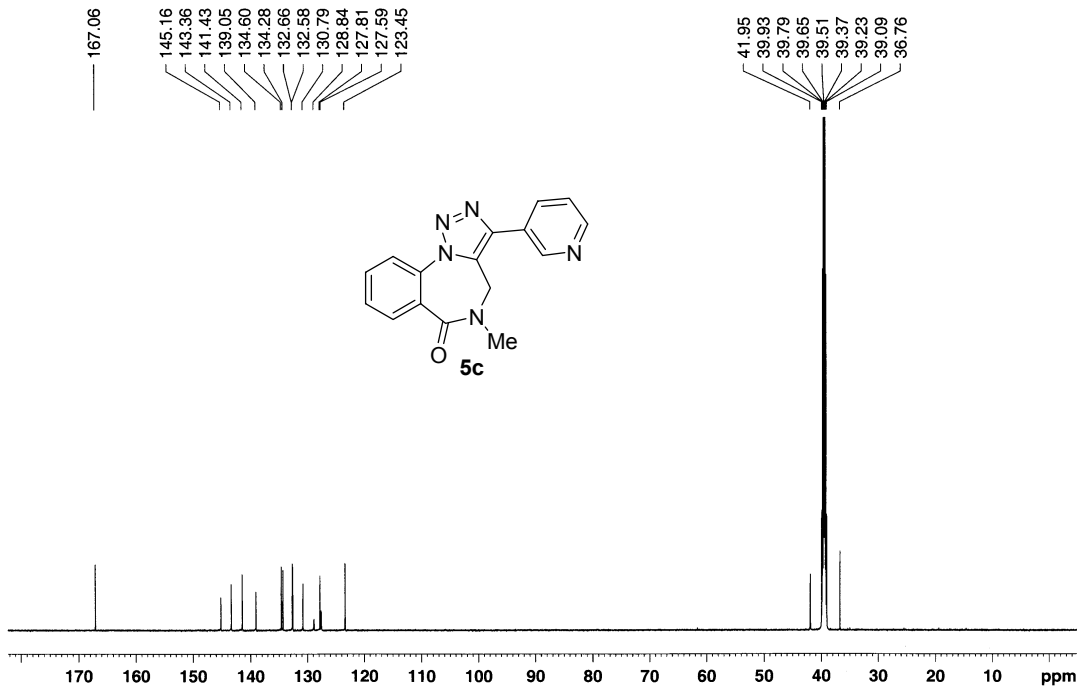
^{13}C NMR (75 MHz, $CDCl_3$) of **5b**



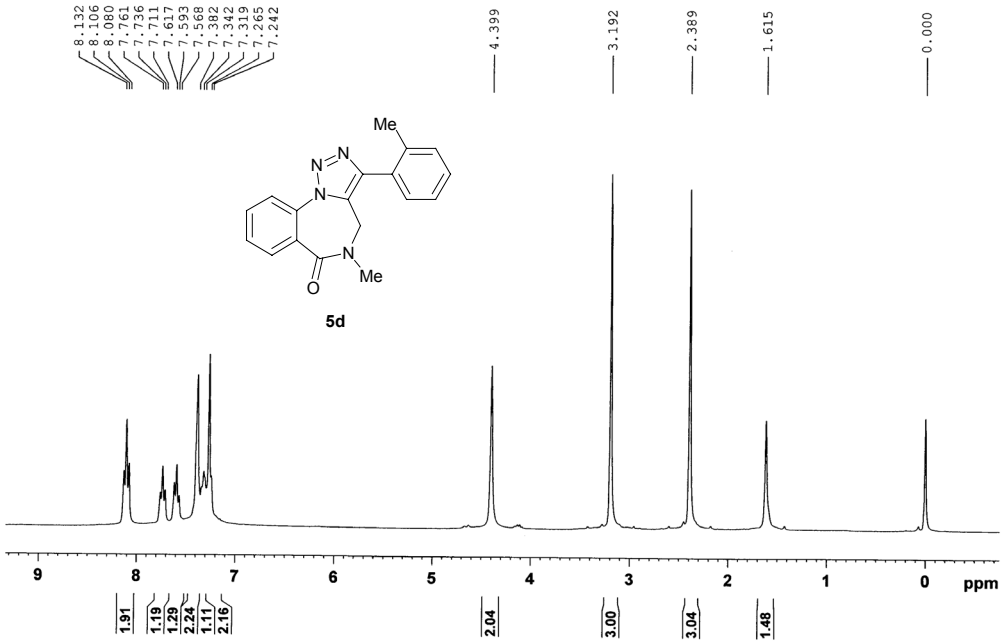
^{1}H NMR (600 MHz, DMSO-d_6) of **5c**



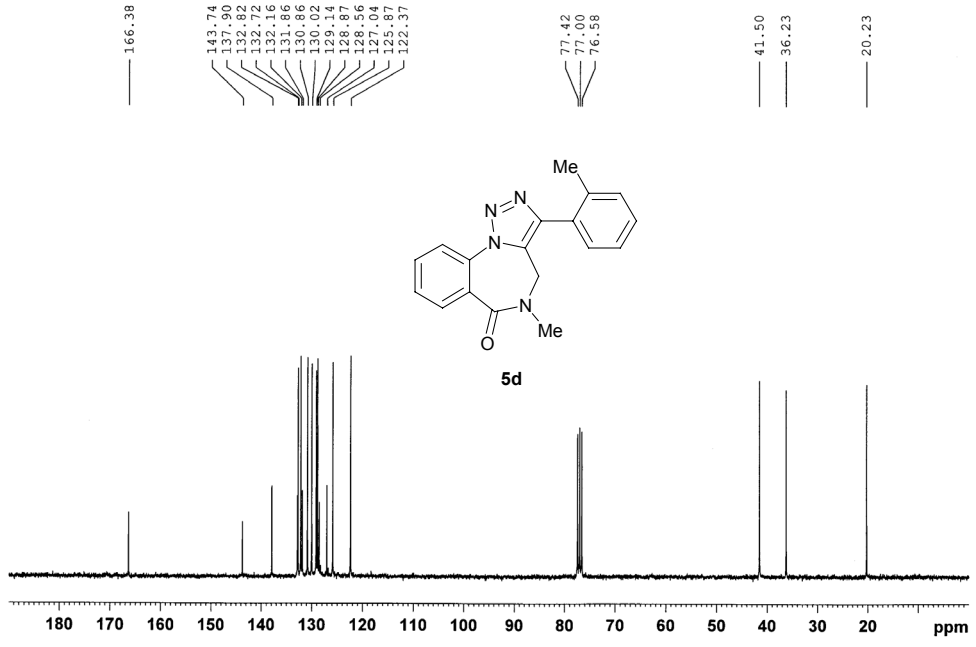
^{13}C NMR (150 MHz, DMSO-d_6) of **5c**



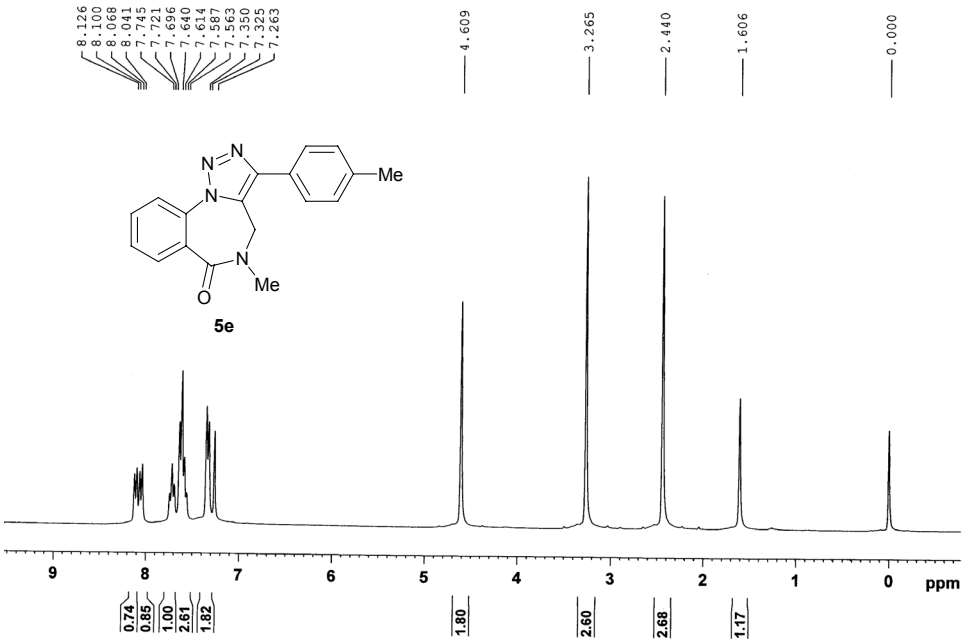
^{1}H NMR (300 MHz, $CDCl_3$) of **5d**



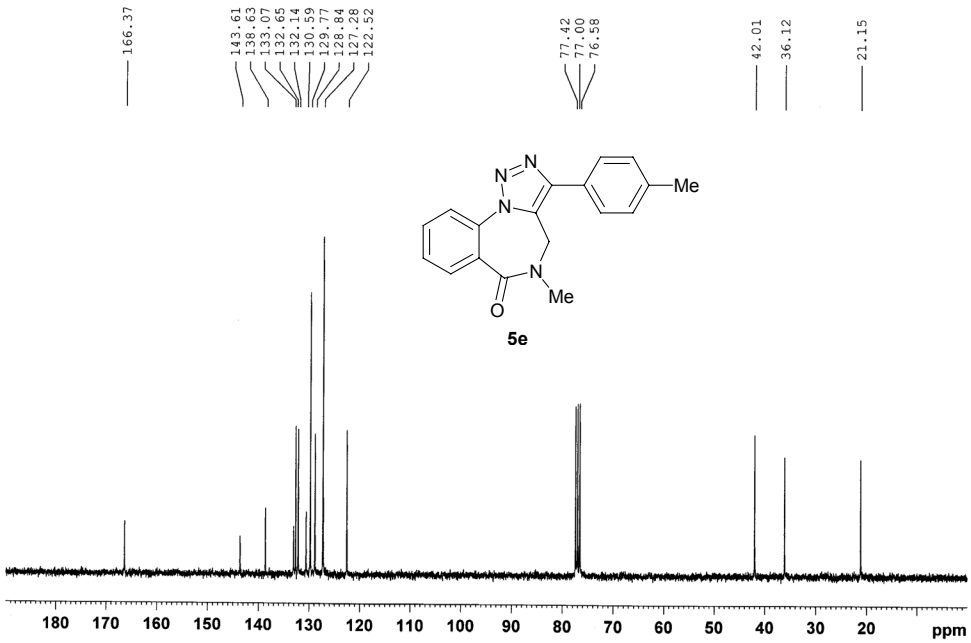
^{13}C NMR (75 MHz, $CDCl_3$) of **5d**



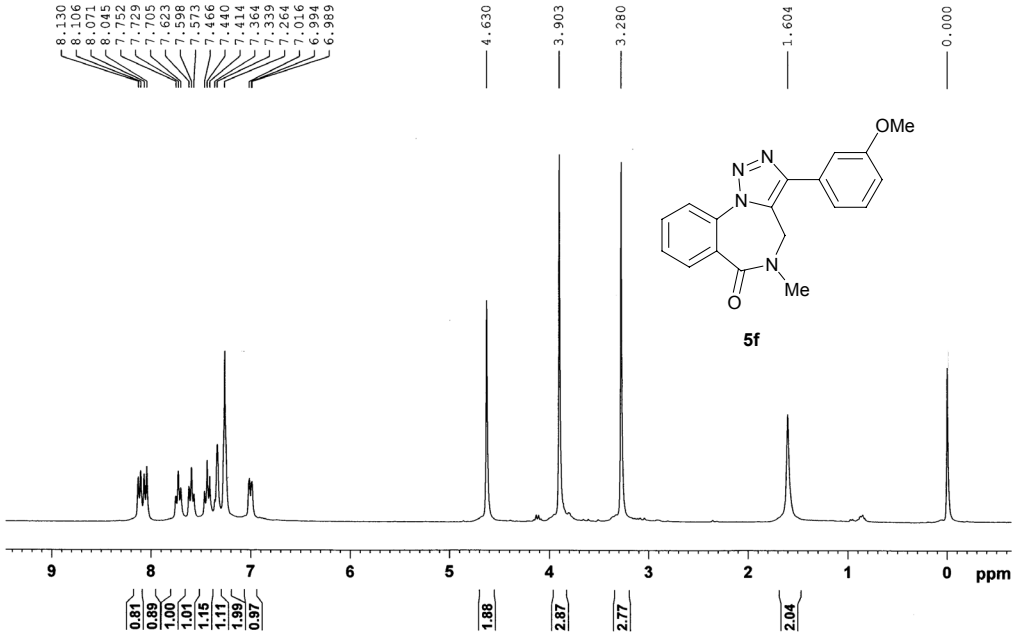
^{1}H NMR (300 MHz, $CDCl_3$) of **5e**



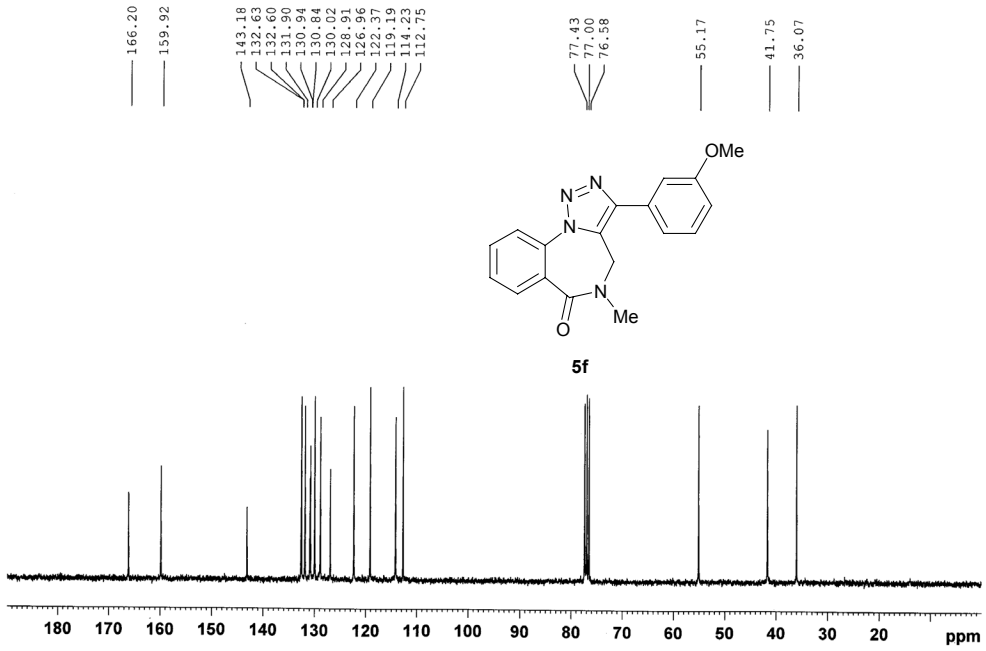
^{13}C NMR (75 MHz, $CDCl_3$) of **5e**



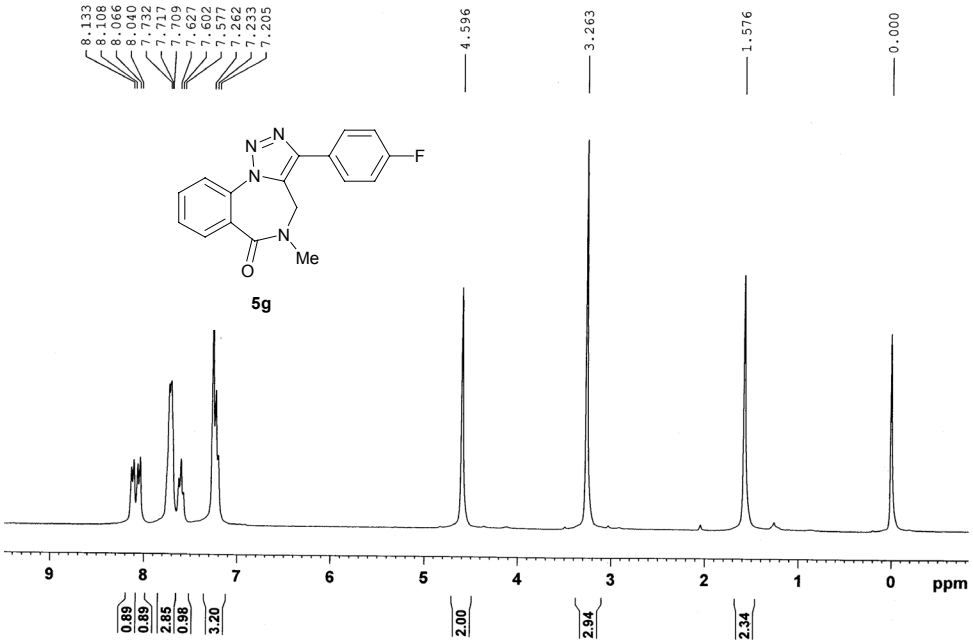
^{1}H NMR (300 MHz, $CDCl_3$) of **5f**



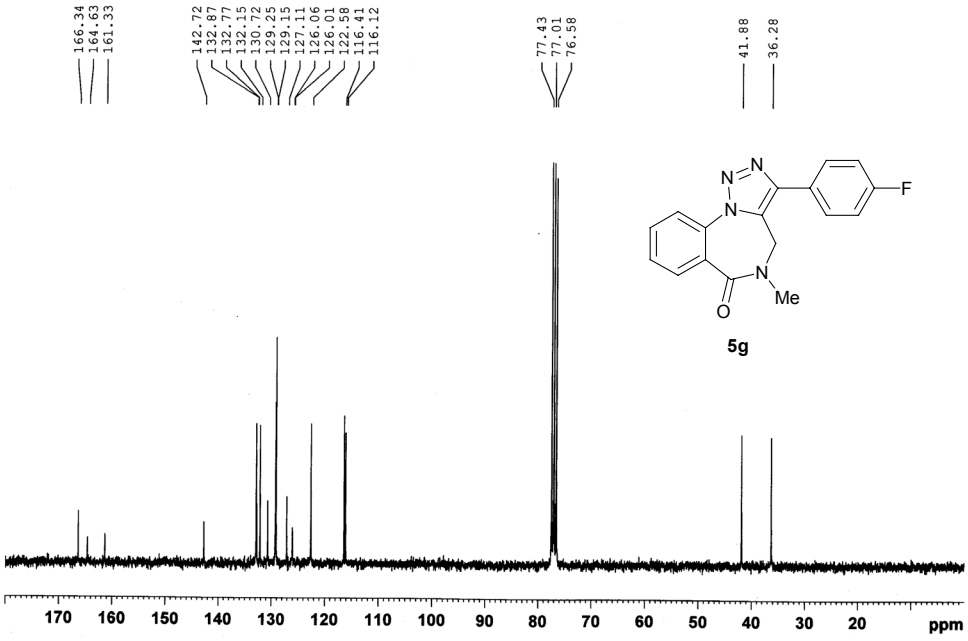
^{13}C NMR (75 MHz, $CDCl_3$) of **5f**



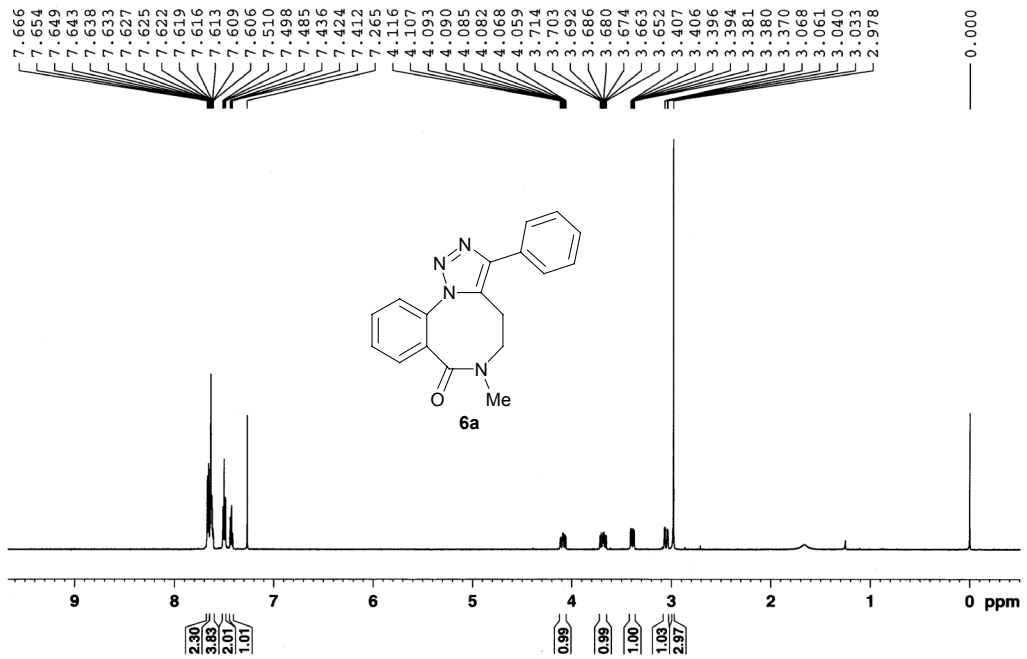
^{1}H NMR (300 MHz, $CDCl_3$) of **5g**



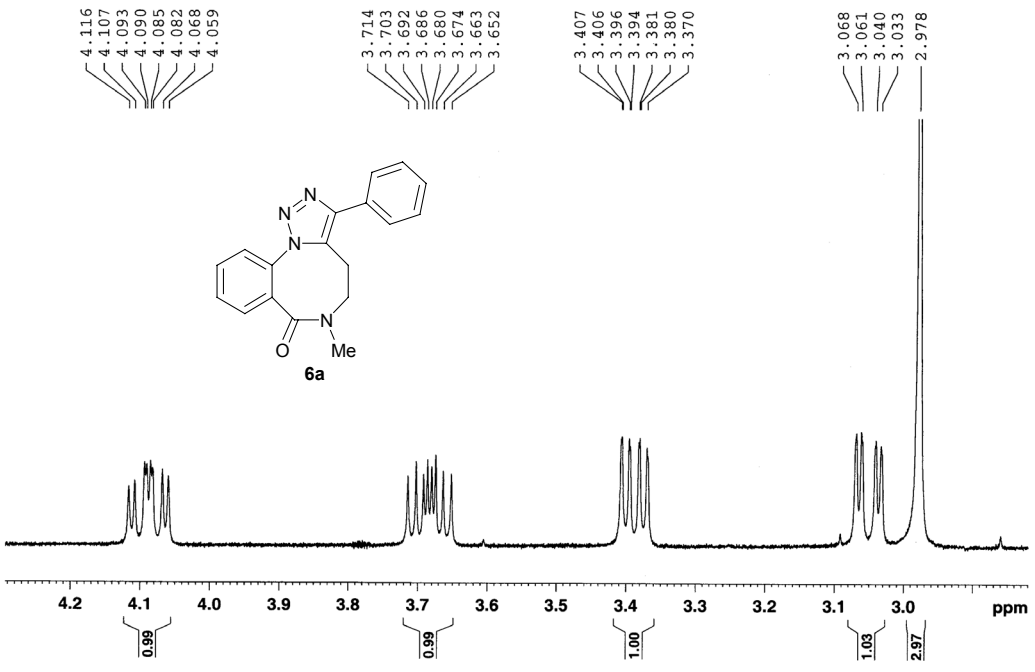
^{13}C NMR (75 MHz, $CDCl_3$) of **5g**



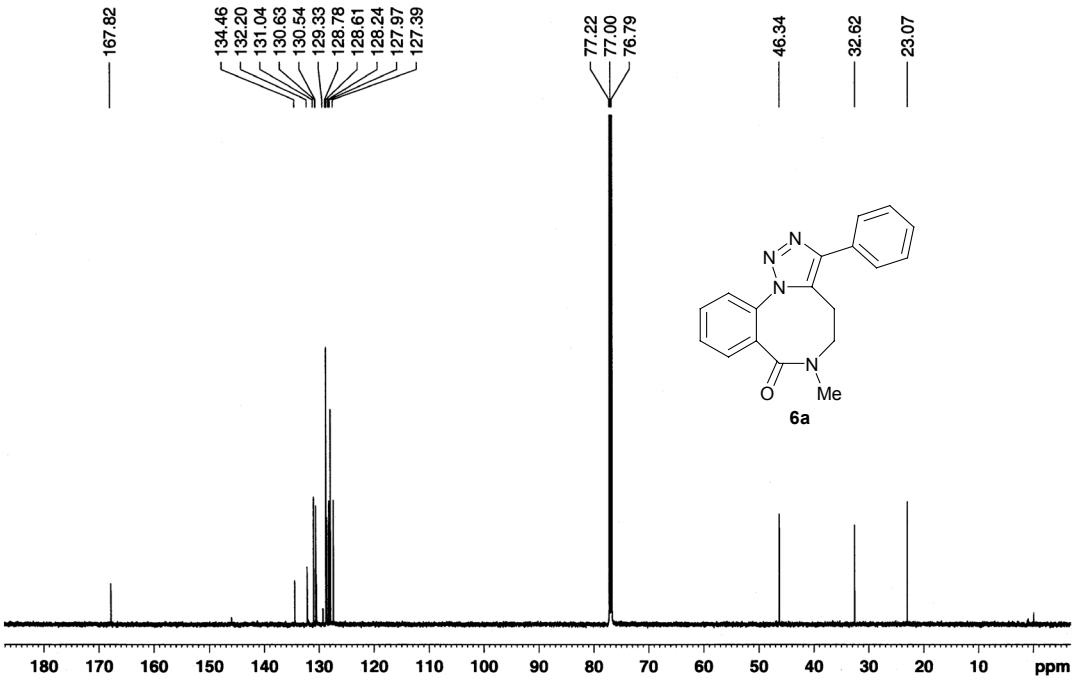
^{1}H NMR (600 MHz, $CDCl_3$) of **6a**



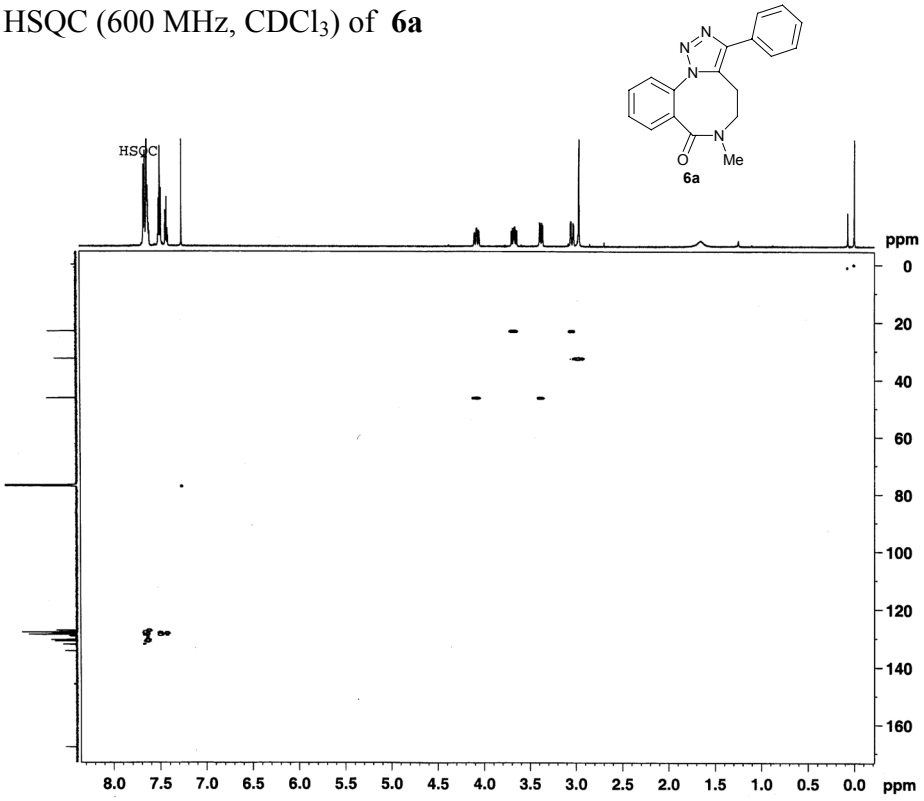
^{1}H NMR (600 MHz, $CDCl_3$) of **6a** (Expanded region from 2.9 to 4.2 ppm)



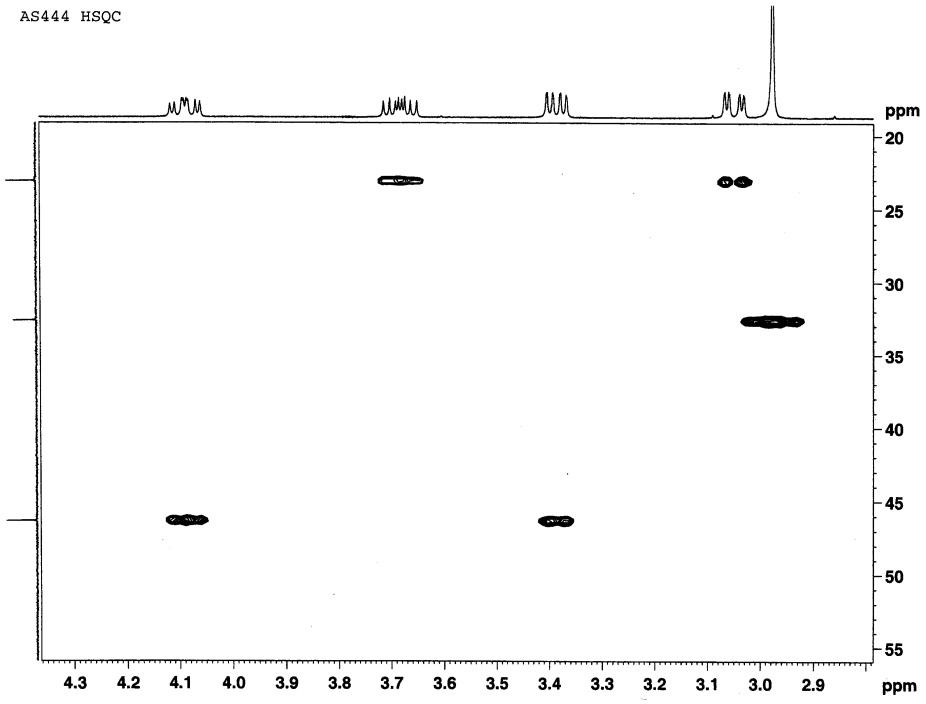
^{13}C NMR (150 MHz, $CDCl_3$) of **6a**



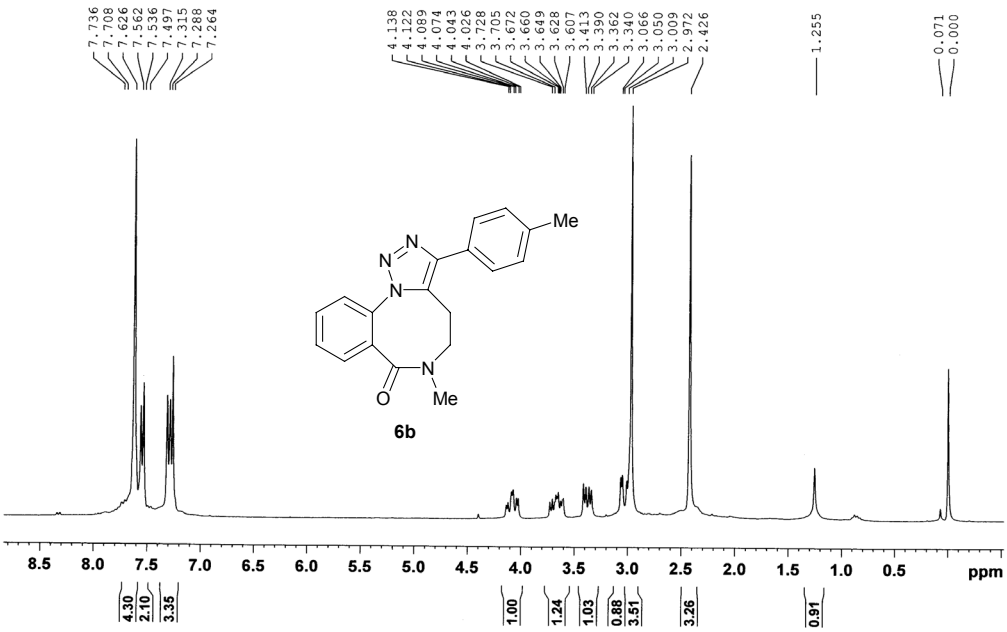
HSQC (600 MHz, $CDCl_3$) of **6a**



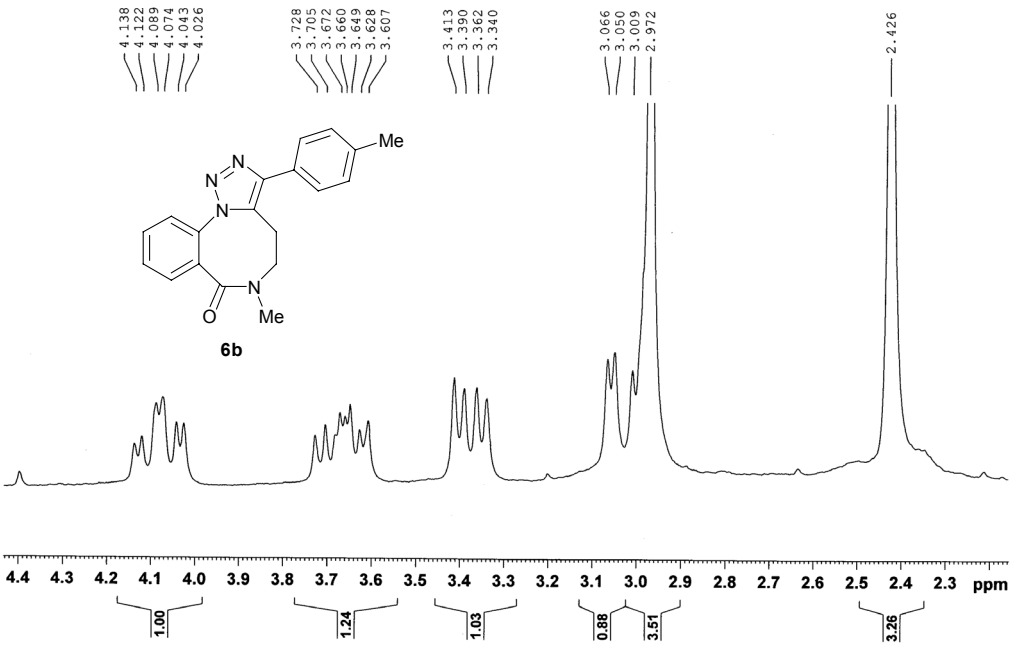
A part of HSQC (600 MHz, $CDCl_3$) of **6a**



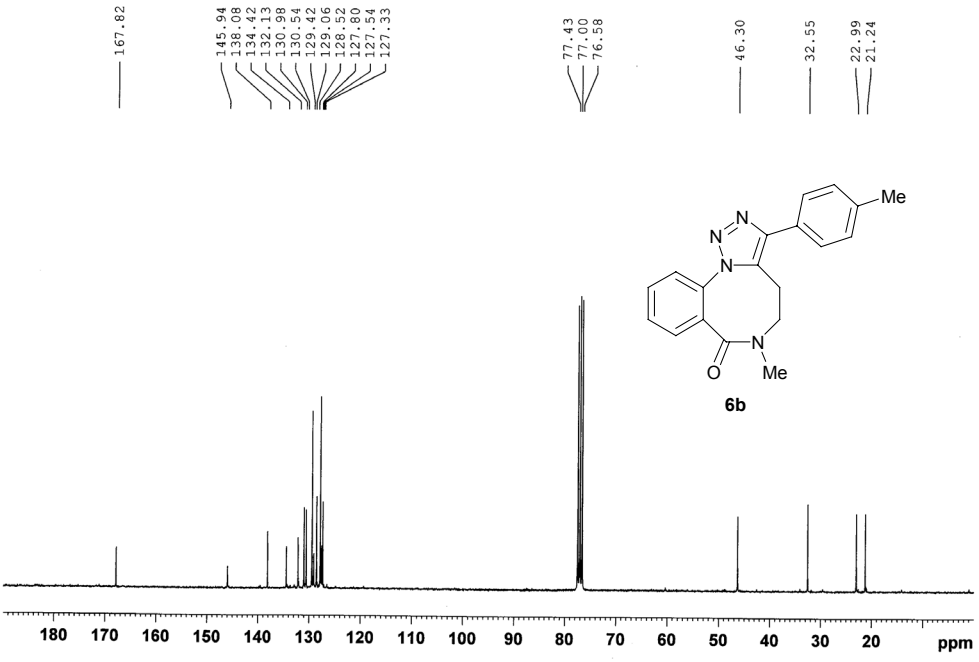
^{1}H NMR (300 MHz, $CDCl_3$) of **6b**



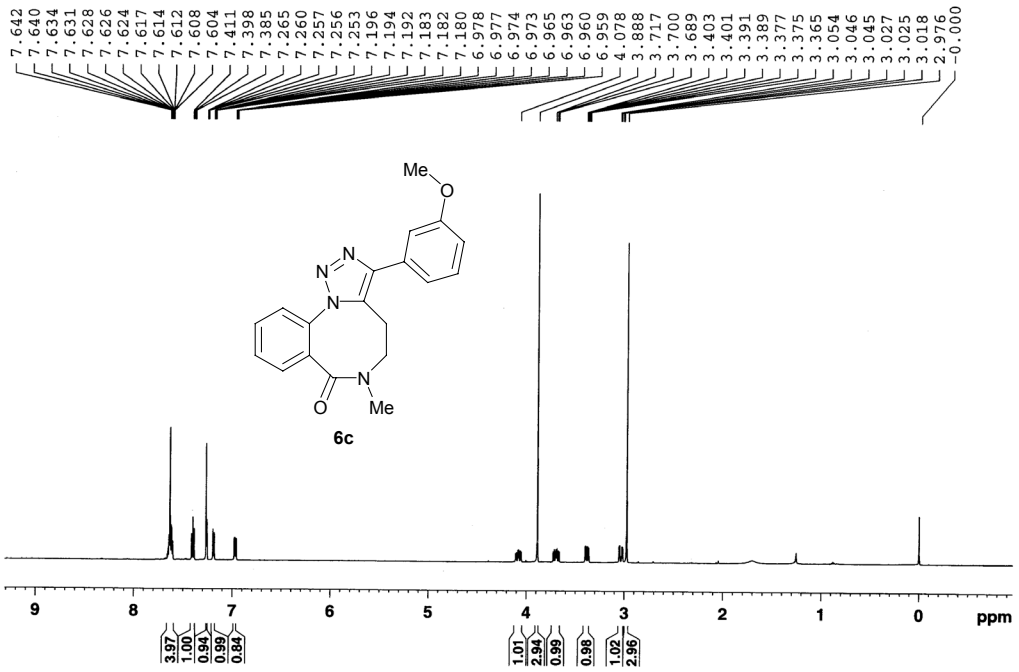
^{1}H NMR (300 MHz, $CDCl_3$) of **6b** (Expanded region 2.3 to 4.3 ppm)



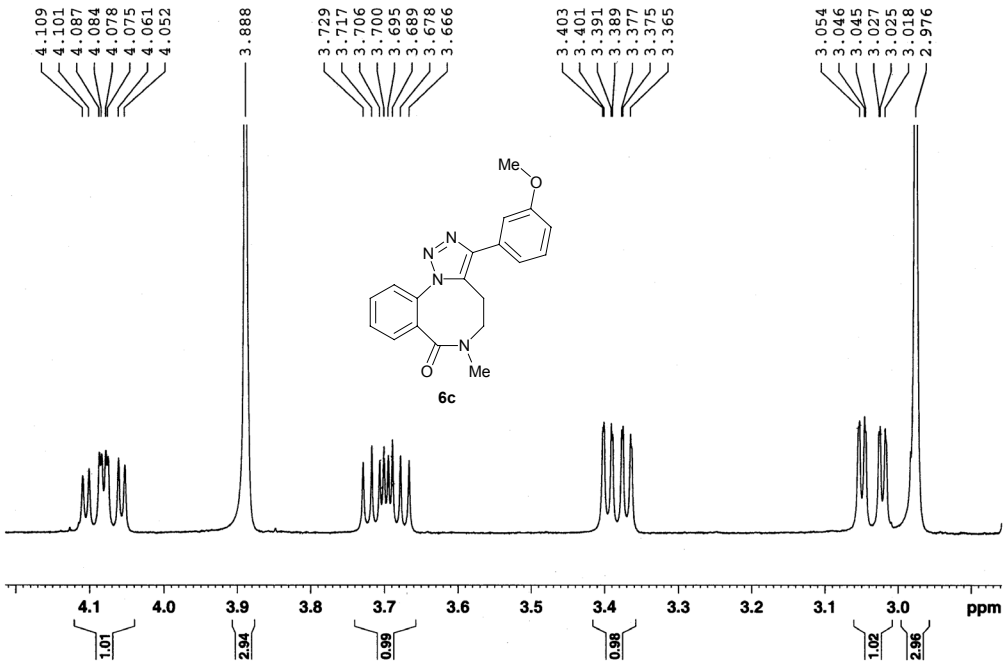
^{13}C NMR (75 MHz, $CDCl_3$) of **6b**



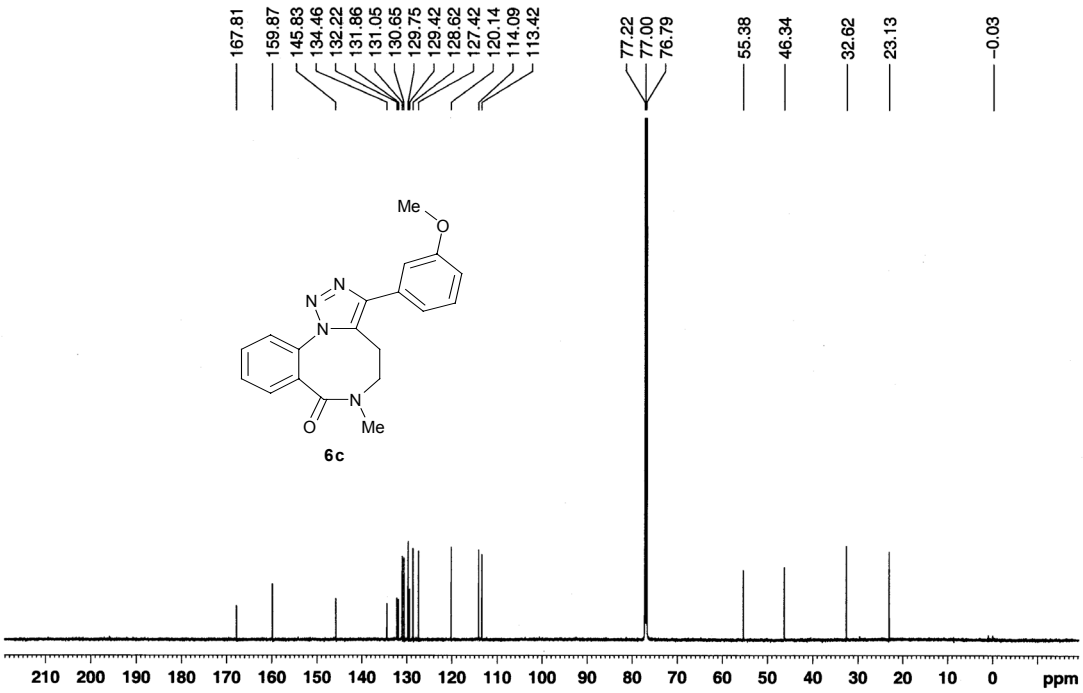
^{1}H NMR (600 MHz, $CDCl_3$) of **6c**



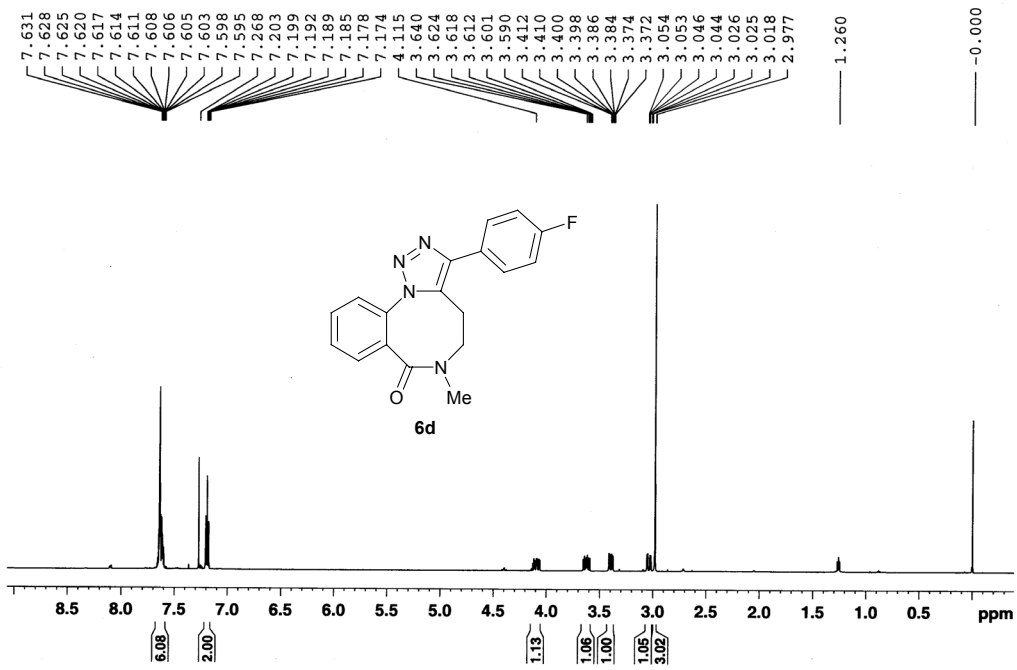
^{1}H NMR (600 MHz, $CDCl_3$) of **6c** (Expanded region 2.8 to 4.2 ppm)



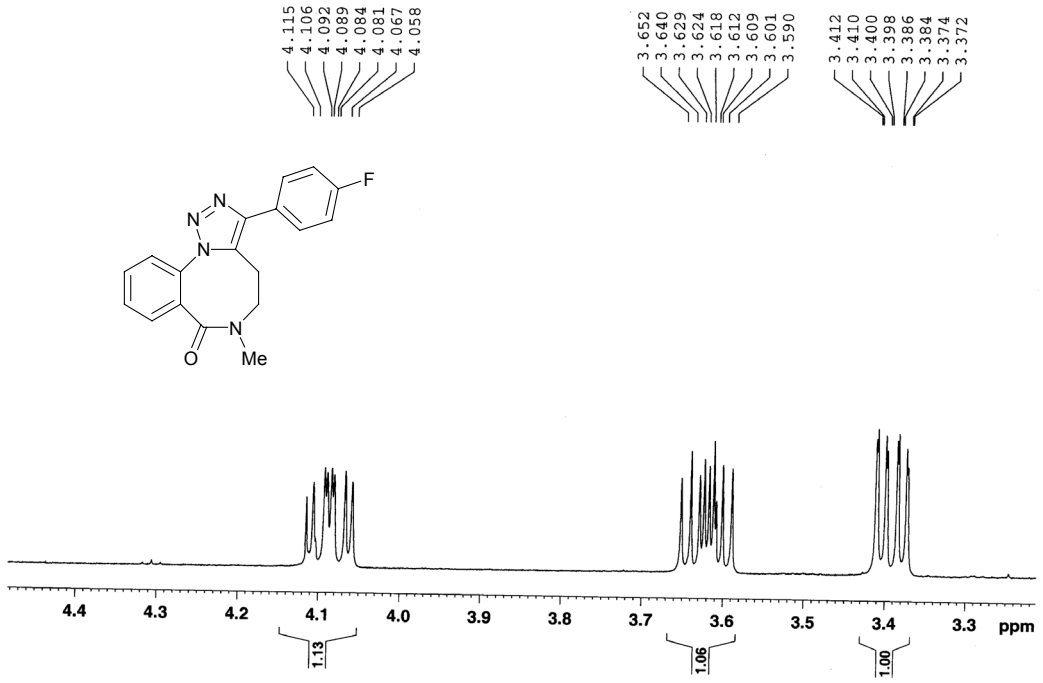
^{13}C NMR (150 MHz, $CDCl_3$) of **6c**



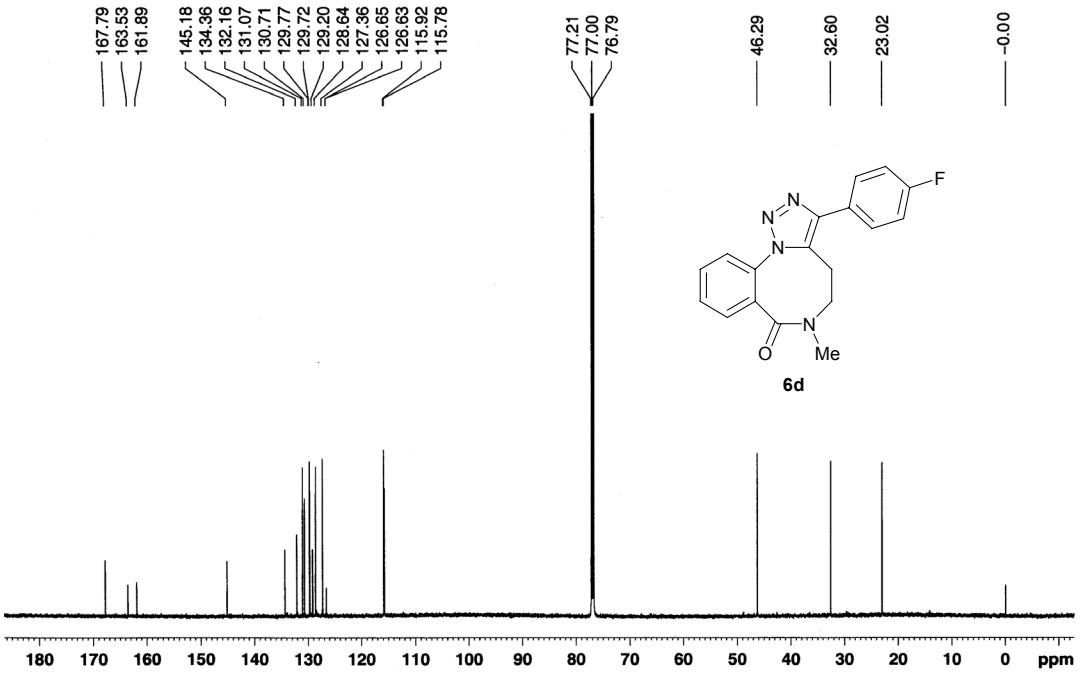
^{1}H NMR (600 MHz, $CDCl_3$) of **6d**



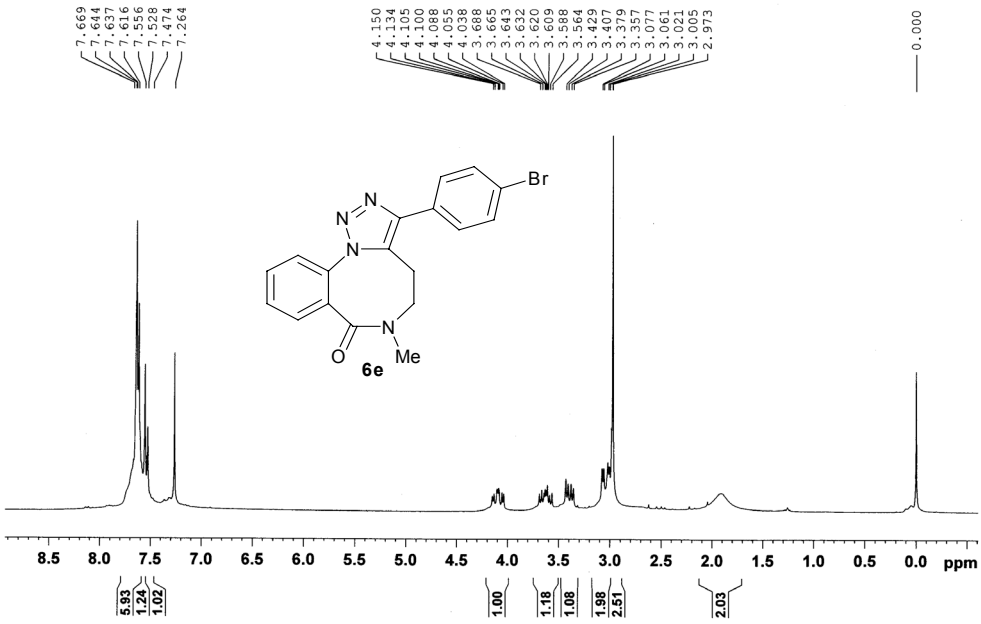
^{1}H NMR (600 MHz, $CDCl_3$) of **6d** (Expanded region 3.3 to 4.2 ppm)



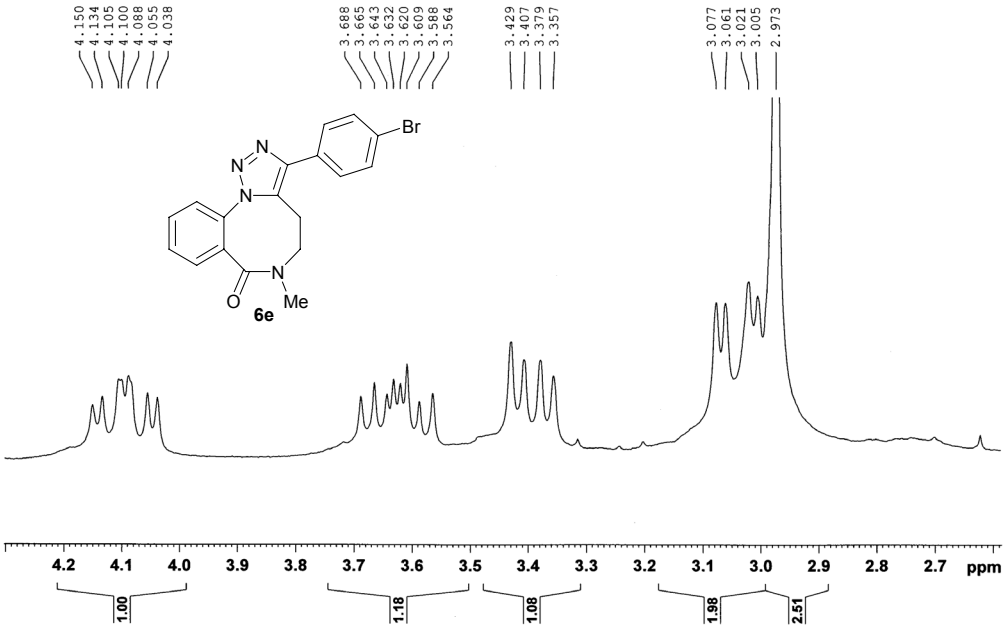
^{13}C NMR (150 MHz, $CDCl_3$) of **6d**



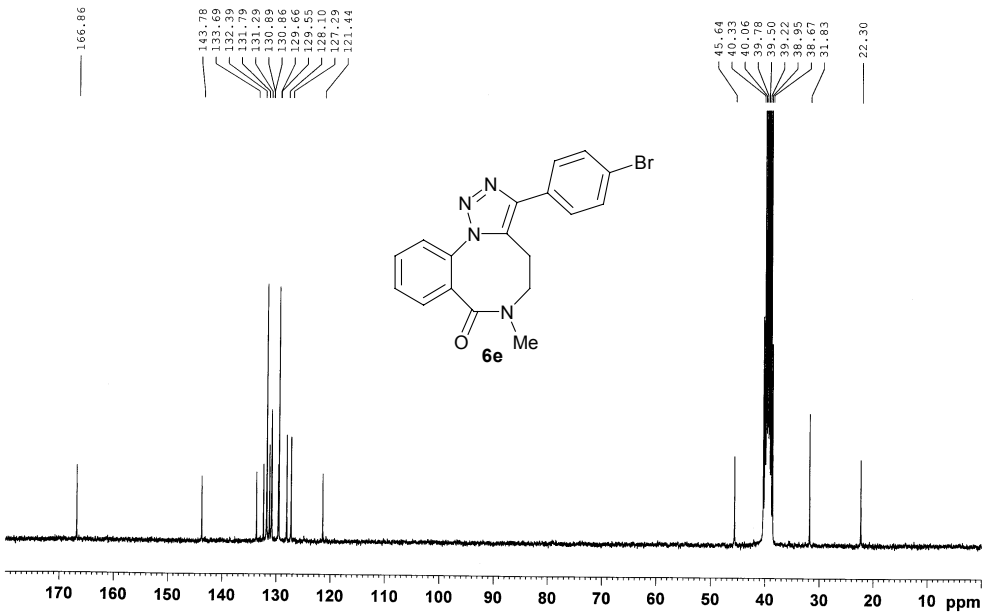
^{1}H NMR (300 MHz, $CDCl_3$) of **6e**



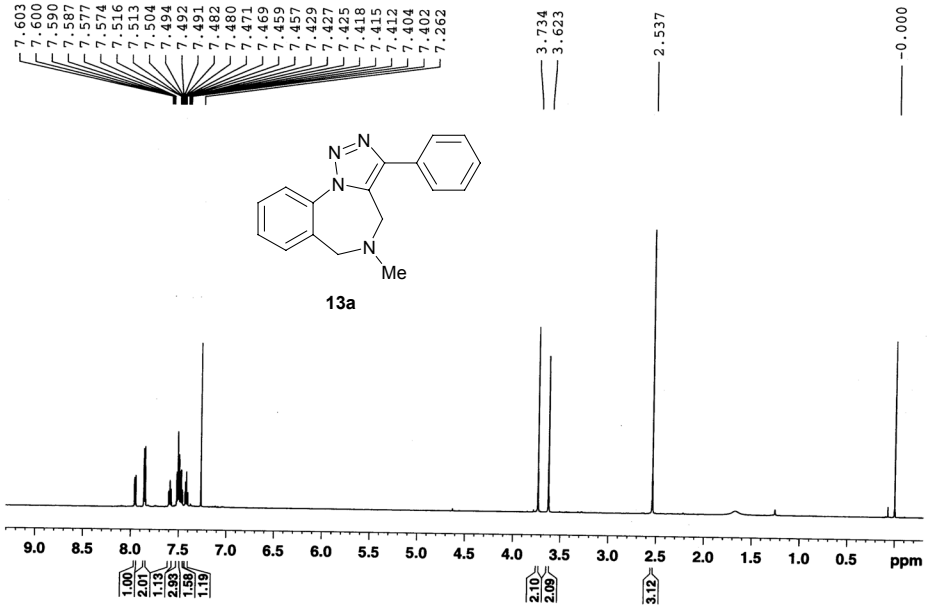
^{1}H NMR (300 MHz, $CDCl_3$) of **6e** (Expanded region 2.8 to 4.2 ppm)



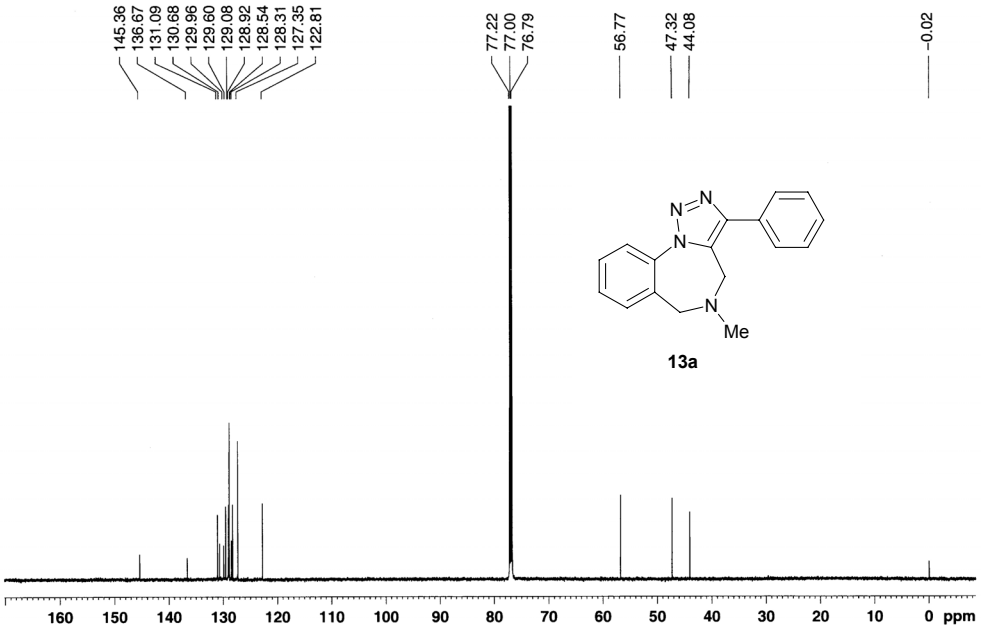
^{13}C NMR (75 MHz, DMSO-d_6) of **6e**



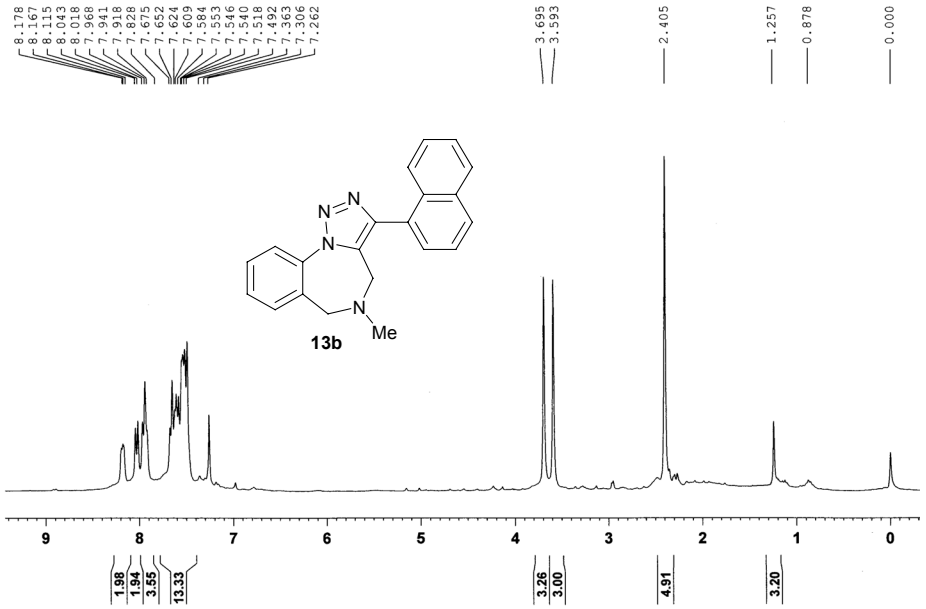
^{1}H NMR (600 MHz, $CDCl_3$) of **13a**



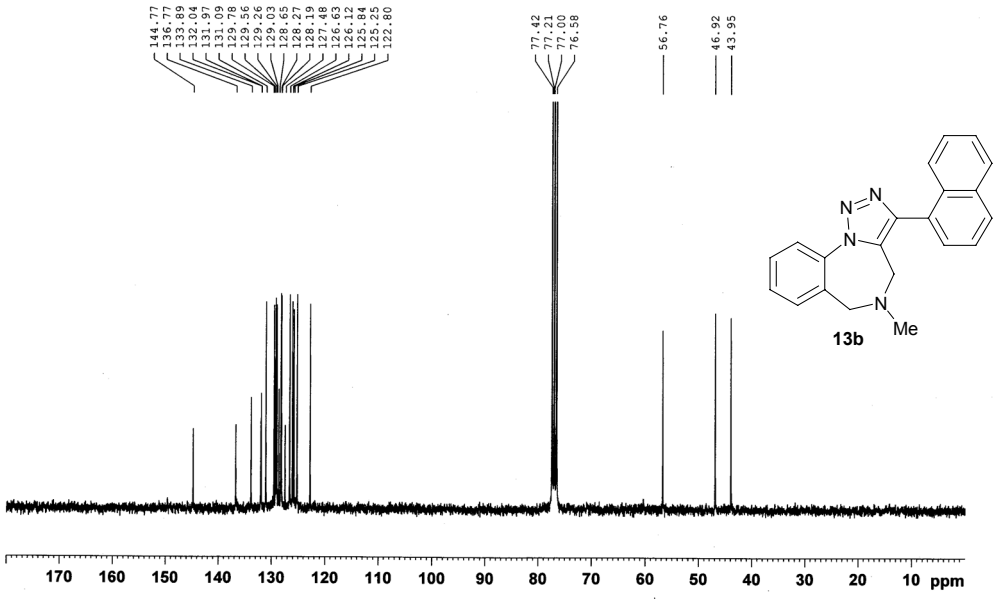
^{13}C NMR (150 MHz, $CDCl_3$) of **13a**



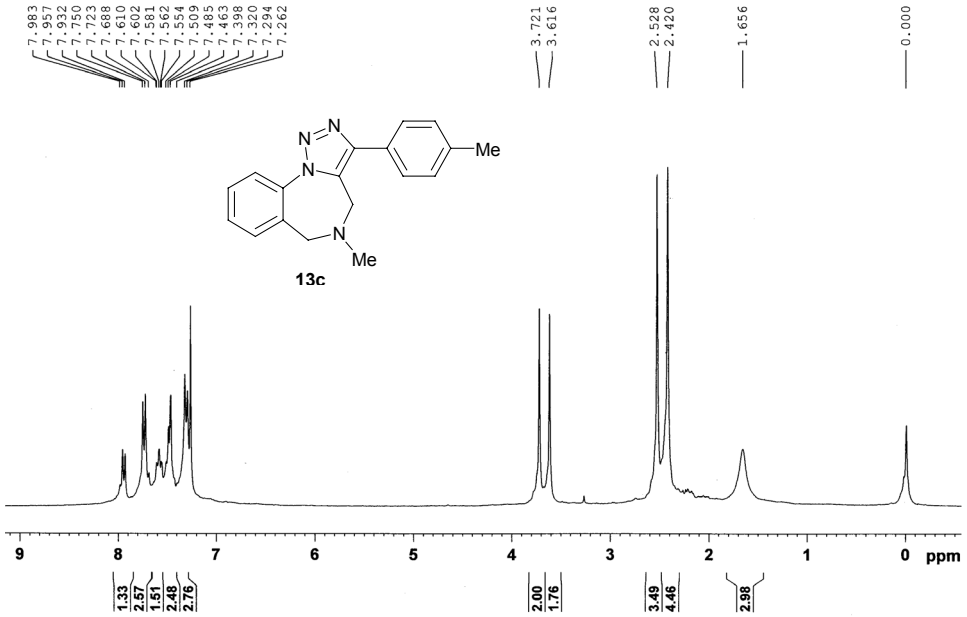
^{1}H NMR(300 MHz ,$CDCl_3$) of **13b**



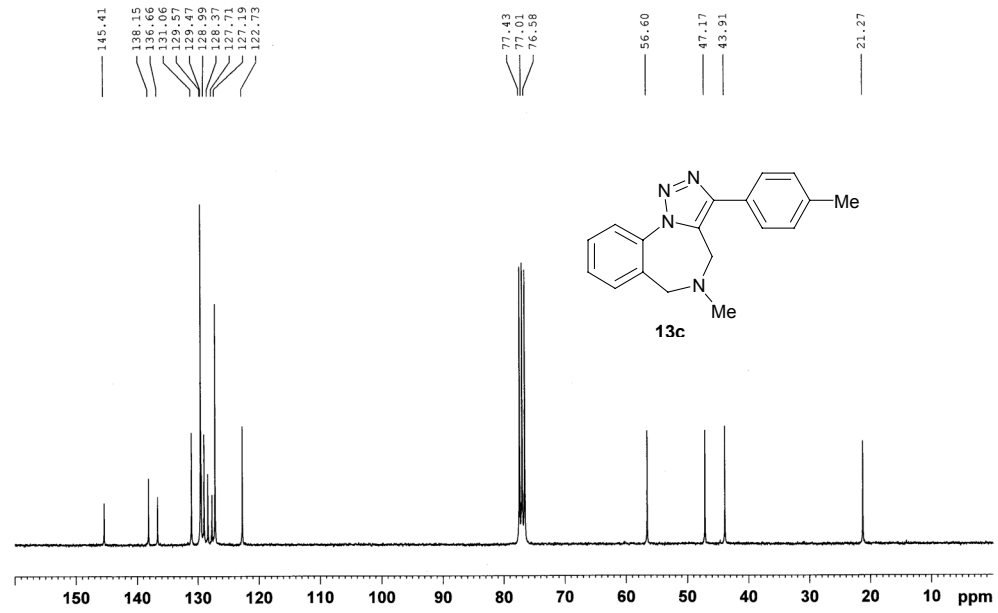
^{13}C NMR (75 MHz, $CDCl_3$) of **13b**



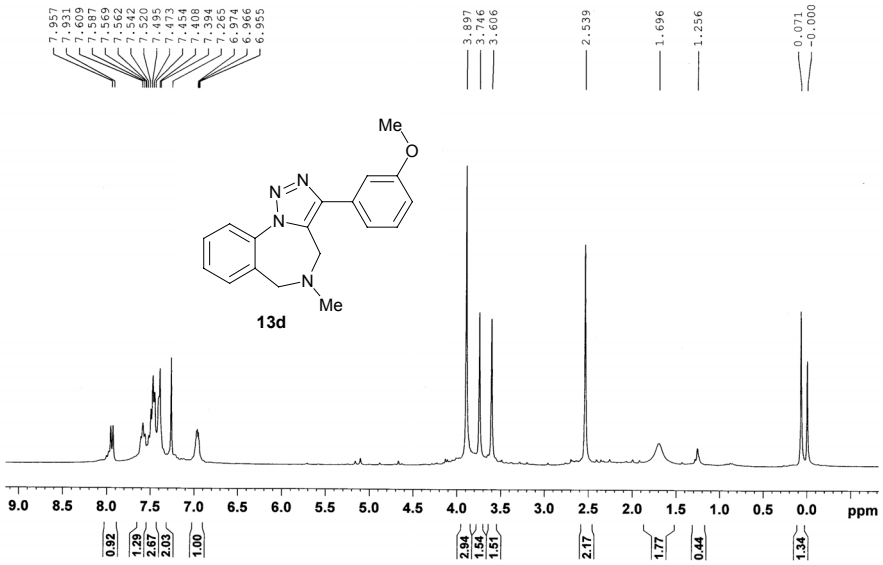
^{1}H NMR (300 MHz, $CDCl_3$) of **13c**



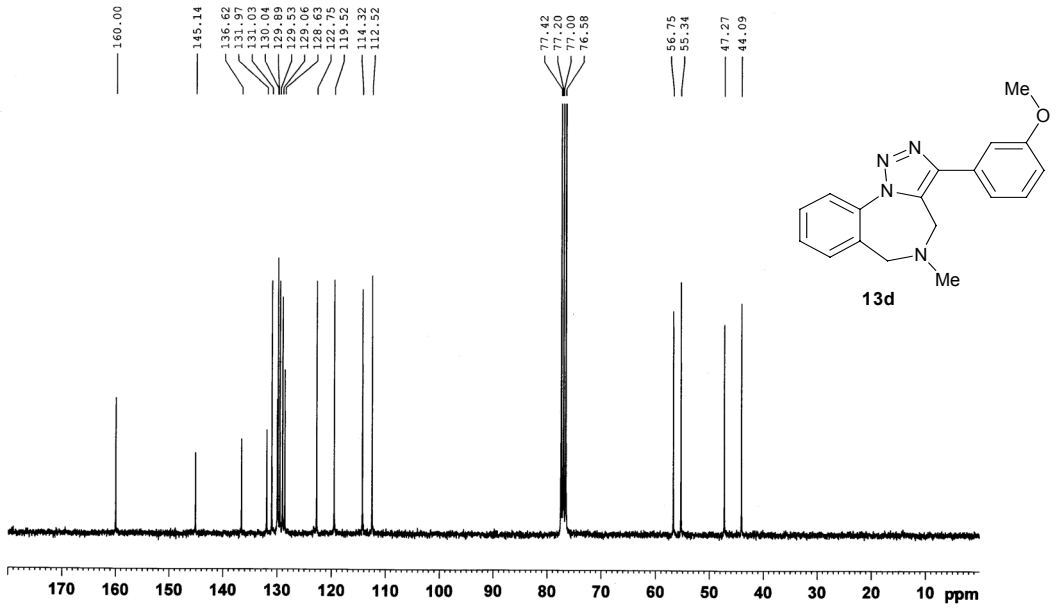
^{13}C NMR (75 MHz, $CDCl_3$) of **13c**



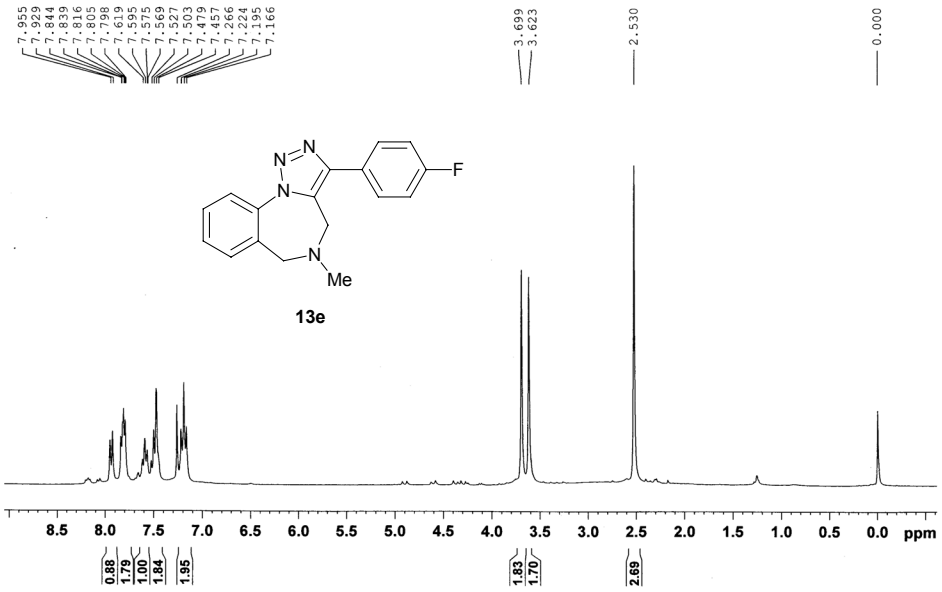
^{1}H NMR (300 MHz, $CDCl_3$) of **13d**



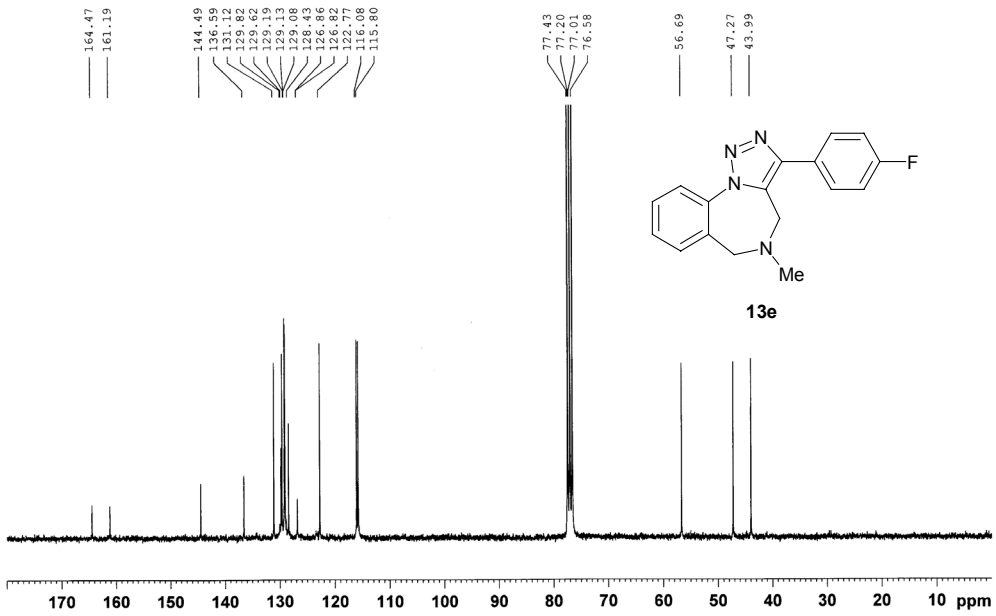
^{13}C NMR (75 MHz, $CDCl_3$) of **13d**



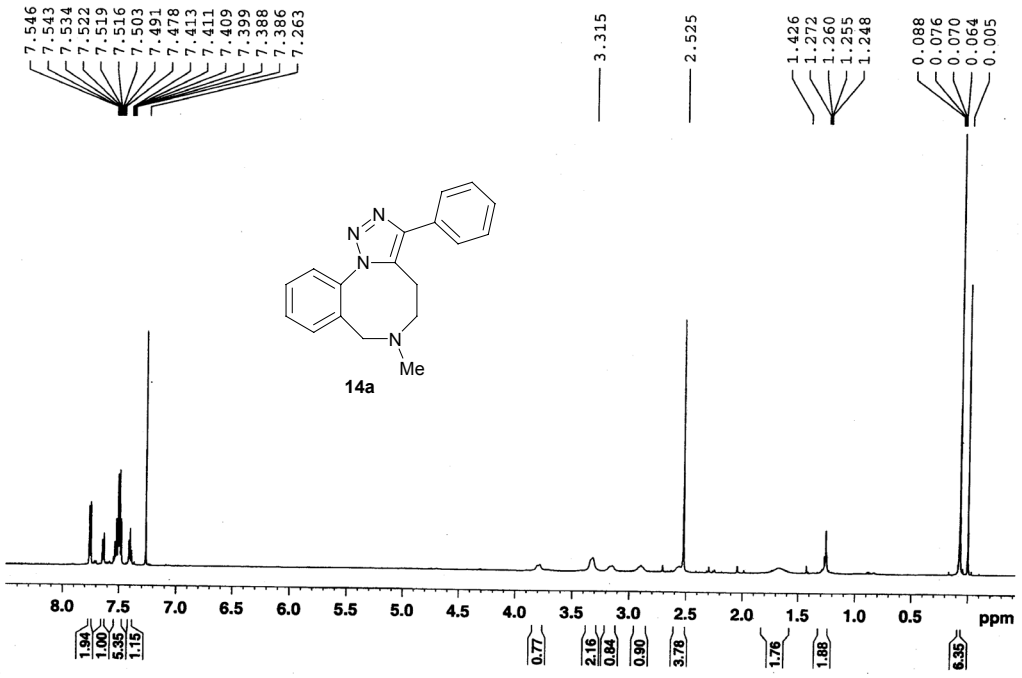
^{1}H NMR (300 MHz, $CDCl_3$) of **13e**



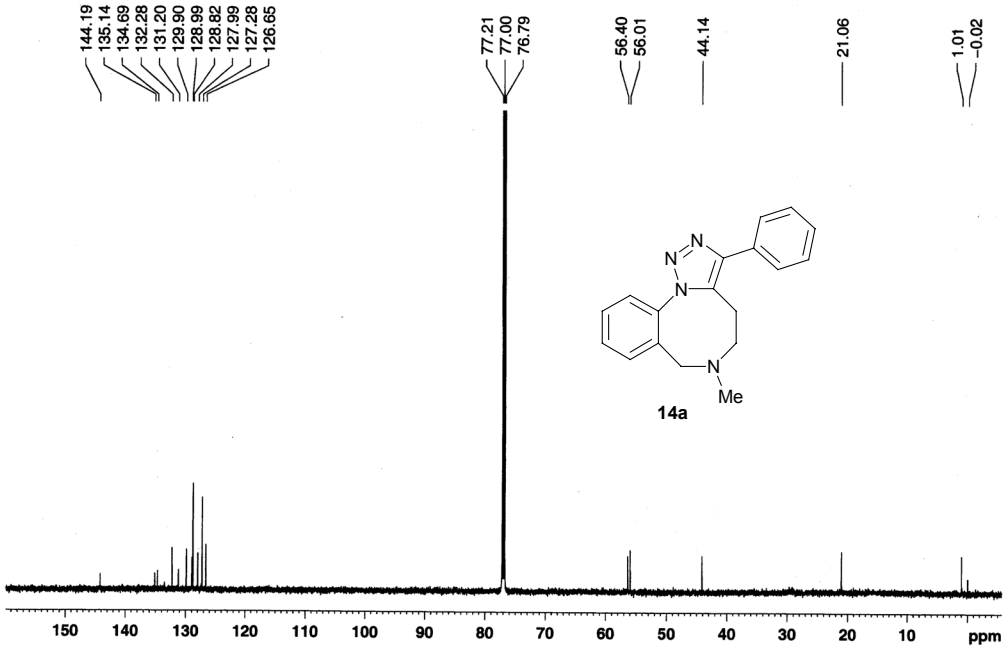
^{13}C NMR (75 MHz, $CDCl_3$) of **13e**



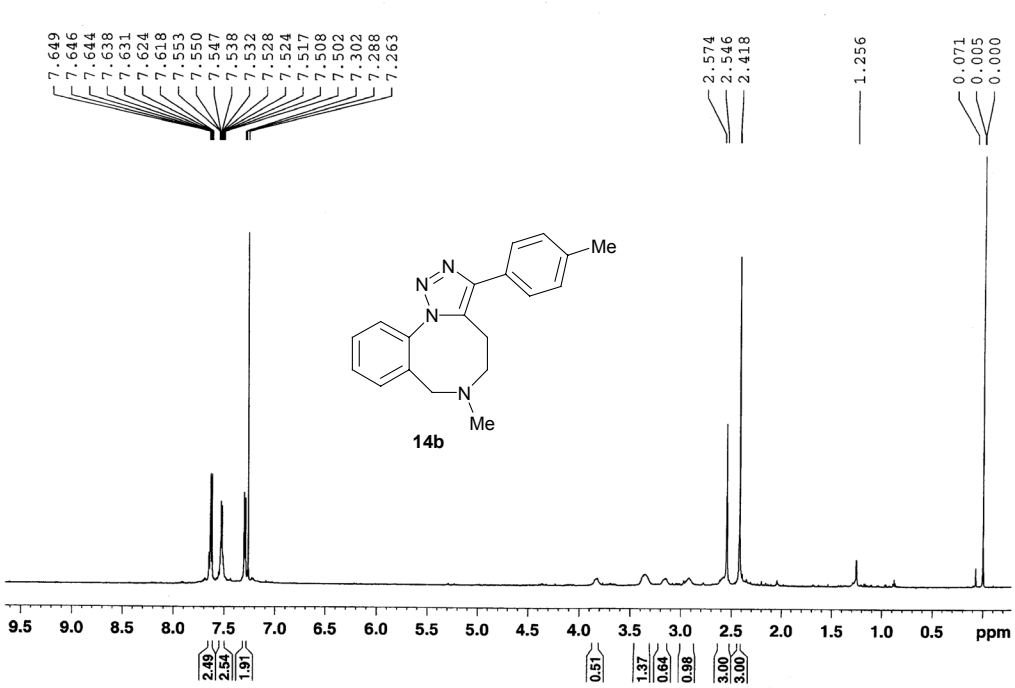
^{1}H NMR (600 MHz, $CDCl_3$) of **14a**



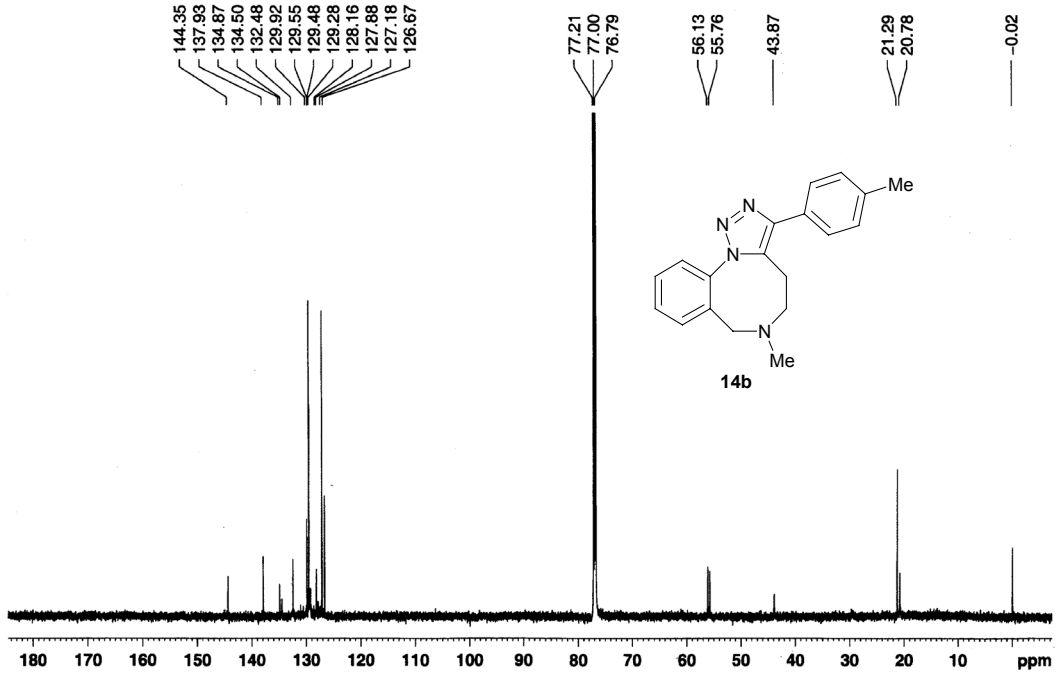
^{13}C NMR (150 MHz, $CDCl_3$) of **14a**



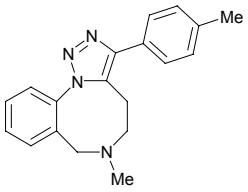
^{1}H NMR (600 MHz, $CDCl_3$) of **14b**



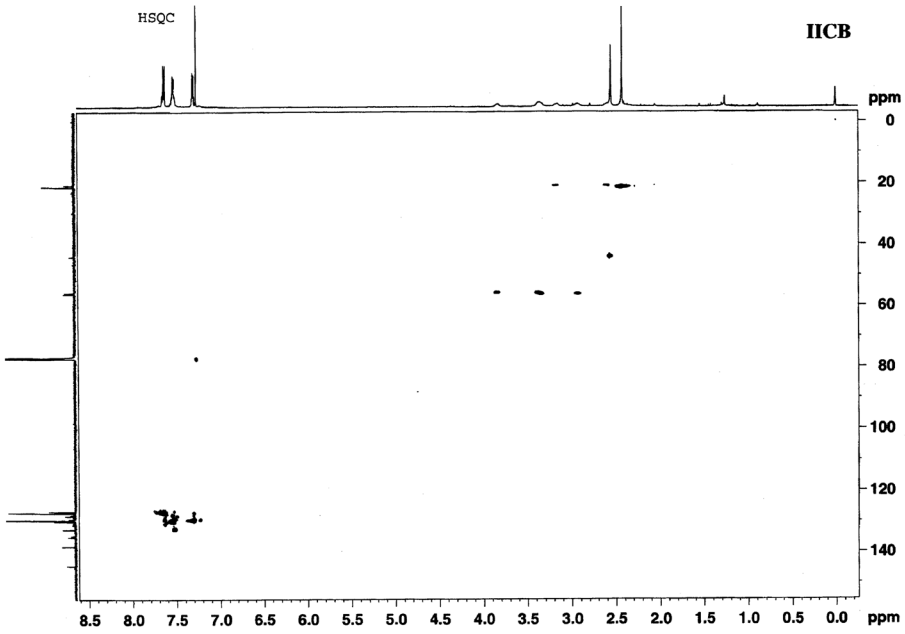
^{13}C NMR(150 MHz, $CDCl_3$) of **14b**



HSQC (600 MHz, $CDCl_3$) of **14b**



14b



A part of HSQC (600 MHz, $CDCl_3$) of **14b**