Supporting Information

Controllable Construction of Pharmaceutical Significant Scaffolds of 2,3-Dihydroquinolin-4-one and Benzoazepine-5-one via Redox-Neutral Cascade Hydride Transfer/Cyclization

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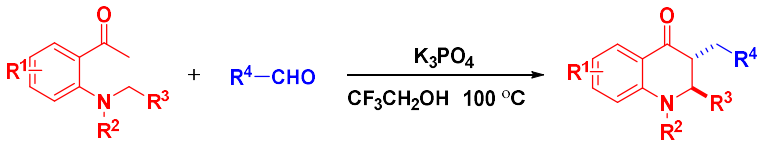
1. General Information

Unless otherwise noted, all reagents and solvents were purchased from the commercial sources and used as received. Thin layer chromatography (TLC) was used to monitor the reaction on Merck 60 F254 precoated silica gel plate (0.2 mm thickness). TLC spots were visualized by UV-light irradiation on Spectroline Model ENF-24061/F 254 nm. The products were purified by flash column chromatography (200-300 mesh silica gel) eluted with the gradient of petroleum ether and ethyl acetate. Proton nuclear magnetic resonance spectra (^{1}H NMR) were recorded on a Bruker 500 MHz NMR spectrometer ($CDCl_3$ or DMSO-d_6 solvent). The chemical shifts were reported in parts per million (ppm), downfield from $SiMe_4$ (δ 0.0) and relative to the signal of chloroform-d (δ 7.26, singlet) or dimethyl sulfoxide-d6 (δ 2.54, singlet). Multiplicities were afforded as: s (singlet); d (doublet); t (triplet); q (quartet); dd (doublets of doublet) or m (multiplets). The number of protons for a given resonance is indicated by nH. Coupling constants were reported as a *J* value in Hz. Carbon nuclear magnetic resonance spectra (^{13}C NMR) was referenced to the appropriate residual solvent peak. High resolution mass spectral analysis (HRMS) was performed on Waters XEVO G2 Q-TOF. All substituted aldehydes and isatins were purchased from adamas-beta.

2. General Procedure

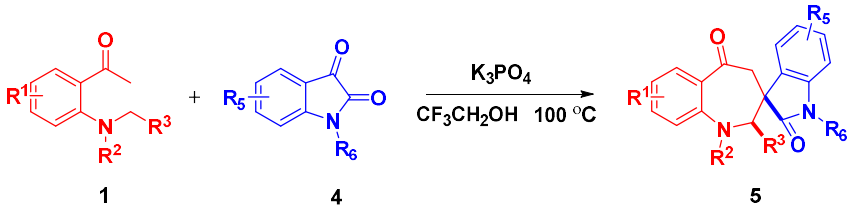
2.1. General Procedure for the Synthesis of 3.



1 2 3

A reaction tube was charged with 2-(dialkylamino)acetophenone (0.1 mmol), aldehydes (0.15 mmol), potassium phosphate (0.1 mmol) and TFE (1.0 mL). The mixture was stirred at 100 °C under an air atmosphere. Upon completion of the reaction as indicated by TLC analysis, the reaction was cooled to room temperature and quenched with saturated aqueous NH_4Cl solution. The mixture was then extracted thrice with EtOAc, and the combined organic phase was washed water and brine, dried over anhydrous Na_2SO_4, which was concentrated in vacuo afterwards. The residue was subjected to flash column chromatography for purification to afford product **3**.

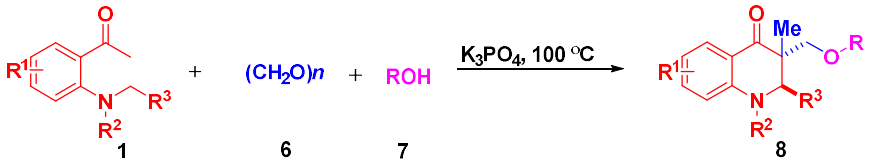
2.2. General Procedure for the Synthesis of 5.



1 4 5

A reaction tube was charged with 2-(dialkylamino)acetophenone (0.1 mmol), isatin (0.15 mmol), potassium phosphate (0.1 mmol) and TFE (1.0 mL). The mixture was stirred at 100 °C under an air atmosphere. Upon completion of the reaction as indicated by TLC analysis, the reaction was cooled to room temperature and quenched by adding saturated aqueous $NaHCO_3$. The crude products were extracted with EtOAc thrice and the combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, and concentrated in vacuo. The residue was purified by flash column chromatography to afford product **5.**

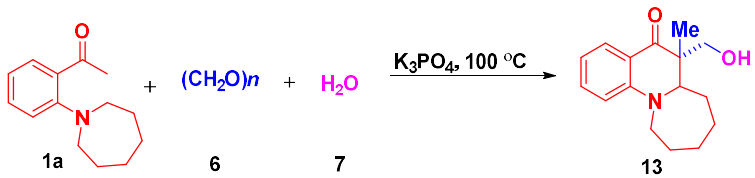
2.3. General Procedure for the Synthesis of 8.



1 6 7 8

A reaction tube was charged with 2-(dialkylamino)acetophenone (0.1 mmol), paraformaldehyde (0.5 mmol), potassium phosphate (0.1 mmol) and alcohol (1.0 mL). The mixture was stirred at 100 °C under an air atmosphere. Upon completion of the reaction as indicated by TLC analysis, the reaction was cooled to room temperature and quenched by adding saturated aqueous $NaHCO_3$. The crude products were extracted with EtOAc thrice and the combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, and concentrated in vacuo. The residue was purified by flash column chromatography to afford product **7.**

2.4. General Procedure for the Synthesis of 13



1a 6 7 13

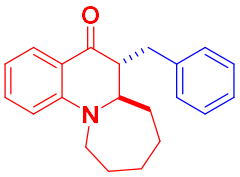
A reaction tube was charged with 1-(2-(azepan-1-yl)phenyl)ethan-1-one (0.1 mmol), paraformaldehyde (0.5 mmol), potassium phosphate (0.1 mmol) and water (1.0 mL). The mixture was stirred at 100 °C under an air atmosphere. Upon completion of the reaction as indicated by TLC analysis, the reaction was cooled to room temperature. The crude products were extracted

with EtOAc thrice and the combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, and concentrated in vacuo. The residue was purified by flash column chromatography to afford product **13.**

3. Characterization of All Compounds

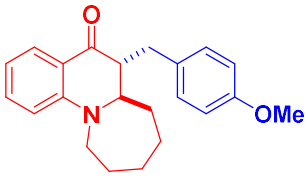
Compounds 3:

6-benzyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3a)



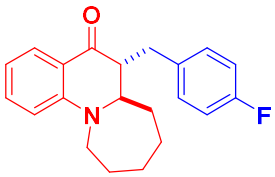
Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (24.4 mg, 80% yield) as a yellow oil.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.91 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.41 (ddd, *J* = 8.7, 7.0, 1.8 Hz, 1H), 7.35 (dd, *J* = 8.1, 6.8 Hz, 2H), 7.28 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.24 – 7.20 (m, 2H), 6.78 – 6.63 (m, 2H), 4.13 (ddd, *J* = 15.2, 6.8, 2.1 Hz, 1H), 3.21 – 3.07 (m, 2H), 2.91 (dd, *J* = 13.4, 4.8 Hz, 1H), 2.76 (dd, *J* = 13.3, 11.4 Hz, 1H), 2.57 (ddd, *J* = 11.4, 4.8, 1.7 Hz, 1H), 2.13 (m, 1H), 1.91 – 1.79 (m, 1H), 1.64 (m, 1H), 1.59 – 1.53 (m, 1H), 1.52 – 1.43 (m, 1H), 1.40 (m, 2H), 1.35 – 1.27 (m, 1H).
^{13}C NMR (125 MHz, $CDCl_3$) δ 196.2, 148.6, 138.9, 135.9, 129.2, 128.6, 128.6, 126.5, 116.8, 115.7, 112.4, 62.3, 53.7, 49.9, 35.9, 30.8, 26.7, 26.1, 25.2 ppm. **HRMS (ESI):** calcd. for $C_{21}H_{23}NO$ $[M+H]^+$: 306.1852; Found: 306.1858.

6-(4-methoxybenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3b)



Reaction time: 40 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (20.8 mg, 62% yield) as a yellow oil.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.79 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.30 (ddd, *J* = 8.6, 6.8, 1.7 Hz, 1H), 7.05 – 6.99 (m, 2H), 6.81 – 6.75 (m, 2H), 6.66 – 6.53 (m, 2H), 4.01 (ddd, *J* = 15.1, 6.8, 2.1 Hz, 1H), 3.73 (s, 3H), 3.12 – 2.98 (m, 2H), 2.74 (dd, *J* = 13.5, 4.9 Hz, 1H), 2.60 (dd, *J* = 13.5, 11.4 Hz, 1H), 2.41 (ddd, *J* = 11.4, 4.9, 1.7 Hz, 1H), 2.10 – 1.96 (m, 1H), 1.83 – 1.69 (m, 1H), 1.59 – 1.49 (m, 1H), 1.46 (dt, *J* = 13.7, 5.2 Hz, 1H), 1.42 – 1.32 (m, 1H), 1.32 – 1.22 (m, 2H), 1.22 – 1.12 (m, 1H).
^{13}C NMR (125 MHz, $CDCl_3$) δ 196.4, 158.3, 148.6, 135.9, 130.8, 130.2, 128.6, 116.8, 115.6, 114.1, 112.4, 62.3, 55.3, 53.9, 49.9, 34.9, 30.8, 26.7, 26.1, 25.2 ppm. **HRMS (ESI)**: calcd. for $C_{22}H_{25}NO_2$ $[M+H]^+$: 336.1958, found: 336.1954.

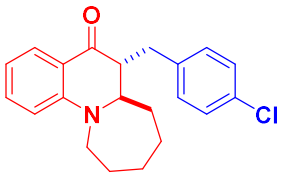
6-(4-fluorobenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3c)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (24.9 mg, 77% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.79 (dd, *J* = 7.8, 1.6 Hz, 1H), 7.38 – 7.26 (m, 1H), 7.06 (dd, *J* = 8.2, 5.4 Hz, 2H), 6.93 (t, *J* = 8.5 Hz, 2H), 6.67 – 6.51 (m, 2H), 4.02 (ddd, *J* = 15.3, 6.8, 2.0 Hz, 1H), 3.02 (ddt, *J* = 15.3, 11.1, 5.2 Hz, 2H), 2.77 (dd, *J* = 13.6, 5.1 Hz, 1H), 2.65 (dd, *J* = 13.5, 11.1 Hz, 1H), 2.42 (dt, *J* = 11.2, 3.1 Hz, 1H), 2.10 – 1.97 (m, 1H), 1.76 (m, 1H), 1.48 (ddd, *J* = 13.9, 8.5, 5.9 Hz, 1H), 1.43 – 1.36 (m, 1H), 1.31 (m, 2H), 1.24 (ddd, *J* = 13.0, 8.5, 3.6 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.1, 162.6, 160.7, 148.5, 136.1, 134.5, 130.5, 128.6, 116.7, 115.8, 115.5, 115.3, 112.4, 62.5, 53.7, 49.9, 35.1, 30.8, 26.7, 25.9, 25.2 ppm. **HRMS (ESI)**: calcd. for $C_{21}H_{22}FNO$ $[M+H]^+$: 324.1758, found: 324.1752.

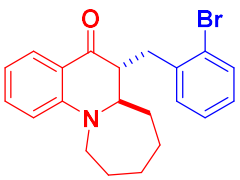
6-(4-chlorobenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3d)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (25.8mg, 76% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.86 (dd, *J* = 7.9, 2.0 Hz, 1H), 7.39 (td, *J* = 7.9, 6.9, 2.0 Hz, 1H), 7.31 – 7.27 (m, 2H), 7.14 – 7.08 (m, 2H), 6.66 (dd, *J* = 12.7, 7.9 Hz, 2H), 4.09 (dd, *J* = 15.4, 6.5 Hz, 1H), 3.16 – 3.01 (m, 2H), 2.84 (dd, *J* = 13.6, 5.1 Hz, 1H), 2.71 (dd, *J* = 13.3, 11.4 Hz, 1H), 2.49 (dd, *J* = 11.1, 4.9 Hz, 1H), 2.10 (ddd, *J* = 15.3, 11.6, 6.4 Hz, 1H), 1.83 (td, *J* = 12.7, 12.3, 5.1 Hz, 1H), 1.63 – 1.57 (m, 1H), 1.56 – 1.44 (m, 1H), 1.39 (m, 2H), 1.34 – 1.27 (m, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.9, 148.5, 137.3, 136.1, 132.4, 130.5, 128.7, 128.6, 116.7, 115.8, 112.4, 62.5, 53.5, 49.9, 35.2, 30.8, 26.7, 25.9, 25.2 ppm. **HRMS (ESI)**: calcd. for $C_{21}H_{22}ClNO$ $[M+H]^+$: 340.1463, found: 340.1468.

6-(2-bromobenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3e)

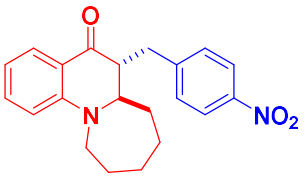


Reaction time: 30 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (30.6 mg, 80% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.90 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.58 (d, *J* = 8.0 Hz, 1H), 7.41 (td, *J* = 7.8, 6.9, 1.7 Hz, 1H), 7.31 – 7.22 (m, 1H), 7.18 – 7.08 (m, 2H), 6.75 – 6.63 (m, 2H), 4.17 – 4.07 (m, 1H), 3.18 (tt, *J* = 10.7, 6.1 Hz, 2H), 3.03 – 2.96 (m, 2H), 2.77 (ddd, *J* = 8.8, 6.6, 1.6 Hz, 1H), 2.14 (dq, *J* = 12.2, 6.1 Hz, 1H), 1.94 – 1.77 (m, 1H), 1.61 (m, 2H), 1.54 – 1.38 (m, 3H), 1.30 (m,

1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.7, 148.5, 138.2, 136.0, 133.2, 131.5, 128.6, 128.4, 127.4, 124.9, 116.7, 115.7, 112.5, 63.2, 51.4, 50.1, 36.2, 31.1, 26.5, 25.9, 25.2 ppm. **HRMS (ESI):** calcd. for $C_{21}H_{22}BrNO$ $[M+H]^+$: 384.0958, found: 384.0954.

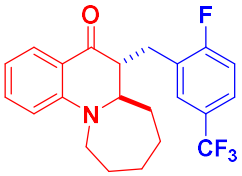
6-(4-nitrobenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3f)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (29.8 mg, 85% yield) as a brown solid. M.p. 142-143℃.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.17 (d, J = 8.4 Hz, 2H), 7.85 (dd, J = 7.8, 1.7 Hz, 1H), 7.40 (ddd, J = 8.7, 6.9, 1.7 Hz, 1H), 7.33 (d, J = 8.4 Hz, 2H), 6.68 (t, J = 8.9 Hz, 2H), 4.11 (ddd, J = 15.2, 6.7, 2.1 Hz, 1H), 3.18 – 3.05 (m, 2H), 2.98 (dd, J = 13.5, 5.9 Hz, 1H), 2.89 (dd, J = 13.5, 10.2 Hz, 1H), 2.57 (ddd, J = 10.3, 5.8, 1.6 Hz, 1H), 2.22 – 2.03 (m, 1H), 1.86 (m, 1H), 1.64 (m, 1H), 1.59 – 1.53 (m, 1H), 1.50 – 1.38 (m, 3H), 1.32 (dq, J = 9.4, 4.7 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 194.99, 148.37, 146.89, 146.71, 136.22, 129.95, 128.61, 123.79, 116.73, 116.09, 112.51, 63.10, 53.05, 50.05, 35.92, 30.84, 26.65, 25.92, 25.15 ppm. **HRMS (ESI)**: calcd. for $C_{21}H_{22}N_2O_3$ $[M+H]^+$: 351.1703, found: 351.1709.

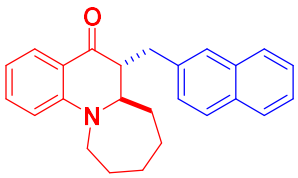
6-(2-fluoro-5-(trifluoromethyl)benzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3g)



Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (32.1 mg, 82% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.85 (d, J = 7.9 Hz, 1H), 7.53 (d, J = 8.7 Hz, 1H), 7.41 (t, J = 8.0 Hz, 1H), 7.33 (s, 1H), 6.93 (d, J = 8.6 Hz, 1H), 6.68 (dd, J = 8.9, 6.6 Hz, 2H), 4.46 (q, J = 7.7 Hz, 2H), 4.08 (dd, J = 15.5, 6.5 Hz, 1H), 3.17 (d, J = 11.9 Hz, 1H), 3.14 – 3.03 (m, 1H), 3.01 (dd, J = 13.5, 6.6 Hz, 1H), 2.92 (dd, J = 12.8, 9.9 Hz, 1H), 2.70 (t, J = 8.1 Hz, 1H), 2.21 – 2.06 (m, 1H), 1.92 – 1.78 (m, 1H), 1.72 – 1.55 (m, 2H), 1.49 (dq, J = 20.0, 9.8, 9.0 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.5, 157.8, 148.3, 135.9, 128.9, 128.8, 128.7, 128.5, 125.5, 116.7, 115.8, 112.4, 111.5, 65.9, 64.1, 50.9, 49.8, 31.2, 30.9, 26.6, 25.9, 25.2 ppm. **HRMS (ESI)**: calcd. for $C_{22}H_{21}F_4NO$ $[M+H]^+$: 392.1632, found: 392.1636.

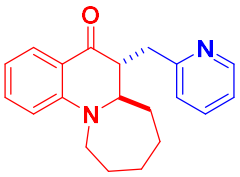
6-(naphthalen-2-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3h)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (18.5 mg, 52% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.90 (d, *J* = 7.8 Hz, 1H), 7.81 (q, *J* = 8.5 Hz, 3H), 7.62 (s, 1H), 7.51 – 7.43 (m, 2H), 7.42 – 7.37 (m, 1H), 7.34 (d, *J* = 8.4 Hz, 1H), 6.72 – 6.64 (m, 2H), 4.13 (dd, *J* = 15.3, 6.7 Hz, 1H), 3.19 – 3.08 (m, 2H), 3.03 (dd, *J* = 13.3, 4.6 Hz, 1H), 2.90 (t, *J* = 12.5 Hz, 1H), 2.64 (dd, *J* = 11.6, 4.7 Hz, 1H), 2.09 (dq, *J* = 15.6, 6.0 Hz, 1H), 1.84 (tt, *J* = 10.6, 6.3 Hz, 1H), 1.57 (td, *J* = 9.1, 8.6, 4.0 Hz, 1H), 1.52 – 1.39 (m, 1H), 1.38 – 1.20 (m, 3H), 0.91 – 0.81 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.2, 148.6, 136.4, 136.1, 133.6, 132.3, 128.6, 128.3, 127.8, 127.7, 127.5, 127.5, 126.2, 125.6, 116.8, 115.7, 112.5, 62.3, 53.6, 49.9, 35.9, 30.7, 26.7, 25.9, 25.1 ppm. **HRMS (ESI)**: calcd. for $C_{25}H_{25}NO$ $[M+H]^+$: 356.2009, found: 356.2007.

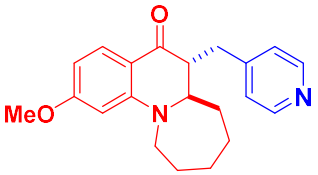
6-(pyridin-2-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3i)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (27.5 mg, 90% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.55 (d, *J* = 4.6 Hz, 1H), 7.85 (d, *J* = 7.8 Hz, 1H), 7.59 (td, *J* = 7.6, 1.8 Hz, 1H), 7.44 – 7.30 (m, 1H), 7.21 – 7.05 (m, 2H), 6.72 – 6.57 (m, 2H), 4.06 (ddd, *J* = 15.4, 6.8, 2.0 Hz, 1H), 3.30 (dd, *J* = 12.4, 3.4 Hz, 1H), 3.15 (ddd, *J* = 16.0, 11.1, 6.0 Hz, 1H), 3.06 – 2.93 (m, 2H), 2.87 – 2.75 (m, 1H), 2.08 (dq, *J* = 14.8, 5.4, 4.8 Hz, 1H), 1.92 – 1.79 (m, 1H), 1.62 (td, *J* = 14.5, 11.9, 6.4 Hz, 1H), 1.54 (ddd, *J* = 9.8, 7.1, 3.9 Hz, 1H), 1.51 – 1.40 (m, 3H), 1.32 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.8, 159.1, 149.4, 148.6, 136.4, 135.9, 128.5, 123.6, 121.5, 116.8, 115.5, 112.4, 63.3, 51.9, 49.9, 38.2, 30.7, 26.8, 26.1, 25.2 ppm. **HRMS (ESI)**: calcd. for $C_{20}H_{22}N_2O$ $[M+H]^+$: 307.1805, found: 307.1809.

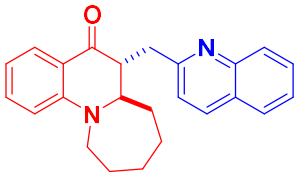
2-methoxy-6-(pyridin-4-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3j)



Reaction time: 24 h. Flash column chromatography on a silica gel (dichloromethane: methyl alcohol, 100:3) afforded the product (22.8 mg, 68% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.58 – 8.51 (m, 2H), 7.84 (dd, *J* = 8.8, 1.6 Hz, 1H), 7.16 – 7.09 (m, 2H), 6.29 (dd, *J* = 8.8, 2.1 Hz, 1H), 6.09 (d, *J* = 2.1 Hz, 1H), 4.04 (dd, *J* = 15.3, 6.6 Hz, 1H), 3.91 (d, *J* = 1.7 Hz, 1H), 3.85 (d, *J* = 1.6 Hz, 3H), 3.12 – 3.02 (m, 2H), 2.88 (dd, *J* = 13.5, 5.0 Hz, 1H), 2.73 (dd, *J* = 13.2, 11.2 Hz, 1H), 2.51 (dd, *J* = 11.0, 4.9 Hz, 1H), 2.17 – 2.04 (m, 1H), 1.84 (m, 1H), 1.68 – 1.59 (m, 1H), 1.55 (h, *J* = 6.9, 5.9 Hz, 1H), 1.39 (m, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 193.7, 166.3, 150.2, 149.8, 148.3, 131.1, 130.9, 128.9, 124.5, 111.3, 103.7, 96.1, 62.9, 55.3, 52.4, 50.2, 35.5, 31.1, 26.6, 25.9, 25.2 ppm. **HRMS (ESI)**: calcd. for $C_{21}H_{24}N_2O_2$ $[M+H]^+$: 337.1911, found: 337.1916.

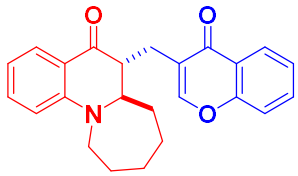
6-(quinolin-2-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3k)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:4) afforded the product (30.3 mg, 85% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.08 (dd, *J* = 8.4, 4.1 Hz, 2H), 7.90 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.80 (d, *J* = 8.1 Hz, 1H), 7.71 (t, *J* = 7.7 Hz, 1H), 7.51 (t, *J* = 7.5 Hz, 1H), 7.42 – 7.35 (m, 1H), 7.31 – 7.23 (m, 1H), 6.72 – 6.61 (m, 2H), 4.09 (ddd, *J* = 15.4, 6.8, 2.1 Hz, 1H), 3.39 (dd, *J* = 12.1, 3.4 Hz, 1H), 3.21 (qd, *J* = 13.6, 7.9 Hz, 3H), 2.91 (dd, *J* = 10.1, 5.5 Hz, 1H), 2.15 – 2.01 (m, 1H), 1.88 (dt, *J* = 12.0, 8.3 Hz, 1H), 1.66 – 1.57 (m, 1H), 1.51 (dq, *J* = 11.0, 6.6, 6.0 Hz, 1H), 1.44 (td, *J* = 10.6, 4.2 Hz, 3H), 1.32 (dp, *J* = 14.3, 5.0, 4.6 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.9, 159.6, 148.7, 147.9, 136.5, 136.1, 129.5, 129.1, 128.5, 127.6, 126.9, 126.1, 121.9, 116.8, 115.5, 112.5, 63.1, 51.8, 49.9, 38.8, 30.7, 26.9, 26.1, 25.2 ppm. **HRMS (ESI)**: calcd. for $C_{24}H_{24}N_2O$ $[M+H]^+$: 357.1961, found: 357.1965.

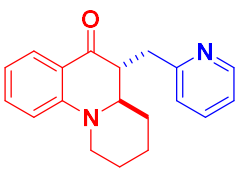
6-((4-oxo-4H-chromen-3-yl)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-on e (3l)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:3) afforded the product (26.9 mg, 72% yield) as a yellow solid. M.p. 158-159℃.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.28 – 8.19 (m, 1H), 7.82 (dd, *J* = 7.8, 1.9 Hz, 1H), 7.67 – 7.61 (m, 1H), 7.58 (s, 1H), 7.39 (dt, *J* = 6.7, 2.8 Hz, 2H), 7.34 (td, *J* = 7.8, 7.0, 1.8 Hz, 1H), 6.62 (t, *J* = 7.5 Hz, 1H), 6.58 (d, *J* = 8.6 Hz, 1H), 3.97 (dd, *J* = 15.4, 6.6 Hz, 1H), 3.52 (dd, *J* = 12.0, 4.3 Hz, 1H), 3.23 (ddd, *J* = 15.9, 11.2, 5.9 Hz, 1H), 2.86 (dd, *J* = 13.3, 5.6 Hz, 1H), 2.67 (m, 2H), 2.08 (ddd, *J* = 19.7, 10.0, 4.4 Hz, 1H), 1.82 (dt, *J* = 13.5, 6.8 Hz, 1H), 1.68 – 1.55 (m, 3H), 1.50 (dq, *J* = 10.2, 6.3, 5.5 Hz, 2H), 1.38 – 1.23 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.6, 177.6, 156.5, 152.8, 148.3, 135.9, 133.4, 128.4, 125.9, 124.9, 123.7, 121.5, 118.1, 116.8, 115.6, 112.3, 65.2, 50.1, 49.9, 31.3, 27.1, 26.6, 25.9, 25.3 ppm. **HRMS (ESI)**: calcd. for $C_{24}H_{23}NO_3$ $[M+H]^+$: 374.1751, found: 374.1754.

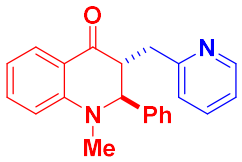
5-(pyridin-2-ylmethyl)-1,2,3,4,4a,5-hexahydro-6H-pyrido[1,2-a]quinolin-6-one (3m)



Reaction time: 40 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:5) afforded the product (21.0 mg, 72% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.48 (d, *J* = 4.9 Hz, 1H), 7.83 (d, *J* = 7.8 Hz, 1H), 7.53 (t, *J* = 7.7 Hz, 1H), 7.34 (t, *J* = 7.9 Hz, 1H), 7.08 (dd, *J* = 10.8, 6.8 Hz, 2H), 6.79 (d, *J* = 8.7 Hz, 1H), 6.66 (t, *J* = 7.4 Hz, 1H), 4.06 (d, *J* = 13.8 Hz, 1H), 3.25 (dt, *J* = 11.9, 3.0 Hz, 1H), 3.14 – 2.96 (m, 2H), 2.94 – 2.76 (m, 2H), 1.72 (d, *J* = 10.1 Hz, 2H), 1.63 – 1.53 (m, 1H), 1.49 – 1.31 (m, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.5, 159.1, 149.9, 149.2, 136.5, 135.7, 128.6, 123.9, 121.5, 119.1, 116.9, 114.3, 62.4, 52.2, 49.3, 37.3, 27.9, 25.1, 23.2 ppm. **HRMS (ESI)**: calcd. for $C_{19}H_{20}N_2O$ $[M+H]^+$: 293.1648, found: 293.1642.

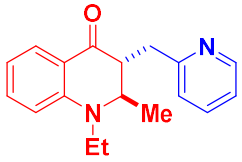
1-methyl-2-phenyl-3-(pyridin-2-ylmethyl)-2,3-dihydroquinolin-4(1H)-one (3n)



Reaction time: 30 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:2) afforded the product (21.0 mg, 64% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.23 (d, *J* = 4.8 Hz, 1H), 7.28 (t, *J* = 7.8 Hz, 1H), 7.23 – 7.17 (m, 1H), 7.06 (t, *J* = 7.8 Hz, 1H), 6.99 (q, *J* = 8.1, 7.4 Hz, 5H), 6.94 (d, *J* = 8.0 Hz, 1H), 6.86 (t, *J* = 6.3 Hz, 1H), 6.31 (t, *J* = 7.4 Hz, 1H), 6.25 (d, *J* = 8.3 Hz, 1H), 3.43 (d, *J* = 13.5 Hz, 1H), 3.22 (dd, *J* = 13.9, 6.3 Hz, 2H), 3.02 (s, *J* = 1.8 Hz, 3H), 3.00 (s, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 202.6, 160.8, 155.7, 148.4, 137.1, 135.9, 135.2, 129.8, 127.9, 126.6, 124.1, 123.8, 121.7, 120.3, 115.9, 107.1, 74.8, 44.0, 41.6, 28.9 ppm. **HRMS (ESI)**: calcd. for $C_{22}H_{20}N_2O$ $[M+H]^+$: 329.1648, found: 329.1645.

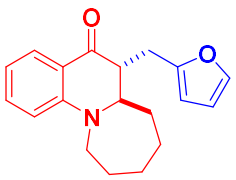
1-ethyl-2-methyl-3-(pyridin-2-ylmethyl)-2,3-dihydroquinolin-4(1H)-one (3o)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:2) afforded the product (19.1 mg, 68% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.54 – 8.45 (m, 1H), 7.81 (d, *J* = 7.8 Hz, 1H), 7.52 (t, *J* = 7.8 Hz, 1H), 7.32 (t, *J* = 8.0 Hz, 1H), 7.07 (t, *J* = 6.2 Hz, 1H), 7.02 (d, *J* = 7.9 Hz, 1H), 6.65 – 6.53 (m, 2H), 3.46 (dp, *J* = 21.0, 7.1 Hz, 2H), 3.18 – 3.07 (m, 1H), 2.91 (m, 2H), 2.79 – 2.73 (m, 1H), 1.21 (td, *J* = 7.1, 2.1 Hz, 3H), 1.05 (dd, *J* = 6.7, 2.2 Hz, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.5, 158.9, 149.4, 147.8, 136.5, 135.8, 128.5, 123.7, 121.6, 117.1, 115.6, 112.4, 57.2, 52.3, 44.5, 38.3, 15.8, 13.2 ppm. **HRMS (ESI)**: calcd. for $C_{18}H_{20}N_2O$ $[M+H]^+$: 281.1648, found: 281.1642.

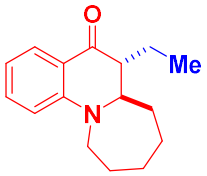
6-(furan-2-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3p)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:20) afforded the product (23.0 mg, 78% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.84 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.39 – 7.32 (m, 2H), 6.69 – 6.59 (m, 2H), 6.30 (dd, *J* = 3.2, 1.9 Hz, 1H), 6.05 (d, *J* = 3.1 Hz, 1H), 4.06 (ddd, *J* = 15.3, 6.7, 2.2 Hz, 1H), 3.28 (ddd, *J* = 11.8, 4.1, 1.8 Hz, 1H), 3.16 (ddd, *J* = 15.3, 11.1, 6.0 Hz, 1H), 2.94 – 2.77 (m, 2H), 2.64 (ddd, *J* = 10.5, 5.5, 1.8 Hz, 1H), 2.09 (m, 1H), 1.92 – 1.78 (m, 1H), 1.69 – 1.53 (m, 2H), 1.47 (m, 3H), 1.38 – 1.29 (m, 1H).**^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.5, 152.8, 148.5, 141.7, 136.1, 128.6, 116.6, 115.6, 112.4, 110.3, 107.1, 63.2, 51.1, 49.9, 30.6, 28.3, 26.9, 26.1, 25.2 ppm. **HRMS (ESI)**: calcd. for $C_{19}H_{21}NO_2$ $[M+H]^+$: 296.1645, found: 296.1641.

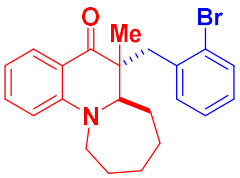
6-ethyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3q)



Reaction time: 30 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (13.6 mg, 56% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.74 (dd, *J* = 8.1, 1.8 Hz, 1H), 7.26 (ddd, *J* = 8.7, 7.0, 1.8 Hz, 1H), 6.53 (dd, *J* = 8.0, 6.3 Hz, 2H), 3.97 (ddd, *J* = 15.3, 6.8, 2.2 Hz, 1H), 3.34 (dq, *J* = 11.9, 1.8 Hz, 1H), 3.13 (ddd, *J* = 15.3, 11.0, 5.9 Hz, 1H), 2.10 (td, *J* = 7.7, 1.8 Hz, 1H), 2.03 (m, 1H), 1.77 (dd, *J* = 12.0, 8.2 Hz, 1H), 1.57 (m, 5H), 1.50 – 1.40 (m, 2H), 1.26 (m, 1H), 0.89 (t, *J* = 7.4 Hz, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.1, 148.2, 135.7, 128.4, 116.7, 115.3, 112.1, 64.7, 53.4, 50.1, 31.4, 26.8, 26.1, 25.3, 23.3, 11.8 ppm. **HRMS (ESI)**: calcd. for $C_{16}H_{21}NO$ $[M+H]^+$: 244.1696, found: 244.1698.

6-(2-bromobenzyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3r)



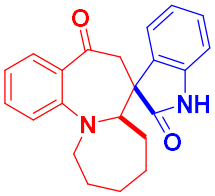
Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (23.0 mg, 58% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.90 (dd, J = 7.8, 1.7 Hz, 1H), 7.51 (dd, J = 8.0, 1.3 Hz, 1H), 7.36 (ddd, J = 8.6, 7.0, 1.8 Hz, 1H), 7.13 (td, J = 7.5, 1.3 Hz, 1H), 7.01 (td, J = 7.6, 1.8 Hz, 1H), 6.85 (dd, J = 7.7, 1.8 Hz, 1H), 6.66 (ddd, J = 7.9, 6.9, 0.9 Hz, 1H), 6.63 (d, J = 8.5 Hz, 1H), 4.09 (ddd, J = 15.2, 6.3, 1.8 Hz, 1H), 3.36 (dd, J = 10.3, 6.5 Hz, 1H), 3.29 – 3.24 (m, 1H), 3.23 – 3.20 (m, 1H), 3.15 (d, J = 13.8 Hz, 1H), 2.14 – 2.03 (m, 1H), 1.71 (m, 3H), 1.59 – 1.45 (m, 3H), 1.43 – 1.35 (m, 1H), 1.09 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.1, 148.4, 137.1, 135.6, 132.9, 131.9, 128.7, 128.1, 126.9, 126.2, 117.3, 115.7, 112.1, 69.9, 50.9, 50.6, 41.2, 27.3, 26.9, 25.9, 25.4, 16.7 ppm. **HRMS (ESI)**: calcd. for $C_{22}H_{24}BrNO$ $[M+H]^+$: 398.1114, found: 398.1117.

Compounds 5:

7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione

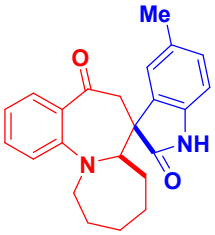
(5a)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (24.9 mg, 72% yield) as a brown solid. M.p. 154-155°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.66 (s, 1H), 7.82 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.28 (ddd, *J* = 8.7, 6.9, 1.8 Hz, 1H), 7.18 – 7.12 (m, 2H), 7.04 (d, *J* = 8.5 Hz, 1H), 6.98 (t, *J* = 7.6 Hz, 1H), 6.85 – 6.81 (m, 1H), 6.76 (t, *J* = 7.4 Hz, 1H), 3.91 – 3.83 (m, 2H), 3.65 (d, *J* = 10.7 Hz, 1H), 3.50 (dd, *J* = 12.0, 4.3 Hz, 1H), 2.23 (d, *J* = 10.6 Hz, 1H), 1.85 – 1.69 (m, 2H), 1.67 – 1.50 (m, 3H), 1.38 (ddd, *J* = 15.0, 7.7, 4.2 Hz, 1H), 1.19 (m, 1H), 1.04 – 0.91 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 199.1, 179.5, 155.7, 139.9, 132.7, 131.3, 130.2, 128.6, 125.0, 123.4, 123.1, 117.7, 115.1, 109.8, 71.6, 64.1, 47.4, 47.3, 29.4, 28.9, 27.9, 26.3 ppm. **HRMS (ESI):** calcd. for $C_{22}H_{22}N_2O_2$ $[M+H]^+$: 347.1754; Found: 347.1757.

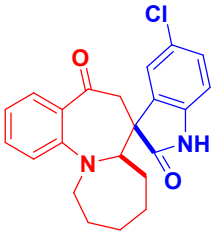
5'-methyl-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5b)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (25.2 mg, 70% yield) as a brown solid. M.p. 162-163°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.74 (s, 1H), 7.27 (ddd, *J* = 8.6, 6.9, 1.8 Hz, 1H), 7.04 (d, *J* = 8.5 Hz, 1H), 6.97 (d, *J* = 5.4 Hz, 2H), 6.76 (t, *J* = 7.4 Hz, 1H), 6.69 (d, *J* = 8.3 Hz, 1H), 3.87 (d, *J* = 10.9 Hz, 2H), 3.63 (d, *J* = 10.7 Hz, 1H), 3.48 (dd, *J* = 12.1, 4.3 Hz, 1H), 2.26 (s, 3H), 2.22 (d, *J* = 10.7 Hz, 1H), 1.84 – 1.70 (m, 2H), 1.71 – 1.60 (m, 1H), 1.56 (m, 3H), 1.39 (ddd, *J* = 14.9, 7.8, 4.3 Hz, 1H), 0.98 (q, *J* = 12.4, 11.8 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 199.0, 178.9, 155.7, 137.1, 132.7, 132.6, 131.4, 130.1, 128.9, 125.1, 124.2, 117.6, 115.0, 109.2, 71.6, 63.9, 47.3, 47.3, 29.4, 28.9, 27.9, 26.3, 21.3 **HRMS (ESI):** calcd. for $C_{23}H_{24}N_2O_2$ $[M+H]^+$: 361.1911; Found: 361.1916.

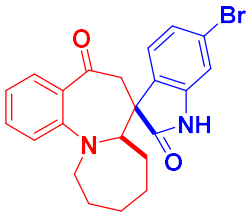
5'-chloro-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5c)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (29.6 mg, 78% yield) as a brown solid. M.p. 158-159°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.60 (s, 1H), 7.81 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.29 (ddd, *J* = 8.7, 6.9, 1.8 Hz, 1H), 7.15 (d, *J* = 7.3 Hz, 2H), 7.04 (d, *J* = 8.5 Hz, 1H), 6.78 (dd, *J* = 8.2, 5.9 Hz, 2H), 3.87 – 3.83 (m, 2H), 3.64 (d, *J* = 10.7 Hz, 1H), 3.46 (dd, *J* = 12.1, 4.3 Hz, 1H), 2.22 (d, *J* = 10.7 Hz, 1H), 1.74 (d, *J* = 7.2 Hz, 2H), 1.64 (td, *J* = 14.0, 11.9, 7.7 Hz, 1H), 1.60 – 1.51 (m, 1H), 1.38 (m, 1H), 1.19 (qd, *J* = 11.0, 5.7 Hz, 2H), 0.99 (q, *J* = 12.2, 11.6 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.8, 178.8, 155.6, 138.3, 132.9, 132.8, 130.1, 128.7, 128.6, 124.9, 124.1, 117.9, 115.1, 110.7, 71.6, 64.2, 47.4, 46.9, 29.4, 28.9, 27.8, 26.2 ppm. **HRMS (ESI):** calcd. for $C_{22}H_{21}ClN_2O_2$ $[M+H]^+$: 381.1364; Found:381.1367.

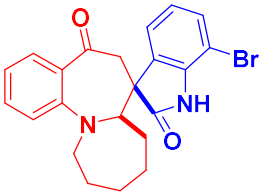
6'-bromo-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5d)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (34.8 mg, 82% yield) as a brown solid. M.p. 156-157°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.43 (s, 1H), 7.80 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.29 (ddd, *J* = 8.7, 7.0, 1.8 Hz, 1H), 7.14 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.06 – 7.00 (m, 3H), 6.78 (t, *J* = 7.4 Hz, 1H), 3.90 – 3.82 (m, 2H), 3.64 (d, *J* = 10.7 Hz, 1H), 3.46 (dd, *J* = 12.1, 4.3 Hz, 1H), 2.20 (d, *J* = 10.7 Hz, 1H), 1.76 (m, 2H), 1.65 (s, 3H), 1.59 – 1.52 (m, 1H), 1.39 (ddd, *J* = 14.7, 7.7, 4.3 Hz, 1H), 0.98 (q, *J* = 12.3, 11.7 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.9, 179.1, 155.6, 141.1, 132.8, 130.2, 130.1, 126.1, 125.0, 124.8, 122.2, 117.9, 115.1, 113.2, 71.5, 63.8, 47.4, 47.1, 29.4, 28.9, 27.8, 26.2 ppm. **HRMS (ESI):** calcd. for $C_{22}H_{21}BrN_2O_2$ $[M+H]^+$: 425.0859; Found: 425.0854.

7'-bromo-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5e)

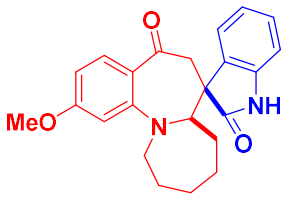


Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (29.7 mg, 70% yield) as a brown solid. M.p. 159-160°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (s, 1H), 7.80 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.33 – 7.26 (m, 2H), 7.10 (d, *J* = 7.4 Hz, 1H), 7.04 (d, *J* = 8.5 Hz, 1H), 6.90 (t, *J* = 7.9 Hz, 1H), 6.77 (t, *J* = 7.4 Hz, 1H), 3.87 (dt, *J* = 8.7, 3.2 Hz, 2H), 3.65 (d, *J* = 10.8 Hz, 1H), 3.48 (dd, *J* = 12.2, 4.3 Hz, 1H), 2.23 (d, *J* = 10.7 Hz, 1H), 1.83 – 1.71 (m, 2H), 1.71 – 1.54 (m, 4H), 1.39 (ddd, *J* = 15.2, 7.7, 4.3 Hz, 1H), 0.98 (q, *J* = 12.3, 11.7 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.6, 177.7, 155.6, 139.1, 132.8,

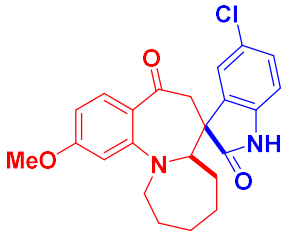
132.4, 131.3, 130.1, 125.0, 124.5, 122.4, 117.8, 115.1, 102.7, 71.6, 65.4, 47.4, 47.2, 29.5, 28.9, 27.9, 26.2 ppm. **HRMS (ESI):** calcd. for $C_{22}H_{21}BrN_2O_2$ $[M+H]^+$: 425.0859; Found: 425.0852.

2-methoxy-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5f)



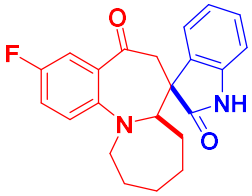
Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (23.3 mg, 62% yield) as a brown solid. M.p. 159-160°C.
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.20 (s, 1H), 7.81 (d, *J* = 8.8 Hz, 1H), 7.17 (dt, *J* = 7.6, 3.8 Hz, 2H), 6.99 (t, *J* = 7.6 Hz, 1H), 6.82 (d, *J* = 7.9 Hz, 1H), 6.49 (d, *J* = 2.2 Hz, 1H), 6.38 (dd, *J* = 8.9, 2.1 Hz, 1H), 3.88 (ddd, *J* = 16.2, 11.0, 2.1 Hz, 1H), 3.82 (s, 1H), 3.79 (s, 3H), 3.59 (d, *J* = 10.8 Hz, 1H), 3.53 (dd, *J* = 12.2, 4.3 Hz, 1H), 2.20 (d, *J* = 10.8 Hz, 1H), 1.81 (dt, *J* = 14.8, 11.2 Hz, 1H), 1.73 (d, *J* = 14.3 Hz, 1H), 1.70 – 1.62 (m, 2H), 1.57 (dd, *J* = 14.8, 11.7 Hz, 1H), 1.38 (ddd, *J* = 15.0, 7.8, 4.2 Hz, 1H), 1.18 (s, 1H), 0.99 (q, *J* = 12.3, 11.8 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.2, 179.4, 163.5, 157.5, 139.7, 132.2, 131.4, 128.5, 123.5, 123.2, 119.7, 109.6, 104.7, 99.9, 71.5, 63.2, 55.3, 47.5, 47.3, 29.3, 28.8, 27.7, 26.3 ppm. **HRMS (ESI):** calcd. for $C_{23}H_{24}N_2O_3$ $[M+H]^+$: 377.1860; Found: 377.1862.

5'-chloro-2-methoxy-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5g)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (31.6 mg, 77% yield) as a brown solid. M.p. 153-154°C.
^{1}H NMR (500 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.86 (d, *J* = 8.8 Hz, 1H), 7.22 – 7.14 (m, 2H), 6.96 (d, *J* = 8.2 Hz, 1H), 6.45 (d, *J* = 2.3 Hz, 1H), 6.39 (dd, *J* = 8.7, 2.0 Hz, 1H), 3.89 (dd, *J* = 15.5, 4.6 Hz, 1H), 3.80 (s, 3H), 3.48 (dd, *J* = 15.7, 10.8 Hz, 1H), 3.19 (d, *J* = 12.0 Hz, 1H), 2.50 (d, *J* = 11.9 Hz, 1H), 1.88 – 1.72 (m, 2H), 1.67 – 1.58 (m, 2H), 1.20 (d, *J* = 13.1 Hz, 3H), 1.09 (q, *J* = 11.3, 8.5 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 195.9, 179.2, 163.3, 156.6, 139.8, 132.9, 131.8, 128.9, 127.7, 123.84, 119.9, 111.8, 104.3, 99.9, 70.9, 63.5, 55.4, 47.7, 47.2, 29.6, 28.6, 27.2, 26.3 ppm. **HRMS (ESI):** calcd. for $C_{23}H_{23}ClN_2O_3$ $[M+H]^+$: 411.1470; Found: 411.1473.

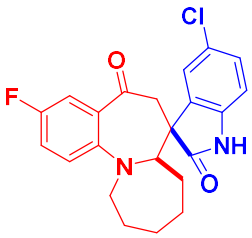
3-fluoro-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5h)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (29.8 mg, 82% yield) as a brown solid. M.p. 151-152°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.26 (s, 1H), 7.50 (dd, *J* = 9.1, 2.7 Hz, 1H), 7.17 (d, *J* = 7.7 Hz, 1H), 7.12 (d, *J* = 7.5 Hz, 1H), 7.03 – 7.00 (m, 2H), 6.99 (s, 1H), 6.83 (d, *J* = 7.8 Hz, 1H), 3.90 (ddd, *J* = 16.4, 9.6, 3.5 Hz, 1H), 3.84 – 3.77 (m, 1H), 3.63 (d, *J* = 10.7 Hz, 1H), 3.44 (dd, *J* = 12.1, 4.2 Hz, 1H), 2.25 (d, *J* = 10.7 Hz, 1H), 1.75 (m, 2H), 1.69 – 1.61 (m, 2H), 1.57 (dd, *J* = 14.9, 11.6 Hz, 1H), 1.38 (ddd, *J* = 15.0, 7.9, 4.3 Hz, 1H), 1.19 (d, *J* = 8.3 Hz, 1H), 0.97 (q, *J* = 12.6, 11.9 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.1, 179.1, 154.6, 151.6, 140.8, 129.8, 128.9, 123.6, 122.6, 119.9, 119.7, 115.8, 115.7, 110.6, 71.5, 63.8, 47.8, 47.3, 29.8, 28.6, 27.5, 26.3 ppm. **HRMS (ESI):** calcd. for $C_{22}H_{21}FN_2O_2$ $[M+H]^+$: 365.1660; Found: 365.1665.

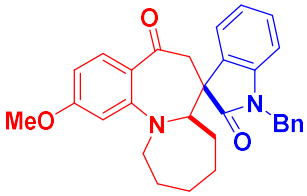
5'-chloro-3-fluoro-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indolin e]-2',5(6H)-dione (5i)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (33.8 mg, 85% yield) as a brown solid. M.p. 157-158°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ 9.06 (s, 1H), 7.57 (d, *J* = 9.0 Hz, 1H), 7.20 (d, *J* = 10.1 Hz, 2H), 7.03 (d, *J* = 8.0 Hz, 1H), 6.95 (dt, *J* = 17.9, 6.0 Hz, 2H), 3.91 (d, *J* = 15.8 Hz, 1H), 3.71 (d, *J* = 11.6 Hz, 1H), 3.51 (dd, *J* = 15.6, 10.2 Hz, 1H), 3.24 (d, *J* = 11.9 Hz, 1H), 2.51 (d, *J* = 11.9 Hz, 1H), 1.81 – 1.72 (m, 2H), 1.68 – 1.59 (m, 2H), 1.20 (d, *J* = 15.4 Hz, 4H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.1, 178.8, 156.6, 154.7, 151.6, 139.5, 131.5, 129.1, 127.9, 125.6, 123.9, 120.2, 115.8, 111.7, 71.6, 64.2, 47.6, 47.3, 29.8, 28.5, 27.4, 26.3 ppm. **HRMS (ESI):** calcd. for $C_{22}H_{20}ClFN_2O_2$ $[M+H]^+$: 399.1270; Found: 399.1273.

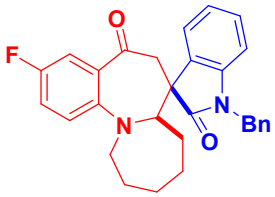
1'-benzyl-2-methoxy-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indol ine]-2',5(6H)-dione (5j)



Reaction time: 40 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:3) afforded the product (31.7 mg, 68% yield) as a brown solid. M.p. 168-169°C.

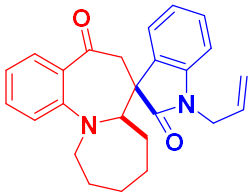
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.81 (d, *J* = 8.8 Hz, 1H), 7.24 (dd, *J* = 13.9, 6.5 Hz, 4H), 7.20 – 7.16 (m, 2H), 7.12 (td, *J* = 7.8, 1.1 Hz, 1H), 6.97 (t, *J* = 7.5 Hz, 1H), 6.67 (d, *J* = 7.8 Hz, 1H), 6.50 (d, *J* = 2.1 Hz, 1H), 6.38 (dd, *J* = 8.9, 2.1 Hz, 1H), 4.87 (s, 2H), 3.93 (ddd, *J* = 16.2, 11.2, 2.1 Hz, 1H), 3.83 (d, *J* = 3.7 Hz, 1H), 3.79 (s, 3H), 3.65 (d, *J* = 10.6 Hz, 1H), 3.57 (dd, *J* = 12.2, 4.3 Hz, 1H), 2.16 (d, *J* = 10.7 Hz, 1H), 1.81 (ddt, *J* = 11.6, 8.1, 3.5 Hz, 1H), 1.75 (d, *J* = 4.0 Hz, 1H), 1.69 – 1.55 (m, 2H), 1.48 (dt, *J* = 15.0, 11.6 Hz, 1H), 1.32 (ddd, *J* = 13.8, 7.7, 4.4 Hz, 1H), 1.19 (d, *J* = 3.0 Hz, 1H), 0.99 (q, *J* = 12.2 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.1, 177.4, 163.5, 157.6, 141.8, 135.8, 132.2, 130.8, 128.8, 128.5, 127.7, 127.3, 123.2, 123.1, 119.7, 109.1, 104.7, 99.9, 71.4, 62.9, 55.4, 47.7, 47.5, 43.8, 29.6, 28.9, 27.7, 26.3 ppm. **HRMS (ESI):** calcd. for $C_{30}H_{30}N_2O_3$ $[M+H]^+$: 467.2329; Found: 467.2323.

1'-benzyl-3-fluoro-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indolin e]-2',5(6H)-dione (5k)



Reaction time: 40 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:3) afforded the product (35.4 mg, 78% yield) as a brown solid. M.p. 165-166°C.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.53 – 7.48 (m, 1H), 7.27 – 7.20 (m, 5H), 7.13 (t, *J* = 7.4 Hz, 2H), 7.02 (dd, *J* = 6.4, 2.5 Hz, 2H), 6.98 (t, *J* = 7.4 Hz, 1H), 6.70 – 6.66 (m, 1H), 4.87 (s, 2H), 3.95 (ddd, *J* = 16.3, 9.8, 3.6 Hz, 1H), 3.83 (dt, *J* = 16.3, 3.7 Hz, 1H), 3.68 (d, *J* = 10.6 Hz, 1H), 3.48 (dd, *J* = 12.0, 4.4 Hz, 1H), 2.21 (d, *J* = 10.6 Hz, 1H), 1.76 (tt, *J* = 10.1, 8.1, 3.9 Hz, 2H), 1.70 – 1.64 (m, 1H), 1.63 – 1.54 (m, 1H), 1.50 – 1.42 (m, 1H), 1.32 (ddd, *J* = 15.1, 7.8, 4.5 Hz, 1H), 1.18 (s, 1H), 1.03 – 0.92 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.9, 177.1, 152.7, 141.8, 135.7, 130.5, 128.9, 128.6, 127.8, 127.3, 125.1, 123.2, 123.1, 120.4, 120.2, 116.4, 116.4, 114.9, 114.7, 109.2, 71.9, 63.9, 47.6, 43.8, 29.7, 29.7, 28.9, 27.9, 26.3 ppm. **HRMS (ESI):** calcd. for $C_{29}H_{27}FN_2O_2$ $[M+H]^+$: 455.2129; Found: 455.2122.

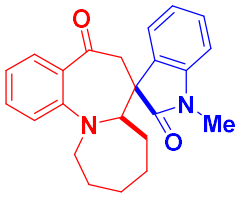
1'-allyl-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5l)



Reaction time: 40 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:4) afforded the product (26.3 mg, 68% yield) as a brown solid. M.p. 162-163°C.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.27 (ddd, *J* = 8.7, 7.0, 1.8 Hz, 1H), 7.18 (d, *J* = 9.7 Hz, 2H), 7.08 – 6.99 (m, 2H), 6.76 (dd, *J* = 7.8, 5.7 Hz, 2H), 5.78 (ddt, *J* = 15.8, 10.5, 5.3 Hz, 1H), 5.18 (dd, *J* = 3.5, 1.9 Hz, 1H), 5.16 – 5.12 (m, 1H), 4.42 – 4.33 (m, 1H), 4.23 (ddt, = 16.3, 5.4, 1.7 Hz, 1H), 3.96 – 3.83 (m, 2H), 3.65 (d, *J* = 10.6 Hz, 1H), 3.52 (dd, *J* = 12.0,

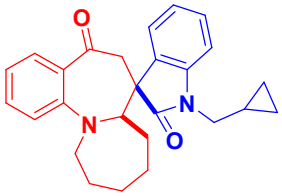
4.3 Hz, 1H), 2.15 (d, *J* = 10.6 Hz, 1H), 1.85 – 1.70 (m, 1H), 1.69 – 1.53 (m, 2H), 1.46 (dt, *J* = 15.1, 11.5 Hz, 1H), 1.32 (ddd, *J* = 15.0, 7.7, 4.4 Hz, 1H), 1.19 (d, *J* = 6.5 Hz, 2H), 1.05 – 0.91 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.8, 176.8, 155.8, 141.8, 132.6, 131.3, 130.7, 130.1, 128.5, 125.1, 123.1, 123.1, 117.7, 117.6, 115.1, 108.9, 71.5, 63.5, 47.6, 47.3, 42.3, 29.5, 28.8, 27.9, 26.3 ppm. **HRMS (ESI):** calcd. for $C_{25}H_{26}N_2O_2$ $[M+H]^+$: 387.2067; Found: 387.2064.

1'-methyl-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5m)



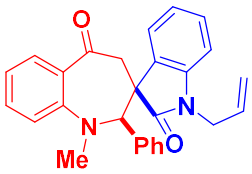
Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:3) afforded the product (23.8 mg, 66% yield) as a brown solid. M.p. 159-160℃.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.89 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.37 – 7.29 (m, 2H), 7.25 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.14 – 7.07 (m, 2H), 6.87 – 6.81 (m, 2H), 4.01 – 3.91 (m, 2H), 3.72 (d, *J* = 10.7 Hz, 1H), 3.57 (dd, *J* = 12.1, 4.4 Hz, 1H), 3.25 (s, 3H), 2.22 (d, *J* = 10.6 Hz, 1H), 1.92 – 1.77 (m, 2H), 1.76 – 1.70 (m, 1H), 1.69 – 1.63 (m, 1H), 1.55 – 1.43 (m, 1H), 1.37 – 1.34 (m, 1H), 1.30 – 1.25 (m, 1H), 1.10 – 0.97 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 199.1, 177.1, 155.7, 142.7, 132.6, 130.7, 130.1, 128.6, 125.1, 123.2, 123.1, 117.6, 115.1, 108.1, 71.5, 63.6, 47.4, 43.6, 29.4, 28.9, 27.9, 26.3, 26.2 ppm. **HRMS (ESI):** calcd. for $C_{23}H_{24}N_2O_2$ $[M+H]^+$: 361.1911; Found: 361.1917.

1'-(cyclopropylmethyl)-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5n)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:3) afforded the product (27.2 mg, 68% yield) as a brown solid. M.p. 159-160℃.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.89 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.37 – 7.28 (m, 2H), 7.25 (s, 1H), 7.14 – 7.05 (m, 2H), 6.93 (d, *J* = 7.8 Hz, 1H), 6.83 (t, *J* = 7.4 Hz, 1H), 4.00 – 3.91 (m, 2H), 3.72 (d, *J* = 10.6 Hz, 1H), 3.64 (dd, *J* = 9.0, 7.0 Hz, 2H), 3.59 – 3.54 (m, 1H), 2.23 (d, *J* = 10.6 Hz, 1H), 1.83 (tdd, *J* = 15.0, 11.0, 5.3 Hz, 2H), 1.73 (dt, *J* = 13.1, 3.5 Hz, 1H), 1.66 – 1.62 (m, 1H), 1.57 – 1.49 (m, 1H), 1.39 (ddd, *J* = 14.8, 7.9, 4.5 Hz, 1H), 1.31 – 1.16 (m, 2H), 1.12 – 0.98 (m, 1H), 0.58 – 0.50 (m, 2H), 0.46 – 0.38 (m, *J* = 5.1 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 199.1, 177.2, 155.8, 142.3, 132.6, 130.8, 130.1, 128.5, 125.1, 123.2, 122.9, 117.6, 115.1, 108.5, 71.5, 63.5, 47.4, 47.4, 44.2, 29.4, 29.1, 27.9, 26.3, 9.8, 3.9, 3.9 ppm. **HRMS (ESI):** calcd. for $C_{26}H_{28}N_2O_2$ $[M+H]^+$: 401.2224; Found: 401.2227.

1'-allyl-1-methyl-2-phenyl-1,2-dihydrospiro[benzo[b]azepine-3,3'-indoline]-2',5(4H)-dione (5o)

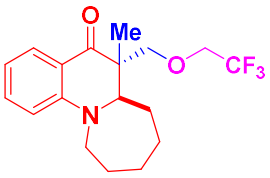


Reaction time: 40 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:4) afforded the product (22.0 mg, 54% yield) as a brown solid. M.p. 147-148°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.13 (dt, *J* = 23.1, 7.8 Hz, 3H), 7.01 – 6.87 (m, 7H), 6.77 – 6.66 (m, 2H), 6.42 – 6.34 (m, 1H), 5.78 (ddt, *J* = 16.4, 10.5, 5.4 Hz, 1H), 5.25 (d, *J* = 17.1 Hz, 1H), 5.18 (d, *J* = 10.3 Hz, 1H), 4.47 – 4.36 (m, 1H), 4.18 (dd, *J* = 16.3, 5.8 Hz, 1H), 3.93 (s, 1H), 3.85 (d, *J* = 13.8 Hz, 1H), 3.39 (d, *J* = 13.9 Hz, 1H), 2.94 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 200.4, 173.1, 160.7, 143.9, 137.3, 134.7, 131.5, 130.0, 128.6, 127.8, 126.6, 125.3, 124.2, 123.9, 122.1, 120.9, 117.8, 116.8, 109.1, 106.5, 74.5, 49.4, 42.6, 38.4, 28.8 ppm. **HRMS (ESI):** calcd. for $C_{27}H_{24}N_2O_2$ $[M+H]^+$: 409.1911; Found: 409.1916.

Compounds 8:

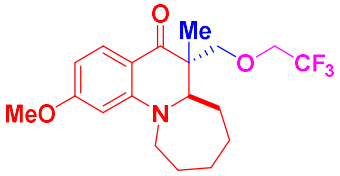
6-methyl-6-((2,2,2-trifluoroethoxy)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8a)



Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (26.6 mg, 78% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.81 (t, *J* = 7.9, 1.8 Hz, 1H), 7.35 (d, *J* = 8.7, 7.0, 1.8 Hz, 1H), 6.70 – 6.56 (m, 2H), 4.04 (m, 1H), 3.91 (qd, *J* = 9.3, 8.8, 3.1 Hz, 1H), 3.88 – 3.84 (m, 1H), 3.82 (d, *J* = 9.8 Hz, 1H), 3.75 – 3.65 (m, 1H), 3.46 (dd, *J* = 11.3, 5.5 Hz, 1H), 3.26 (ddd, *J* = 15.3, 11.6, 5.4 Hz, 1H), 2.05 (m, 1H), 1.78 (m, 1H), 1.74 – 1.64 (m, 2H), 1.63 – 1.55 (m, 2H), 1.54 – 1.48 (m, 1H), 1.41 (m, 1H), 1.36 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.5, 148.3, 135.9, 128.3, 116.4, 115.4, 112.1, 74.0, 68.9, 66.3, 51.0, 48.5, 27.3, 26.1, 25.9, 25.3, 20.0, 15.3 ppm. **HRMS (ESI):** calcd. for $C_{18}H_{22}F_3NO_2$ $[M+H]^+$: 342.1675, found: 342.1679.

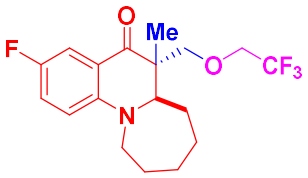
2-methoxy-6-methyl-6-((2,2,2-trifluoroethoxy)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8b)



Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (28.6 mg, 77% yield) as a yellow oil.

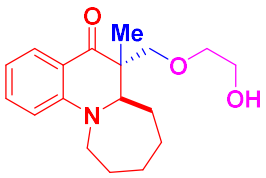
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 – 7.74 (m, 1H), 6.27 – 6.20 (d, *J* = 10.0 Hz, 1H), 6.08 – 6.02 (s, 1H), 4.02 (dd, *J* = 15.3, 6.1 Hz, 1H), 3.95 – 1.87 (m, 2H), 3.84 (s, 3H), 3.80 (d, *J* = 10.0 Hz, 1H), 3.75 – 3.62 (m, 1H), 3.43 (dd, *J* = 11.6, 5.3 Hz, 1H), 3.25 (ddd, *J* = 16.0, 12.2, 5.8 Hz, 1H), 2.05 (dt, *J* = 12.8, 6.4 Hz, 1H), 1.85 – 1.74 (m, 1H), 1.70 (m, 2H), 1.57 (dt, *J* = 19.5, 7.7 Hz, 3H), 1.42 (m, 1H), 1.34 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.1, 166.1, 150.1, 130.6, 111.1, 103.2, 95.6, 74.1, 68.9, 66.5, 55.2, 51.2, 48.3, 27.3, 26.5, 25.9, 25.3, 20.2, 15.3 ppm. **HRMS (ESI):** calcd. for $C_{19}H_{24}F_3NO_3$ $[M+H]^+$: 372.1781, found: 372.1786.

1-fluoro-6-methyl-6-((2,2,2-trifluoroethoxy)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8c)



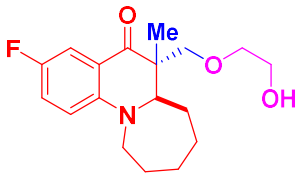
Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (30.9 mg, 86% yield) as a yellow oil.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.47 (s, 1H), 7.11 (d, *J* = 7.8, 2.7 Hz, 1H), 6.61 (td, *J* = 8.6, 3.7 Hz, 1H), 4.01 (dd, *J* = 15.7, 6.5 Hz, 1H), 3.94 – 3.86 (t, *J* = 4.9 Hz, 2H), 3.83 (t, *J* = 10.1 Hz, 1H), 3.81 – 3.68 (m, 1H), 3.44 (dd, *J* = 11.4, 5.4 Hz, 1H), 3.27 (m, 1H), 2.02 (tq, *J* = 13.0, 6.6, 6.1 Hz, 1H), 1.83 – 1.74 (m, 1H), 1.74 – 1.64 (m, 2H), 1.57 (p, *J* = 6.3, 5.4 Hz, 2H), 1.54 – 1.46 (m, 1H), 1.44 – 1.36 (m, 1H), 1.34 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.8, 155.2, 145.2, 123.8, 123.6, 113.5, 113.1, 73.8, 68.8, 66.3, 64.9, 51.2, 50.6, 27.3, 25.9, 25.2, 19.9, 15.2 ppm. **HRMS (ESI):** calcd. for $C_{18}H_{21}F_3NO_2$ $[M+H]^+$: 360.1581, found: 360.1587.

6-((2-hydroxyethoxy)methyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8d)



Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (25.8 mg, 85% yield) as a yellow oil.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.73 – 7.68 (d, *J* = 7.9, 1.6 Hz, 1H), 7.26 (t, *J* = 8.6, 7.0, 1.5 Hz, 1H), 6.53 (m, 2H), 3.95 (m, 1H), 3.73 – 3.67 (m, 2H), 3.62 – 3.57 (m, 1H), 3.54 – 3.51 (m, 2H), 3.42 (q, *J* = 4.7 Hz, 1H), 3.37 – 3.30 (m, 1H), 3.16 (ddd, *J* = 15.3, 11.6, 5.5 Hz, 1H), 2.10 (s, 1H), 2.02 – 1.90 (m, 1H), 1.69 (tt, *J* = 11.8, 6.0 Hz, 1H), 1.60 (m, 2H), 1.49 – 1.45 (ddd, *J* = 18.7, 8.5, 4.0 Hz, 2H), 1.43 – 1.40 (m, 1H), 1.38 – 1.32 (m, 1H), 1.26 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.1, 148.4, 135.8, 128.4, 116.6, 115.4, 112.1, 72.7, 72.2, 66.9, 61.7, 50.9, 48.5, 27.3, 26.4, 26.1, 25.3, 20.3 ppm. **HRMS (ESI):** calcd. for $C_{18}H_{25}NO_3$ $[M+H]^+$: 304.1907, found: 304.1904.

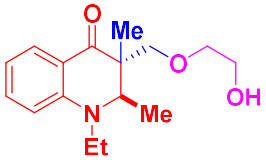
3-fluoro-6-((2-hydroxyethoxy)methyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8e)



Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (28.2 mg, 88% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 (s, 1H), 7.16 – 7.06 (m, 1H), 6.59 (d, *J* = 9.0, 4.2 Hz, 1H), 3.98 (m, 1H), 3.81 – 3.75 (m, 1H), 3.70 (dt, *J* = 5.0, 2.4 Hz, 1H), 3.62 (t, *J* = 6.5 Hz, 3H), 3.54 – 3.49 (m, 1H), 3.45 – 3.37 (m, 1H), 3.27 (td, *J* = 15.7, 13.7, 5.3 Hz, 1H), 2.19 (s, 1H), 2.02 (m, 1H), 1.76 (dt, *J* = 11.8, 6.0 Hz, 1H), 1.69 (q, *J* = 8.2, 7.4 Hz, 2H), 1.57 (m, 2H), 1.49 (dd, *J* = 8.4, 4.8 Hz, 1H), 1.40 (q, *J* = 6.8 Hz, 1H), 1.20 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.3, 153.4, 145.8, 123.7, 123.5, 113.5, 113.1, 72.9, 72.7, 65.7, 61.7, 50.7, 27.4, 26.1, 26.0, 25.4, 20.1, 15.5 ppm. **HRMS (ESI):** calcd. for $C_{18}H_{24}FNO_3$ $[M+H]^+$: 322.1813, found: 322.1817.

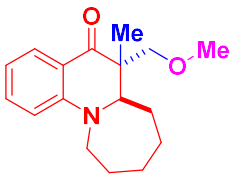
1-ethyl-3-((2-hydroxyethoxy)methyl)-2,3-dimethyl-2,3-dihydroquinolin-4(1H)-one (8f)



Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (21.1 mg, 76% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$)δ 7.76 (d, *J* = 8.1, 1.8 Hz, 1H), 7.28 (t, *J* = 7.7, 7.0, 1.8 Hz, 1H), 6.56 (m, 2H), 3.75 – 3.67 (m, 1H), 3.61 (t, *J* = 4.6 Hz, 1H), 3.58 (d, *J* = 9.8 Hz, 1H), 3.56 – 3.52 (m, 2H), 3.44 (dt, *J* = 9.4, 4.6 Hz, 1H), 3.41 – 3.35 (m, 1H), 3.07 (m, 1H), 2.15 (s, 1H), 1.22 (d, *J* = 5.6 Hz, 1H), 1.20 (d, *J* = 7.3 Hz, 3H), 1.15 (s, 3H), 1.01 (t, *J* = 6.4 Hz, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.4, 148.1, 135.7, 128.5, 117.6, 115.6, 112.2, 74.3, 72.8, 61.7, 59.5, 50.1, 43.9, 15.7, 13.1, 11.2 ppm. **HRMS (ESI):** calcd. for $C_{16}H_{23}NO_3$ $[M+H]^+$: 278.1751, found: 278.1758.

6-(methoxymethyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8g)

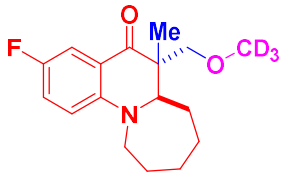


Reaction time: 8 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:30) afforded the product (20.8 mg, 76% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.79 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.32 (ddd, *J* = 8.6, 7.0, 1.7 Hz, 1H), 6.64 – 6.56 (m, 2H), 4.03 (ddd, *J* = 15.3, 6.3, 2.0 Hz, 1H), 3.68 (d, *J* = 9.7 Hz, 1H), 3.52 (d, *J* = 9.8 Hz, 1H), 3.42 (dd, *J* = 11.3, 5.4 Hz, 1H), 3.37 (s, 3H), 3.25 – 3.23 (m, 1H), 2.08 – 1.98 (m, 1H), 1.78 – 1.72 (ddt, *J* = 13.7, 11.3, 5.7 Hz, 2H), 1.69 – 1.65 (m, 2H), 1.59 – 1.52 (m, 2H), 1.39 (ddt, *J* = 13.7, 9.0, 4.6 Hz, 1H), 1.31 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.1, 148.3, 135.7, 128.3, 116.5, 115.2, 112.1, 73.9, 66.6, 59.4, 50.9, 48.3, 27.4, 26.2, 25.9, 25.3, 20.3 ppm. **HRMS (ESI):** calcd. for $C_{17}H_{23}NO_2$ $[M+H]^+$: 274.1802; Found: 274.1808.

3-fluoro-6-((methoxy-d$_3$)methyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(

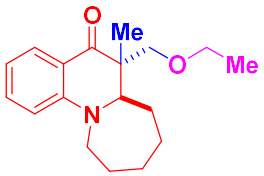
6H)-one (8h)



Reaction time: 8 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:30) afforded the product (24.1 mg, 82% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 (s, 1H), 7.11 (t, *J* = 8.5 Hz, 1H), 6.59 (d, *J* = 3.8, 2.8 Hz, 1H), 3.99 (td, *J* = 17.6, 16.7, 5.8 Hz, 1H), 3.68 (dd, *J* = 9.8, 2.2 Hz, 1H), 3.55 (m, 1H), 3.43 (dd, *J* = 11.5, 5.2 Hz, 1H), 3.33 – 3.19 (m, 1H), 2.03 (ddd, *J* = 17.9, 8.6, 4.6 Hz, 1H), 1.77 (dt, *J* = 12.0, 6.9 Hz, 1H), 1.74 – 1.65 (m, 2H), 1.64 – 1.53 (m, 2H), 1.53 – 1.46 (m, 1H), 1.39 (d, *J* = 10.3 Hz, 1H), 1.32 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.5, 155.1, 145.2, 123.6, 123.4, 113.3, 112.9, 73.6, 66.6, 58.6, 51.1, 48.6, 27.4, 25.9, 25.2, 20.2, 15.5 ppm. **HRMS (ESI):** calcd. for $C_{17}H_{19}D_3FNO_2$ $[M+H]^+$: 295.1896, found: 295.1892.

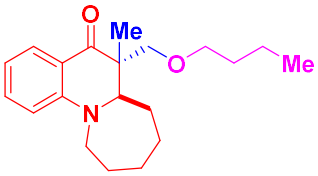
6-(ethoxymethyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8i)



Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:30) afforded the product (21.5 mg, 75% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.79 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.32 (ddd, *J* = 8.7, 7.0, 1.8 Hz, 1H), 6.64 – 6.55 (m, 2H), 4.03 (ddd, *J* = 15.1, 6.4, 2.0 Hz, 1H), 3.70 (d, *J* = 9.8 Hz, 1H), 3.56 – 3.49 (m, 2H), 3.46 – 3.40 (m, 1H), 3.29 – 3.23 (m, 1H), 2.09 – 2.01 (m, 1H), 1.78 – 1.72 (ddt, *J* = 19.5, 9.1, 5.5 Hz, 2H), 1.71 – 1.64 (m, 2H), 1.58 – 1.54 (m, 2H), 1.48 (ddd, *J* = 11.6, 7.6, 3.6 Hz, 1H), 1.42 – 1.35 (m, 1H), 1.32 (s, 3H), 1.21 (t, *J* = 7.1 Hz, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.4, 148.4, 135.7, 128.3, 116.6, 115.2, 112.1, 71.3, 66.9, 66.6, 50.9, 48.3, 27.4, 26.1, 26.1, 25.3, 20.4, 15.1 ppm. **HRMS (ESI):** calcd. for $C_{18}H_{25}NO_2$ $[M+H]^+$: 288.1958; Found: 288.1952.

6-(butoxymethyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8j)

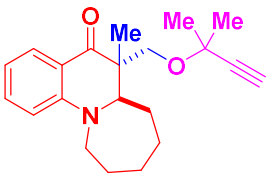


Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:10) afforded the product (25.8 mg, 82% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.24 (ddd, *J* = 8.7, 7.0, 1.8 Hz, 1H), 6.53 (d, *J* = 8.6 Hz, 1H), 6.50 (ddd, *J* = 7.8, 6.9, 1.0 Hz, 1H), 3.95 (ddd, *J* = 15.2, 6.4, 2.1 Hz, 1H), 3.62 (d, *J* = 9.7 Hz, 1H), 3.46 (d, *J* = 9.7 Hz, 1H), 3.43 – 3.38 (m, 1H), 3.38 – 3.33 (m, 2H), 3.17 (ddd, *J* = 15.2, 11.6, 5.6 Hz, 1H), 1.95 (m, 1H), 1.74 – 1.55 (m, 3H), 1.49 (m, 4H), 1.43 – 1.35 (m, 1H), 1.34 – 1.27 (m, 3H), 1.24 (s, 3H), 0.86 (t, *J* = 7.4 Hz, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ

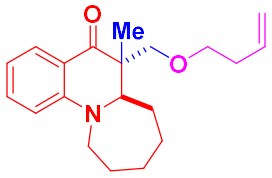
197.4, 147.4, 134.6, 127.3, 115.6, 114.1, 110.9, 70.5, 70.3, 65.6, 49.8, 47.4, 30.6, 26.3, 25.1, 24.9, 24.3, 19.4, 18.4, 12.9 ppm. **HRMS (ESI):** calcd. for $C_{20}H_{29}NO_2$ $[M+H]^+$: 316.2271; Found: 316.2278.

6-methyl-6-(((2-methylbut-3-yn-2-yl)oxy)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8k)



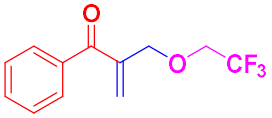
Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:25) afforded the product (20.8 mg, 64% yield) as a yellow oil.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.80 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.33 (ddd, *J* = 8.7, 7.0, 1.8 Hz, 1H), 6.64 – 6.55 (m, 2H), 4.03 (ddd, *J* = 15.2, 6.4, 2.1 Hz, 1H), 3.87 (d, *J* = 9.4 Hz, 1H), 3.69 (d, *J* = 9.4 Hz, 1H), 3.40 (dd, *J* = 11.3, 5.3 Hz, 1H), 3.29 – 3.20 (m, 1H), 2.39 (s, 1H), 2.03 (m, 1H), 1.81 (tt, *J* = 10.3, 4.4 Hz, 1H), 1.76 – 1.72 (m, 1H), 1.70 – 1.64 (m, 1H), 1.62 – 1.60 (m, 1H), 1.58 – 1.55 (m, 1H), 1.54 – 1.50 (m, 1H), 1.48 (s, 3H), 1.47 (s, 3H), 1.44 – 1.34 (m, 1H), 1.30 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.5, 148.4, 135.6, 128.3, 116.6, 115.1, 111.9, 85.9, 72.1, 69.9, 66.5, 64.7, 50.9, 48.1, 28.9, 28.5, 27.4, 26.1, 25.9, 25.4, 20.3 ppm. **HRMS (ESI):** calcd. for $C_{21}H_{27}NO_2$ $[M+H]^+$: 326.2115, found: 326.2112.

6-((but-3-en-1-yloxy)methyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8l)



Reaction time: 20 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:25) afforded the product (19.4 mg, 62% yield) as a yellow oil.
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.79 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.37 – 7.28 (m, 1H), 6.63 – 6.53 (m, 2H), 5.83 (ddt, *J* = 17.1, 10.3, 6.7 Hz, 1H), 5.17 – 4.98 (m, 2H), 4.03 (ddd, *J* = 15.2, 6.4, 2.0 Hz, 1H), 3.71 (d, *J* = 9.6 Hz, 1H), 3.58 – 3.54 (m, 1H), 3.48 (dt, *J* = 9.6, 6.7 Hz, 1H), 3.42 (dd, *J* = 10.8, 5.9 Hz, 1H), 3.24 (ddd, *J* = 15.3, 11.5, 5.5 Hz, 1H), 2.35 (m, 2H), 2.03 (m, 1H), 1.78 – 1.70 (m, 2H), 1.69 – 1.65 (m, 2H), 1.59 – 1.55 (m, 2H), 1.54 – 1.45 (m, 1H), 1.43 – 1.36 (m, 1H), 1.31 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.3, 148.4, 135.7, 135.4, 128.3, 116.6, 116.3, 115.2, 112.1, 71.6, 70.9, 66.6, 50.9, 48.4, 34.1, 27.4, 26.1, 26.1, 25.3, 20.4 ppm. **HRMS (ESI):** calcd. for $C_{20}H_{27}NO_2$ $[M+H]^+$: 314.2115, found: 314.2112.

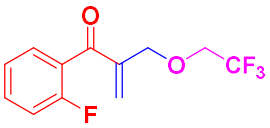
1-phenyl-2-((2,2,2-trifluoroethoxy)methyl)prop-2-en-1-one (10)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:30) afforded the product (22.5 mg, 92% yield) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.79 – 7.75 (m, 2H), 7.59 – 7.55 (m, 1H), 7.49 – 7.43 (m, 2H), 6.20 (d, J = 1.6 Hz, 1H), 5.88 (q, J = 1.0 Hz, 1H), 4.54 (d, J = 1.4 Hz, 2H), 3.94 (q, J = 8.6 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 196.3, 143.4, 137.2, 132.6, 129.4, 128.4, 127.4, 125.1, 122.8, 71.2, 68.6, 29.7 ppm. **HRMS (ESI):** calcd. for $C_{12}H_{11}F_3O_2$ $[M+H]^+$: 245.0784, found: 245.0789.

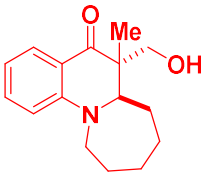
1-(2-fluorophenyl)-2-((2,2,2-trifluoroethoxy)methyl)prop-2-en-1-one (12)



Reaction time: 36 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:30) afforded the product (24.6 mg, 94% yield) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.52 – 7.48 (m, 1H), 7.48 – 7.42 (m, 1H), 7.23 (td, J = 7.5, 1.1 Hz, 1H), 7.13 (ddd, J = 9.5, 8.3, 1.1 Hz, 1H), 6.28 (t, J = 1.6 Hz, 1H), 5.93 (t, J = 1.6 Hz, 1H), 4.54 (d, J = 1.4 Hz, 2H), 3.94 (q, J = 8.6 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 193.6, 160.8, 158.8, 144.3, 132.9, 130.3, 129.9, 124.2, 116.2, 70.1, 68.3, 29.7 ppm. **HRMS (ESI):** calcd. for $C_{12}H_{10}F_4O_2$ $[M+H]^+$: 263.0690, found: 263.0697.

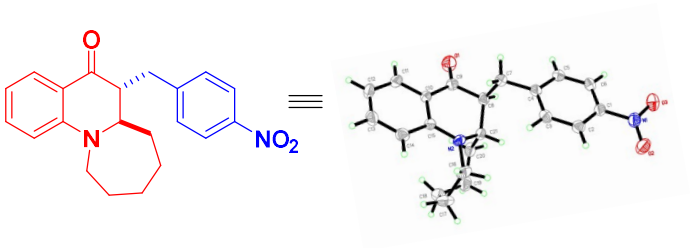
6-(hydroxymethyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (13)



Reaction time: 24 h. Flash column chromatography on a silica gel (ethyl acetate: petroleum ether, 1:1) afforded the product (21.3 mg, 82% yield) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.81 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.38 (ddd, *J* = 8.7, 7.0, 1.8 Hz, 1H), 6.69 – 6.62 (m, 2H), 4.12 – 4.05 (m, 1H), 3.79 – 3.63 (m, 1H), 3.46 (d, *J* = 11.2 Hz, 1H), 3.32 – 3.24 (m, 1H), 3.21 (dd, *J* = 11.7, 5.4 Hz, 1H), 2.95 (s, 1H), 2.08 – 2.05 (m, 1H), 1.82 – 1.76 (m, 1H), 1.74 – 1.65 (m, 2H), 1.62 – 1.54 (m, 2H), 1.52 – 1.42 (m, 2H), 1.37 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 200.9, 148.4, 136.2, 128.3, 116.3, 115.6, 112.2, 68.7, 65.4, 51.1, 50.5, 27.2, 25.9, 25.2, 19.3, 14.9 ppm. **HRMS (ESI):** calcd. for $C_{16}H_{21}NO_2$ $[M+H]^+$: 260.1645, found: 260.1649.

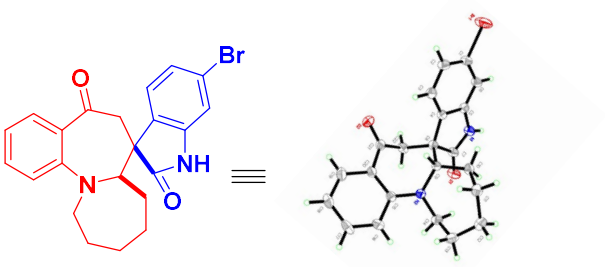
4. Crystal Structures and Data



3f (CCDC: 2124513)

Table 1. Crystal data and structure refinement for 3f.

Identification code	3f
Empirical formula	$C_{21}H_{22}N_2O_3$
Formula weight	350.40
Temperature	293(2) K
Wavelength	1.54184 A
Crystal system, space group	Triclinic, P-1
Unit cell dimensions	a = 8.2810(10) A alpha = 71.987(9) deg.
	b = 9.4019(9) A beta = 87.243(9) deg.
	c = 12.3847(13) A gamma = 75.194(9) deg.
Volume	886.04(18) A^3
Z, Calculated density	2, 1.313 Mg/m^3
Absorption coefficient	0.713 mm^-1
F(000)	372
Crystal size	0.140 x 0.120 x 0.120 mm
Theta range for data collection	3.755 to 67.246 deg.
Limiting indices	-9<=h<=9, -10<=k<=11, -14<=l<=14
Reflections collected / unique	5368 / 3144 [R(int) = 0.0220]
Completeness to theta = 67.246	99.1 %
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	3144 / 0 / 236
Goodness-of-fit on F^2	1.048
Final R indices [I>2sigma(I)]	R1 = 0.0481, wR2 = 0.1135
R indices (all data)	R1 = 0.0632, wR2 = 0.1260
Extinction coefficient	0.0189(11)
Largest diff. peak and hole	0.188 and -0.169 e.A^-3



5d (CCDC: 2124547)

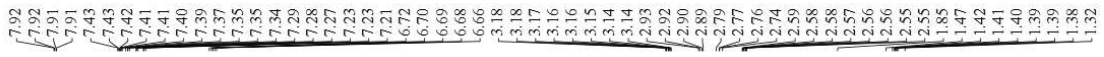
Table 2. Crystal data and structure refinement for 5d.

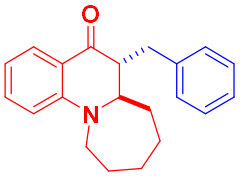
Identification code	5d
Empirical formula	$C_{22}H_{21}BrN_2O_2$
Formula weight	425.32
Temperature	293(2) K
Wavelength	1.54184 A
Crystal system, space group	Monoclinic, P2(1)/c
Unit cell dimensions	a = 13.8236(3) A alpha = 90 deg.
	b = 19.2351(5) A beta = 91.195(3) deg.
	c = 8.2291(3) A gamma = 90 deg.
Volume	2187.62(10) A^3
Z, Calculated density	4, 1.291 Mg/m^3
Absorption coefficient	2.696 mm^-1
F(000)	872
Crystal size	0.120 x 0.120 x 0.110 mm
Theta range for data collection	3.198 to 71.047 deg.
Limiting indices	-15<=h<=16, -16<=k<=23, -10<=l<=10
Reflections collected / unique	14147 / 4181 [R(int) = 0.0384]
Completeness to theta = 67.684	100.0 %
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	4181 / 0 / 244
Goodness-of-fit on F^2	0.905
Final R indices [I>2sigma(I)]	R1 = 0.0525, wR2 = 0.1973
R indices (all data)	R1 = 0.0689, wR2 = 0.2204
Extinction coefficient	n/a
Largest diff. peak and hole	0.628 and -0.993 e.A^-3

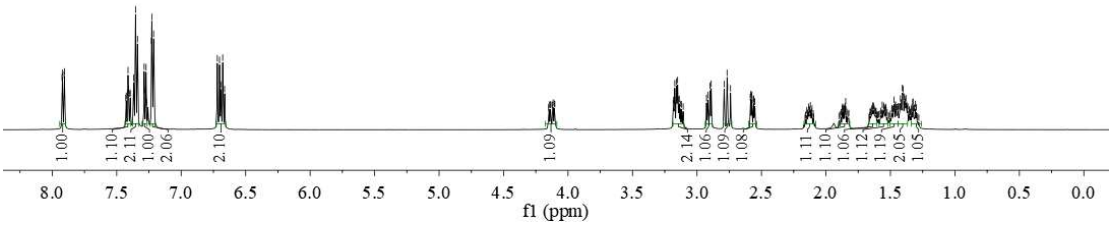
5. ^{1}H and ^{13}C NMR Spectra

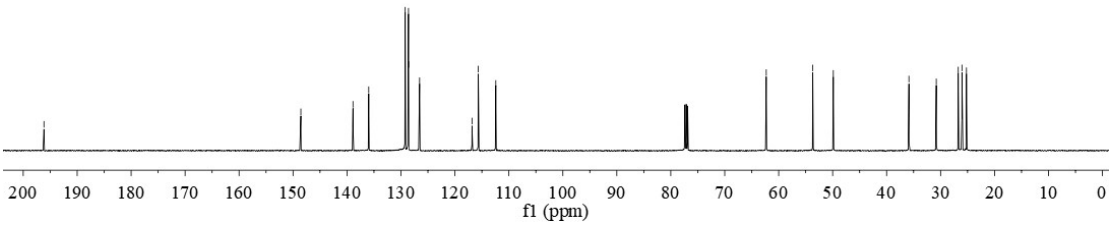
Compounds 3:

6-benzyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3a)

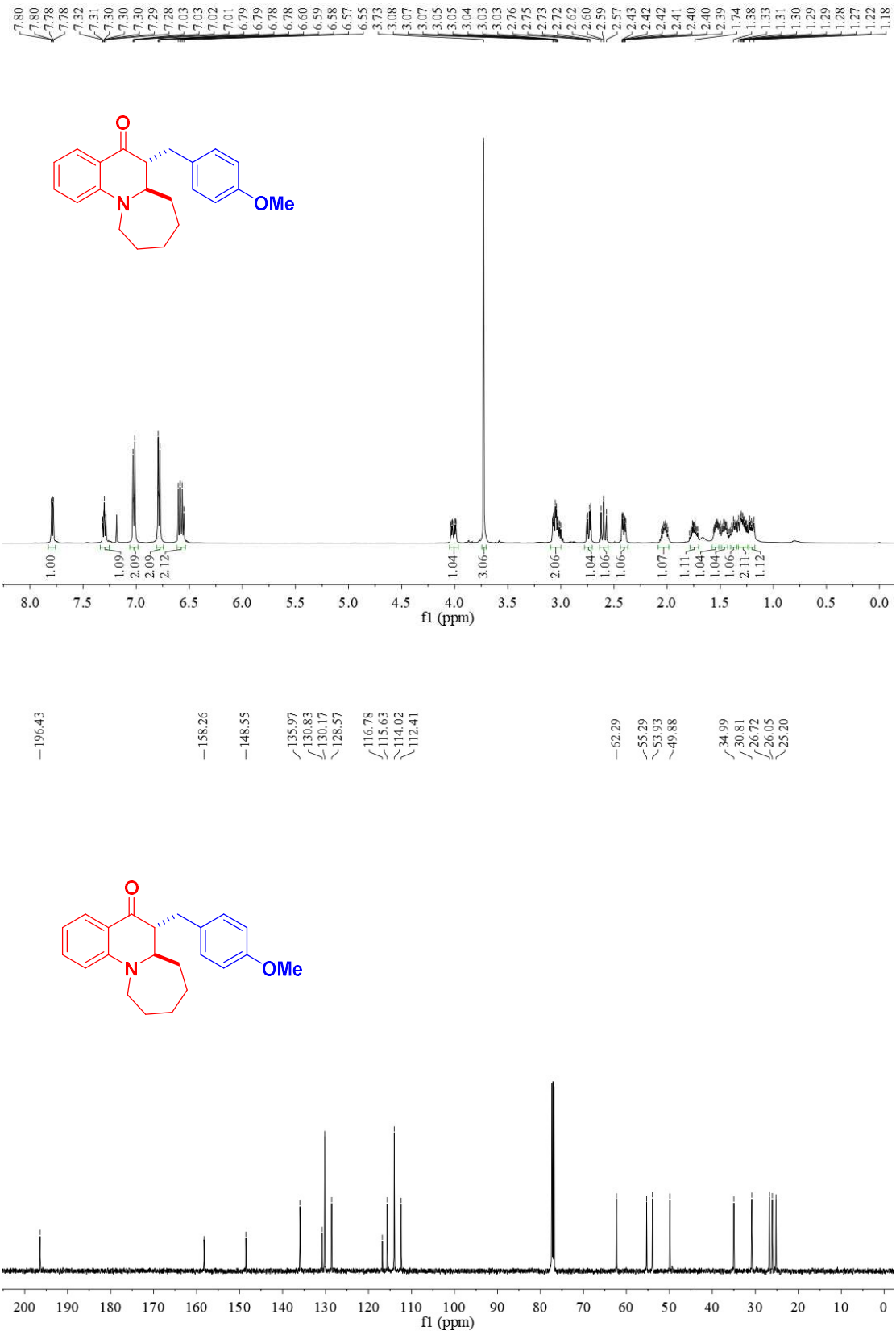




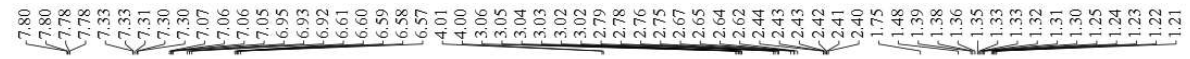


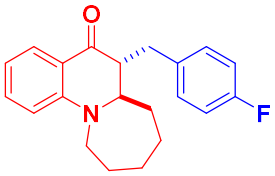


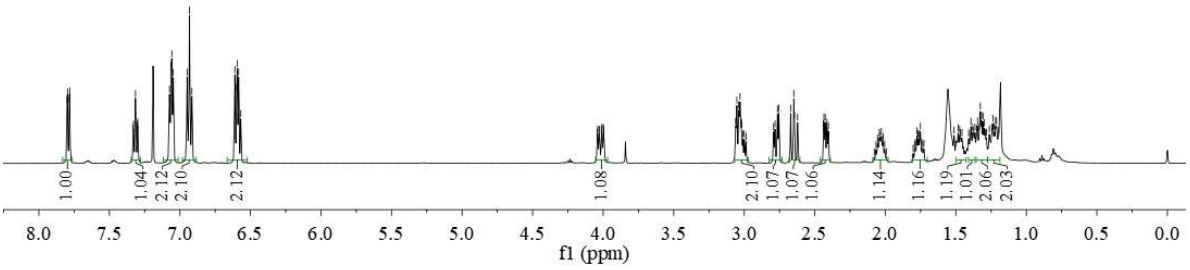
6-(4-methoxybenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3b)

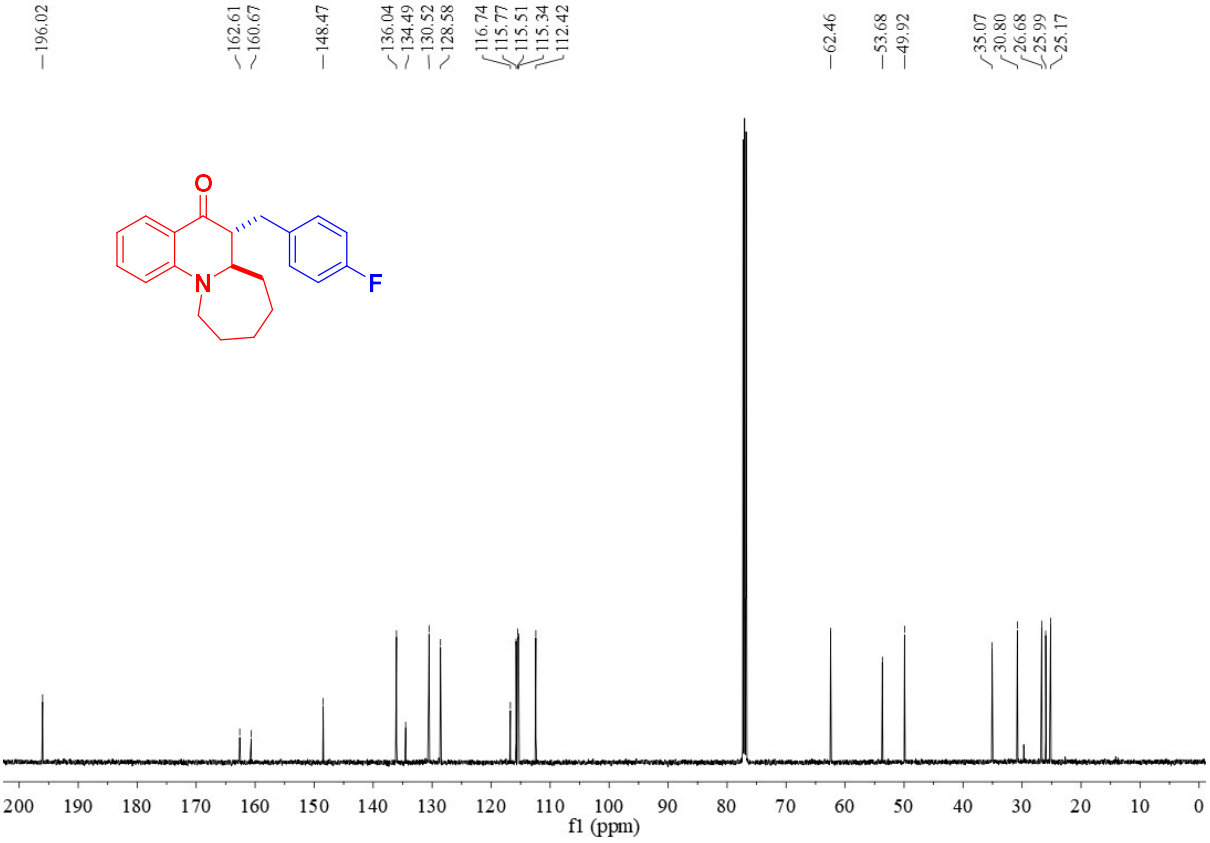


6-(4-fluorobenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3c)

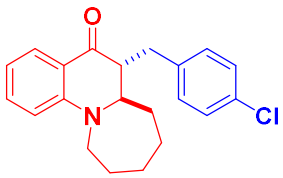


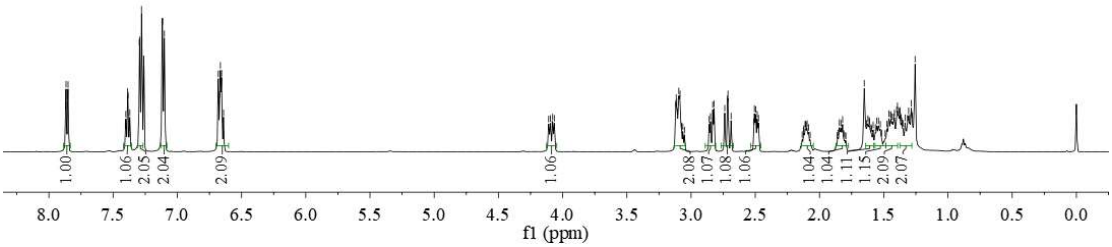


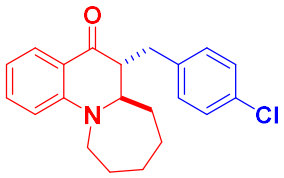


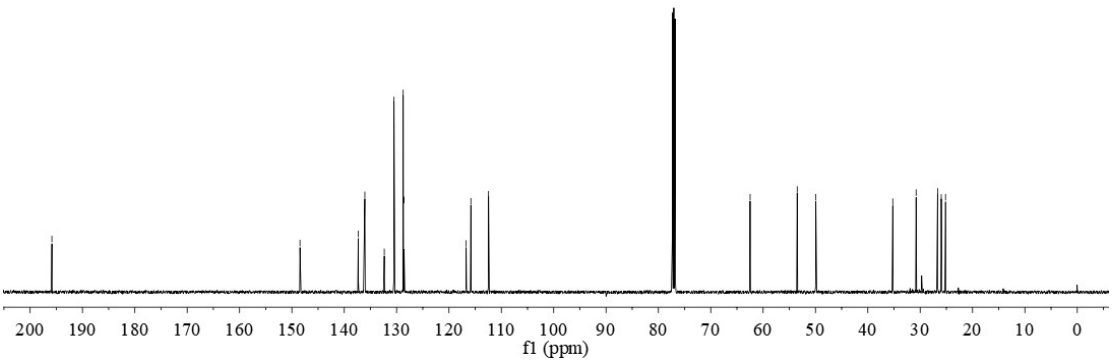


6-(4-chlorobenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3d)

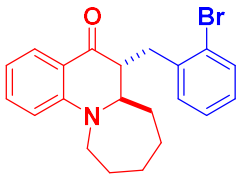


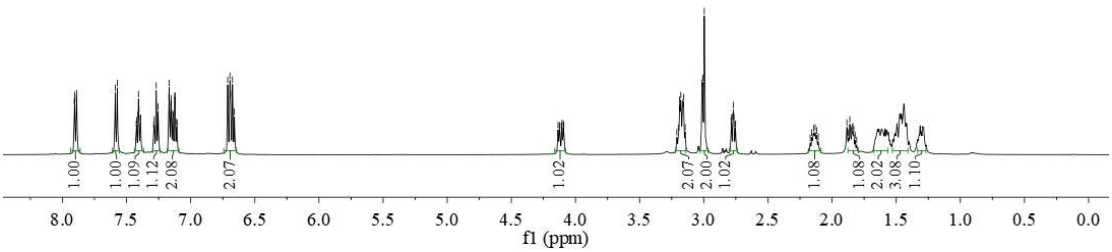


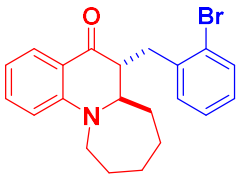


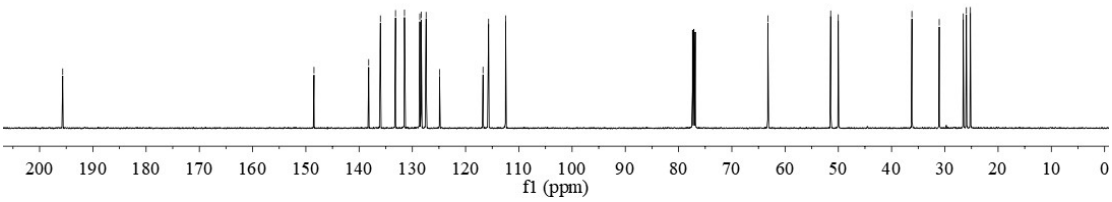


6-(2-bromobenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3e)

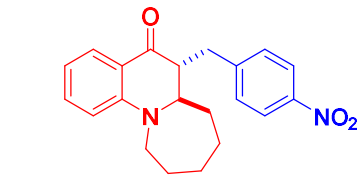


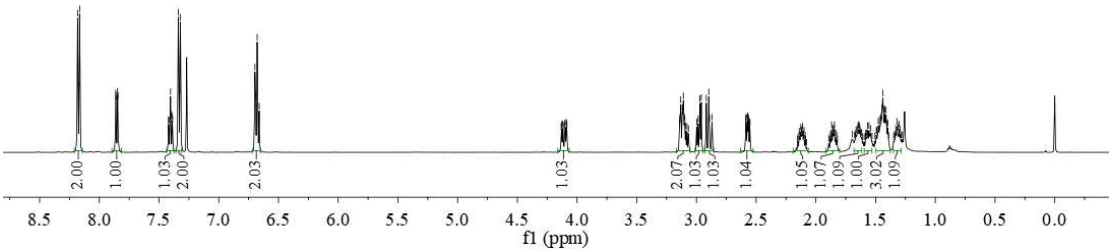


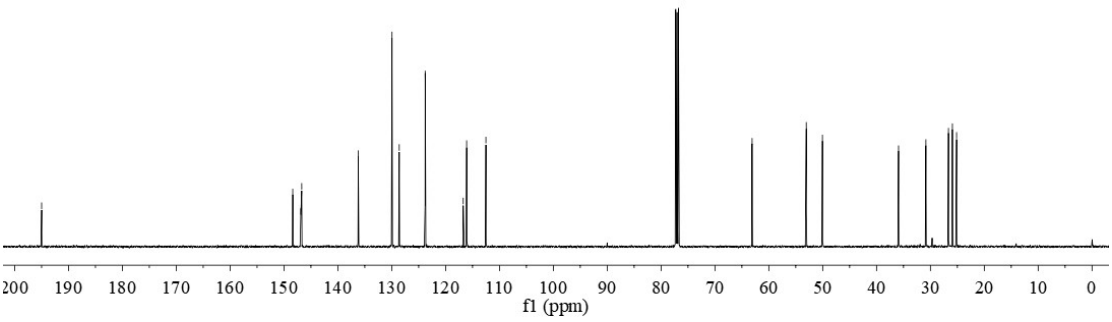




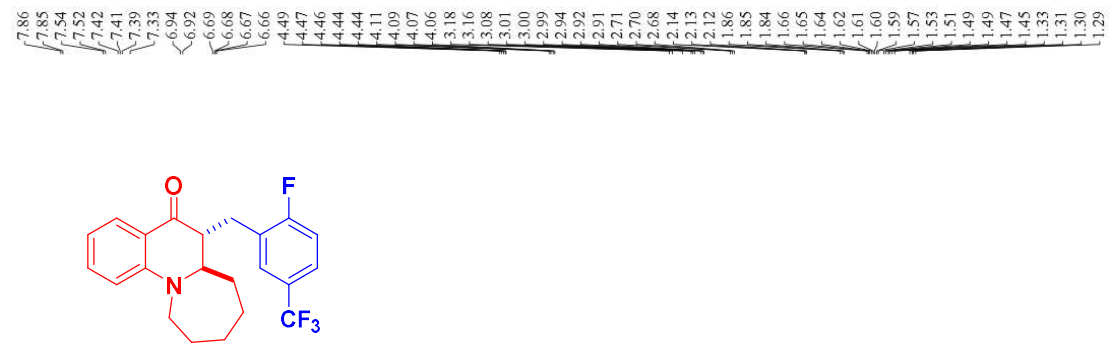
6-(4-nitrobenzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3f)

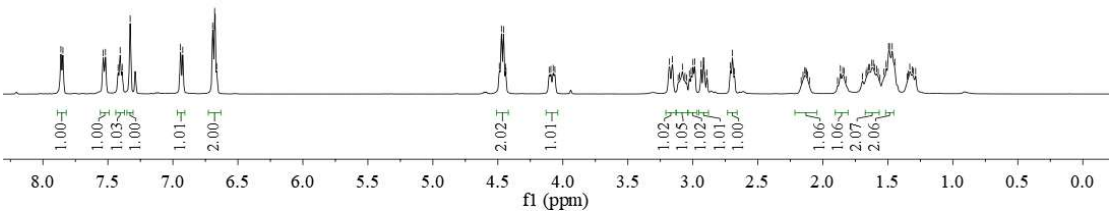


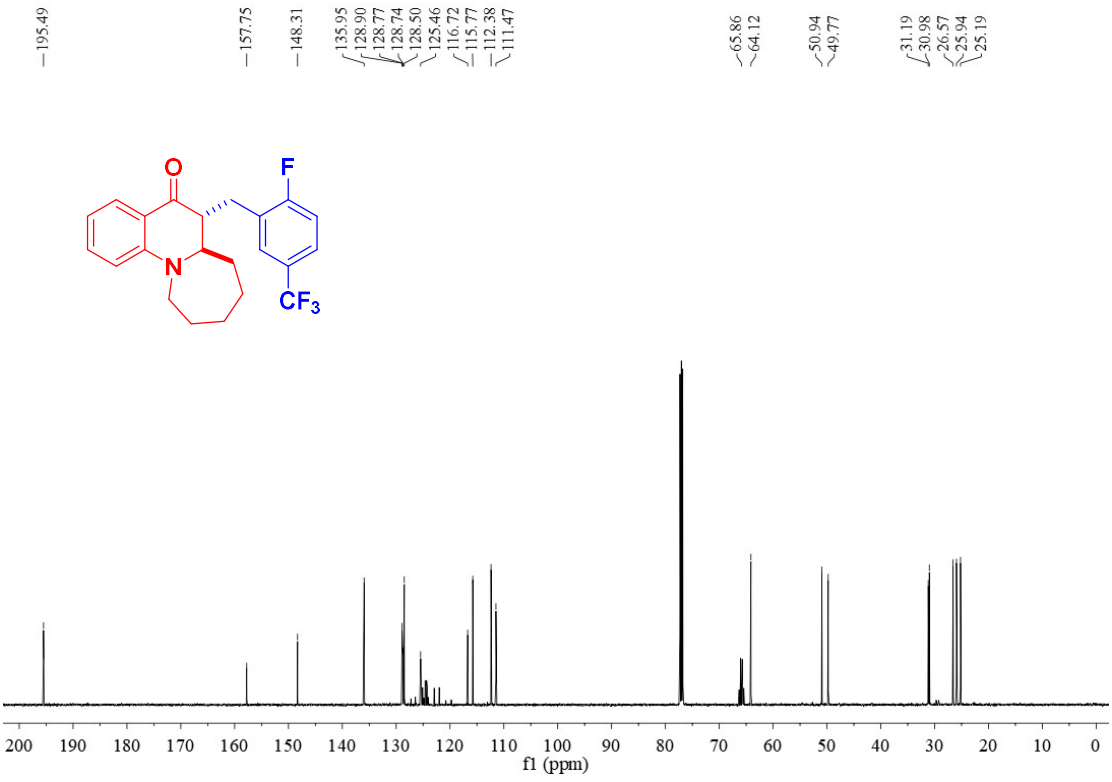




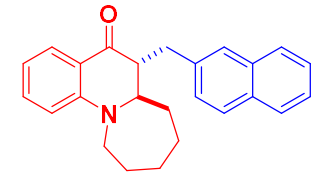
6-(2-fluoro-5-(trifluoromethyl)benzyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3g)

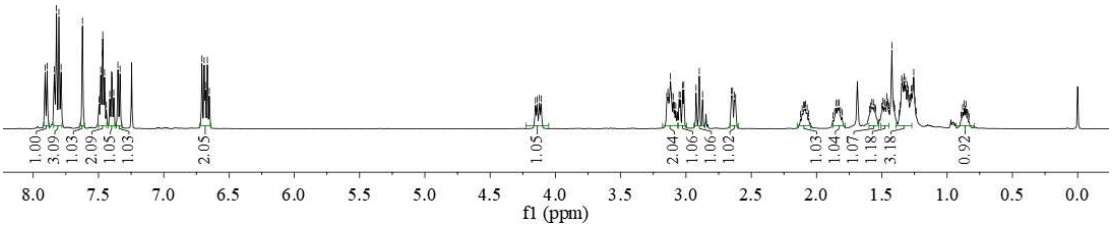


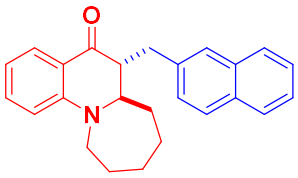


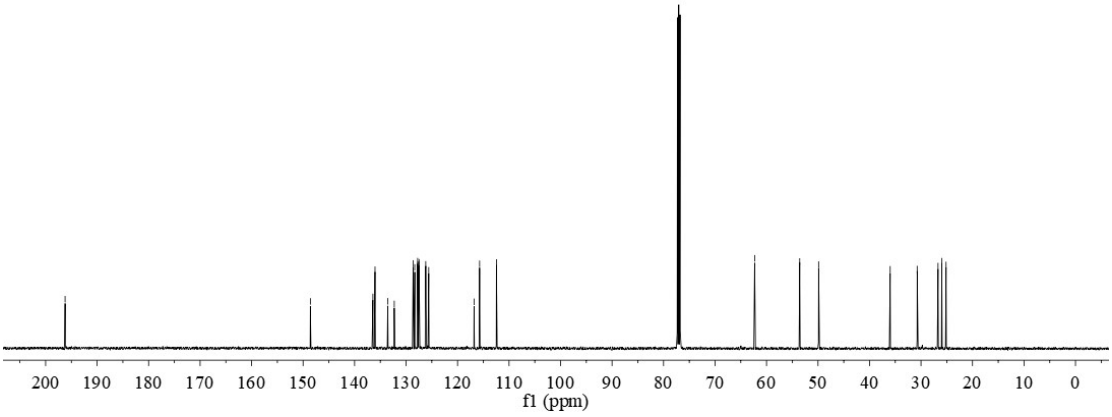


6-(naphthalen-2-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3h)

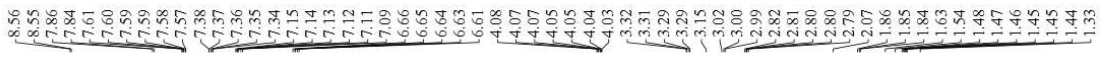


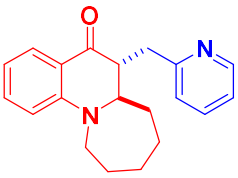


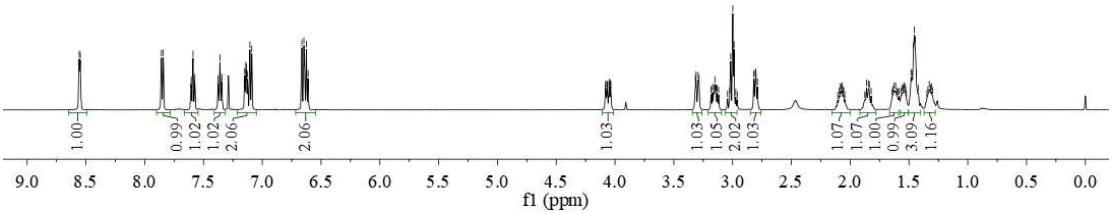


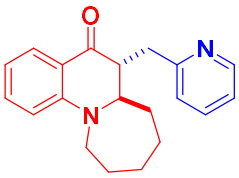


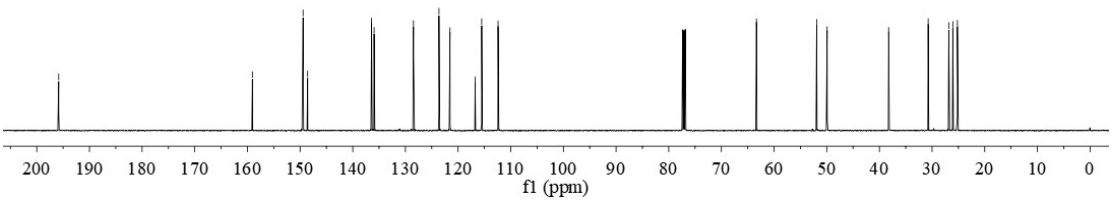
6-(pyridin-2-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3i)





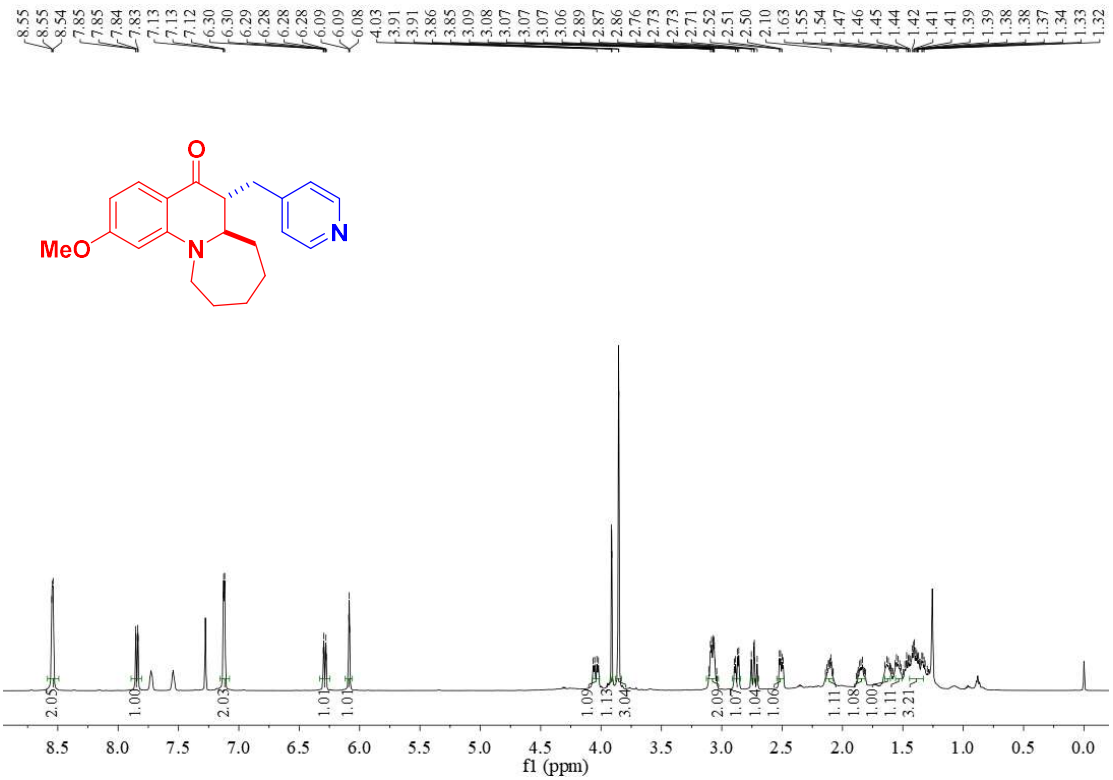


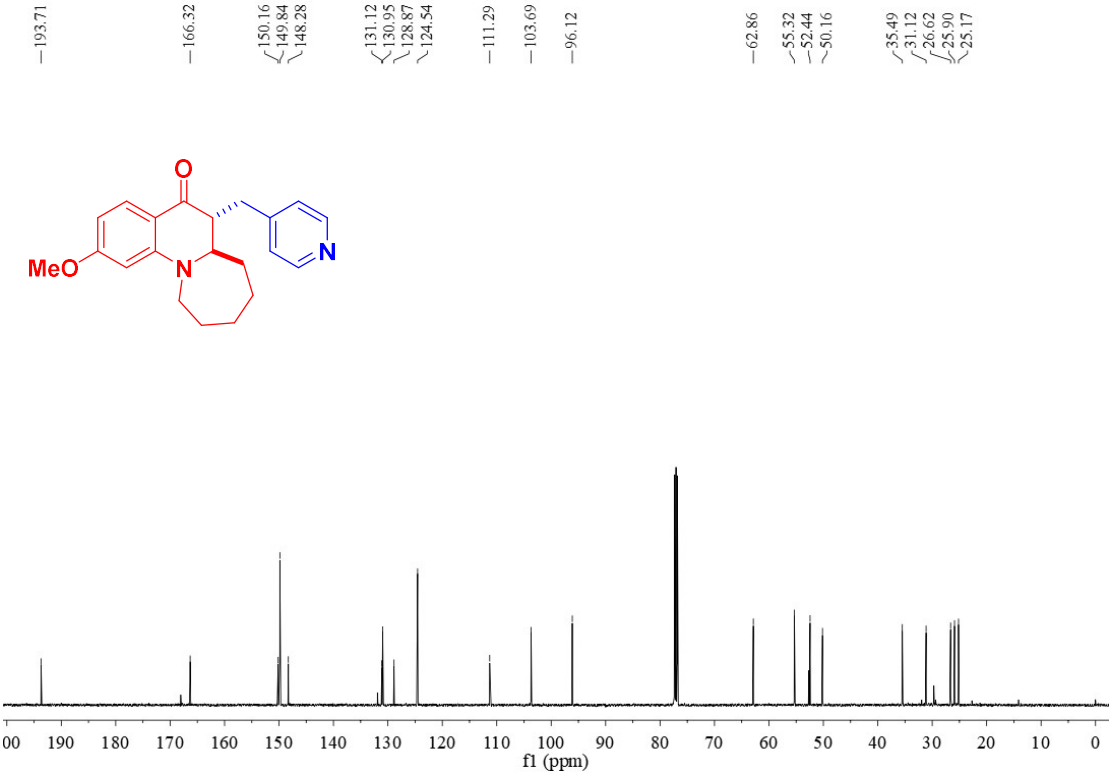




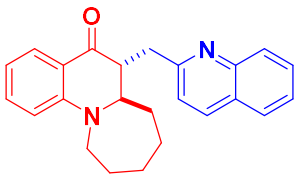
2-methoxy-6-(pyridin-4-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one

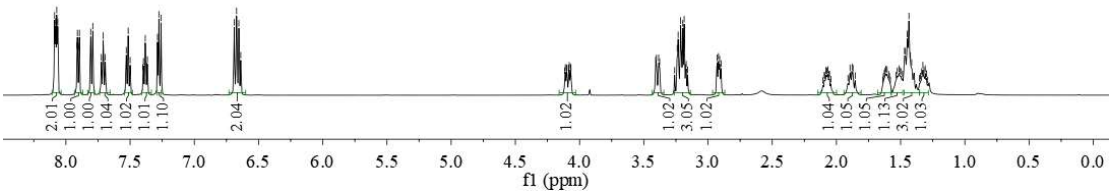
(3j)

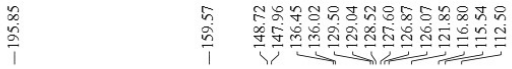


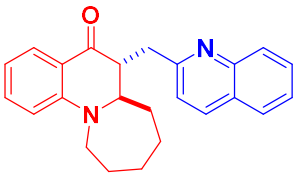


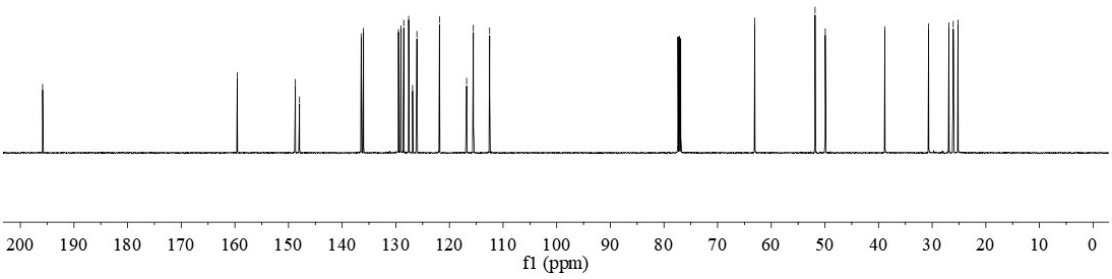
6-(quinolin-2-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3k)





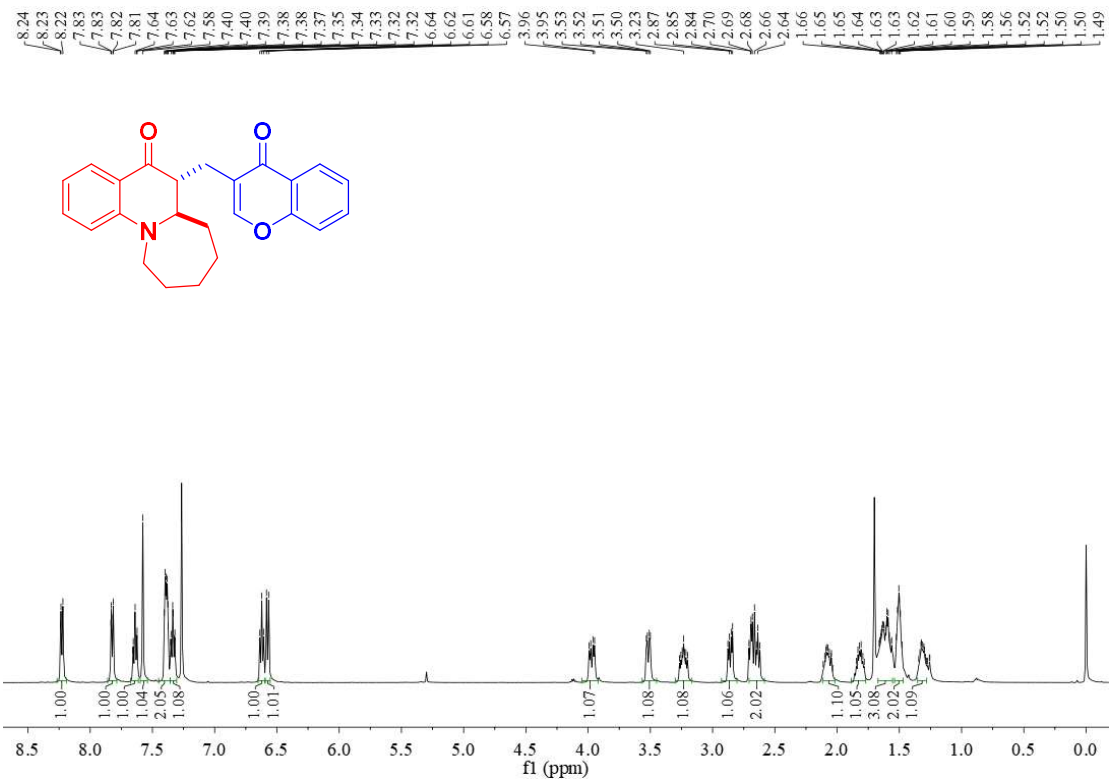


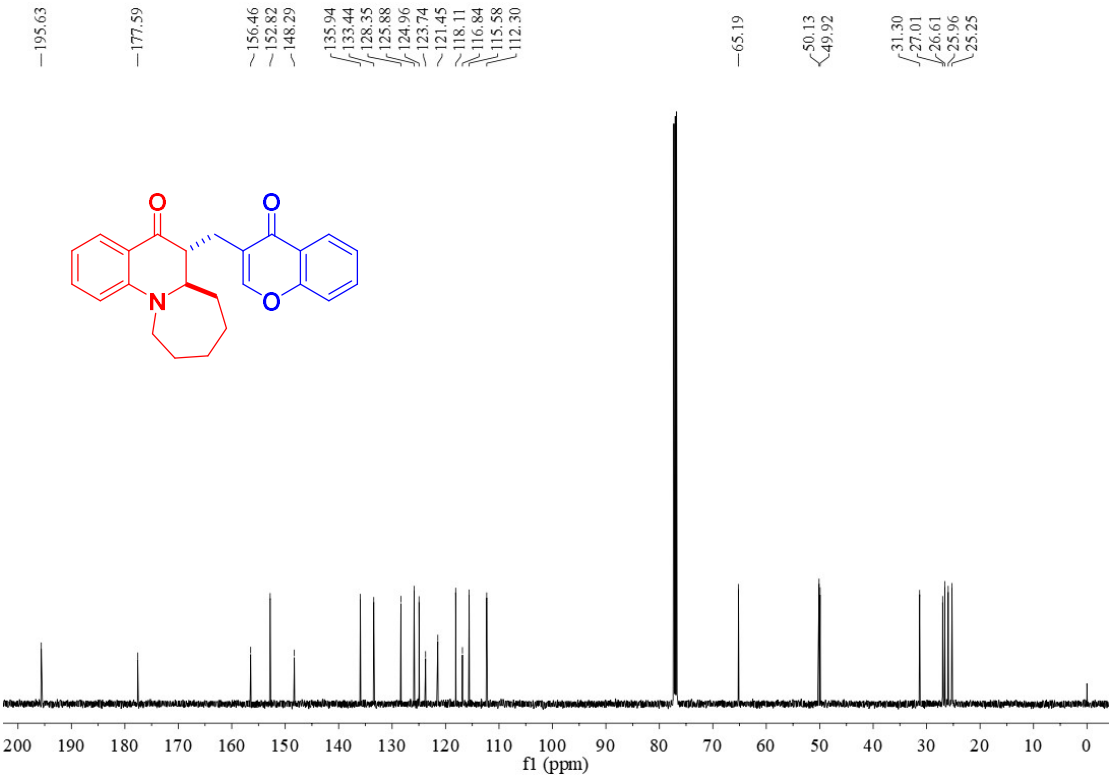




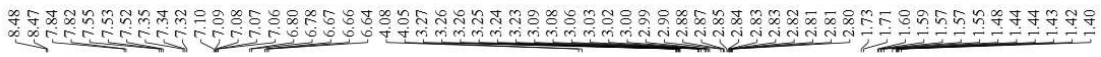
6-((4-oxo-4H-chromen-3-yl)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-on

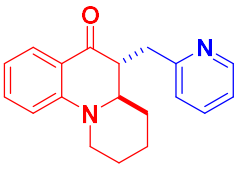
e (3l)

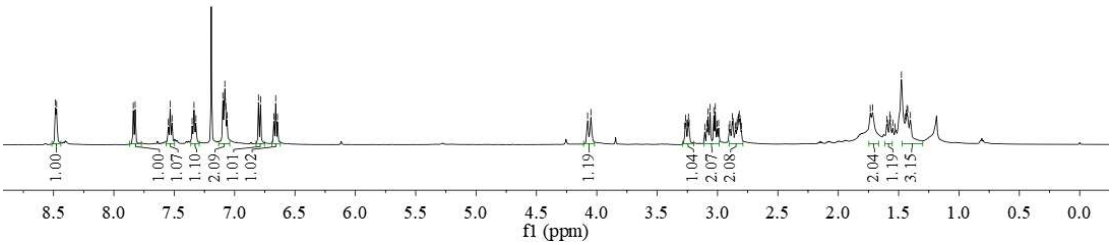


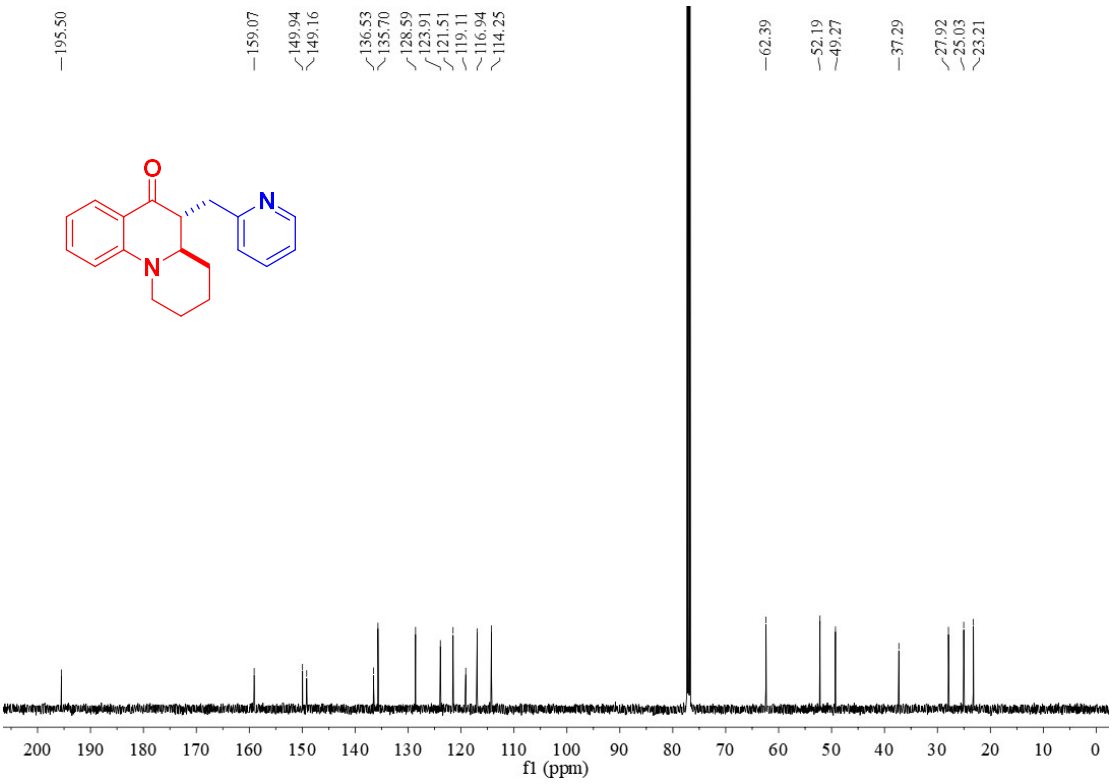


5-(pyridin-2-ylmethyl)-1,2,3,4,4a,5-hexahydro-6H-pyrido[1,2-a]quinolin-6-one (3m)

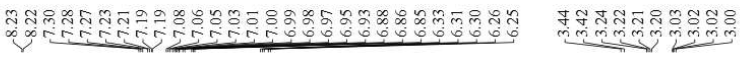


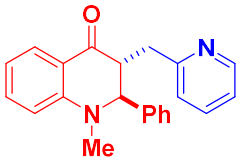


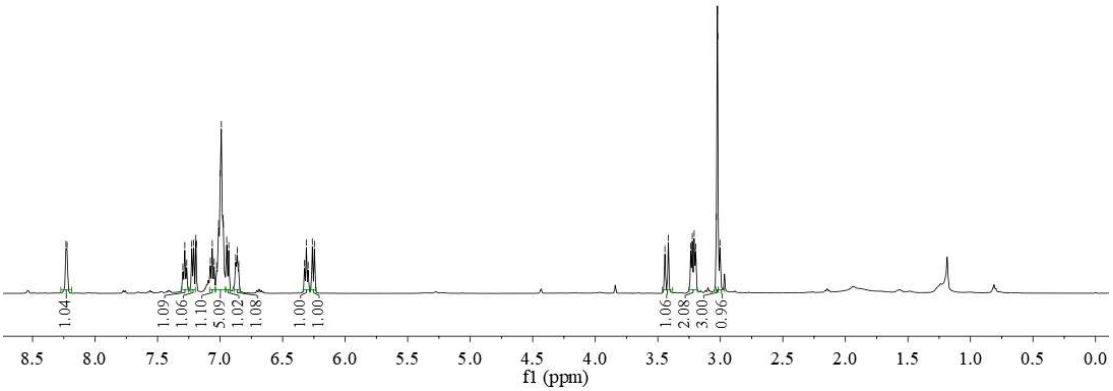


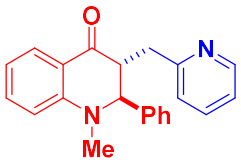


1-methyl-2-phenyl-3-(pyridin-2-ylmethyl)-2,3-dihydroquinolin-4(1H)-one (3n)

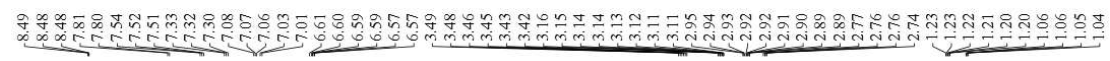


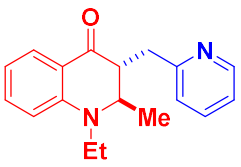


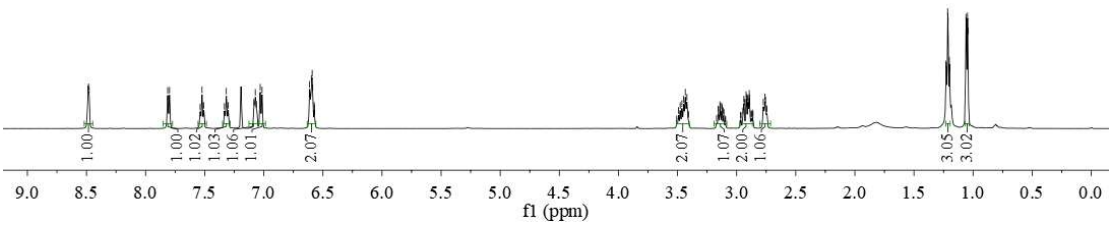


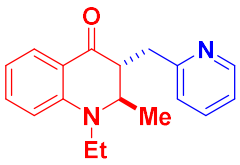


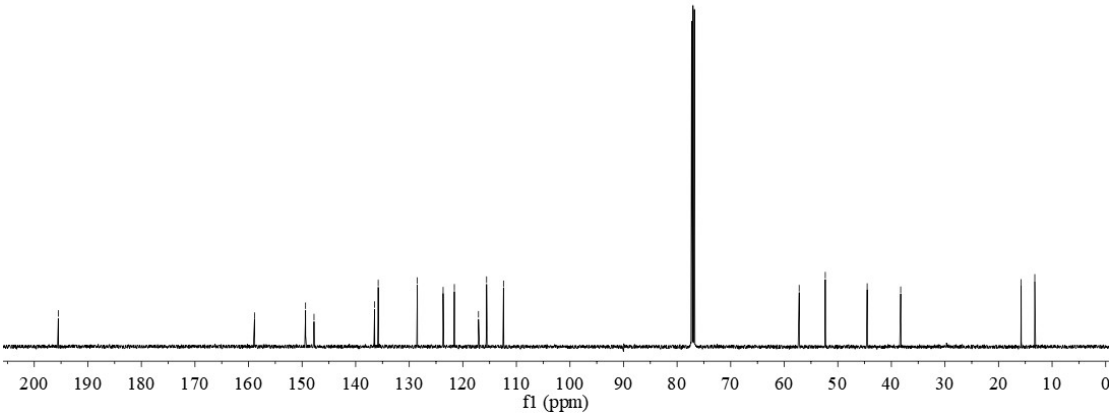
1-ethyl-2-methyl-3-(pyridin-2-ylmethyl)-2,3-dihydroquinolin-4(1H)-one (3o)



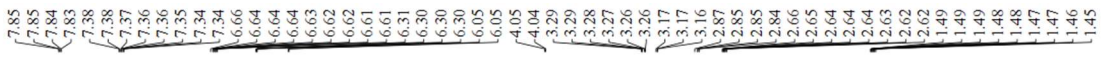


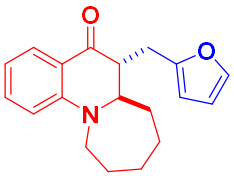


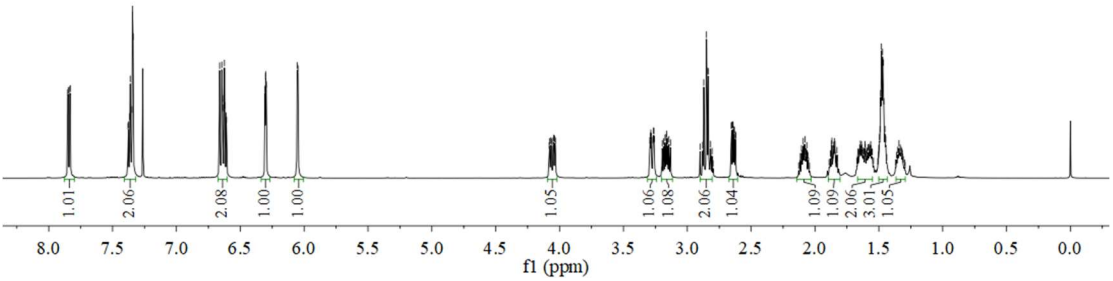


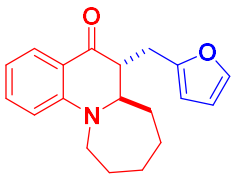


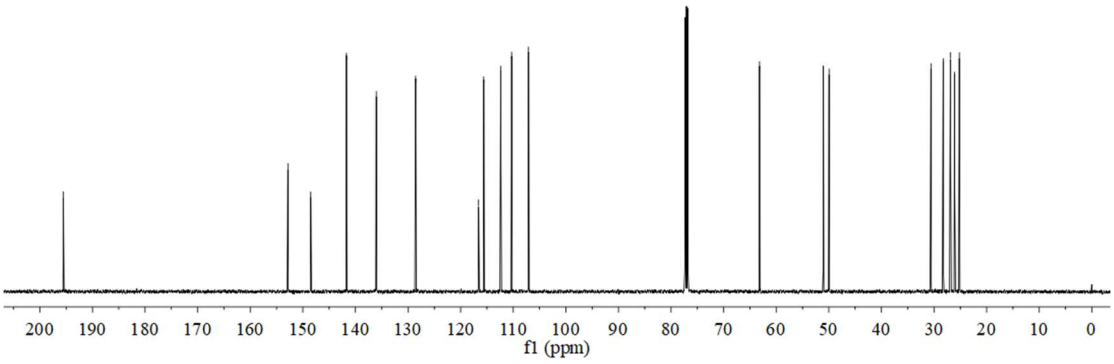
6-(furan-2-ylmethyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3p)



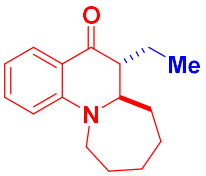


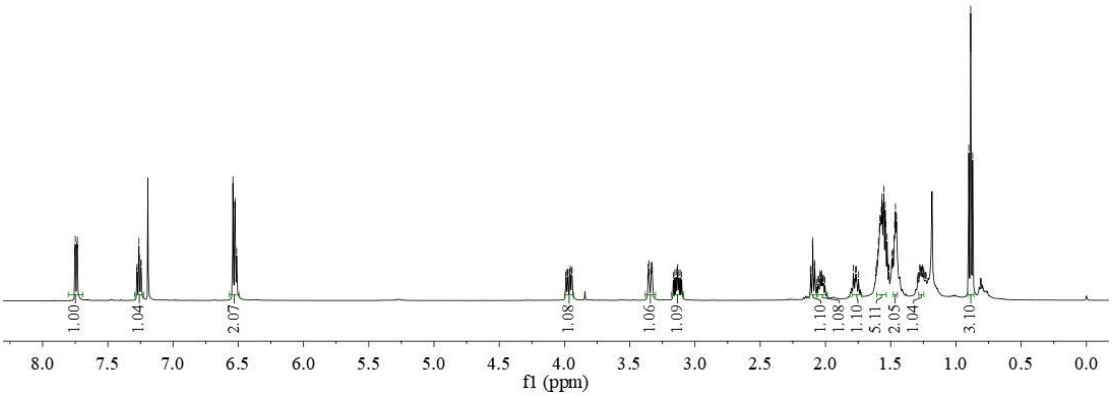


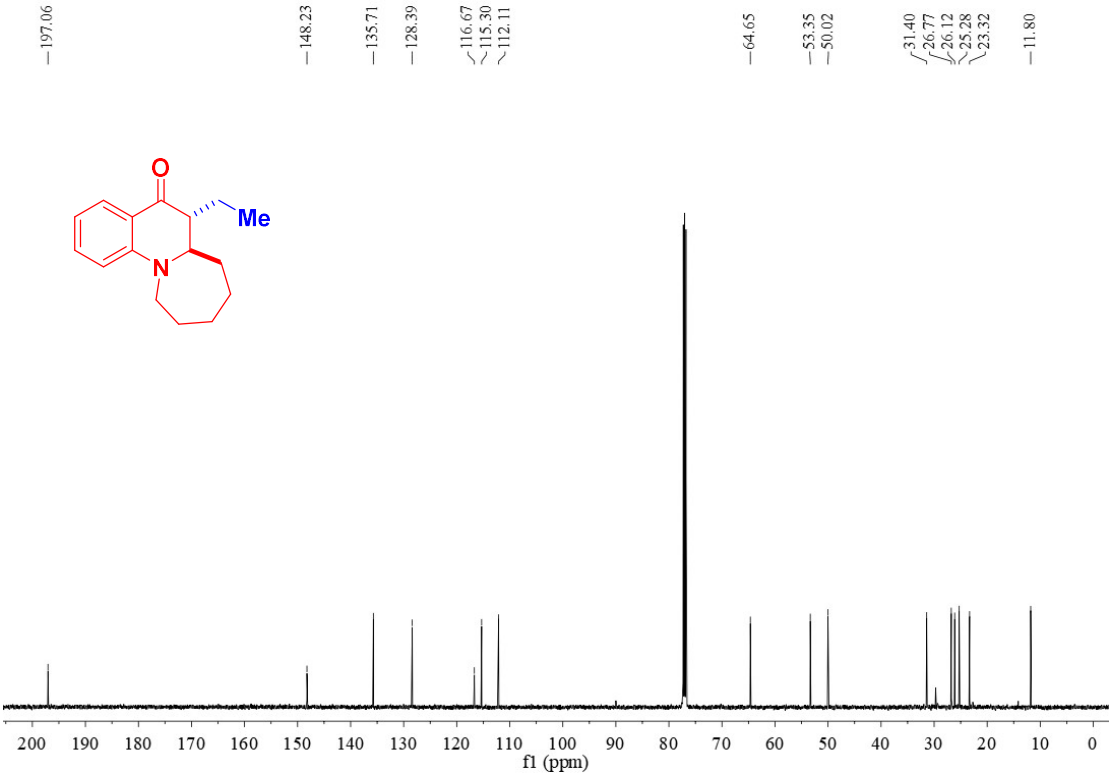




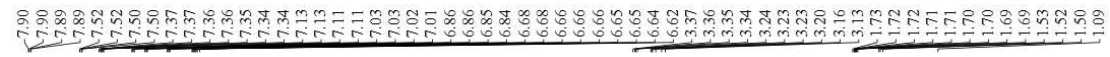
6-ethyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3q)

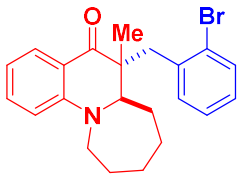


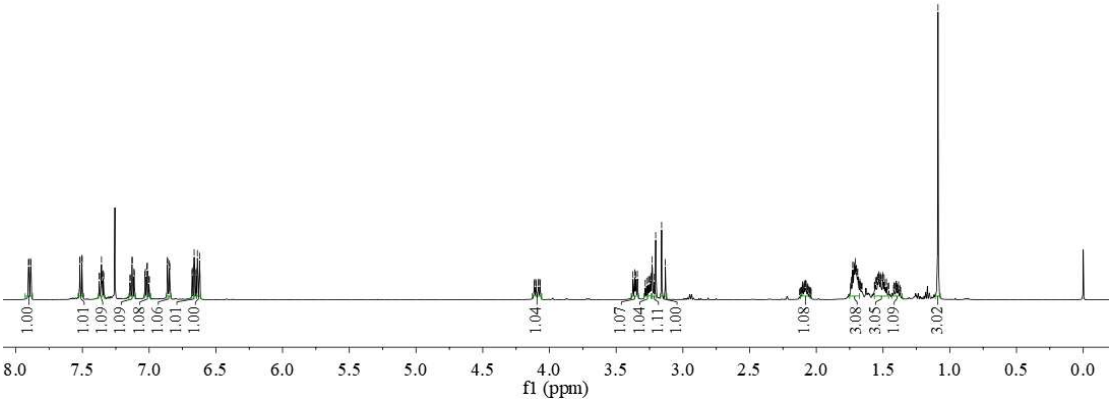


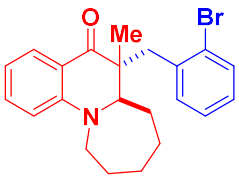


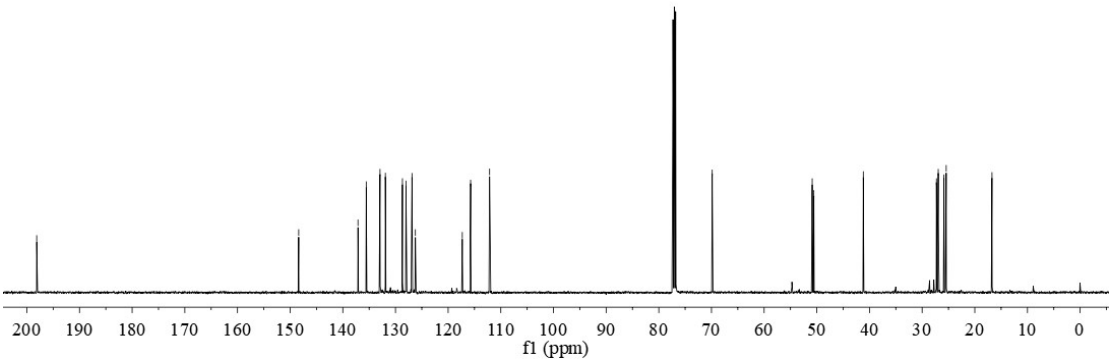
6-(2-bromobenzyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (3r)







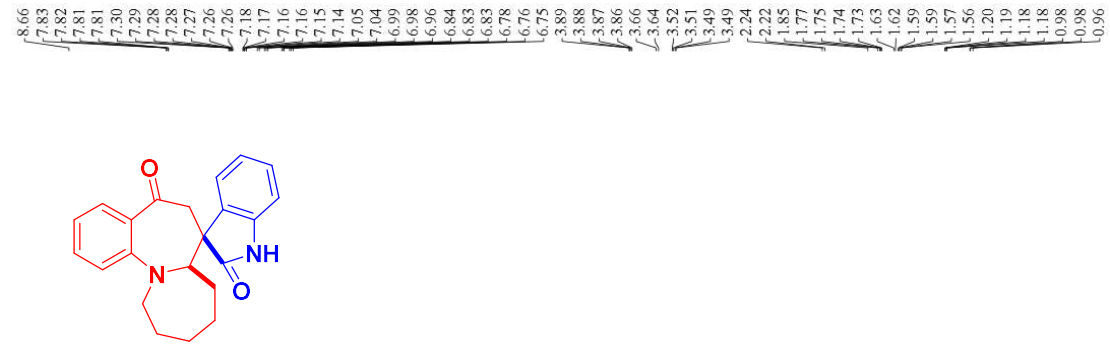


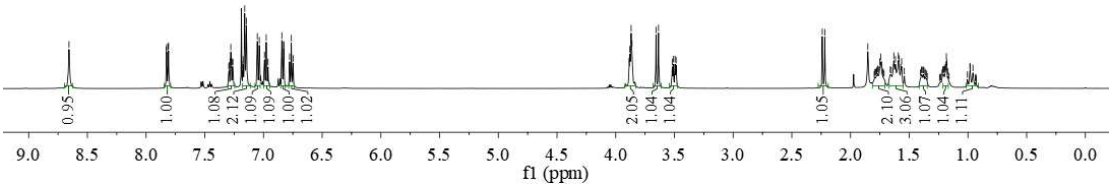


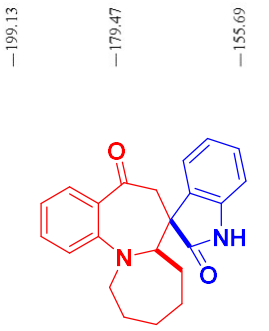
Compounds 5:

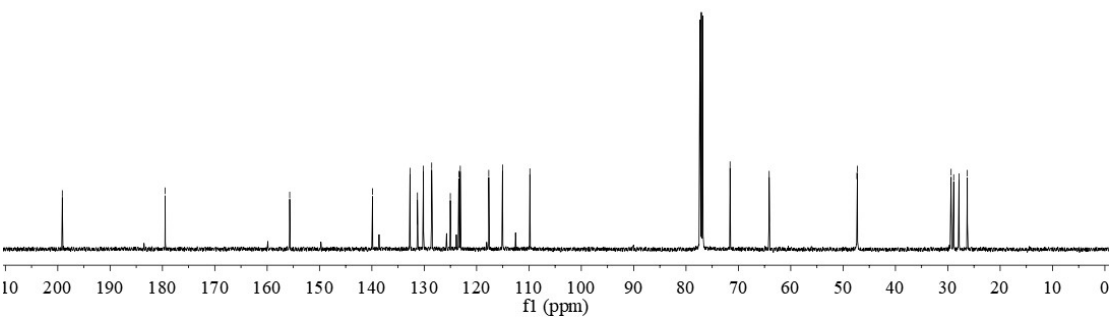
7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione

(5a)

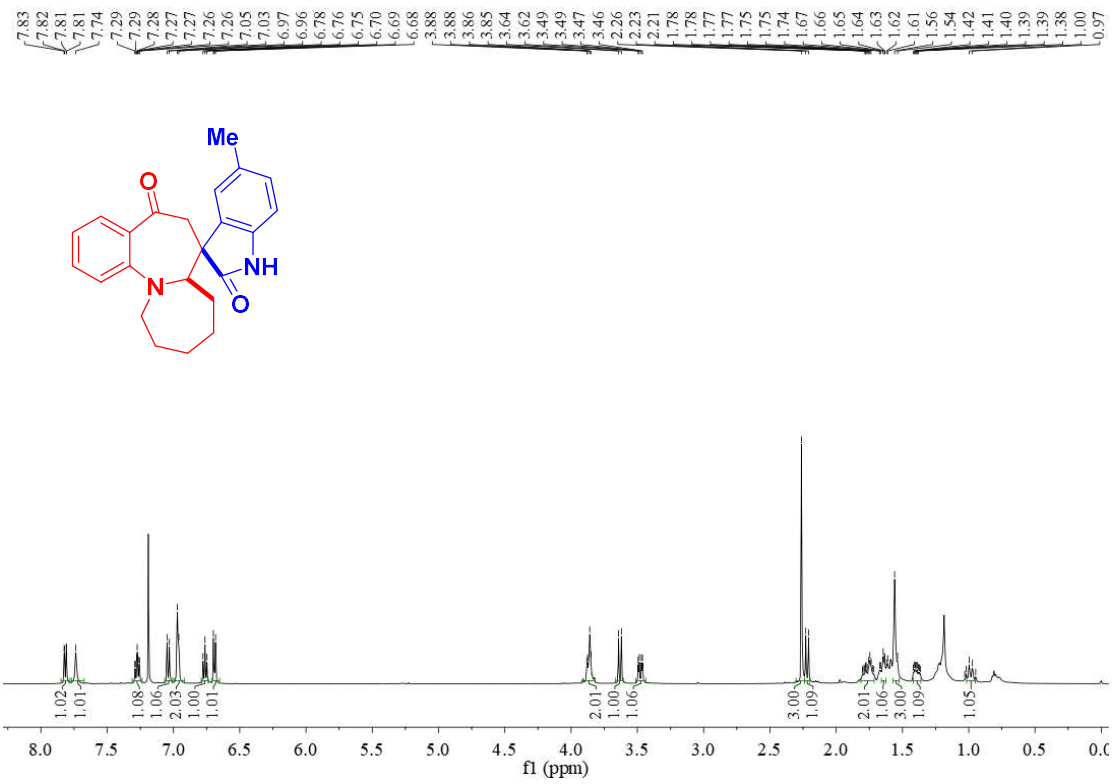


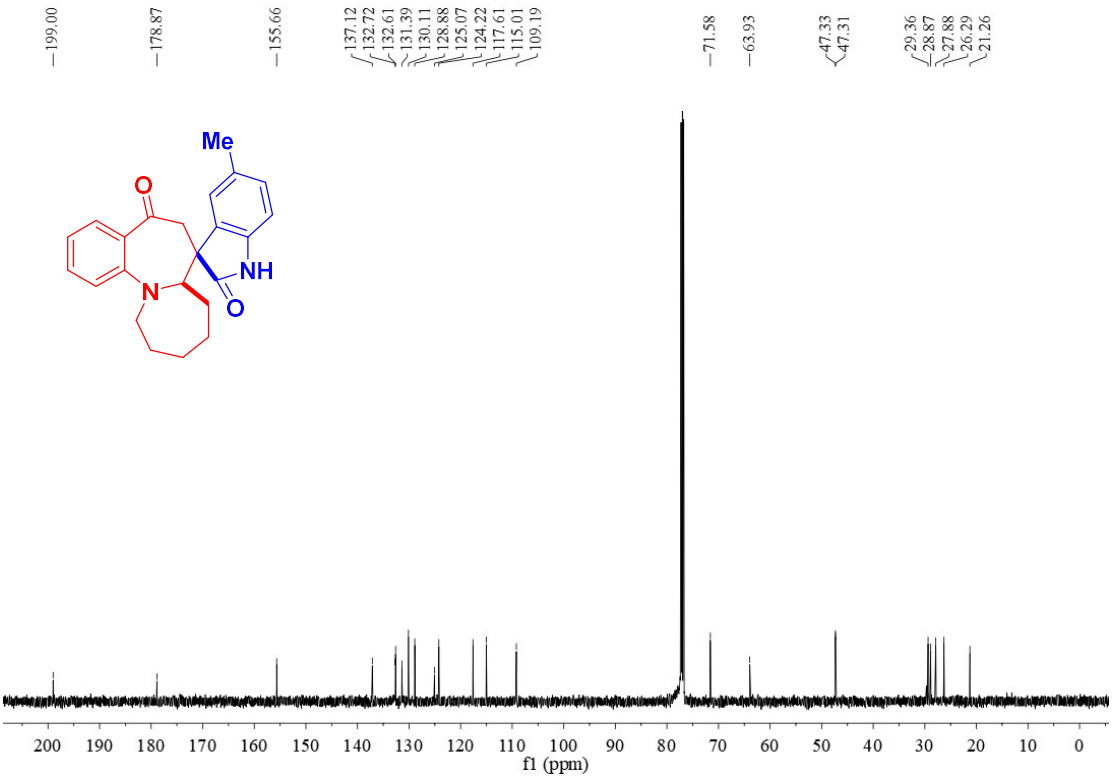




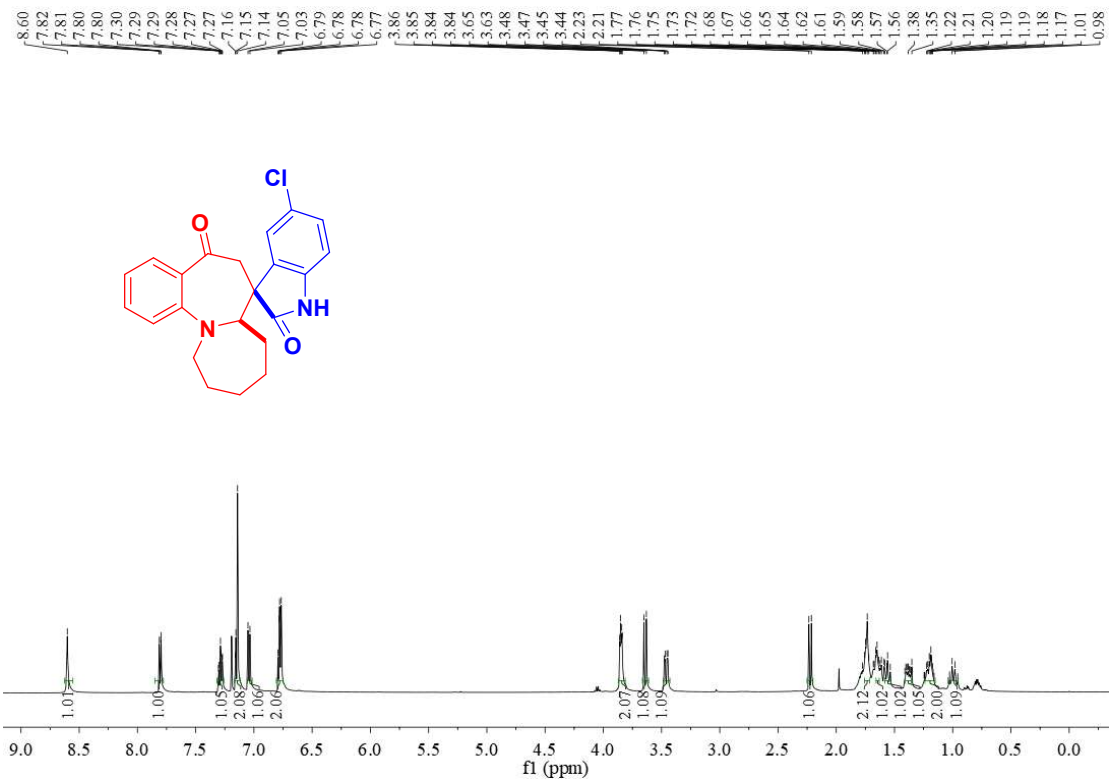


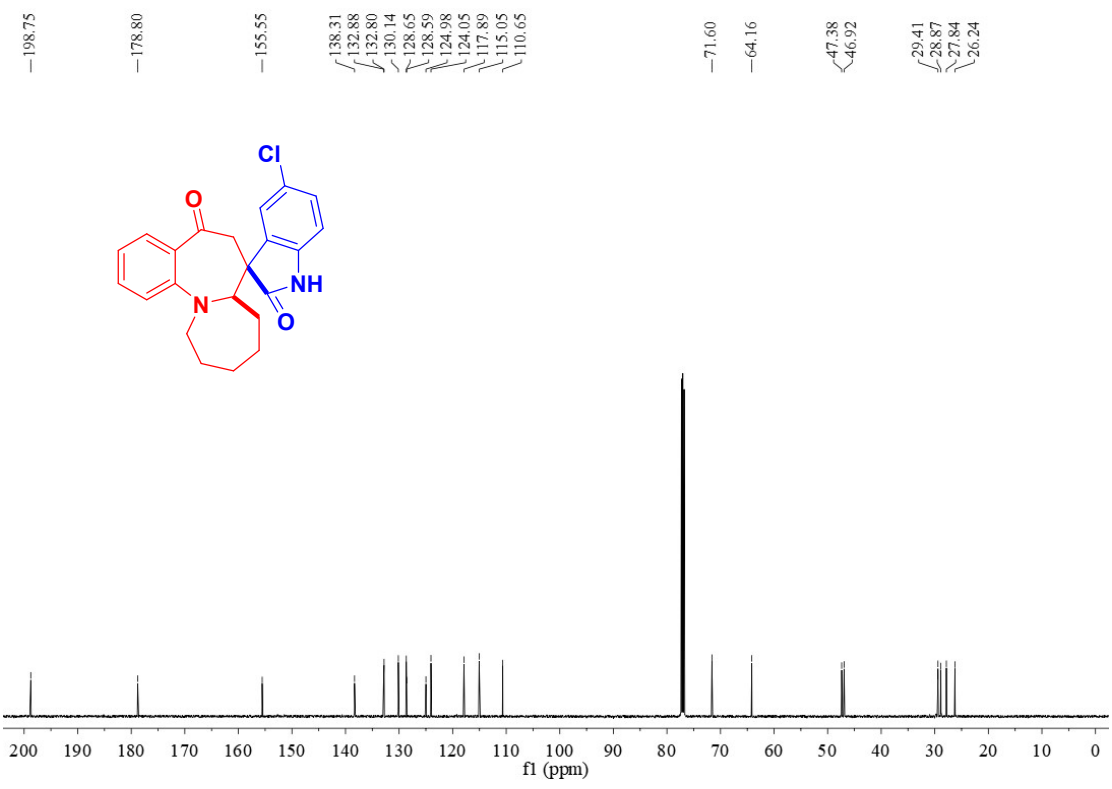
5'-methyl-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5b)



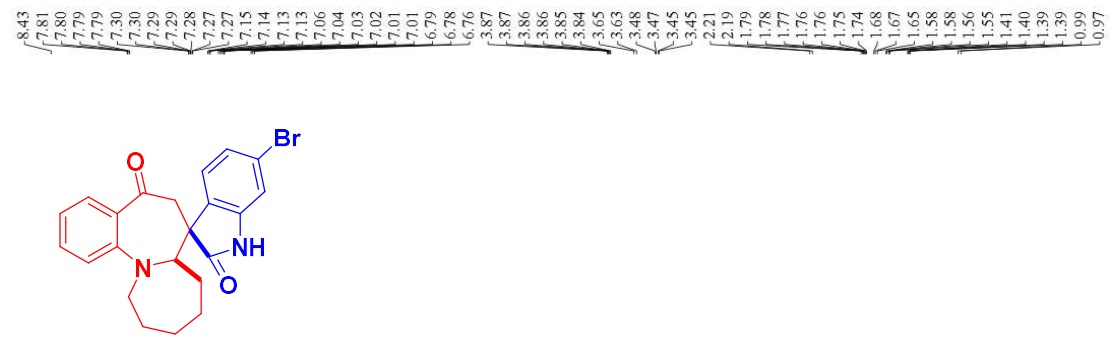


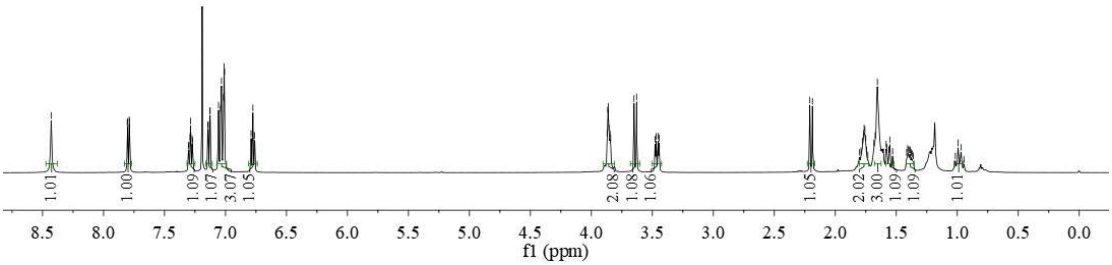
5'-chloro-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5c)

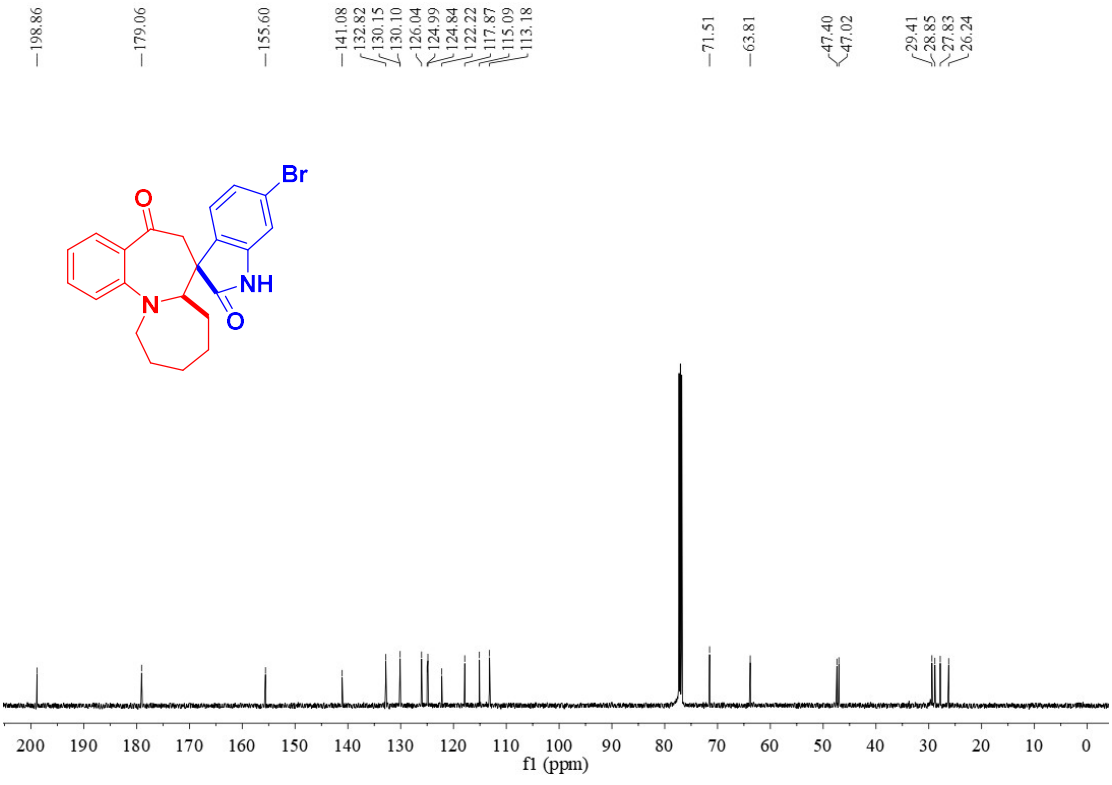




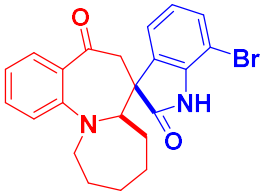
6'-bromo-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5d)

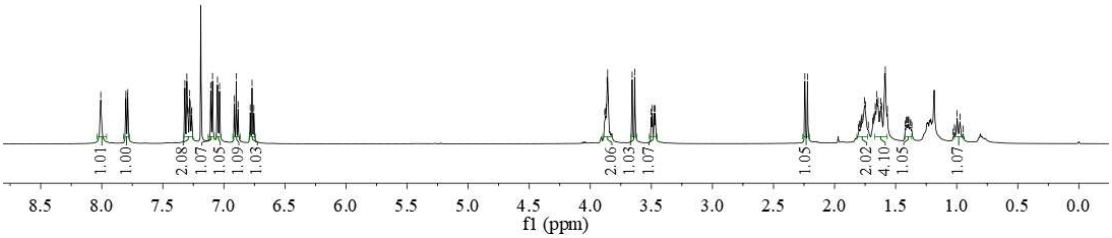


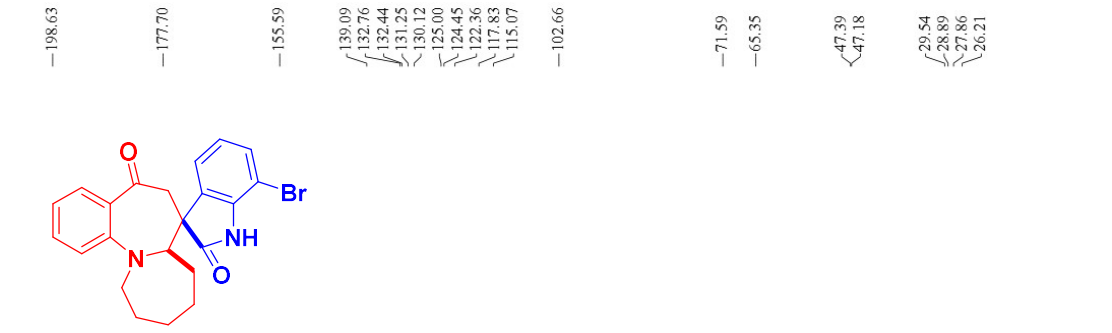


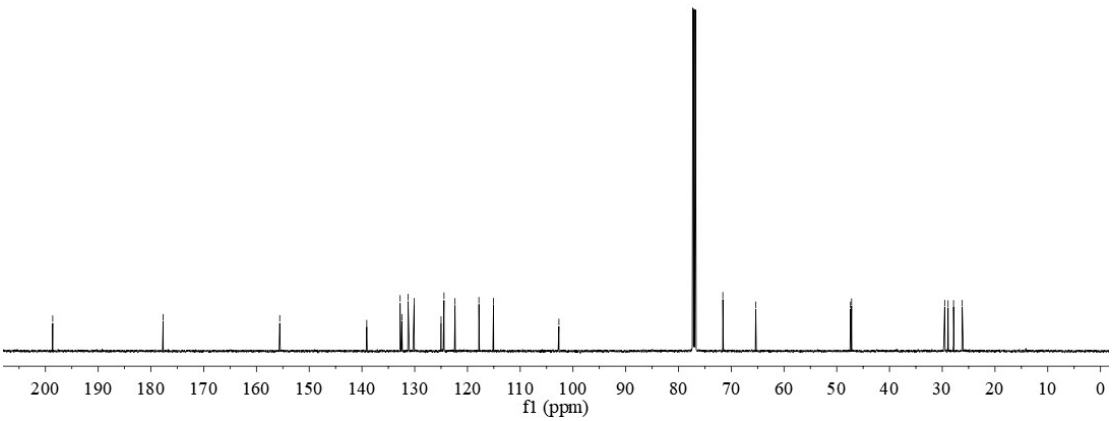


7'-bromo-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5e)

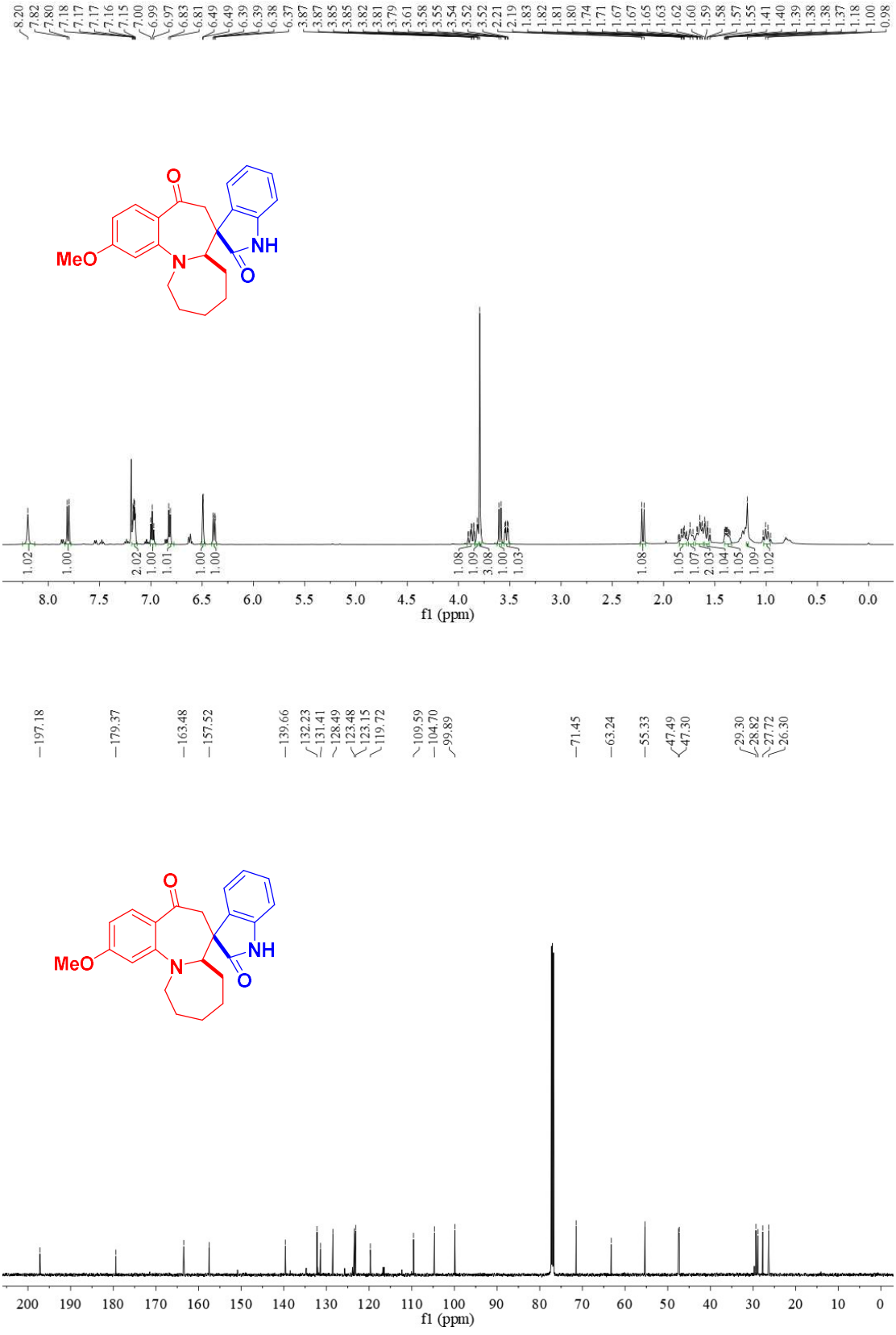




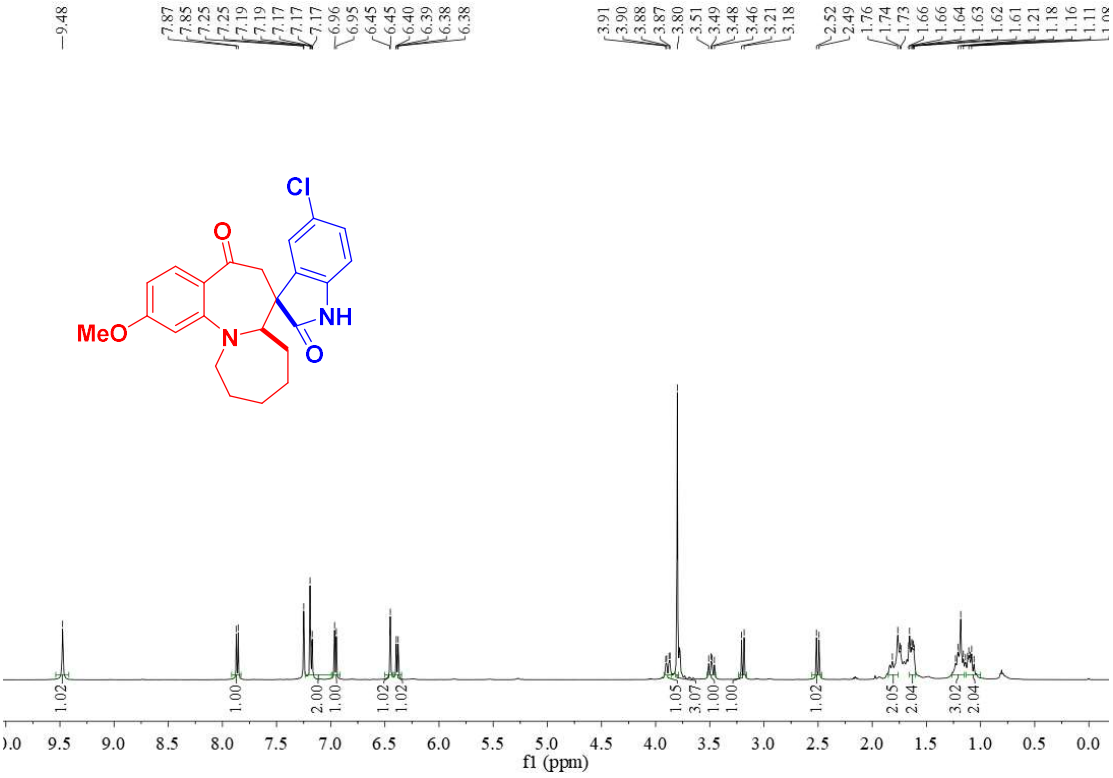


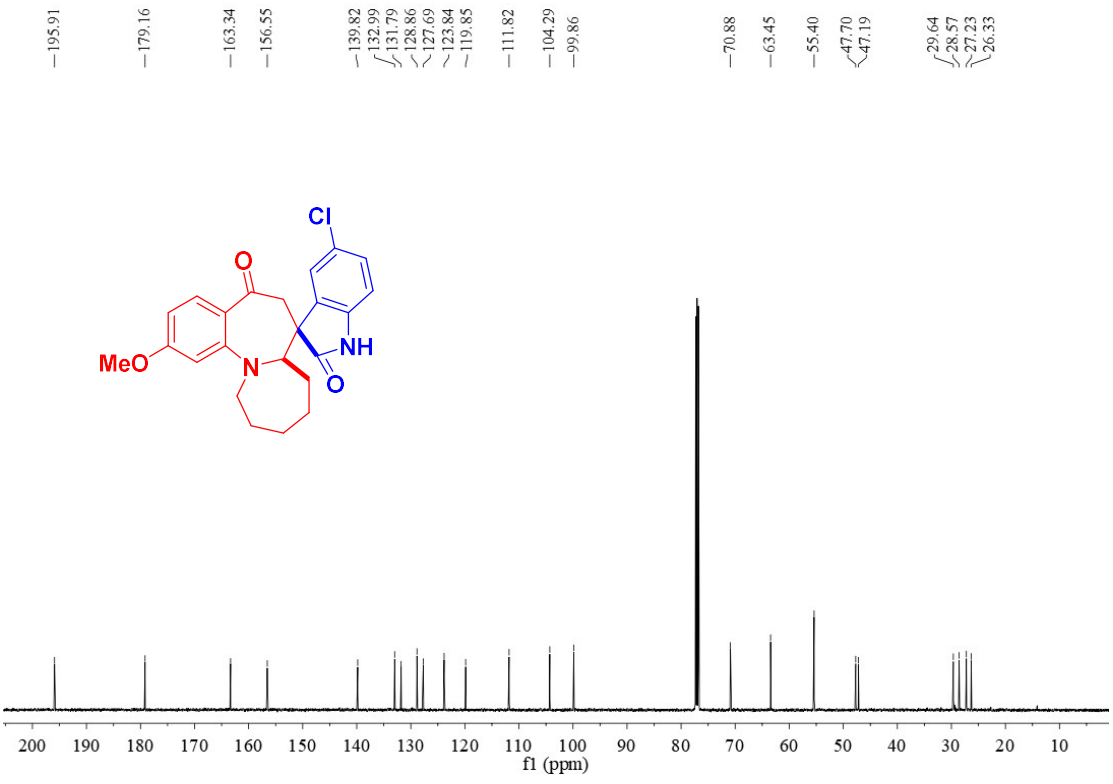


2-methoxy-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5f)

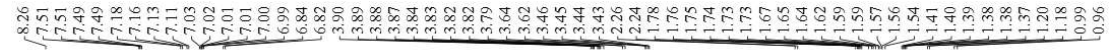


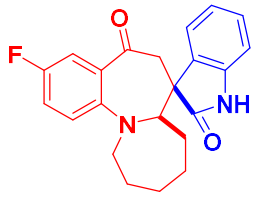
5'-chloro-2-methoxy-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5g)

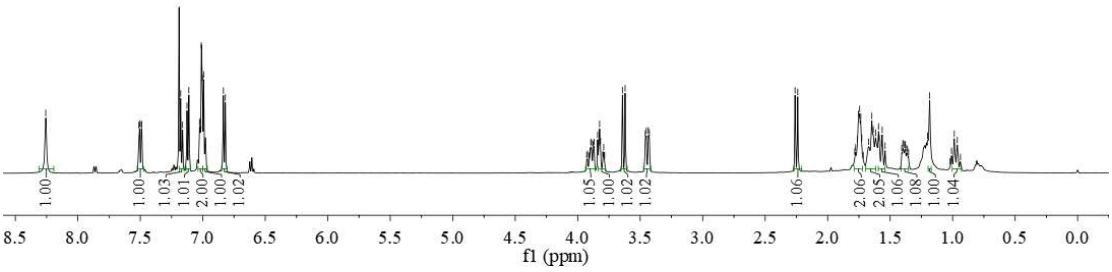


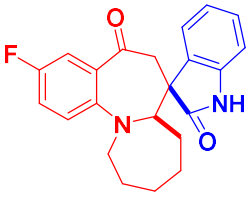


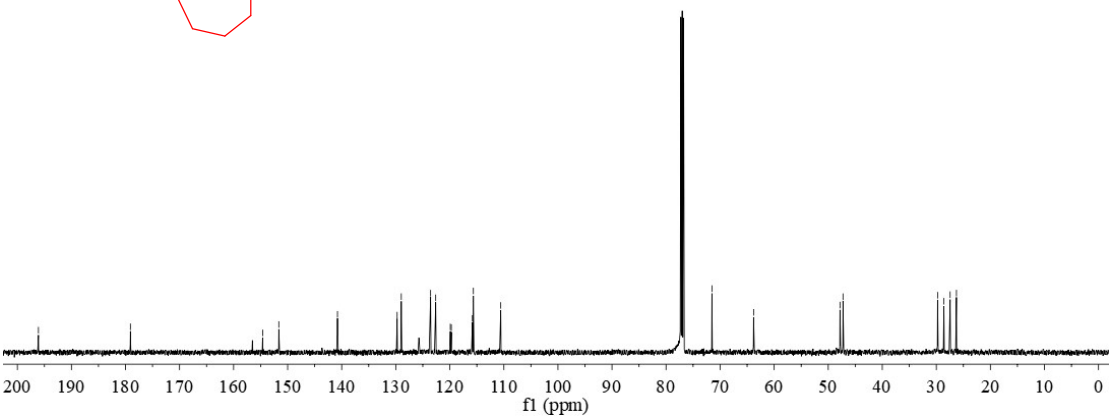
3-fluoro-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5h)



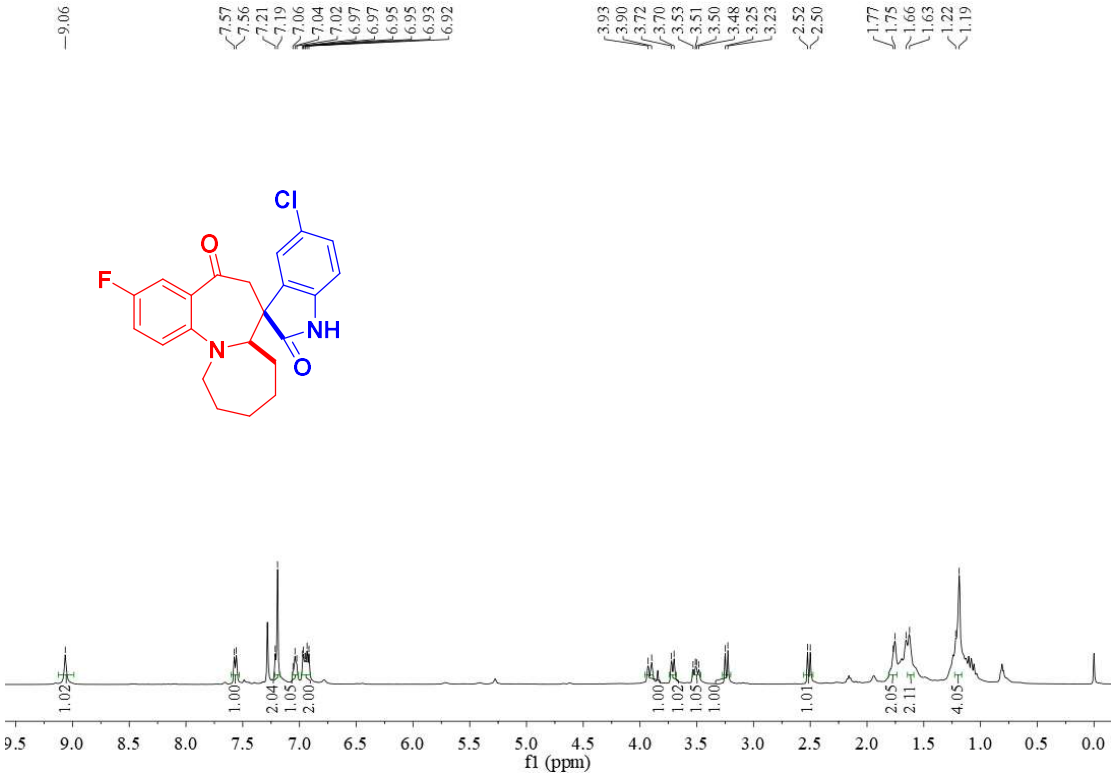


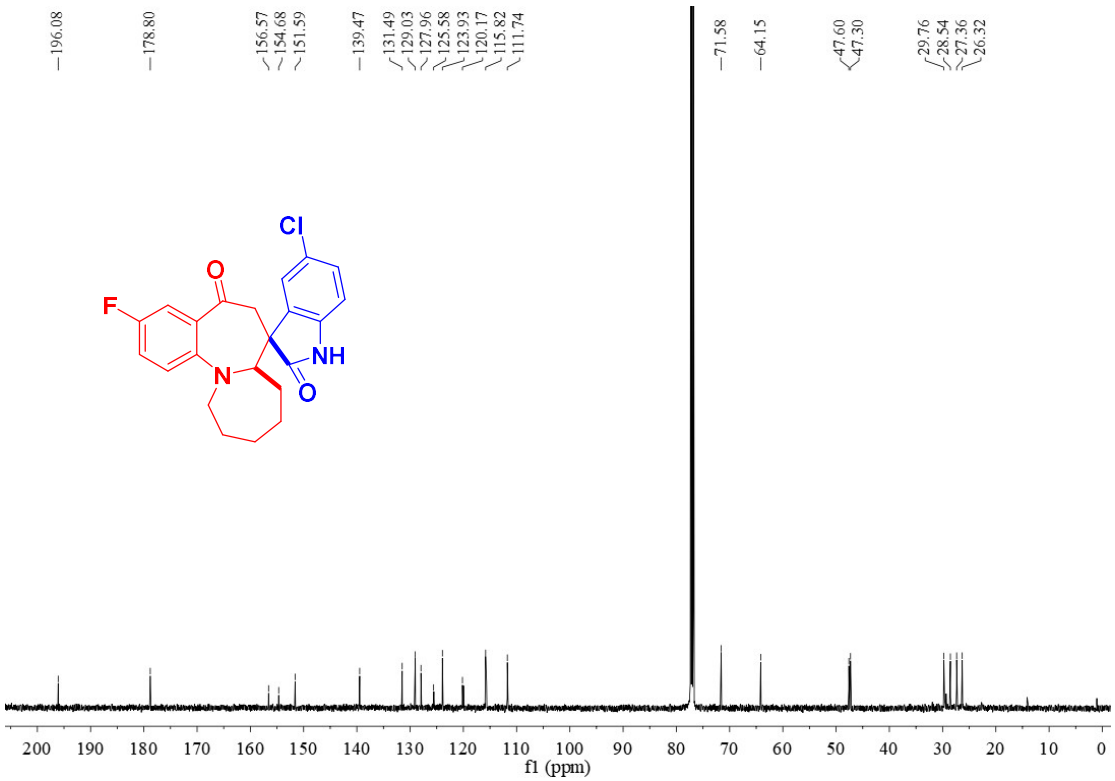




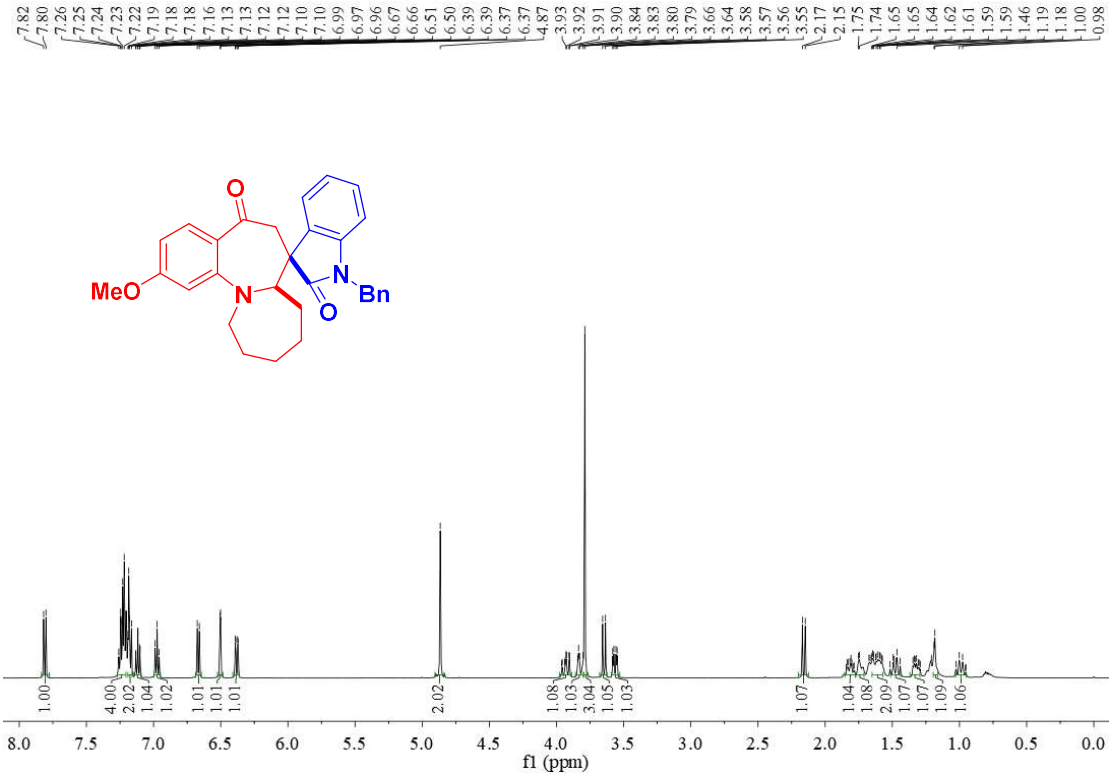


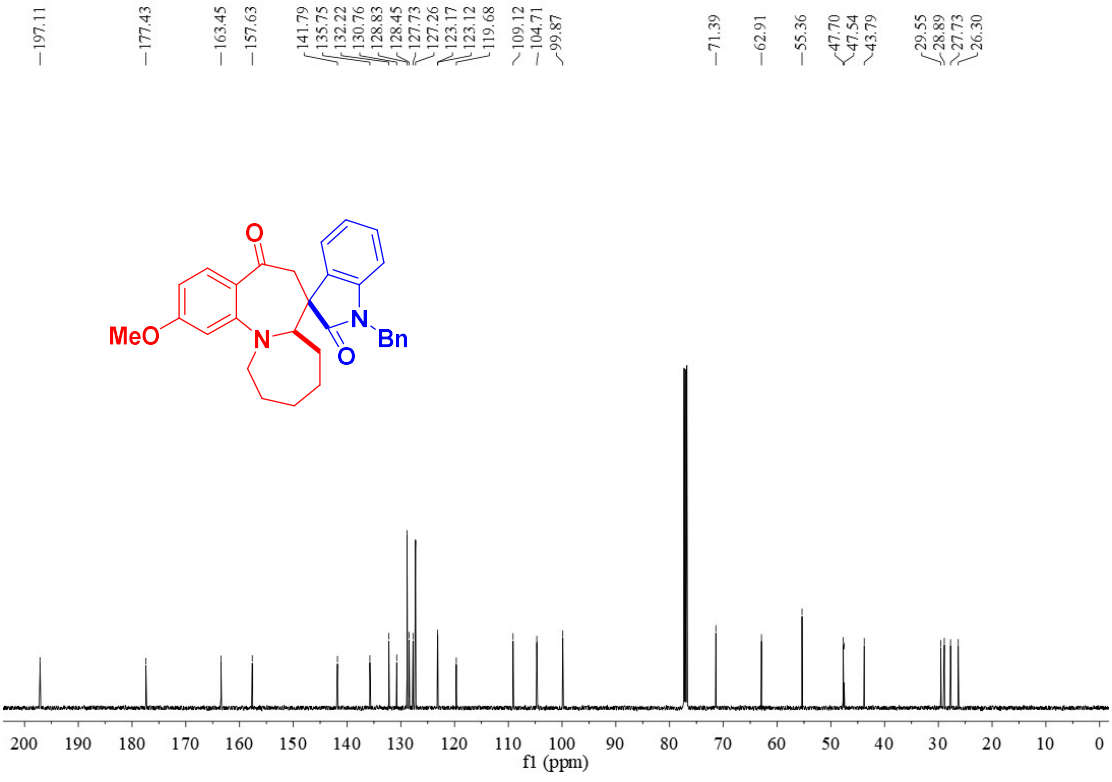
5'-chloro-3-fluoro-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indolin e]-2',5(6H)-dione (5i)



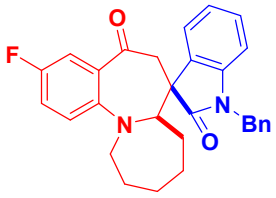


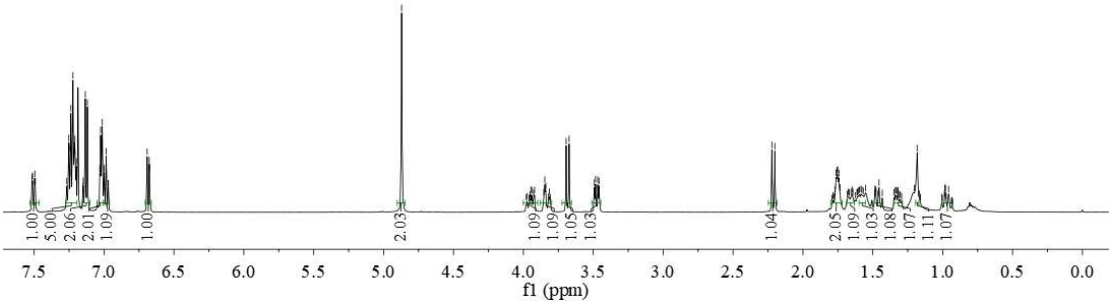
1'-benzyl-2-methoxy-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5j)

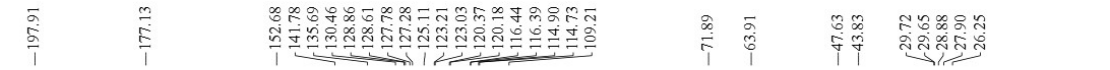


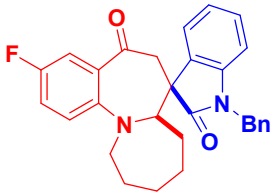


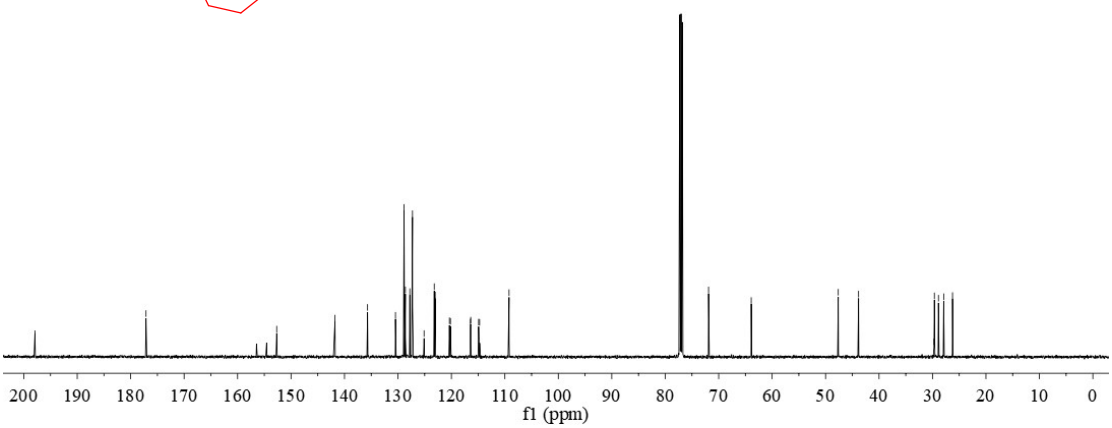
1'-benzyl-3-fluoro-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indolin e]-2',5(6H)-dione (5k)



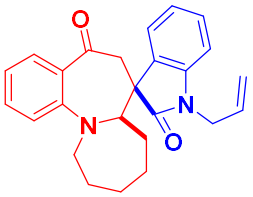


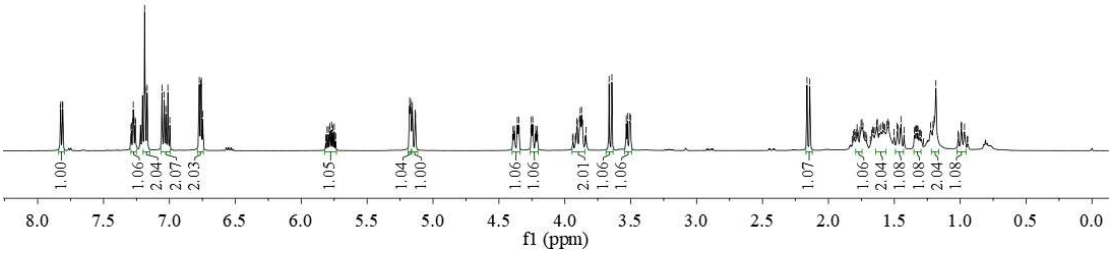


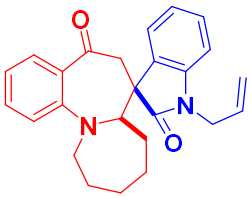




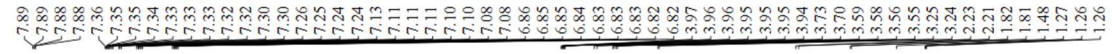
1'-allyl-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5l)

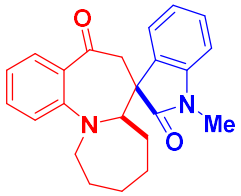


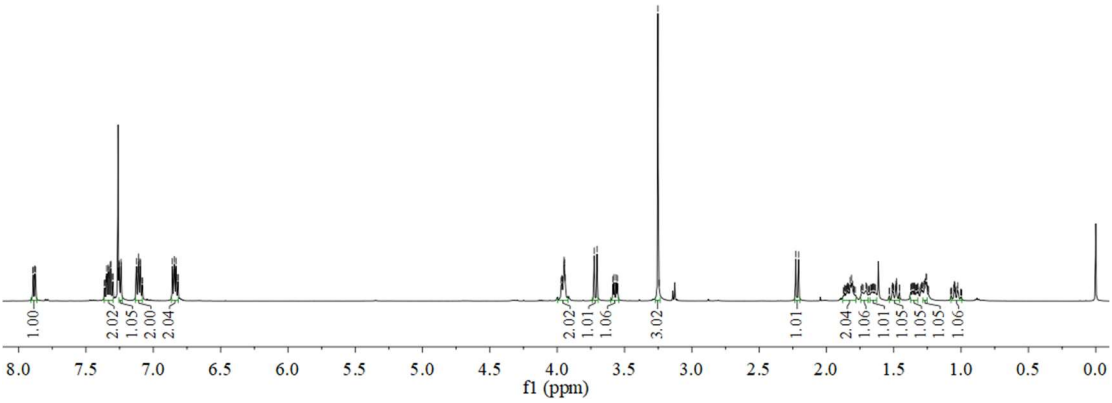


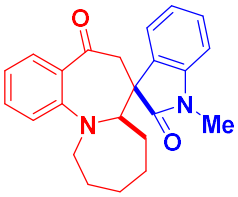


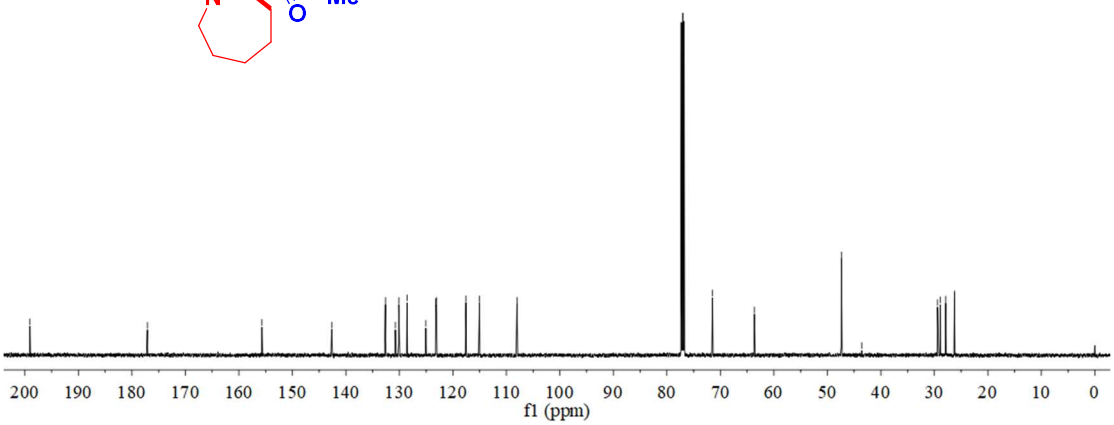
1'-methyl-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5m)



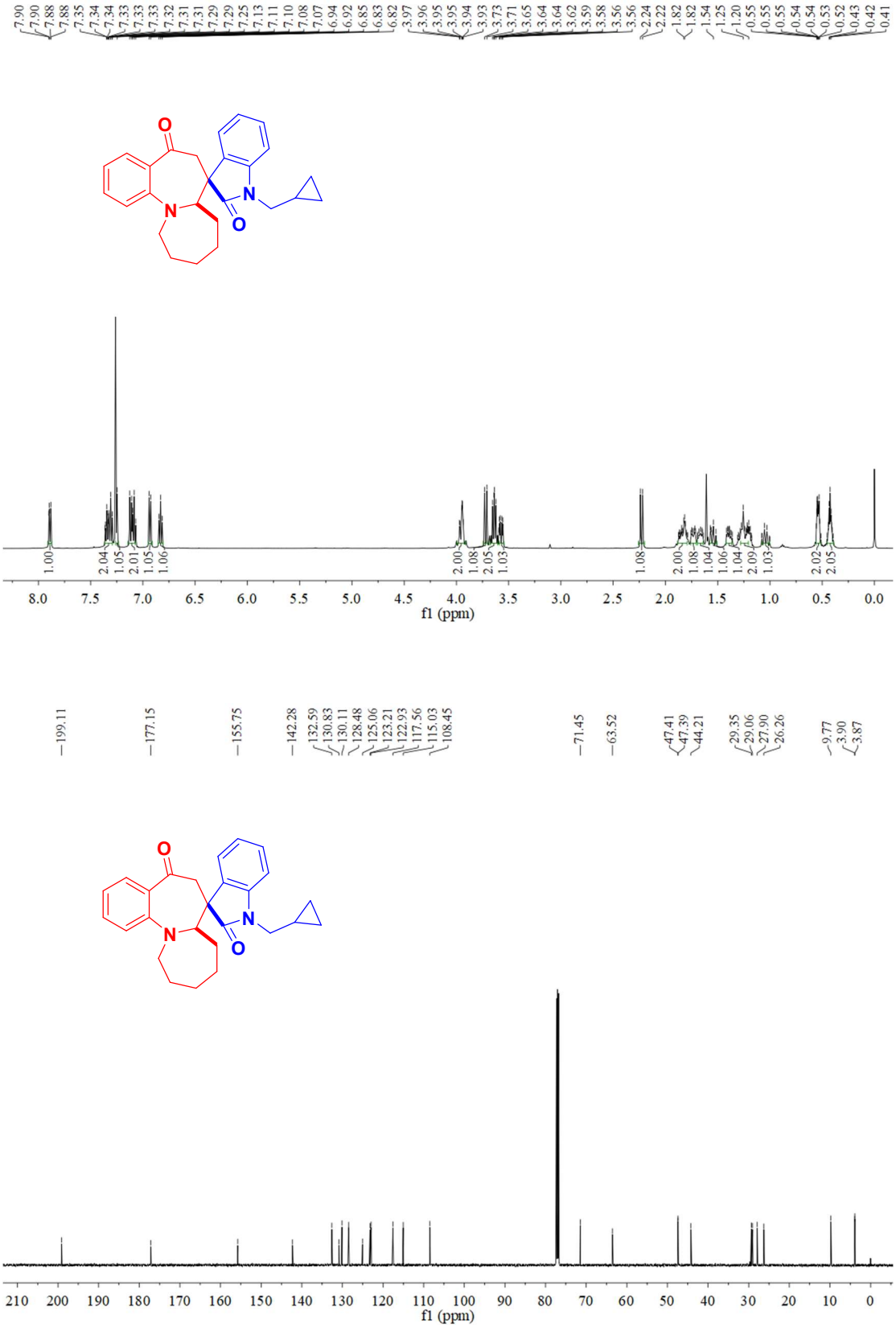






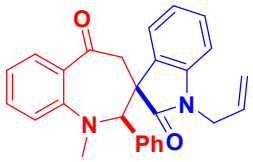


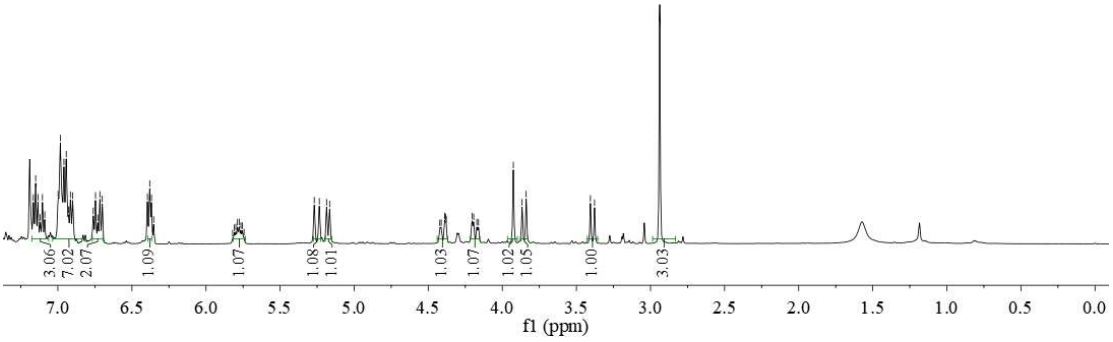
1'-(cyclopropylmethyl)-7a,8,9,10,11,12-hexahydrospiro[azepino[1,2-a]benzo[f]azepine-7,3'-indoline]-2',5(6H)-dione (5n)

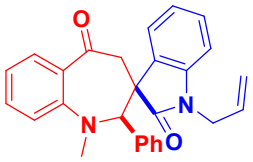


1'-allyl-1-methyl-2-phenyl-1,2-dihydrospiro[benzo[b]azepine-3,3'-indoline]-2',5(4H)-dione

(5o)

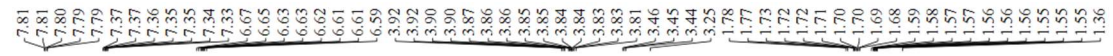


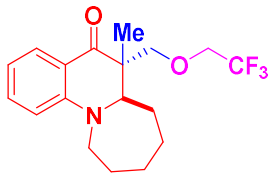


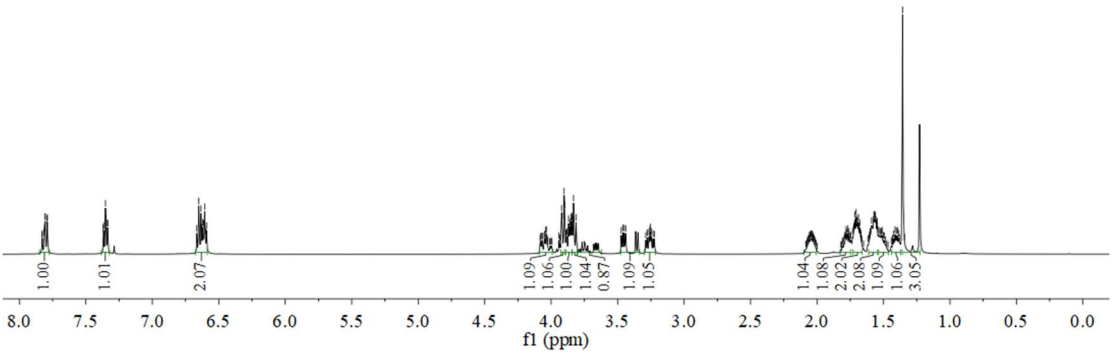


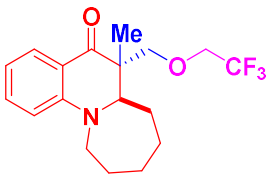
Compounds 8:

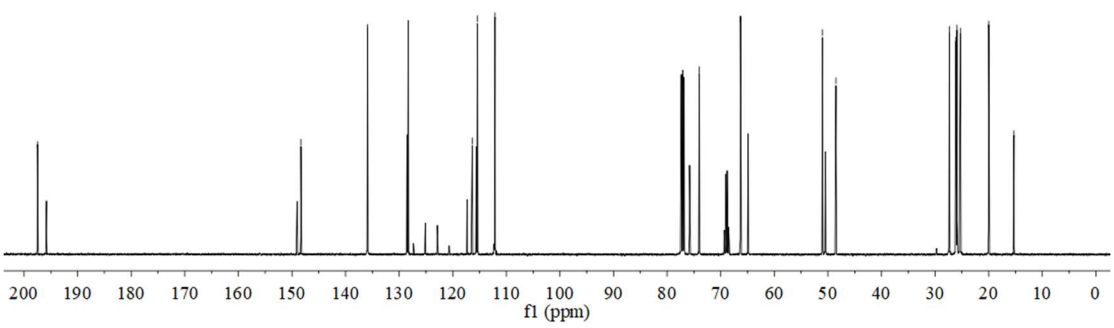
6-methyl-6-((2,2,2-trifluoroethoxy)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8a)



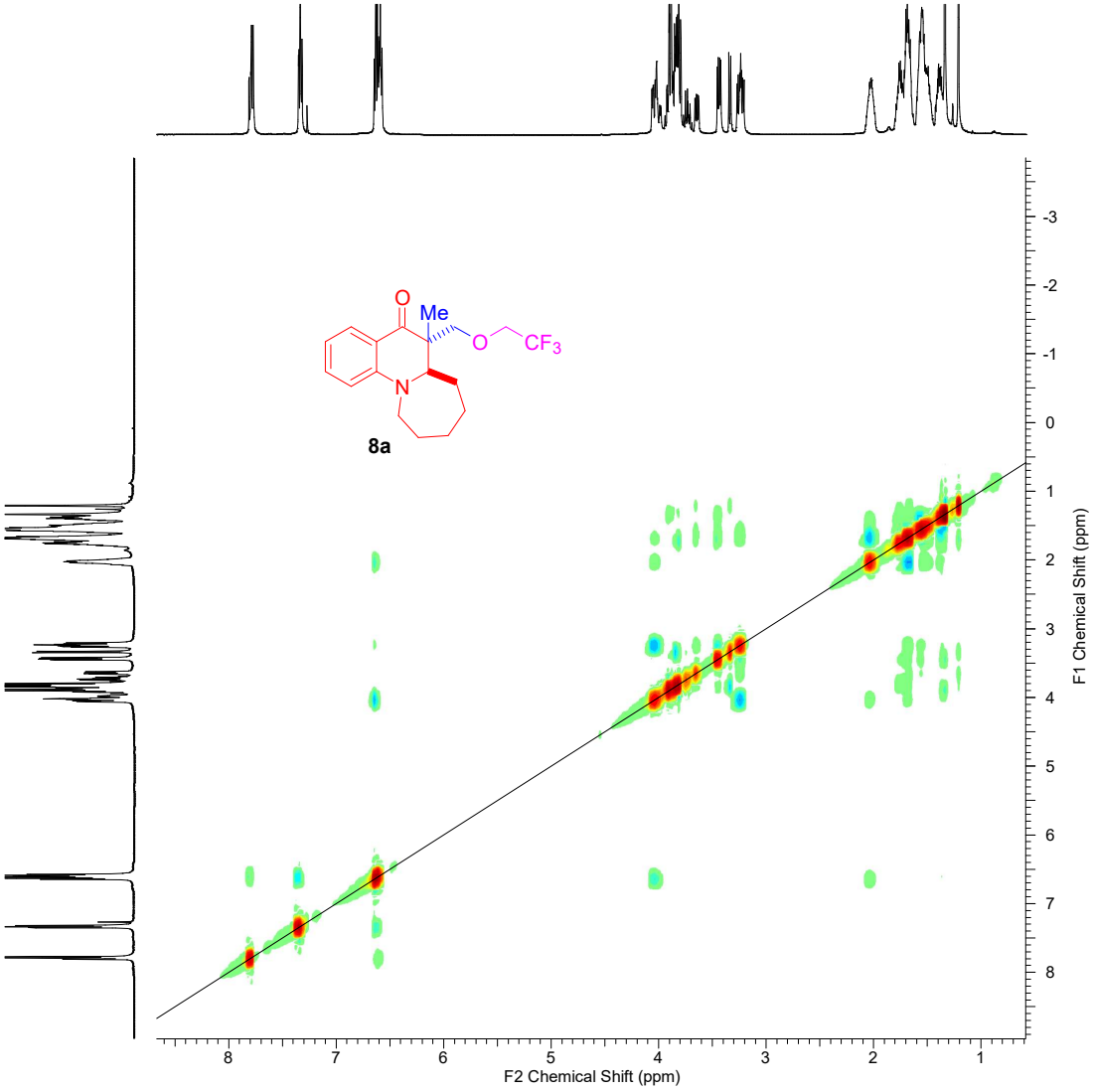




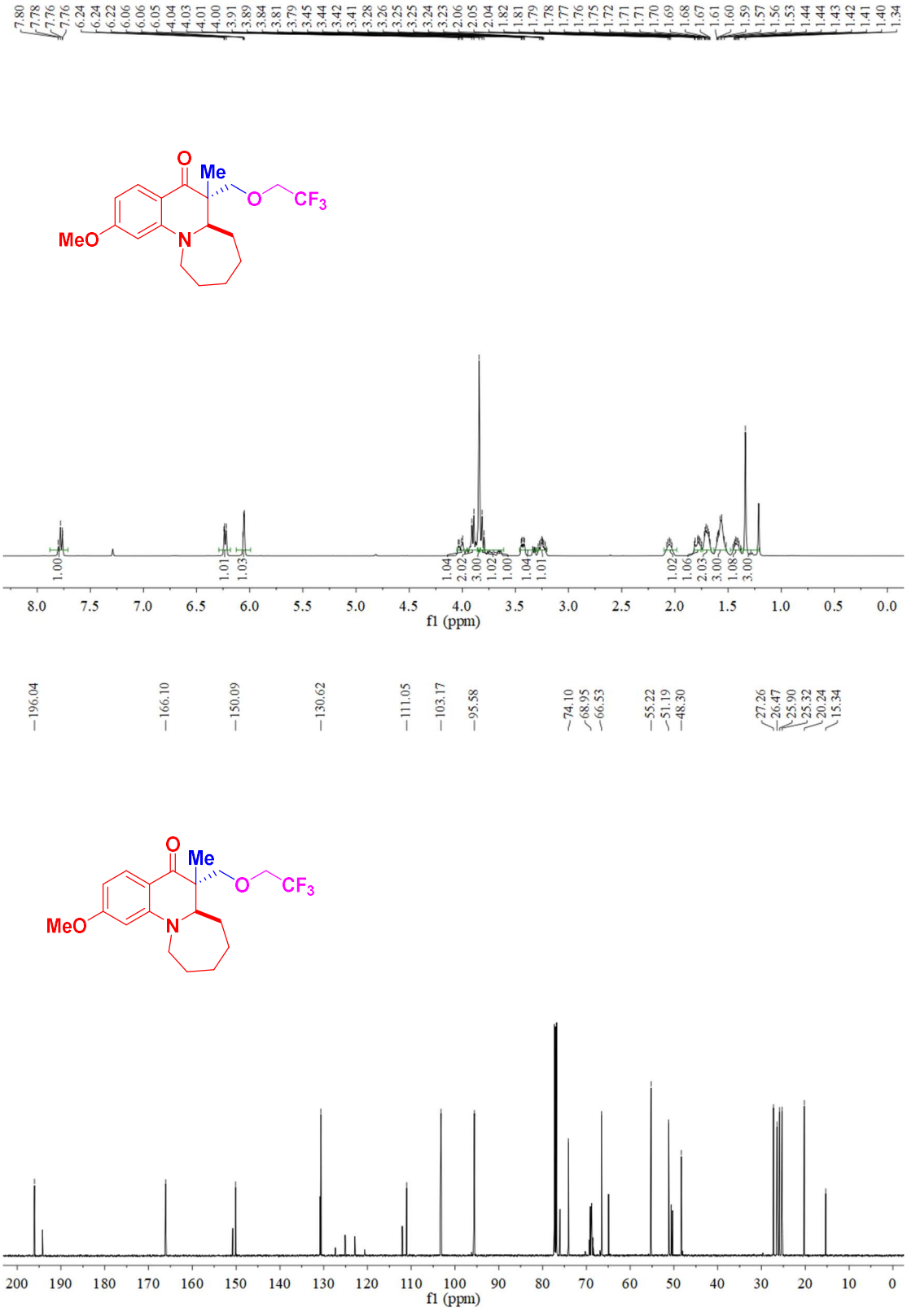




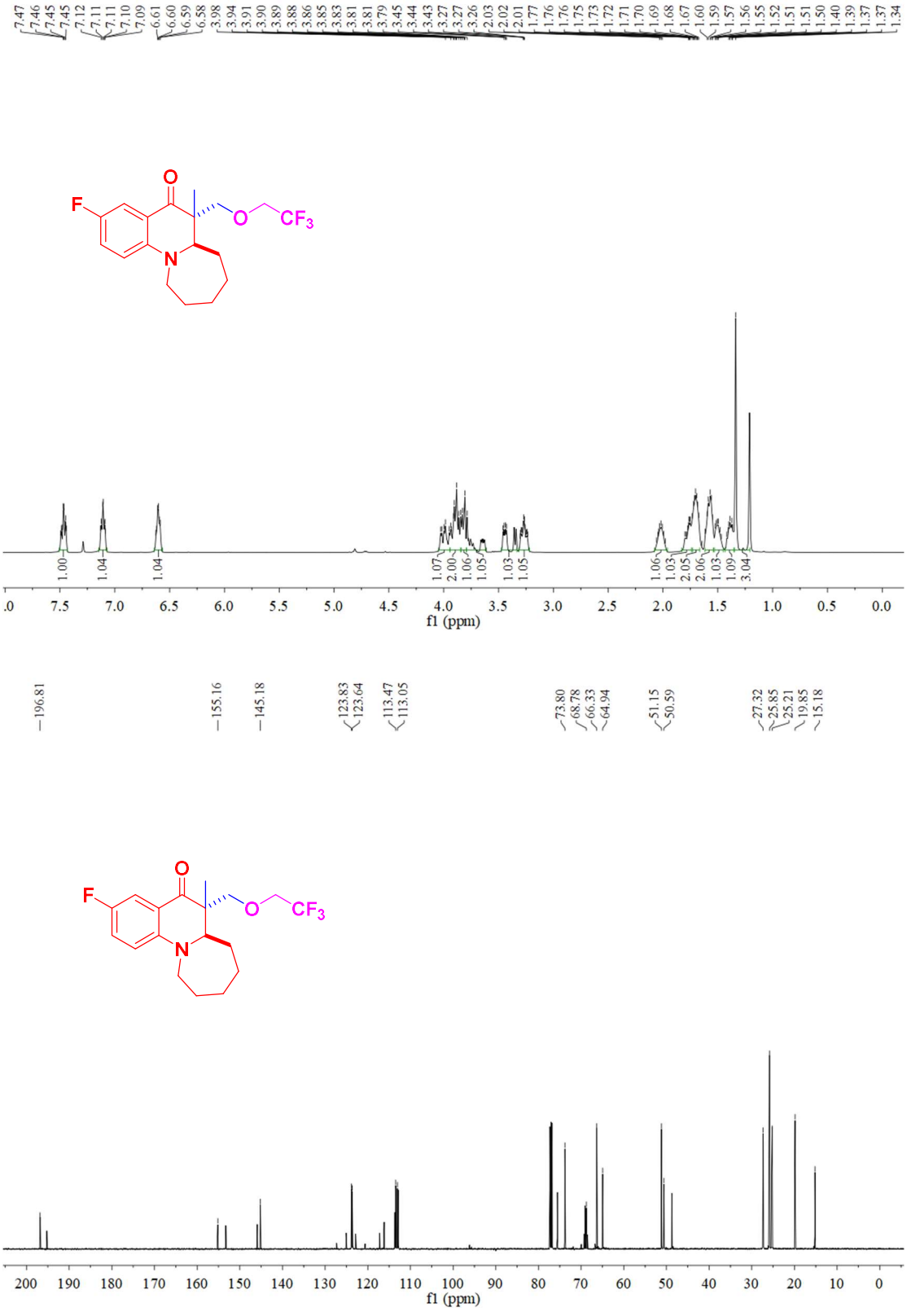
NOESY of 6-methyl-6-((2,2,2-trifluoroethoxy)methyl)-6a,7,8,9,10,11-hexahydroazepino- [1,2-a]quinolin-5(6H)-one (8a)



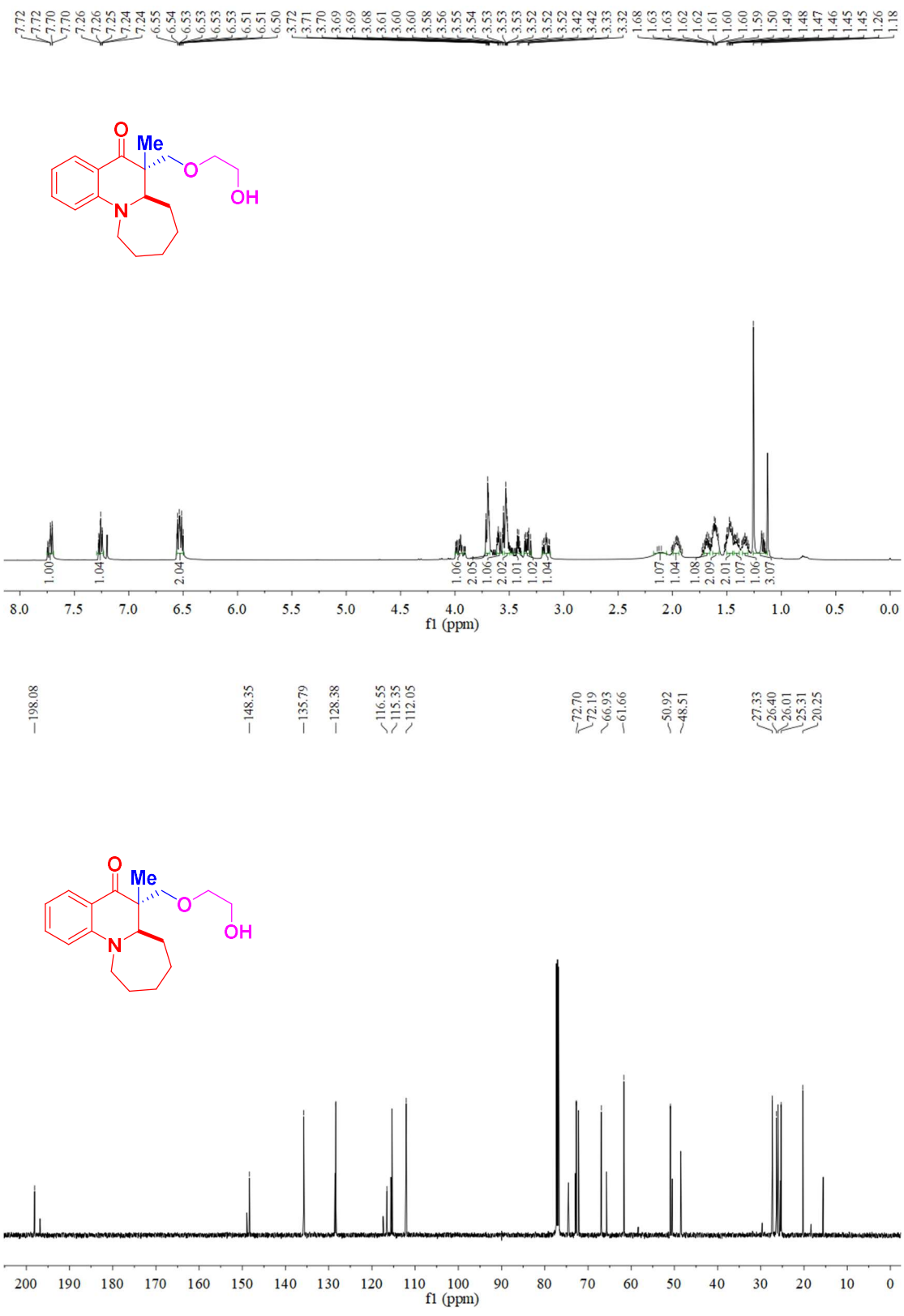
2-methoxy-6-methyl-6-((2,2,2-trifluoroethoxy)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a] quinolin-5(6H)-one (8b)



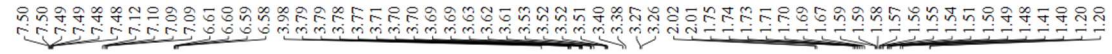
1-fluoro-6-methyl-6-((2,2,2-trifluoroethoxy)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8c)

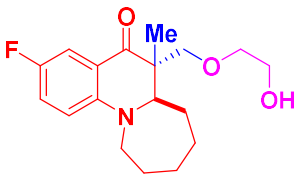


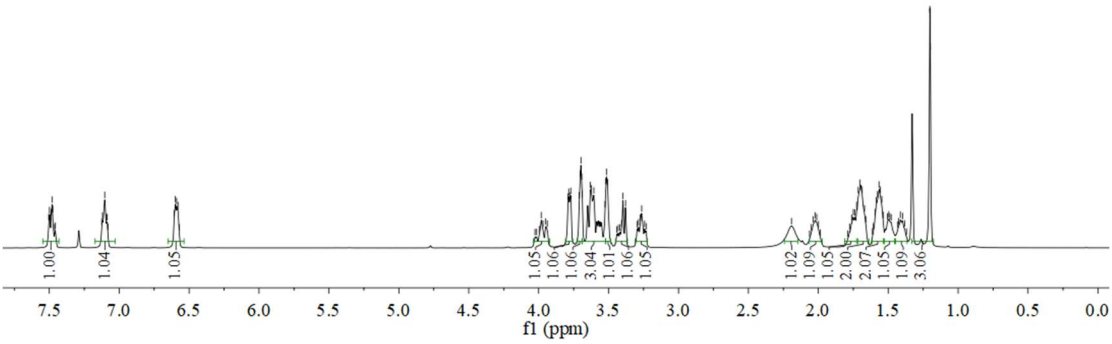
6-((2-hydroxyethoxy)methyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8d)

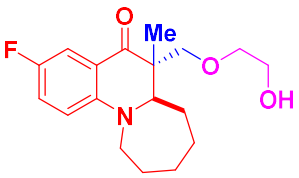


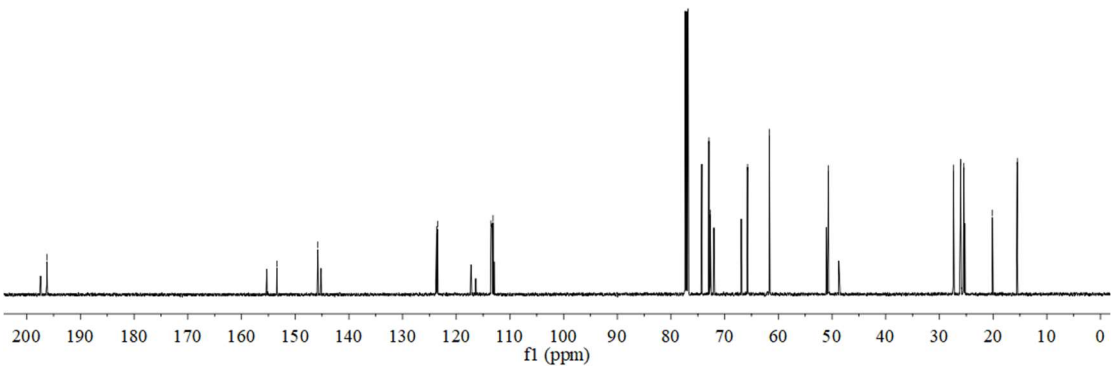
3-fluoro-6-((2-hydroxyethoxy)methyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8e)



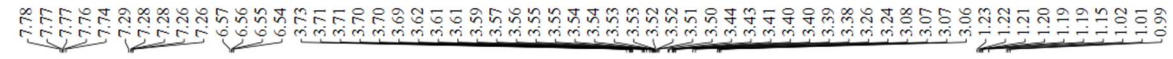


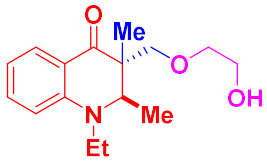


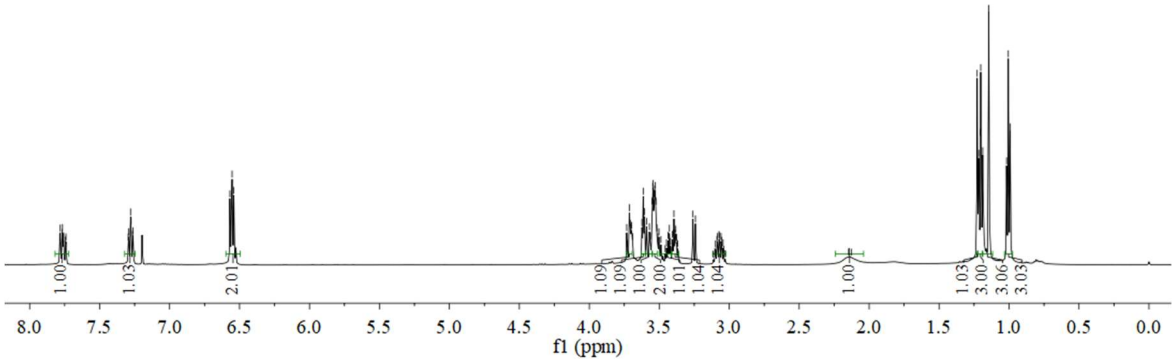


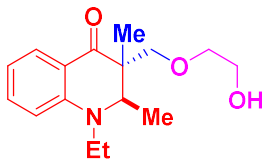


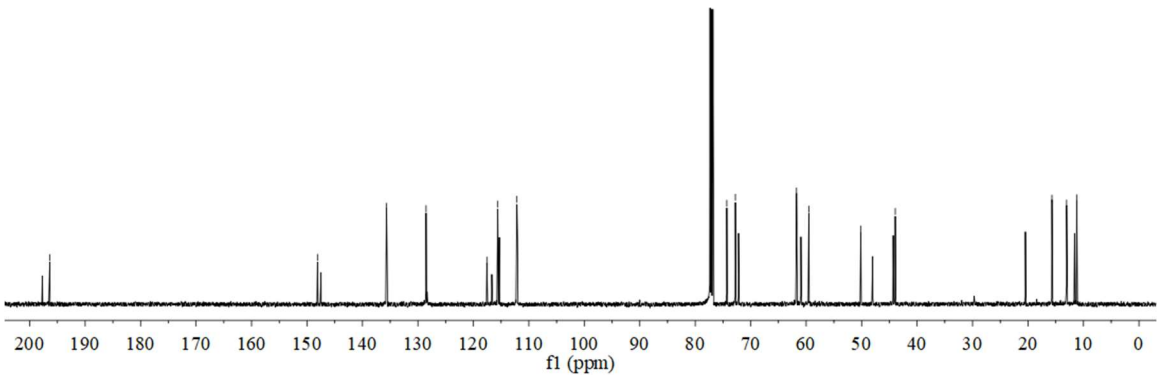
1-ethyl-3-((2-hydroxyethoxy)methyl)-2,3-dimethyl-2,3-dihydroquinolin-4(1H)-one (8f)



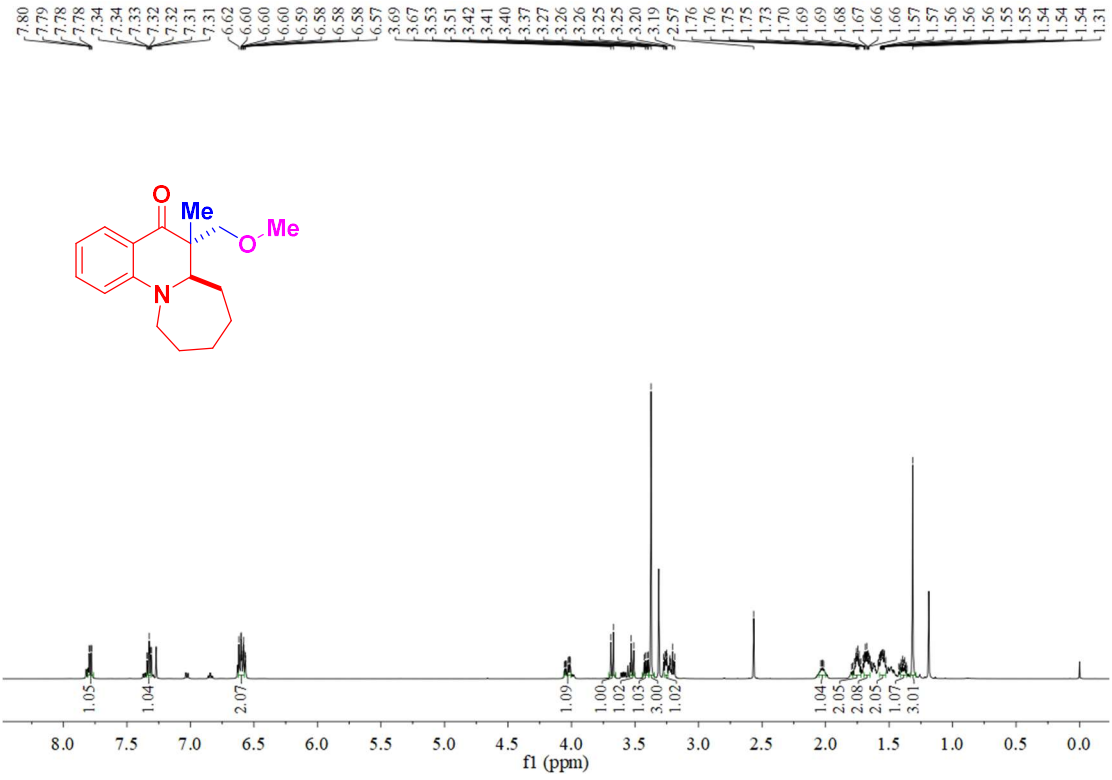


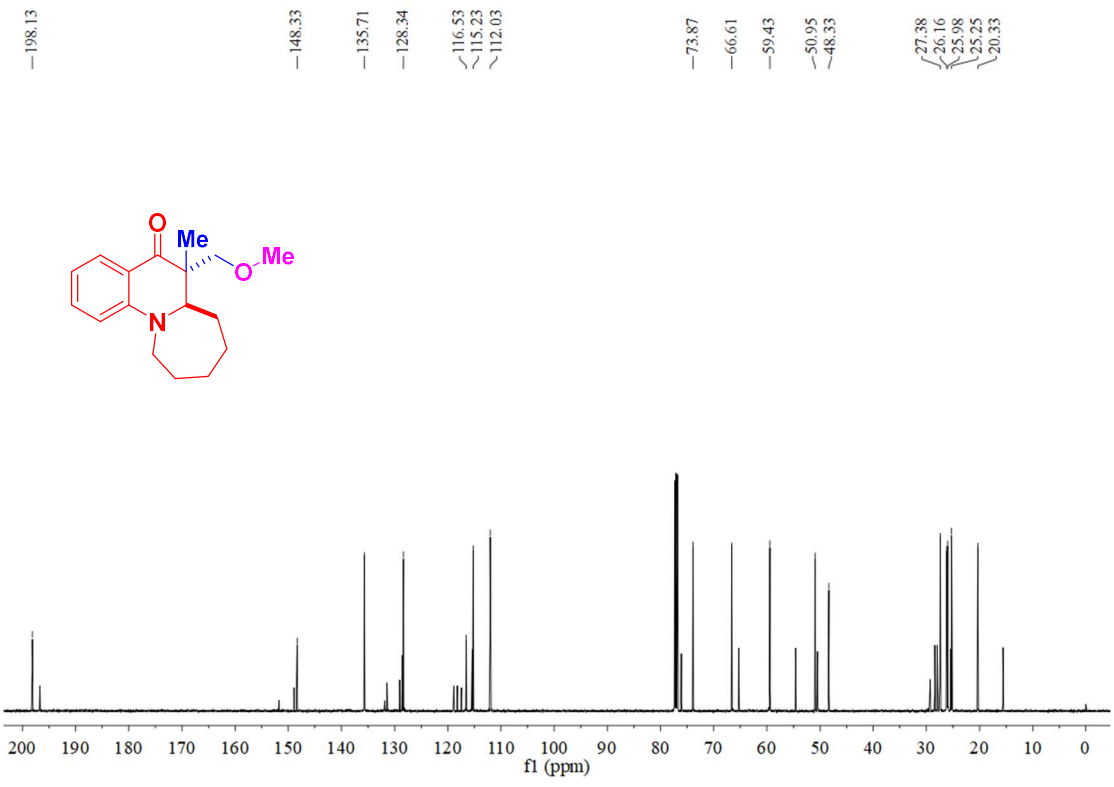




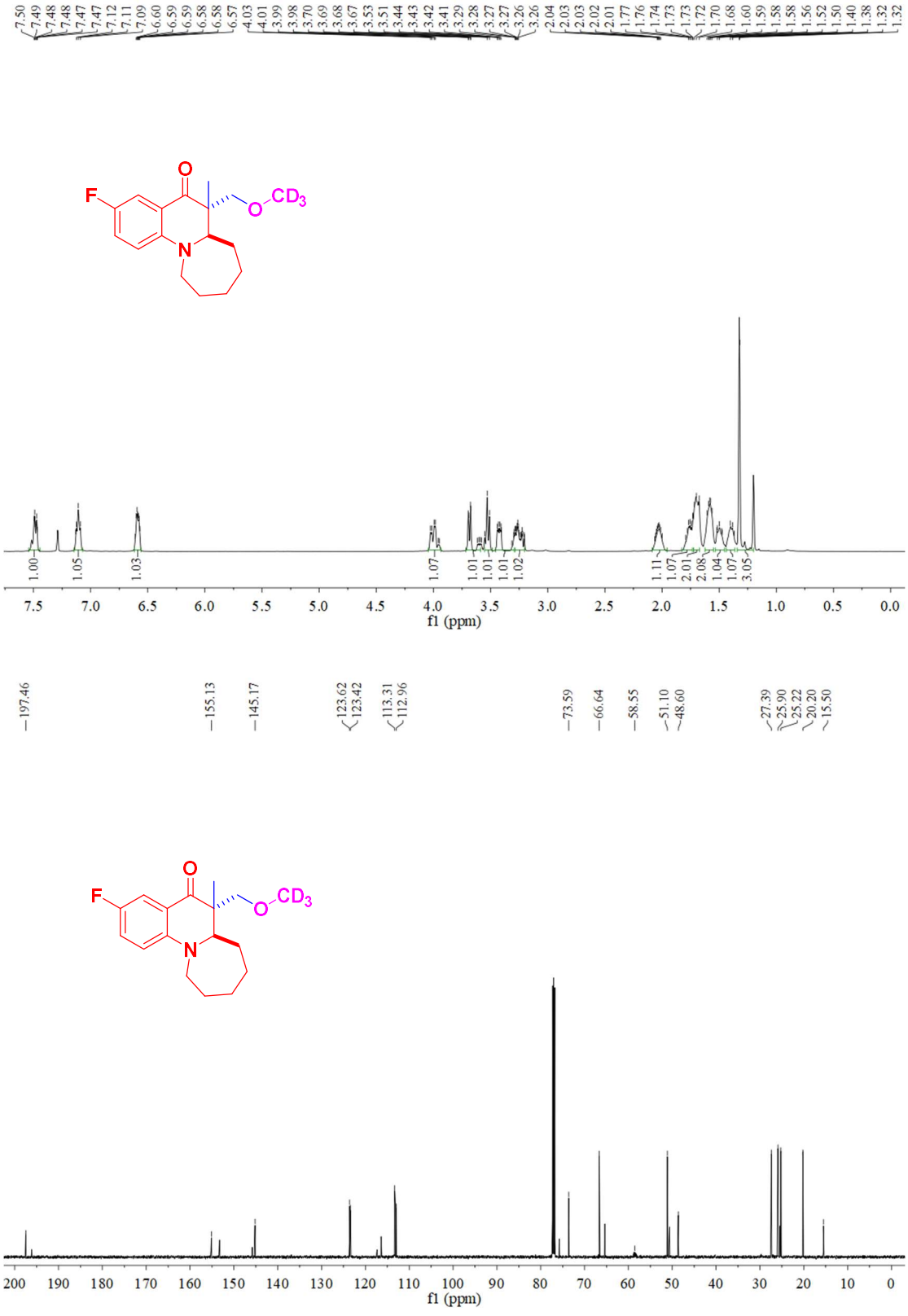


6-(methoxymethyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8g)

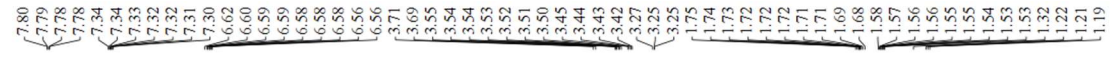


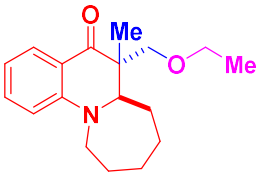


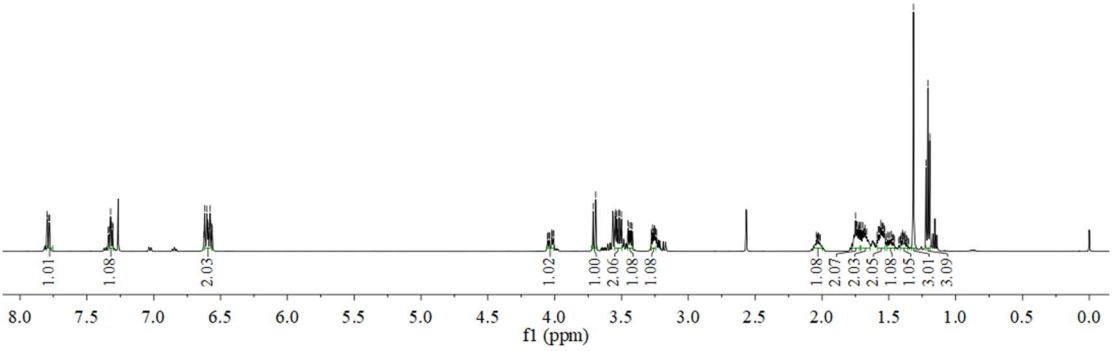
3-fluoro-6-((methoxy-d_3)methyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8h)

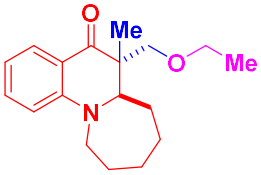


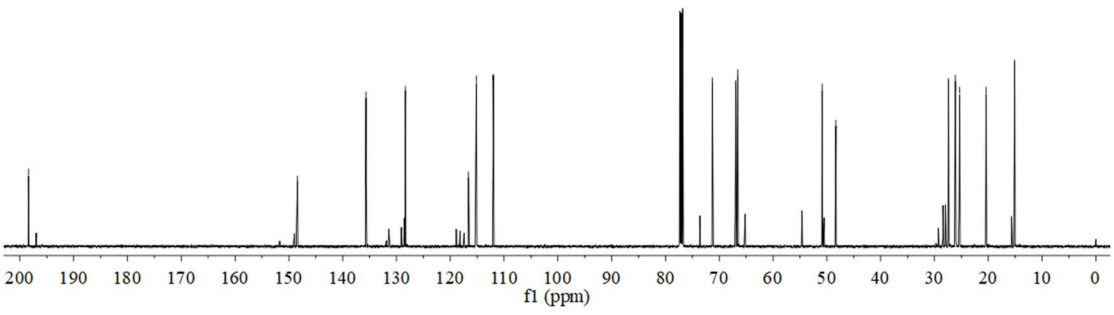
6-(ethoxymethyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8i)



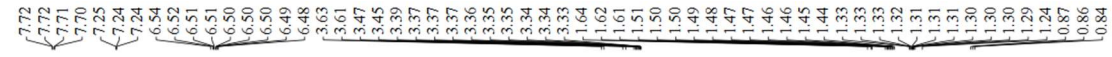


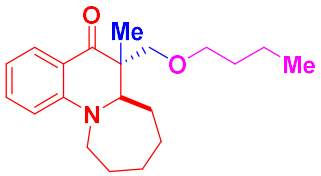


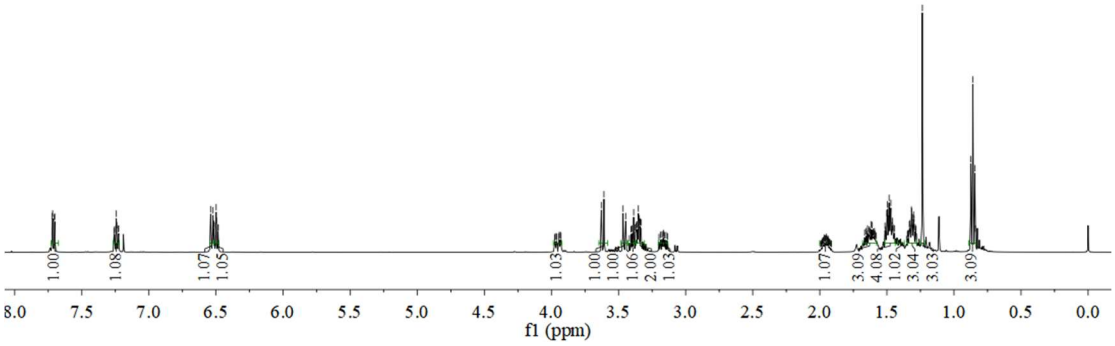


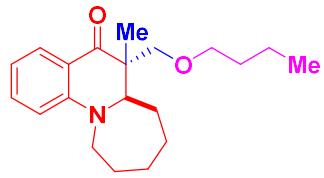


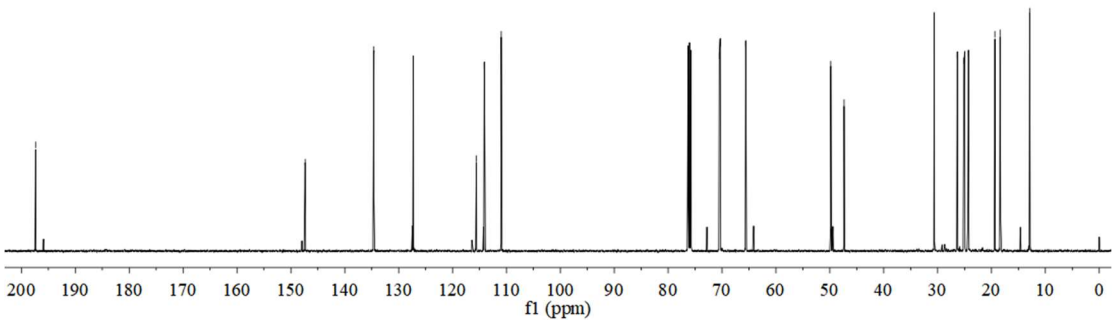
6-(butoxymethyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8j)



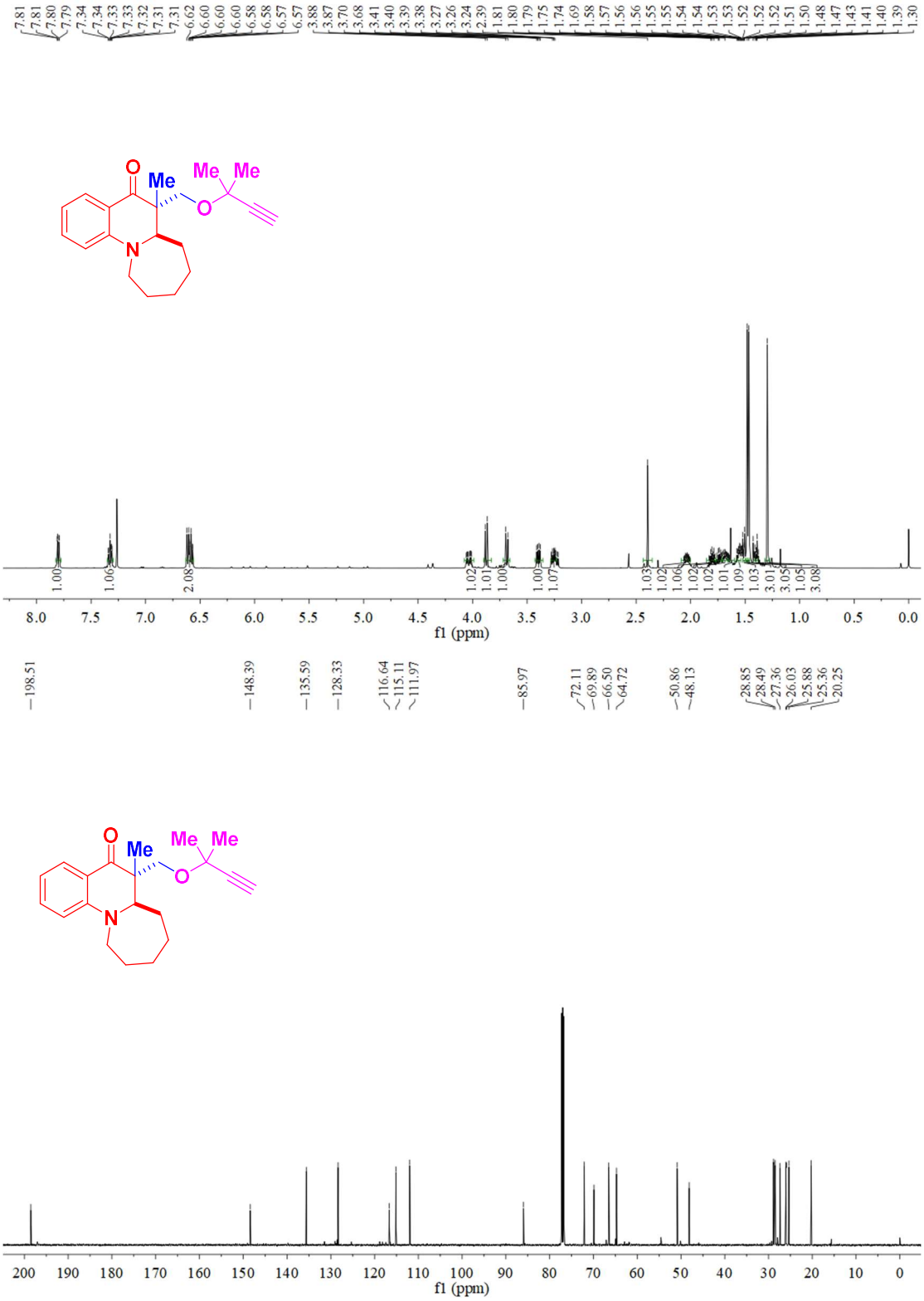




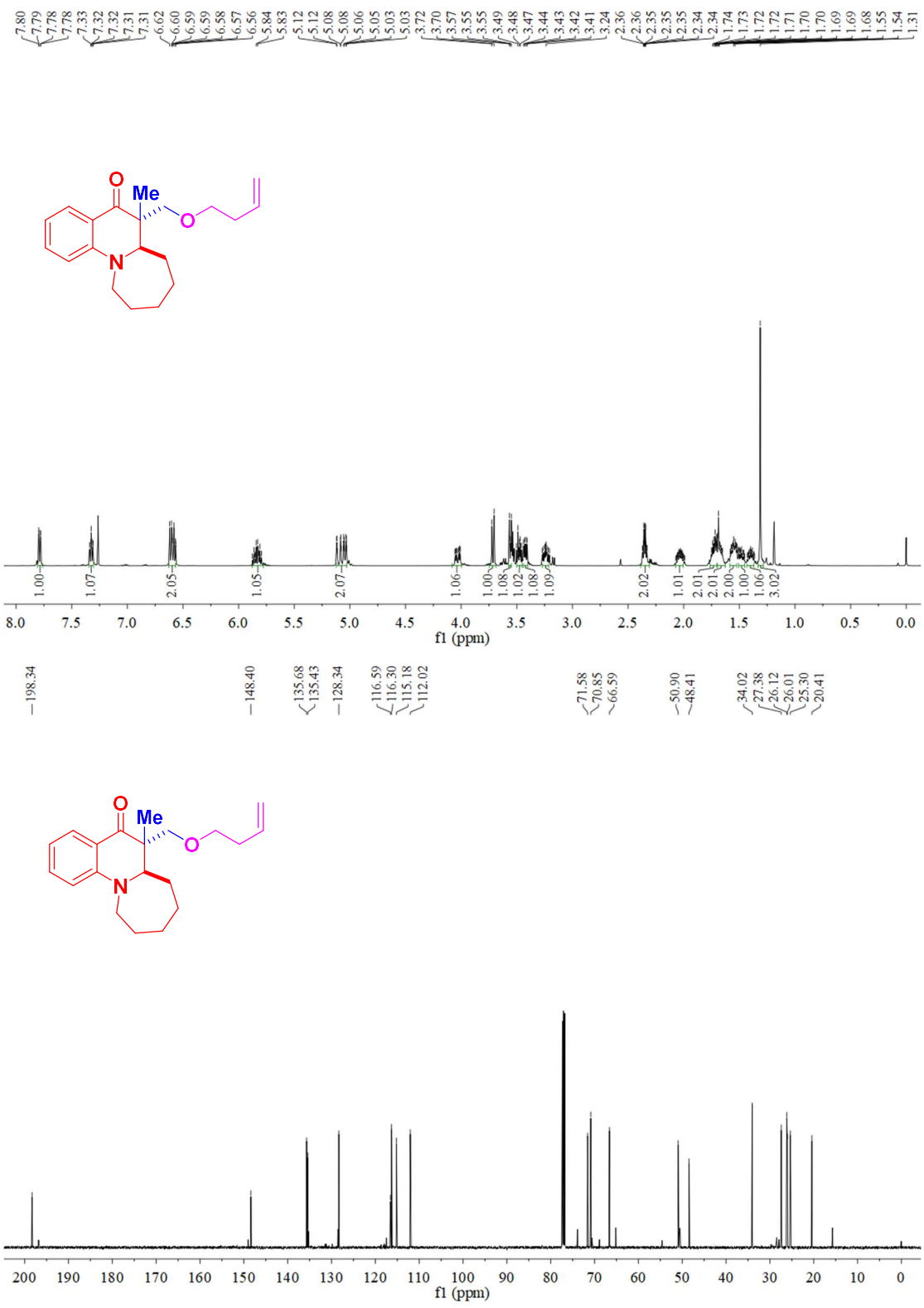




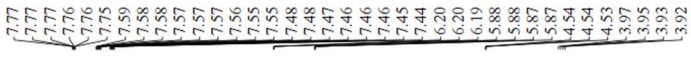
6-methyl-6-(((2-methylbut-3-yn-2-yl)oxy)methyl)-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8k)

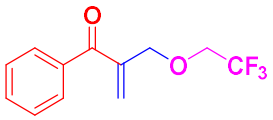


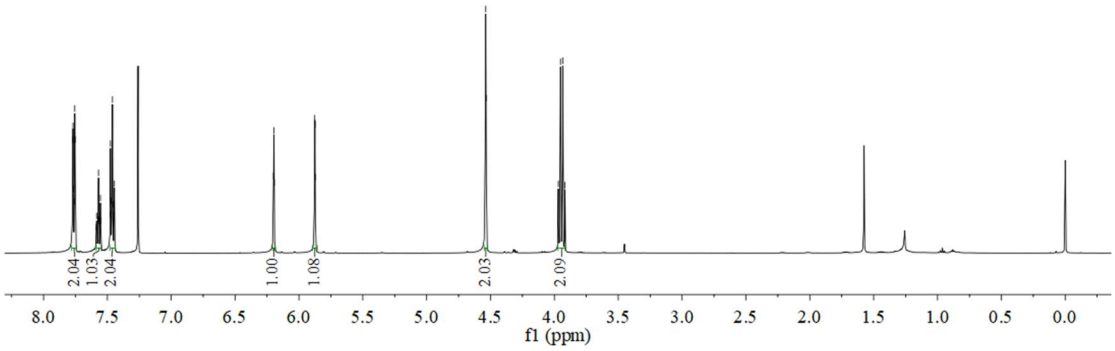
6-((but-3-en-1-yloxy)methyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (8l)

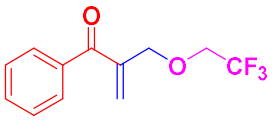


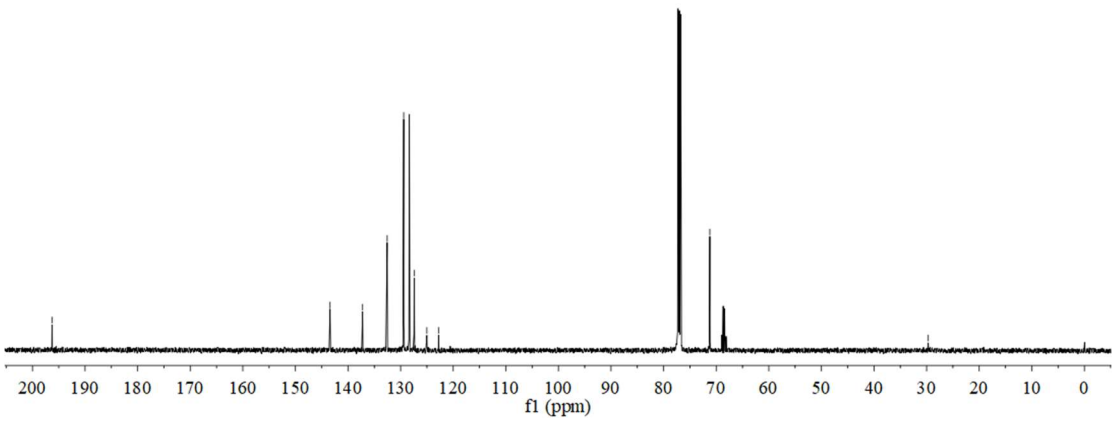
1-phenyl-2-((2,2,2-trifluoroethoxy)methyl)prop-2-en-1-one (10)



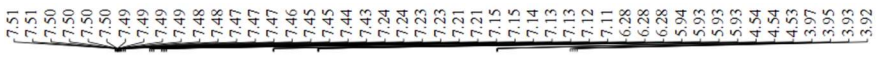


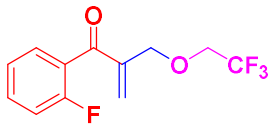


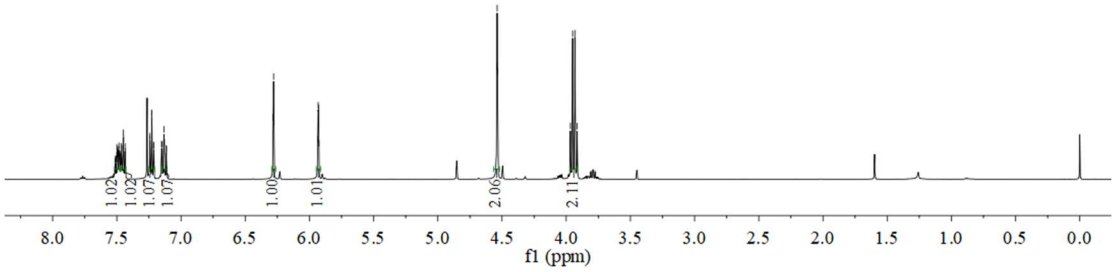


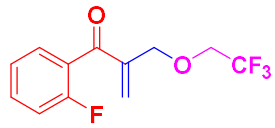


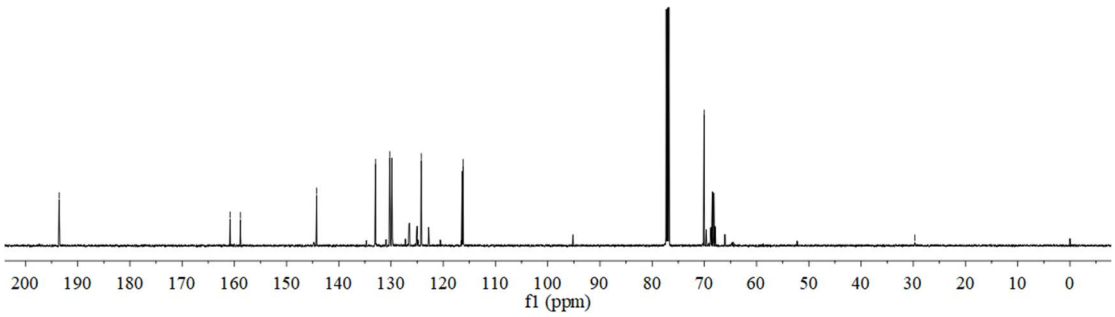
1-(2-fluorophenyl)-2-((2,2,2-trifluoroethoxy)methyl)prop-2-en-1-one (12)











6-(hydroxymethyl)-6-methyl-6a,7,8,9,10,11-hexahydroazepino[1,2-a]quinolin-5(6H)-one (13)