Supporting Information for:

Palladium-Catalyzed Markovnikov Hydroaminocarbonylation of 1,1-Disubstituted and 1,1,2-Trisubstituted Alkenes for Formation of Amides with Quaternary Carbon

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1. General information.

Chemicals

Chemicals were commercially purchased from Adamas-beta, Energy Chemical, Aladdin, etc, and directly used without further purification unless otherwise stated. PdCl₂, PdBr₂, PdI₂, Pd(PPh₃)₄ and Pd(PPh₃)₂Cl₂ were purchased from Adamas-beta. THF used in the reaction was purchased from Shanghai Titan Scientific Co., Ltd. (H₂O \leq 0.1%) and without further purification. Anhydrous THF used in mechanistic studies was distilled from sodium/benzophenone until the indicator had turned a persistent blue color. There is still contained 43 ppm of water in anhydrous THF according to *J. Org. Chem.* **2010**, *75*, 8351–8354.

Chromatography

Analytical thin-layer chromatography (TLC) was carried out with silica gel pre-coated glass plates (TLC-Silica gel GF254, coating thickness: 0.20-0.25 mm, particle size: 10-40 μ m) purchased from Xinnuo Chemical (Yantai, China). The TLC was visualized with a UV lamp (254 or 365 nm). Flash Column chromatography was carried out on silica gel (60 Å, 200-300 mesh) purchased from Xinnuo Chemicals (Yantai, China) with technical grade solvents as the eluent. All the yields referred to spectroscopically and chromatographically pure compounds.

Nuclear Magnetic Resonance (NMR) Spectroscopy

¹H NMR spectra were recorded on Bruker AVANCE III-400 instrument (400 MHz spectrometer). The analytical sample was dissolved in an appropriate deuterated solvent. The employed deuterated solvent and the measuring frequency are indicated in each ¹H NMR data. Chemical shifts are reported in parts per million (ppm) with the solvent resonance as the internal reference (CDCl₃ δ 7.26, d^6 -DMSO δ 2.50). The following abbreviations (or combinations thereof) were used to explain multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, b = broad. Coupling constants, J were reported in Hertz unit (Hz).

¹³C NMR spectra were recorded on Bruker AVANCE III - 400 instrument (101 MHz spectrometer). The employed deuterated solvent and the measuring frequency are both indicated in each ¹³C NMR data. Chemical shifts are reported in ppm with the solvent resonance as the internal reference (CDCl₃ δ 77.16). ¹⁹F NMR data were recorded on Bruker AVANCE III - 400 instrument (376 MHz spectrometer).

High Resolution Mass Spectrometry (HRMS)

HRMS were recorded on a liquid chromatography/quadrupole time-of-flight mass spectrometer (MicroTof-Q II mass spectrometer, Bruker Daltonics) using electrospray ionization-time of flight (ESI-TOF) at Instrumental Analysis Center of Northwest University. The calculated values are based on the most abundant isotope.

X-ray crystallography

X-ray crystallography was performed on a BRUKERSMA RTAPEXIICCD diffractometer at Instrumental Analysis Center of Northwest University.

2. Preparation of 1,1-disubstituted alkenes, and 1,1,2-trisubstituted alkenes

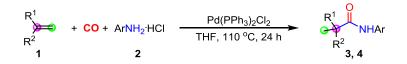
$$\begin{array}{c} O \\ Har \end{array} + Ph_3P^+MeBr \end{array} \xrightarrow{t'BuOK} Ar \\ \hline THF, rt \end{array}$$

To a 25 ml round bottomed flask were added methyl triphenylphosphonium bromide (7.5 mmol, 1.5 equiv) and ^{*t*}BuOK (7.5 mmol, 1.5 equiv). Adding 10 mL of dry THF under argon, the mixture was stirred at room temperature for 1 hour. After that diluted ketone (5 mmol, 1.0 equiv) in dry THF (3 mL) was added, then the reaction was stirred at room temperature for overnight. The mixture was diluted with CH_2Cl_2 (25 mL), washed with brine (3×15 mL), dried with Na_2SO_4 , filtered and concentrated in vacuum. The crude material was purified by column chromatography (hexanes as the eluent) to afford the 1,1-disubstituted alkenes.

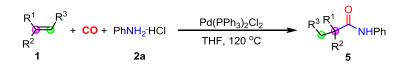
$$Ar + Ph_3P^+EtBr^- + THF, rt + Ph_3P^+EtBr^- + THF, rt + Ph_3P^+EtBr^- + Ph_3P^+ + Ph_3P^- +$$

To a 25 ml round bottomed flask were added ethyl triphenylphosphonium bromide (7.5 mmol, 1.5 equiv) and ^{*t*}BuOK (7.5 mmol, 1.5 equiv). Adding 10 mL of dry THF under argon, the mixture was stirred at room temperature for 1 hour. After that diluted ketone (5 mmol, 1.0 equiv) in dry THF (3 mL) was added, then the reaction was stirred at room temperature for overnight. The mixture was diluted with CH_2Cl_2 (25 mL), washed with brine (3×15 mL), dried with Na_2SO_4 , filtered and concentrated in vacuum. The crude material was purified by column chromatography (hexanes as the eluent) to afford the 1,1,2-trisubstituted alkenes.

3. Typical procedure for the palladium-catalyzed Markovnikov hydroaminocarbonylation



For Table 2: A mixture of 1,1-disubstituted alkenes 1 (0.24 mmol, 1.2 equiv), aniline hydrochloride salts 2 (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivities were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the product **3** and **4**.



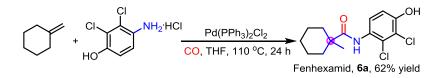
For Table 3: A mixture of 1,1,2-trisubstituted alkenes 1 (0.24 mmol, 1.2 equiv), aniline hydrochloride salt 2a (0.2 mmol, 1.0 equiv), Pd (PPh₃)₂Cl₂ (0.006 mmol, 3 mol%), and THF (0.3 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 65 atm of CO. The reaction mixture in autoclave was reacted at 120 °C for 96-144 hours without stirring. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivities were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the products 5.

Notably, we found that the stirring played an important role in the reaction. Only trace of product was observed when the reaction was stirring at 500 rpm (lots of palladium black formed, as following Figure, right). However, the reaction goes well when it was performed without stirring (as following Figure, left). The detailed mechanism remains unclear.

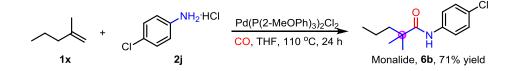


For left reaction, without stirring; for right reaction, stirring at 500 rpm

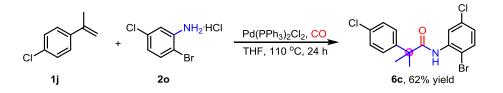
4. Synthetic applications of the reaction



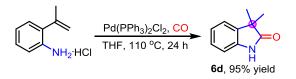
of 1-methylenecyclohexane (0.24)А mixture mmol. 1.2 equiv), 2,3-dichloro-4-aminophenol hydrochloride (0.2 mmol, 1.0 equiv), Pd(PPh₃)₂Cl₂ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivity (b/l=95:5) were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 6/1) to give the fenhexamid **6a** in 62% yield.



A mixture of **1x** (0.24 mmol, 1.2 equiv), **2j** (0.2 mmol, 1.0 equiv), Pd(P(2-MeOPh)₃)₂Cl₂ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivity (b:l=95:5) were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the **6b** in 71% yield.



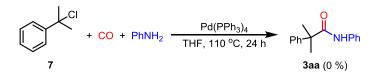
A mixture of **1j** (0.24 mmol, 1.2 equiv), **2o** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivity (b/l=97:3) were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the **6c** in 62% yield.



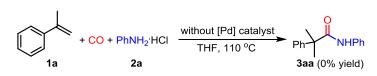
A mixture of 2-(prop-1-en-2-yl)aniline hydrochloride (0.20 mmol, 1.0 equiv), Pd(PPh₃)₂Cl₂ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. The regioselectivity (b:l>99:1) were determined by GC-MS analysis of the crude products. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the **6d** in 95% yield.

5. Mechanistic studies

5.1 Control experiments (Scheme 3 in maintext)



A mixture of (2-chloropropan-2-yl)benzene **7** (0.24 mmol, 1.2 equiv), aniline (0.2 mmol, 1.0 equiv), Pd(PPh₃)₄ (0.01 mmol, 5 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 $^{\circ}$ C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. No desired **3aa** was detected by GC-MS.



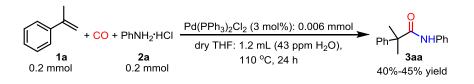
A mixture of α -methyl styrene **1a** (0.24 mmol, 1.2 equiv), aniline hydrochloride salt **2a** (0.2 mmol, 1.0 equiv), THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. No desired **3aa** was detected by GC-MS.

$$\begin{array}{c} & & & \\ & & & \\ & & & \\ & & & \\ & & & 1a \end{array} + \begin{array}{c} & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & & \\ & & & \\ & & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & &$$

A mixture of α -methyl styrene **1a** (0.24 mmol, 1.2 equiv), phenylcarbamic chloride **8** (0.2 mmol, 1.0 equiv), Pd(PPh₃)₄ (0.01 mmol, 5 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. No desired **3aa** was detected by GC-MS.

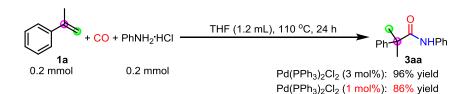
5.2 Anhydrous studies

Anhydrious THF was distilled from sodium/benzophenone once the indicator had turned a persistent blue color. There is still contained 43 ppm of water in anhydrous THF according to *J. Org. Chem.* **2010**, *75*, 8351–8354. Before they were used in the reaction, anilines hydrochloride, palladium catalyst, glass tube and autoclave were dried in a drying box at 120 °C for 3h.



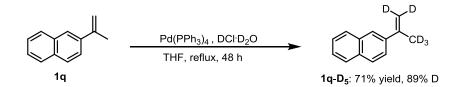
A mixture of **1a** (0.24 mmol, 1.2 equiv), **2a** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and anhydrious THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the product **3aa**.

Above anhydrous reaction was run 3 times, 40-45% yield of **3aa** was obtained. There is still 0.003 mmol water in 1.2 mL anhydrous THF (43 ppm), which is 0.5 equiv for Pd(PPh₃)₂Cl₂ catalyst (3 mol%). Further control experiment in the presence of 1 mol% of Pd(PPh₃)₂Cl₂ catalyst in 1.2 mL commercially purchased THF resulted in 86% yield of **3aa**. These experiments suggested water played an important role in the reaction.



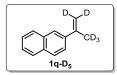
5.3 Deuterium-Labeling studies

5.3.1 Preparation of 1q-D₅



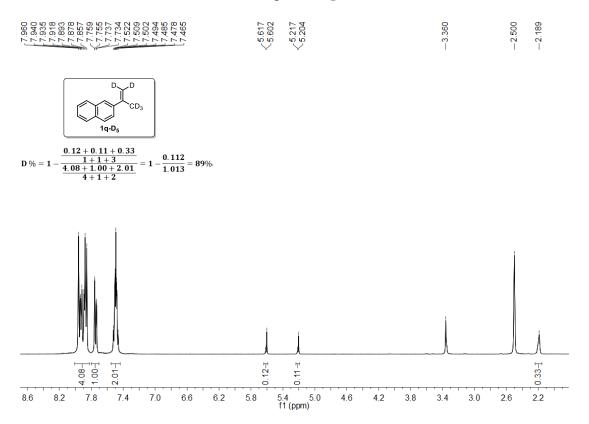
A mixture of 2-isopropenylnaphthalene 1q (0.2 mmol, 1.0 equiv), DCl⁻D₂O (93.6 mg, 20.0 equiv), Pd(PPh₃)₄ (0.006 mmol, 3 mol%), and anhydrous THF (1.2 mL) were added into a round bottomed flask which was reflux under argon in an oil bath

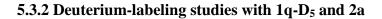
for 48 hours. After completion, the reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 100/1) to give the **1q-D**₅ in 71% yield with 89% D.

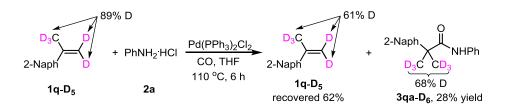


1q-D₅: ¹H NMR (400 MHz, d^6 -DMSO) δ 7.96-7.86 (m, 4H), 7.75 (dd, J = 8.8, 1.4 Hz, 1H), 7.52-7.47 (m, 2H), 5.61 (d, J = 6.0 Hz, 0.12 H), 5.21 (d, J = 5.2 Hz, 0.11 H), 2.19 (s, 0.33 H).

¹H NMR (400 MHz, d^6 -DMSO) of compound **1q-D**₅

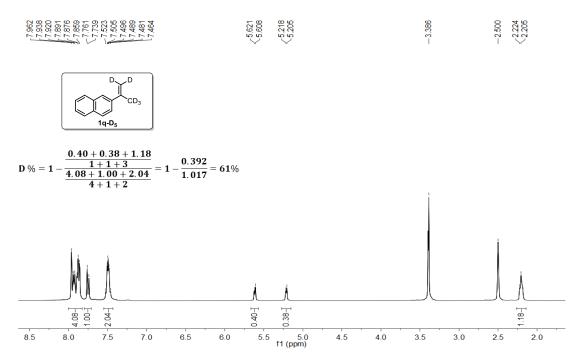




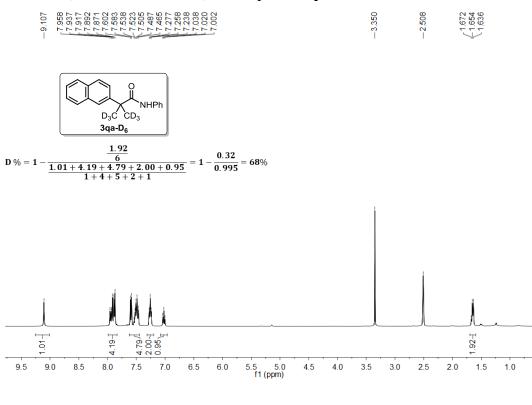


A mixture of $1q-D_5$ (0.2 mmol, 1.0 equiv, 89% D), 2a (0.2 mmol, 1.0 equiv), Pd(PPh₃)₂Cl₂ (0.006 mmol, 3 mol%), and anhydrous THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 6 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the product $3qa-D_6$ in 28% yield (68 atom % D in $3qa-D_6$ was determined by ¹H NMR), and the $1q-D_5$ was recovered in 62% yield (61 atom % D in $1q-D_5$ was determined by ¹H NMR).

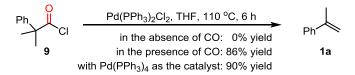
¹H NMR (400 MHz, d^6 -DMSO) of **1q-D**₅



¹H NMR (400 MHz, d^6 -DMSO) of compound **3qa-D**₆



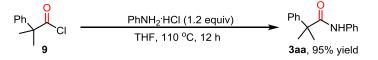
5.4 Control experiments



The 2-methyl-2-phenylpropanoyl chloride **9** (0.2 mmol, 1.0 equiv), $Pd(PPh_3)_2Cl_2$ (0.006 mmol, 3 mol%), and anhydrous THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with Ar for three times in a well-ventilated fume hood, and then pressurized to 10 atm of Ar. The reaction mixture in autoclave was stirred at 110 °C for 6 hours under Ar. After completion, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of Ar. The alkene **1a** was not observed.

When the autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The alkene **1a** was obtained in 86% yield.

When $Pd(PPh_3)_4$ was used as catalyst, the autoclave was evacuated and backfilled with Ar for three times, and then pressurized to 10 atm of Ar. After reaction, the **1a** was obtained in 90% yield.



A mixture of 2-methyl-2-phenylpropanoyl chloride **9** (0.20 mmol, 1.0 equiv), aniline hydrochloride salt **2a** (0.24 mmol, 1.2 equiv) and anhydrous THF (1.2 mL) were added to a 10 ml round bottomed flask under argon, the mixture was stirred at $110 \,^{\circ}$ C for 12 hours. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the **3aa** in 95% yield.

5.5 Hammett plot analysis

Ph + ArNH₂·HCI / PhNH₂·HCI
$$\frac{[Pd]/L, CO}{THF, 110 °C}$$
 Ph NHAr + Ph NHPh
1a $2x/2a$ 3-x-a 3aa

A mixture of α -methyl styrene **1a** (0.2 mmol, 1.0 equiv), ArNH₂HCl **2x** (0.2 mmol, 1.0 equiv), PhNH₂.HCl **2a** (0.2 mmol, 1.0 equiv), PdCl₂(PPh₃)₂ (0.006 mmol, 3 mol%), and THF (1.2 mL) were added into a glass tube which was placed in an autoclave. The autoclave was evacuated and backfilled with CO for three times in a well-ventilated fume hood, and then pressurized to 45 atm of CO. The reaction mixture in autoclave was stirred at 110 °C for 24 hours. After that, the autoclave was removed from the oil bath and cooled to room temperature prior to the release of excess carbon monoxide. Then the corresponding reaction mixture was purified by flash column chromatography on a silica gel column (petroleum ether/ethyl acetate = 10/1) to give the mixture products. The ratio of different products was determined by the ¹H NMR analysis. See following table.

ArNH ₂ ⁻ HCl	σ	Conv. of 1a	Ratio of Y_{3-x-a} : Y_{3aa}	k _x /k _H	log (k _x /k _H)
<i>p</i> -OMe	-0.268	86%	25% : 61%	0.41	-0.387
<i>p</i> -Me	-0.170	82%	28%:54%	0.51	-0.292
p-Cl	0.227	77%	47% : 30%	1.57	0.196
<i>p</i> -Br	0.232	83%	51% : 32%	1.59	0.201

Figure S1 Hammett plot. The conversion of 1a was calculated based on mixture products, the ratio of Y_{3-x-a}/Y_{3aa} was determined by ¹H NMR.

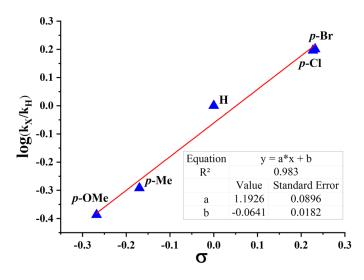
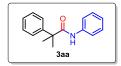


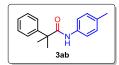
Figure S2. Hammett plot for the reaction using *para*-substituted anilines hydrochloride. Logarithm of the ratio of rate constant $(\log(k_x/k_H)$ versus σ p for the hydroaminocarbonylation reaction of *p*-substituted anilines hydrochloride with α -methyl styrene.

6. Characterization data of products



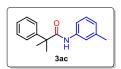
2-methyl-N,2-diphenylpropanamide (3aa)

Yield = 96%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.45-7.37 (m, 4H), 7.36-7.29 (m, 3H), 7.26-7.22 (m, 2H), 7.06-7.02 (m 1H), 6.81 (s, 1H), 1.66 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.6, 144.7, 138.1, 128.9, 129.0, 127.5, 126.6, 124.2, 119.8, 48.1, 27.1. HRMS calcd. (ESI) m/z for C₁₆H₁₇NNaO [M+Na]⁺: 262.1202, found: 262.1202.



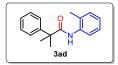
2-methyl-2-phenyl-*N*-(*p*-tolyl)propanamide (3ab)

Yield = 85%, b/l = 98:2; ¹H NMR (400 MHz, CDCl₃) δ 7.45-7.37 (m, 4H), 7.30 (t, *J* = 7.0 Hz, 1H), 7.23 (d, *J* = 8.4 Hz, 2H), 7.05 (d, *J* = 8.4 Hz, 2H), 6.77 (s, 1H), 2.26 (s, 3H), 1.65 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.5, 144.8, 135.5, 133.8, 129.4, 129.0, 127.4, 126.5, 119.8, 48.0, 27.1, 20.9. HRMS calcd (ESI) m/z for C₁₇H₁₉NNaO [M+Na]⁺: 273.1358, found: 276.1359.



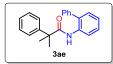
2-methyl-2-phenyl-*N*-(*m*-tolyl)propanamide (3ac)

Yield = 92%, b/l = 98:2; ¹H NMR (400 MHz, CDCl₃) δ 7.45-7.37 (m, 4H), 7.33-7.28 (m, 1H), 7.23 (d, *J* = 1.6 Hz, 1H), 7.13-7.11 (m, 2H), 6.87-6.85 (m, 1H), 6.78 (s, 1H), 2.28 (s, 3H), 1.65 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.6, 144.7, 138.9, 138.0, 129.1, 128.8, 127.4, 126.5, 125.0, 120.4, 116.8, 48.1, 27.1, 21.5. HRMS calcd. (ESI) m/z for C₁₇H₁₉NNaO [M+Na]⁺: 273.1358, found: 273.1358.



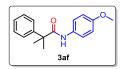
2-methyl-2-phenyl-*N*-(*o*-tolyl)propanamide (3ad)

Yield = 76%, b/l = 97:3, ¹H NMR (400 MHz, CDCl₃) δ 7.87 (d, *J* = 8.0 Hz, 1H), 7.51-7.48 (m, 2H), 7.44-7.40 (m, 2H), 7.34-7.31 (m, 1H), 7.17 (t, *J* = 7.6 Hz, 1H), 7.05 (d, *J* = 7.2 Hz, 1H), 6.99 (t, *J* = 7.6 Hz, 1H), 6.69 (s, 1H), 1.78 (s, 3H), 1.70 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.7, 144.8, 136.0, 130.3, 129.1, 128.0, 127.6, 126.9, 126.8, 124.7, 121.9, 48.2, 27.0, 17.1. HRMS calcd (ESI) m/z for C₁₇H₁₉NO: [M+Na]⁺ 273.1358, found: 276.1353.



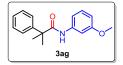
N-([1,1'-biphenyl]-2-yl)-2-methyl-2-phenylpropanamide (3ae)

Yield = 91%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 8.40 (d, *J* = 8.4 Hz, 1H), 7.36-7.26 (m, 2H), 7.25-7.17 (m, 7H), 7.13-7.07 (m, 2H),7.01 (s, 1H), 6.97-6.94(m, 2H) 1.51 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.4, 144.0, 137.7, 135.3, 131.9, 130.0 129.0, 128.9, 128.8, 128.5, 127.6, 127.2, 126.2, 123.8, 120.3, 48.1, 26.8. HRMS calcd. (ESI) m/z for C₂₂H₂₁NNaO [M+Na]⁺: 338.1515, found: 338.1515.



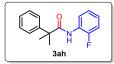
N-(4-methoxyphenyl)-2-methyl-2-phenylpropanamide (3af)

Yield = 67%, b/l > 99:1; ¹H NMR (400 MHz, CDCl₃) δ 7.50-7.37 (m, 4H), 7.33-7.29 (m, 1H), 7.28-7.14 (m, 2H), 6.83-6.76 (m, 2H), 6.71 (s, 1H), 3.76 (s, 3H), 1.66 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.6, 156.4, 144.9, 131.2, 129.1, 127.5, 126.6, 121.7, 114.1, 55.6, 48.0, 27.2. HRMS calcd. (ESI) m/z for C₁₇H₁₉NNaO₂ [M+Na]⁺: 292.1308, found: 292.1311.



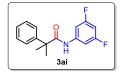
N-(3-methoxyphenyl)-2-methyl-2-phenylpropanamide (3ag)

Yield = 83%, b/l = 96:4, ¹H NMR (400 MHz, CDCl₃) δ 7.45-7.37 (m, 4H), 7.31 (t, *J* = 7.0 Hz, 1H), 7.24 (t, *J* = 2.2 Hz, 1H), 7.11 (t, *J* = 8.2 Hz, 1H), 6.83 (s, 1H), 6.74-6.71 (m, 1H), 6.62-6.59 (m, 1H), 3.76 (s, 3H), 1.66 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.7, 160.2, 144.6, 139.3, 129.5, 129.1, 127.5, 126.5, 111.7, 110.3, 105.2, 55.3, 48.2, 27.1. HRMS calcd. (ESI) m/z for C₁₇H₁₉NNaO₂ [M+Na]⁺: 292.1308, found: 292.1312.



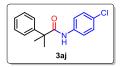
N-(2-fluorophenyl)-2-methyl-2-phenylpropanamide (3ah)

Yield = 90%, b/l = 90:10, ¹H NMR (400 MHz, CDCl₃) δ 8.30-8.25 (m, 1H), 7.47-7.44 (m, 2H), 7.42-7.38 (m, 2H), 7.32-7.29 (m, 1H), 7.13-7.06 (m, 2H), 6.99-6.93 (m, 2H), 1.68 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.8, 153.7, 151.3, 144.2, 129.1, 127.6, 126.5, 124.6 (d, *J* = 3.3 Hz), 124.2 (d, *J* = 7.6 Hz), 121.6, 114.7 (d, *J* = 19.1 Hz), 48.3, 27.0; ¹⁹F NMR (376 MHz, CDCl₃) δ -114.9. HRMS calcd. (ESI) m/z for C₁₆H₁₆FNNaO [M+Na]⁺: 280.1108, found: 280.1119.



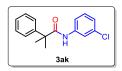
N-(3,5-difluorophenyl)-2-methyl-2-phenylpropanamide (3ai)

Yield = 88%, b/l = 95:5, ¹H NMR (400 MHz, CDCl₃) δ 7.41-7.29 (m, 5H), 7.00-6.95 (m, 3H), 6.49-6.44 (m, 1H), 1.64 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.9, 163.1 (dd, *J* = 244.7, 14.6 Hz), 144.0, 140.2 (t, *J* = 13.3 Hz), 129.2, 127.7, 126.4, 102.7 (dd, *J* = 20.6, 8.4 Hz), 99.3 (t, *J* = 25.4 Hz), 48.3, 26.9; ¹⁹F NMR (376 MHz, CDCl₃) δ -109.0. HRMS calcd (ESI) m/z for C₁₆H₁₅F₂NNaO [M+Na]⁺: 298.1013, found: 298.0998.



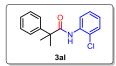
N-(4-chlorophenyl)-2-methyl-2-phenylpropanamide (3aj)

Yield = 94%, b/l > 99:1; ¹H NMR (400 MHz, CDCl₃) δ 7.44-7.38 (m, 4H), 7.34-7.27 (m, 3H), 7.21-7.17 (m, 2H), 6.83 (s, 1H), 1.65 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.0, 143.3, 137.9, 133.4, 129.2, 129.0, 128.0, 124.4, 119.9, 47.8, 27.1. HRMS calcd. (ESI) m/z for C₁₆H₁₆ClNNaO [M+Na]⁺: 296.0812, found: 296.0798.



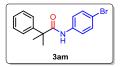
N-(3-chlorophenyl)-2-methyl-2-phenylpropanamide (3ak)

Yield = 93%, b/l = 98:2; ¹H NMR (400 MHz, CDCl₃) δ 7.49 (d, *J* = 2.0 Hz, 1H), 7.43-7.38 (m, 4H), 7.36-7.29 (m, 1H), 7.18-7.11 (m, 2H), 7.02-6.99 (m, 1H), 6.87 (s, 1H), 1.65 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.8, 144.3, 139.2, 134.6, 129.9, 129.2, 127.6, 126.5, 124.2, 119.9, 117.7, 48.2, 27.0. HRMS calcd. (ESI) m/z for C₁₆H₁₆ClNNaO [M+Na]⁺: 296.0812, found: 296.0810.



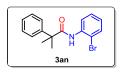
N-(2-chlorophenyl)-2-methyl-2-phenylpropanamide (3al)

Yield = 95%, b/l = 96:4; ¹H NMR (400 MHz, CDCl₃) δ 8.35 (dd, *J* = 9.6, 1.4 Hz, 1H), 7.49-7.47 (m, 3H), 7.43-7.39 (m, 2H), 7.36-7.29 (m, 1H), 7.24-7.20 (m, 2H), 6.97-6.93 (m, 1H), 1.70 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.8, 144.1, 134.9, 129.1, 128.9, 127.7, 127.6, 126.6, 124.4, 122.9, 121.2, 48.4, 26.9. HRMS calcd. (ESI) m/z for C₁₆H₁₆ClNNaO [M+Na]⁺: 296.0812, found: 296.0822.



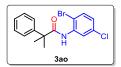
N-(4-chlorophenyl)-2-methyl-2-phenylpropanamide (3am)

Yield = 93%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.44-7.38 (m, 4H), 7.36-7.29 (m, 3H), 7.26-7.22 (m, 2H), 6.82 (s, 1H), 1.65 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.7, 144.4, 137.1, 131.9, 129.2, 127.6, 126.5, 121.4, 116.8, 48.2, 27.1. HRMS calcd. (ESI) m/z for C₁₆H₁₆BrNNaO [M+Na]⁺: 340.0307, found: 340.0307.



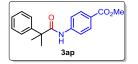
N-(2-bromophenyl)-2-methyl-2-phenylpropanamide (3an)

Yield = 64%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 8.34 (dd, *J* = 8.4, 1.6 Hz, 1H), 7.50-7.47 (m, 3H), 7.44-7.39 (m, 3H), 7.34-7.25 (m, 2H), 6.92-6.88 (m, 1H), 1.71 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.9, 144.1, 136.0, 132.2, 129.2, 128.3, 127.6, 126.7, 124.9, 121.4, 113.4, 48.4, 26.9. HRMS calcd. (ESI) m/z for C₁₆H₁₆BrNNaO [M+Na]⁺: 340.0307, found: 340.0298.



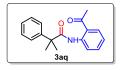
N-(2-bromo-4-chlorophenyl)-2-methyl-2-phenylpropanamide (3ao)

Yield = 72%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 8.47 (d, *J* = 2.4 Hz, 1H), 7.49-7.40 (m, 5H), 7.35-7.30 (m, 2H), 6.88 (dd, *J* = 8.8, 2.4 Hz, 1H), 1.70 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 176.0, 143.7, 136.8, 134.3, 132.7, 129.3, 127.8, 126.7, 124.8, 121.1, 110.8, 48.5, 26.8. HRMS calcd (ESI) m/z for C₁₆H₁₅BrClNNaO [M+Na]⁺: 373.9917, found: 373.9916.



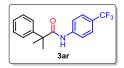
methyl 4-(2-methyl-2-phenylpropanamido)benzoate (3ap)

Yield = 84%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.90 (d, *J* = 8.8 Hz, 2H), 7.46-7.36 (m, 6H), 7.32-7.27 (m, 1H), 7.18 (s, 1H), 3.82 (s, 3H), 1.66 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.9, 166.6, 144.2, 142.3, 130.7, 129.1, 127.5, 126.4, 125.3, 118.8, 51.9, 48.2, 26.9. HRMS calcd. (ESI) m/z for C₁₈H₁₉NNaO₃ [M+Na]⁺: 320.1257, found: 320.1266.



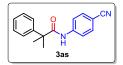
N-(2-acetylphenyl)-2-methyl-2-phenylpropanamide (3aq)

Yield = 91%, b/l = 93:7, ¹H NMR (400 MHz, CDCl₃) δ 11.56 (s, 1H), 8.79 (dd, *J* = 8.4, 0.8 Hz, 1H), 7.81 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.54-7.46 (m, 3H), 7.39-7.35 (m, 2H), 7.29-7.25 (m, 1H), 7.07-7.03 (m, 1H), 2.54 (s, 3H), 1.70 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 202.4, 176.8, 144.7, 141.3, 135.0, 131.6, 128.7, 127.0, 126.2, 122.1, 121.8, 120.5, 48.4, 28.5, 26.8. HRMS calcd (ESI) m/z for C₁₈H₁₉NNaO₂ [M+Na]⁺: 304.1308, found: 304.1318.



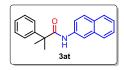
2-methyl-2-phenyl-N-(4-(trifluoromethyl)phenyl)propanamide (3ar)

Yield = 84%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.50-7.39 (m, 8H) 7.35-7.30 (m, 1H), 7.02 (s, 1H), 1.66 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 176.0, 144.2, 141.1, 129.2, 127.7, 126.5, 126.2 (q, *J* = 7.5Hz, 3.7Hz), 125.6 (d, *J* = 25.7Hz), 122.8, 119.3, 48.3, 27.0. ¹⁹F NMR (376 MHz, CDCl₃) δ -32.6. HRMS calcd. (ESI) m/z for C₁₇H₁₆F₃NNaO [M+Na]⁺: 330.1076, found: 330.1080.



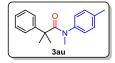
N-(4-cyanophenyl)-2-methyl-2-phenylpropanamide (3as)

Yield = 58%, b/l = 97:3, ¹H NMR (400 MHz, CDCl₃) δ 7.54-7.48 (m, 4H), 7.42 (d, J = 4.4 Hz, 4H), 7.37-7.31 (m, 1H), 7.05 (s, 1H), 1.67 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 176.1, 143.9, 142.1, 133.1, 129.2, 127.7, 126.4, 119.5, 118.9, 106.8, 48.3, 26.9. HRMS calcd. (ESI) m/z for C₁₇H₁₆N₂NaO [M+Na]⁺: 287.1154, found: 287.1165.



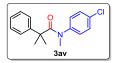
2-methyl-N-(naphthalen-2-yl)-2-phenylpropanamide (3at)

Yield = 78%, b/l = 90:10, ¹H NMR (400 MHz, CDCl₃) δ 8.10 (s, 1H), 7.73-7.67 (m, 3H), 7.46 (d, *J* = 7.6 Hz, 2H), 7.40-7.30 (m, 5H), 7.21 (dd, *J* = 8.8, 2.0 Hz, 1H), 6.99 (s, 1H), 1.69 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.9, 144.6, 135.5, 133.9, 130.6, 129.1, 128.6, 127.7, 127.6, 127.5, 126.6, 126.5, 125.0, 119.9, 116.4, 48.2, 27.2. HRMS calcd. (ESI) m/z for C₂₀H₁₉NNaO [M+Na]⁺: 312.1358, found: 312.1359.



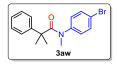
N,2-dimethyl-2-phenyl-*N*-(*p*-tolyl)propenamide (3au)

Yield = 70%, b/l = 93:7, ¹H NMR (400 MHz, CDCl₃) δ 7.18-6.46 (m, 9H), 3.10 (m, 3H), 2.26 (s, 3H), 1.45 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 176.4, 146.4, 141.3, 136.8, 129.2, 128.4, 126.2, 125.4, 47.6, 40.8, 28.7, 21.1. HRMS calcd. (ESI) m/z for C₁₈H₂₁NNaO [M+Na]⁺: 390.1515, found: 290.1515.



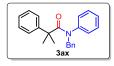
N-(4-chlorophenyl)-*N*,2-dimethyl-2-phenylpropanamide (3av)

Yield = 71%, b/l = 90:10, ¹H NMR (600 MHz, CDCl₃) δ 7.22-7.04 (m, 7H), 6.57 (m, 2H), 3.06 (s, 3H), 1.47 (s, 6H); ¹³C NMR (151 MHz, CDCl₃) δ 176.3, 146.0 142.5, 132.7, 129.8, 128.8, 128.6, 126.5, 125.4, 47.7, 40.6, 29.8, 28.6. HRMS calcd. (ESI) m/z for C₁₇H₁₈ClNNaO [M+Na]⁺: 310.0969, found: 310.0969.



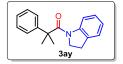
N-(4-bromophenyl)-*N*,2-dimethyl-2-phenylpropanamide (3aw)

Yield = 75%, b/l = 88:12, ¹H NMR (600 MHz, d^{6} -DMSO) δ 7.34-7.22 (m, 5H), 7.09 (s, 2H), 6.80 (s, 2H), 2.90 (s, 3H), 1.39 (s, 6H); ¹³C NMR (151 MHz, d^{6} -DMSO) δ 174.9, 145.8, 143.5, 131.5, 130.1, 128.6, 126.4, 125.0, 119.5, 47.0, 28.4. HRMS calcd. (ESI) m/z for C₁₇H₁₈BrNNaO [M+Na]⁺: 354.0463, found: 354.0461.



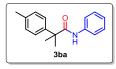
N-benzyl-2-methyl-*N*,2-diphenylpropanamide (3ax)

Yield = 61%, b/l = 86:14, ¹H NMR (400 MHz, CDCl₃) δ 7.34-6.89 (m, 14H), 6.29 (s, 2H), 4.79 (s, 2H), 1.45 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 176.1, 146.2, 141.8, 137.9, 130.2, 129.0, 128.3, 128.3, 128.1, 127.3, 127.1, 126.2, 125.6, 56.1, 47.9, 29.0. HRMS calcd. (ESI) m/z for C₂₃H₂₃NNaO [M+Na]⁺: 352.1671, found: 352.1666.



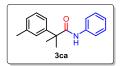
1-(indolin-1-yl)-2-methyl-2-phenylpropan-1-one (3ay)

Yield = 52%, b/l = 83:17, ¹H NMR (400 MHz, CDCl₃) δ 8.33 (d, *J* = 8.0 Hz, 1H), 7.35-7.29 (m, 4H), 7.26-7.20 (m, 3H), 7.11 (d, *J* = 6.8 Hz, 1H), 7.00 (t, *J* = 7.6 Hz, 1H), 3.37 (t, *J* = 8.0 Hz, 2H), 2.78 (t, *J* = 8.0 Hz, 2H), 1.65 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.0, 145.6, 144.5, 131.2, 129.1, 127.5, 126.7, 125.5, 124.4, 123.9, 118.4, 49.0, 48.7, 28.9, 27.8. HRMS calcd. (ESI) m/z for C₁₈H₁₉NNaO [M+Na]⁺: 288.1358 found: 288.1356.



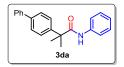
2-methyl-*N*-phenyl-2-(*p*-tolyl)propanamide (3ba)

Yield = 89% b/l = 98:2, ¹H NMR (400 MHz, CDCl₃) δ 7.35-7.30 (m, 4H), 7.23-7.17 (m, 4H), 7.00 (t, *J* = 7.6 Hz, 1H), 6.89 (s, 1H), 2.34 (s, 3H), 1.62 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.8, 144.6, 138.7, 138.1, 129.0, 128.2, 127.3, 124.2, 123.6, 119.7, 48.0, 27.1, 21.7. HRMS calcd. (ESI) m/z for C₁₆H₁₇NO [M+Na]⁺: 262.1202, found: 262.1211.



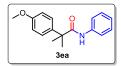
2-methyl-*N*-phenyl-2-(*m*-tolyl)propanamide (3ca)

Yield = 78%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) 7.35 (d, J = 7.6 Hz, 2H), 7.30-7.21 (m, 5H), 7.12 (d, J = 7.2 Hz, 1H), 7.06-7.02 (m, 1H), 6.83 (s, 1H), 2.37 (s, 3H), 1.65 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.8, 144.6, 138.7, 138.1, 128.9, 128.2, 127.3, 124.2, 123.6, 119.7, 48.0, 27.1, 21.7. HRMS calcd. (ESI) m/z for C₁₇H₁₉NNaO [M+Na]⁺: 276.1358, found: 276.1370.



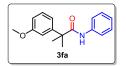
2-([1,1'-biphenyl]-4-yl)-2-methyl-*N*-phenylpropanamide (3da)

Yield = 95%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.64-7.60 (m, 4H), 7.53-7.50 (m, 2H), 7.47-7.43 (m, 2H), 7.39-7.33 (m, 3H), 7.28-7.24 (m, 2H), 7.07-7.03 (m, 1H), 6.88 (s, 1H), 1.70 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.6, 143.7, 140.4, 140.3, 138.1, 129.0, 129.0, 127.7, 127.6, 127.1, 127.1, 124.3, 119.8, 48.0, 27.2. HRMS calcd. (ESI) m/z for C₂₂H₂₁NNaO [M+Na]⁺: 338.1515, found: 338.1515.



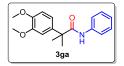
2-(4-methoxyphenyl)-2-methyl-N-phenylpropanamide (3ea)

Yield = 84%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.36-7.34 (m, 4H), 7.24 (t, *J* = 7.2 Hz, 2H), 7.06-7.02 (m, 1H), 6.94-6.89 (m, 3H), 3.81 (s, 3H), 1.63 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 176.0, 158.8, 138.1, 136.5, 128.9, 127.7, 124.1, 119.7, 114.3, 55.3, 47.4, 27.2. HRMS calcd. (ESI) m/z for C₁₇H₁₉NNaO₂ [M+Na]⁺: 292.1308, found: 292.1308.



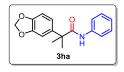
2-(3-methoxyphenyl)-2-methyl-N-phenylpropanamide (3fa)

Yield = 91%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.38-7.35 (m, 4H), 7.27-7.23 (m, 2H), 7.04 (t, *J* = 2.8 Hz, 1H), 6.95-6.91 (m, 2H), 6.85 (s, 1H), 3.82 (s, 3H), 1.64 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.5, 160.1, 146.3, 138.1, 130.1, 128.9, 124.2, 119.8, 119.0, 113.0, 112.2, 55.4, 48.1, 27.1. HRMS calcd. (ESI) m/z for C₁₇H₁₉NNaO₂ [M+Na]⁺: 292.1308, found: 292.1306.



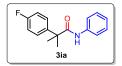
2-(3,4-dimethoxyphenyl)-2-methyl-N-phenylpropanamide (3ga)

Yield = 95%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.36 (d, *J* = 8.0 Hz, 2H), 7.27-7.23 (m, 2H), 7.06-6.99 (m, 2H), 6.90 (d, *J* = 2.4 Hz, 2H), 6.88 (s, 1H), 3.89 (s, 3H), 3.86 (s, 3H), 1.65 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.9, 149.3, 148.4, 138.0, 137.1, 128.9, 124.2, 119.7, 118.5, 111.3, 110.1, 56.0, 55.9, 47.7, 27.2. HRMS calcd. (ESI) m/z for C₁₈H₂₁NNaO₃ [M+Na]⁺: 322.1412, found: 322.1412.



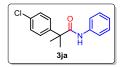
2-(benzo[d][1,3]dioxol-5-yl)-2-methyl-N-phenylpropanamide (3ha)

Yield = 83%, b/l > 99:1; ¹H NMR (400 MHz, CDCl₃) δ 7.38 (d, *J* = 8.0 Hz, 2H), 7.26 (t, *J* = 7.6 Hz, 2H), 7.05 (t, *J* = 7.4 Hz, 1H), 6.91-6.89 (m, 3H), 6.83-6.81 (m, 1H), 5.97 (s, 2H), 1.62 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.6, 148.3, 146.9, 138.6, 138.1, 129.0, 124.2, 119.7, 119.6, 108.5, 107.4, 101.4, 47.9, 27.3. HRMS calcd. (ESI) m/z for C₁₇H₁₇NNaO₃ [M+Na]⁺: 306.1100, found: 306.1114.



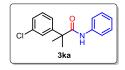
2-(4-fluorophenyl)-2-methyl-N-phenylpropanamide (3ia)

Yield = 70%, b/l = 94:6, ¹H NMR (400 MHz, CDCl₃) δ 7.42-7.34 (m, 4H), 7.27-7.23 (m, 2H), 7.09-7.03 (m, 3H), 6.87 (s, 1H), 1.63 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.3, 161.9 (d, J = 245.2 Hz), 140.5, 137.9, 129.0, 128.2 (d, J = 7.8 Hz), 124.3, 119.8, 115.8 (d, J = 21.1 Hz), 47.6, 27.2; ¹⁹F NMR (376 MHz, CDCl₃) δ -131.8. HRMS calcd. (ESI) m/z for C₁₆H₁₆FNNaO [M+Na]⁺: 280.1108, found: 280.1109.



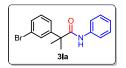
2-(4-chlorophenyl)-2-methyl-N-phenylpropanamide (3ja)

Yield = 73%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.37-7.35 (m, 6H), 7.28-7.24 (m, 2H), 7.07 (t, *J* = 7.2 Hz, 1H), 6.81 (s, 1H), 1.64 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.0, 143.3, 137.9, 133.4, 129.2, 129.0, 128.0, 124.4, 119.9, 47.8, 27.1. HRMS calcd. (ESI) m/z for C₁₆H₁₆ClNNaO [M+Na]⁺: 296.0812, found: 296.0812.



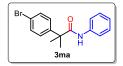
2-(3-chlorophenyl)-2-methyl-N-phenylpropanamide (3ka)

Yield = 86%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.43 (s, 1H), 7.37 (d, *J* = 8.0 Hz, 2H), 7.32-7.24 (m, 5H), 7.06 (t, *J* = 7.2 Hz, 1H), 6.84 (s, 1H), 1.64 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 174.0, 146.2, 137.9, 135.0, 130.3, 129.0, 127.7, 126.6, 124.9, 124.5, 119.9, 48.1, 27.0. HRMS calcd. (ESI) m/z for C₁₆H₁₆ClNNaO [M+Na]⁺: 296.0812, found: 296.0824.



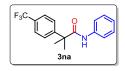
2-(4-bromophenyl)-2-methyl-N-phenylpropanamide (3la)

Yield = 92%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.58 (t, *J* = 1.6 Hz 1H), 7.44 (d, *J* = 8.0 Hz, 1H), 7.37 (t, *J* = 8.0 Hz, 3H), 7.29-7.24 (m, 3H), 7.07 (t, *J* = 7.2 Hz, 1H), 6.82 (s, 1H), 1.64 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 174.7, 147.1, 137.8, 130.6, 129.4, 129.0, 125.4, 124.4, 123.2, 119.9, 48.0, 27.0. HRMS calcd. (ESI) m/z for C₁₆H₁₆BrNNaO [M+Na]⁺: 340.0307, found: 340.0317.



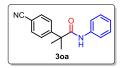
2-(3-bromophenyl)-2-methyl-N-phenylpropanamide (3ma)

Yield = 72%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) 7.51-7.48 (m, 2H), 7.37-7.34 (m, 2H), 7.30-7.03 (m, 4H), 7.08-7.03 (m, 1H), 6.87 (s, 1H), 1.61 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 174.9, 143.8, 137.9, 132.2, 129.0, 128.3, 124.4, 121.5, 119.9, 47.9, 27.1. HRMS calcd. (ESI) m/z for C₁₆H₁₆BrNNaO [M+Na]⁺: 340.0307, found: 340.0319.



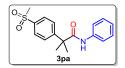
2-methyl-*N*-phenyl-2-(4-(trifluoromethyl)phenyl)propanamide (3na)

Yield = 73%, b/l = 97:3, ¹H NMR (400 MHz, CDCl₃) δ 7.64 (d, *J* = 8.0 Hz, 2H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.38-7.36 (m, 2H), 7.28-7.24 (m, 2H), 7.10-7.054 (m, 1H), 6.86 (s, 1H), 1.67 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 174.5, 149.0, 137. 8, 130.2, 129.6 (d, *J* = 32.4 Hz), 129.0, 126.9, 126.0 (d, *J* = 32.4 Hz), 125.5, 124.4 (d, *J* = 170.3 Hz), 120.0, 48.2, 27.0; ¹⁹F NMR (376 MHz, CDCl₃) δ -62.42. HRMS calcd. (ESI) m/z for C₁₇H₁₆F₃NNaO [M+Na]+: 330.1076, found: 330.1085.



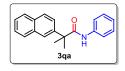
2-(4-cyanophenyl)-2-methyl-N-phenylpropanamide (3oa)

Yield = 94%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.66 (d, *J* = 8.4 Hz, 2H), 7.55 (d, *J* = 8.4 Hz, 2H), 7.39 (d, *J* = 8.0 Hz, 2H), 7.30-7.26 (m, 2H), 7.09 (t, *J* = 7.4 Hz, 1H), 6.86 (s, 1H), 1.67 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 173.9, 150.3, 137.7, 132.8, 129.1, 127.3, 124.7, 120.0, 118.6, 111.3, 48.4, 26.9. HRMS calcd. (ESI) m/z for C₁₇H₁₆N₂NaO [M+Na]⁺: 287.1154, found: 287.1157.



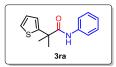
2-methyl-2-(4-(methylsulfonyl)phenyl)-N-phenylpropanamide (3pa)

Yield = 93%, b/l > 99:1; ¹H NMR (400 MHz, d^6 -DMSO) δ 9.24 (s, 1H), 7.93 (d, J = 8.4 Hz, 2H), 7.65-7.60 (m, 4H), 7.28 (t, J = 7.8 Hz, 2H), 7.04 (t, J = 7.4 Hz, 1H), 3.21 (s, 3H), 1.61 (s, 6H); ¹³C NMR (101 MHz, d^6 -DMSO) δ 173.9, 151.7, 139.1, 138.9, 128.5, 127.1, 127.0, 123.5, 120.4, 47.8, 43.6, 26.6. HRMS calcd. (ESI) m/z for C₁₇H₁₉N₃NaOS [M+Na]⁺: 340.0977, found: 340.0977.



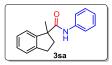
2-methyl-2-(naphthalen-2-yl)-N-phenylpropanamide (3qa)

Yield = 95%, b/l > 99:1; ¹H NMR (400 MHz, CDCl₃) δ 7.69-7.82 (m, 4H), 7.52-7.45 (m, 3H),7.32 (d, *J* = 8.0 Hz, 2H) 7.20 (t, *J* = 7.2 Hz, 2H), 7.01 (t, *J* = 7.2Hz, 2H), 6.86 (s, 1H), 1.74 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.5, 142.1, 138.0, 133.4, 132.8, 128.9, 128.2, 127.7, 126.7, 126.4, 125.4, 124.6, 124.2, 119.8, 48.4, 27.1. HRMS calcd. (ESI) m/z for C₂₀H₁₉NNaO [M+Na]⁺: 312.1358, found: 312.1351.



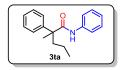
2-methyl-*N*-phenyl-2-(thiophen-2-yl)propanamide (3ra)

Yield = 48%, b/l > 99:1; ¹H NMR (400 MHz, CDCl₃) δ 7.36 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 4.8 Hz, 1H), 7.28-7.25 (m, 2H), 7.18 (s, 1H), 7.10 (d, *J* = 2.8 Hz, 1H), 7.08-7.05 (m, 2H), 1.75 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 174.2, 149.6, 137.9, 129.0, 127.5, 125.5, 125.1, 124.4, 119.8, 46.4, 28.3. HRMS calcd. (ESI) m/z for C₁₄H₁₅NNaOS [M+Na]⁺: 268.0766, found: 268.0766.



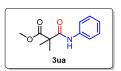
N,1-dimethyl-*N*-phenyl-2,3-dihydro-1H-indene-1-carboxamide (3sa)

Yield = 75%, b/l > 99:1, ¹H NMR (600 MHz, CDCl₃) δ 7.36-7.31 (m, 6H), 7.26-7.24 (m, 2H), 7.06 (t, *J* = 6.0 Hz, 2H), 3.03-2.96 (m, 2H), 2.73-2.70 (m, 1H), 2.14-2.09 (m, 1H), 1.65 (s, 3H); ¹³C NMR (151 MHz, CDCl₃) δ 174.9, 145.7, 144.9, 137.8, 129.0, 128.4, 127.5, 125.7, 124.3, 123.7, 119.7, 56.7, 40.2, 30.6, 24.5. HRMS calcd. (ESI) m/z for C₁₇H₁₇NNaO [M+Na]⁺: 288.1358, found: 288.1358.



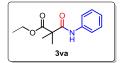
2-methyl-*N*,2-diphenylpentanamide (3ta)

Yield = 51%, b/l = 88:12, ¹H NMR (400 MHz, CDCl₃) δ 7.41-7.34 (m, 5H), 7.32-7.29 (m, 1H), 7.28-7.24 (m, 3H), 7.07-7.03 (m, 1H), 6.79 (s, 1H), 2.11-1.98 (m, 2H), 1.62 (s, 3H), 1.32-1.26 (m, 1H), 1.20-1.12 (m, 1H), 0.92 (t, *J* = 6.8 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 175.4, 143.9, 138.1, 129.1, 129.0, 127.4, 127.1, 124.2, 119.8, 51.8, 41.3, 24.1, 17.9, 14.8. HRMS calcd. (ESI) m/z for C₁₇H₁₇NNaO [M+Na]⁺: 290.1515, found: 290.1515.



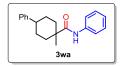
methyl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (3ua)

Yield = 86%, b/l > 99:1; ¹H NMR (400 MHz, CDCl₃) δ 8.55 (s, 1H), 7.53 (d, *J* = 7.6 Hz, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.11 (t, *J* = 7.2 Hz, 1H), 3.79 (s, 3H), 1.56 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 176.1, 169.7, 137.9, 129.1, 124.5, 120.1, 53.1, 50.6, 24.0. HRMS calcd. (ESI) m/z for C₁₂H₁₅NNaO₃ [M+Na]⁺: 244.0944, found: 244.0954.



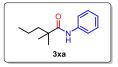
ethyl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (3va)

Yield = 85%, b/l > 99:1, ¹H NMR (600 MHz, CDCl₃) δ 8.63 (s, 1H), 7.53 (d, 4.0Hz, 2H), 7.32 (t, *J* = 8.1 Hz, 2H), 7.10 (t, *J* = 10.5 Hz, 1H), 4.24 (q, *J* = 6.6 Hz, 2H), 1.55 (s, 6H), 1.30 (t, *J* = 6.9 Hz, 3H); ¹³C NMR (151 MHz, CDCl₃) δ 175.6, 169.2, 137.9, 129.0, 124.4, 120.0, 62.1, 50.5, 24.0, 14.1. HRMS calcd. (ESI) m/z for C₁₃H₁₇NNaO₃ [M+Na]+: 258.1100, found:258.1101.



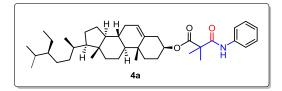
methyl-N,4-diphenylcyclohexane-1-carboxamide (3wa)

Yield = 52%, b/l = 95:5, ¹H NMR (400 MHz, CDCl₃) δ 7.55 (d, *J* = 8.0 Hz, 2H), 7.39 (s, 1H), 7.34-7.30 (m, 4H), 7.25-7.16 (m, 3H), 7.10 (t, *J* = 7.6 Hz, 1H), 2.59-2.48 (m, 1H), 1.95-1.86 (m, 5H), 1.78-1.67 (m, 3H), 1.41 (s, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 177.1, 146.7, 138.2, 129.1, 128.5, 126.9, 126.3, 124.4, 120.2, 43.8, 42.2, 34.5, 29.3, 20.8. HRMS calcd. (ESI) m/z for C₂₀H₂₃NNaO [M+Na]⁺: 316.1671, found: 316.1677.



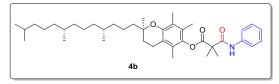
2,2-dimethyl-*N*-phenylpentanamide (3xa)

Yield = 60%, b/l = 94:6; ¹H NMR (400 MHz, CDCl₃) δ 7.52 (d, *J* = 8.0 Hz, 2H), 7.38 (s, 1H), 7.29 (t, *J* = 7.8 Hz, 2H), 7.08 (t, *J* = 7.2 Hz, 1H), 1.60-1.55 (m, 2H), 1.37-1.29 (m, 2H), 1.27 (s, 6H), 0.91 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 176.2, 138.1, 129.1, 124.3, 120.1, 44.0, 43.2, 25.7, 18.3, 14.7. HRMS calcd. (ESI) m/z for C₁₃H₁₉NNaO [M+Na]⁺: 228.1358, found: 228.1358.



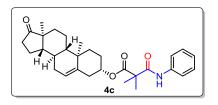
(3*S*,8*S*,9*S*,10*R*,13*R*,14*S*,17*R*)-17-((2*R*,5*S*)-5-ethyl-6-methylheptan-2-yl)-10,13-dim ethyl-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenan thren-3-yl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (4a)

Yield = 65%, b/l > 20:1 (based on ¹H NMR), ¹H NMR (400 MHz, CDCl₃) δ 8.65 (s, 1H), 7.54-7.51 (m, 2H), 7.34-7.29 (m, 2H), 7.12-7.08 (m, 1H), 5.39 (d, *J* = 4.4 Hz, 1H), 4.74-4.66 (m, 1H), 2.35 (d, *J* = 7.2 Hz, 2H), 2.03-1.95 (m, 2H), 1.90-1.82 (m, 3H), 1.69-1.62 (m, 2H), 1.59-1.57 (m, 1H), 1.54 (s, 6H), 1.51-1.43 (m, 4H), 1.37-1.30 (m, 2H), 1.28-1.19 (m, 3H), 1.20-1.10 (m, 6H), 1.02 (s, 3H), 0.96 (d, *J* = 6.0 Hz, 1H), 0.92 (d, *J* = 6.4 Hz, 3H), 0.86-0.81 (m, 10H), 0.68 (s, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 175.0, 170.0, 139.3, 138.0, 129.1, 124.4, 123.2, 120.0, 75.8, 56.8, 56.2, 50.6, 50.1, 45.9, 42.4, 39.8, 37.9, 37.0, 36.7, 36.3, 34.0, 32.0, 31.9, 29.3, 28.4, 27.7, 26.2, 24.4, 24.1, 24.0, 23.2, 21.2, 20.0, 19.4, 19.2, 18.9, 12.1, 12.0. C₃₉H₅₉NNaO₃ [M+Na]⁺: 626.4543, found: 626.4513.



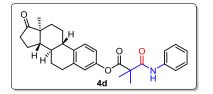
(*R*)-2,5,7,8-tetramethyl-2-((4*R*,8*R*)-4,8,12-trimethyltridecyl)chroman-6-yl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (4b)

Yield = 89%, b/l > 20:1 (based on ¹H NMR), ¹H NMR (600 MHz, CDCl₃) δ 8.80 (s, 1H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.32 (t, *J* = 7.5 Hz, 2H), 7.11 (t, *J* = 7.2 Hz, 1H), 2.59 (t, *J* = 6.6 Hz, 2H), 2.09 (s, 3H), 2.00 (s, 3H), 1.95 (s, 3H), 1.78 (s, 6H), 1.58-1.50 (m, 3H), 1.37 (s, 3H), 1.26-1.22 (m, 11H), 1.14-1.06 (m, 7H), 0.87-0.84 (m, 14H); ¹³C NMR (151 MHz, CDCl₃) δ 174.8, 169.4, 149.8 140.2, 137.8, 129.1, 126.5, 124.8, 124.6, 123.5, 120.1, 117.7, 75.3, 50.7, 40.6, 39.5, 37.5, 37.4, 32.9, 32.9, 32.8, 31.3, 31.0, 28.0, 24.9, 24.6, 24.4, 23.7, 22.9, 22.8, 21.1, 20.7, 19.9, 19.8, 13.0, 12.1, 12.0. HRMS calcd. (ESI) m/z for C₄₀H₆₁NNaO₄ [M+Na]⁺: 642.4492, found: 642.4463.



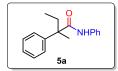
(3*S*,8*R*,9*S*,10*R*,13*S*,14*S*)-10,13-dimethyl-17-oxo-2,3,4,7,8,9,10,11,12,13,14,15,16,17 -tetradecahydro-1H-cyclopenta[a]phenanthren-3-yl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (4c)

Yield = 86%, b/l > 20:1 (based on ¹H NMR), ¹H NMR (400 MHz, CDCl₃) δ 8.60 (s, 1H), 7.53 (d, *J* = 8.0 Hz, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.11 (t, *J* = 7.6 Hz, 1H), 5.43 (d, *J* = 4.4 Hz, 1H), 4.71-7.66 (m, 1H), 2.46 (dd, *J* = 19.2, 8.8 Hz, 1H), 2.37 (d, *J* = 7.6 Hz, 2H), 2.14-2.05 (m, 2H), 1.99-1.84 (m, 4H), 1.69-1.65 (m, 4H), 1.55 (s, 4H), 1.33-1.26 (m, 4H), 1.20-1.14 (m, 2H), 1.06 (s, 3H), 0.89 (s, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 175.0, 169.9, 139.6, 137.9, 129.1, 124.4, 122.4, 120.0, 75.5, 51.8, 50.6, 50.2, 47.6, 37.9, 36.9, 36.8, 35.9, 31.5, 31.5, 30.9, 29.8, 27.6, 24.0, 24.0, 22.0, 20.4, 19.5, 13.6. C₂₉H₃₇NNaO₄ [M+Na]⁺: 500.2771, found: 500.2762.



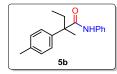
(8*R*,9*S*,13*S*,14*S*)-13-methyl-17-oxo-7,8,9,11,12,13,14,15,16,17-decahydro-6H-cyclo penta[a]phenanthren-3-yl 2,2-dimethyl-3-oxo-3-(phenylamino)propanoate (4d)

Yield = 61%, b/l > 20:1 (based on ¹H NMR), ¹H NMR (400 MHz, CDCl₃) δ 8.52 (s, 1H), 7.54 (d, *J* = 8.0 Hz, 2H), 7.35-7.30 (m, 3H), 7.12 (t, *J* = 7.2 Hz 1H), 6.86 (d, *J* = 8.4 Hz, 1H), 6.82 (s, 1H), 3.48 (d, *J* =0.4 Hz, 1H) 2.92-2.90 (m, 2H), 2.51 (dd, *J* = 18.8, 8.8Hz, 1H), 2.42-2.38 (m, 1H), 2.30-2.26 (m, 1H), 2.19-2.12 (m, 1H), 2.10-1.95 (m, 3H), 1.71 (s, 6H), 1.66-1.60 (m, 2H), 1.57-1.42 (m, 4H), 0.91 (s, 3H); ¹³C NMR (151 MHz, CDCl₃) δ 221.0, 174.7, 169.4, 148.4, 138.4, 138.1, 137.8, 129.1, 126.7, 124.6, 121.3, 120.1, 118.4, 50.8, 50.4, 48.0, 44.2, 38.0, 35.9, 31.6, 29.5, 26.4, 25.8, 24.0, 21.7, 13.9. HRMS calcd. (ESI) m/z for C₂₉H₃₃NNaO₄ [M+Na]⁺: 482.2301, found: 482.2295.



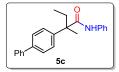
2-methyl-*N*,2-diphenylbutanamide (5a)

Yield = 56%, b/l = 98:2, ¹H NMR (600 MHz, d^6 -DMSO) δ 9.06 (s, 1H), 7.58 (d, J = 8.4 Hz, 2H), 7.34-7.33 (m, 4H), 7.27-7.24 (m, 3H), 7.01 (t, J = 6.6 Hz, 1H), 2.17-2.14 (m, 1H), 1.94-1.90 (m, 1H), 1.50 (s, 3H), 0.78 (t, J = 7.2 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 175.3, 143.5, 138.1, 129.0, 129.0, 127.4, 127.1, 124.2, 119.8, 52.0, 31.6, 23.4, 9.0. HRMS calcd. (ESI) m/z for C₁₇H₁₉NNaO [M+H]⁺: 254.1539, found: 254.1539



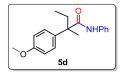
2-methyl-*N*-phenyl-2-(*p*-tolyl)butanamide (5b)

Yield = 66%, b/l = 85:15, ¹H NMR (600 MHz, d^6 -DMSO) δ 8.99 (s, 1H), 7.57 (d, J = 7.8 Hz, 2H), 7.26-7.23 (m, 2H), 7.20 (d, J = 8.4 Hz, 2H), 7.14 (d, J = 7.8 Hz, 2H), 7.01 (t, J = 7.2 Hz, 1H), 2.27 (s, 3H), 2.15-2.10 (m, 1H), 1.96-1.87 (m, 1H), 1.48 (s, 3H), 0.77 (t, J = 7.2 Hz, 3H); ¹³C NMR (151 MHz, d^6 -DMSO) δ 174.3, 142.1, 139.3, 135.4, 128.9, 128.4, 126.1, 123.2, 120.3, 50.7, 31.01, 22.7, 20.6 9.1. HRMS calcd. (ESI) m/z for C₁₈H₂₁NNaO [M+Na]⁺: 290.1515, found: 250.1513.



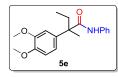
2-([1,1'-biphenyl]-4-yl)-2-methyl-N-phenylbutanamide (5c)

Yield = 60%, b/l >99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.63-7.60 (m, 4H), 7.48-7.43 (m, 4H), 7.40-7.34 (m, 3H), 7.28-7.24 (m, 2H), 7.05 (t, *J* = 7.6 Hz, 1H), 6.89 (s, 1H), 2.24-2.09 (m, 2H), 1.64 (s, 3H), 0.88 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 175.2, 142.6, 140.4, 140.1, 138.0, 129.0, 129.0, 127.6, 127.6, 127.1, 124.3, 119.8, 51.8, 31.7, 23.5, 8.9. HRMS calcd. (ESI) m/z for C₂₃H₂₃NNaO [M+Na]⁺: 352.1671, found: 352.1659.



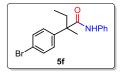
2-(4-methoxyphenyl)-2-methyl-*N*-phenylbutanamide (5d)

Yield = 74%, b/l = 87:13, ¹H NMR (400 MHz, CDCl₃) δ 7.37-7.35 (m, 2H), 7.33-7.30 (m, 2H), 7.27-7.23 (m, 2H), 7.06-7.02 (m, 1H), 6.94-6.91 (m, 2H), 6.86 (s, 1H), 3.278 (s, 3H), 1.92-1.86 (m, 1H), 2.18-2.04 (m, 2H), 1.58 (s, 3H), 0.83 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 175.7, 158.7, 138.1, 135.3, 128.9, 128.3, 124.1, 119.7, 114.3, 55.4, 51.3, 31.6, 23.5, 8.9. HRMS calcd. (ESI) m/z for C₁₈H₂₁NNaO₂ [M+Na]⁺: 306.1464, found: 306.1464.



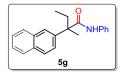
2-(3,4-dimethoxyphenyl)-2-methyl-N-phenylbutanamide (5e)

Yield = 76%, b/l = 88:12, ¹H NMR (400 MHz, CDCl₃) δ 7.36 (d, *J* = 7.6 Hz, 2H), 7.25 (t, *J* = 7.2 Hz, 2H), 7.04 (t, *J* = 7.2 Hz, 1H), 6.97 (dd, *J* = 7.4, 2.0 Hz, 1H), 6.92 (s, 1H), 6.89-6.86 (m, 2H), 3.90 (s, 3H), 3.85 (s, 3H), 2.20-2.04 (m, 2H), 1.59 (s, 3H), 0.83 (t, *J* = 7.6 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 175.6, 149.2, 148.2, 138.0, 135.8, 128.9, 124.1, 119.6, 119.0, 111.0, 110.3, 56.0, 55.9, 51.5, 31.5, 23.3, 8.9. HRMS calcd. (ESI) m/z for C₁₉H₂₃NNaO₃ [M+Na]⁺: 336.1570, found: 336.1570.



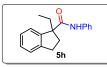
2-(4-bromophenyl)-2-methyl-N-phenylbutanamide (5f)

Yield = 51%, b/l = 96:4, ¹H NMR (400 MHz, CDCl₃) δ 7.51 (d, *J* = 8.8 Hz, 2H), 7.37 (d, *J* = 8.0 Hz, 2H), 7.29-7.25 (m, 4H), 7.07 (t, *J* = 7.2 Hz, 1H), 6.78 (s, 1H), 2.17-2.00 (m, 2H), 1.58 (s, 3H), 0.84 (t, *J* = 7.6 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 174.5, 142.8, 137.9, 132.1, 129.1, 128.9, 124.4, 121.4, 119.9, 51.7, 31.7, 23.3, 8.9. HRMS calcd. (ESI) m/z for C₁₇H₁₈BrNNaO3 [M+Na]⁺: 354.0463, found: 354.0462.



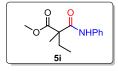
2-methyl-2-(naphthalen-2-yl)-N-phenylbutanamide (5g)

Yield = 57%, b/l > 99:1, ¹H NMR (400 MHz, CDCl₃) δ 7.88-7.83 (m, 4H), 7.54-7.44 (m, 3H), 7.34-7.32 (m, 2H), 7.24-7.20 (m, 2H), 7.05-7.01 (m, 1H), 6.83 (s, 1H), 2.30-2.20 (m, 2H), 1.70 (s, 3H), 0.85 (t, *J* = 7.6Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 175.2, 141.0, 138.0, 133.4, 132.5, 129.0, 128.9, 128.2, 127.7, 126.6, 126.4, 125.7, 125.5, 124.2, 119.8, 52.1, 31.4, 23.3, 8.9. HRMS calcd. (ESI) m/z for C₂₁H₂₁NNaO [M+Na]⁺: 326.1515, found: 326.1515.



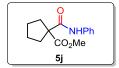
1-ethyl-N-phenyl-2,3-dihydro-1H-indene-1-carboxamide (5h)

Yield = 61%, b/l = 87:13, ¹H NMR (400 MHz, CDCl₃) δ 7.39-7.36 (m, 2H), 7.31-7.30 (m, 3H), 7.29-7.24 (m, 3H), 7.19 (s, 1H), 7.06 (t, *J* = 7.2 Hz, 1H), 3.04-2.91 (m, 2H), 2.65-2.58 (m, 1H), 2.24-2.17 (m, 1H), 2.12-2.06 (m, 2H), 0.91 (t, *J* = 7.6 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 174.3, 145.6, 144.1, 139.0, 129.0, 128.3, 127.2, 125.7, 124.4, 124.3, 119.8, 61.4, 36.7, 30.5, 30.0, 9.6. HRMS calcd. (ESI) m/z for C₁₈H₁₉NNaO [M+Na]⁺: 288.1358, found: 288.1358.



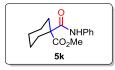
methyl 2-methyl-2-(phenylcarbamoyl)butanoate (5i)

Yield = 63%, b/l = 97:3,¹H NMR (400 MHz, CDCl₃) δ 9.18 (s, 1H), 7.57-7.55 (m, 2H), 7.33 (t, *J* = 7.6 Hz, 2H), 7.11 (t *J* = 7.6 Hz, 1H), 3.80 (s, 3H), 2.15-2.60 (m, 1H), 1.98-1.89 (m, 1H), 1.52 (s, 3H), 0.91 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 176.4, 169.3, 137.9, 129.1, 124.4, 120.1, 54.9, 53.0, 32.2, 20.6, 9.7. HRMS calcd. (ESI) m/z for C₁₃H₁₇NNaO₃ [M+Na]⁺: 258.1100, found:258.1100.



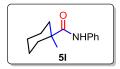
methyl 1-(phenylcarbamoyl)cyclopentane-1-carboxylate (5j)

Yield = 65%, b/l = 86:14,¹H NMR (400 MHz, CDCl₃) δ 8.23 (s, 1H), 7.53-7.51 (m, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.10 (t, *J* = 7.2 Hz, 1H), 3.78 (s, 3H), 2.33-2.27 (m, 4H), 1.81-1.67 (m, 4H); ¹³C NMR (101 MHz, CDCl₃) δ 175.7, 169.0, 138.0, 129.1, 124.4, 119.9, 61.8, 53.2, 35.1, 25.5, 19.3. HRMS calcd. (ESI) m/z for C₁₄H₁₇NNaO₃ [M+Na]⁺: 270.1100, found: 270.1100.



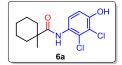
methyl 1-(phenylcarbamoyl)cyclohexane-1-carboxylate (5k)

Yield = 61%, b/l = 89:11,¹H NMR (400 MHz, CDCl₃) δ 7.79 (s, 1H), 7.52-7.49 (m, 2H), 7.31 (t, *J* = 7.6 Hz, 2H), 7.10 (t, *J* = 7.2 Hz, 1H), 3.79 (s, 3H), 2.28-2.24 (m, 2H) 1.96-1.89 (m, 2H), 1.76-1.60 (m, 2H), 1.54-1.45 (m, 2H), 1.38-1.32 (m, 2H); ¹³C NMR (101 MHz, CDCl₃) δ 174.4, 168.6, 137.8, 129.1, 124.6, 119.9, 56.2, 53.0, 32.1, 25.3, 23.4. HRMS calcd. (ESI) m/z for C₁₅H₁₉NNaO [M+Na]⁺: 284.1257, found: 284.1257.



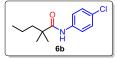
1-methyl-N-phenylcyclohexane-1-carboxamide (5l)

Yield = 55%, b/l = 80:20, ¹H NMR (600 MHz, CDCl₃) δ 7.54 (d, *J* = 7.2 Hz, 2H), 7.37 (s, 1H), 7.33-7.30 (m, 2H), 7.10 (t, *J* = 7.2 Hz, 1H), 2.03-2.01 (m, 2H), 1.62-1.58 (m, 2H), 1.54-1.47 (m, 3H), 1.45-1.41 (m, 2H), 1.39-1.36 (m, 1H), 1.26 (s, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 174.0, 138.2, 129.1, 124.2, 120.1, 43.7, 35.8, 26.6, 25.9, 23.0. HRMS calcd. (ESI) m/z for C₁₄H₁₉NNaO [M+Na]⁺: 240.1358, found: 240.1357.



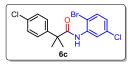
N-(2,3-dichloro-4-hydroxyphenyl)-1-methylcyclohexane-1-carboxamide (6a)

Yield = 62%, b/l = 95:5,¹H NMR (400 MHz, CDCl₃) δ 8.05 (d, *J* = 9.2 Hz, 1H), 7.75 (s, 1H), 6.94 (d, *J* = 9.2 Hz, 1H), 5.93 (s, 1H), 2.06-2.02 (m, 2H), 1.65-1.60 (m, 2H), 1.57-1.52 (m, 4H), 1.46-1.37 (m, 2H), 1.29 (s, 3H); ¹³C NMR (151 MHz, CDCl₃) δ 176.5, 149.4, 128.9, 123.3, 122.1, 119.1, 114.8, 44.2, 35.8,26.7, 25.8, 23.0. HRMS calcd. (ESI) m/z for C₁₄H₁₇Cl₂NNaO₂ [M+Na]⁺: 324.0528, found: 324.0529.



N-(4-chlorophenyl)-2,2-dimethylpentanamide (6b)

Yield = 71%, b/l = 95:5, ¹H NMR (400 MHz, CDCl₃) δ 7.47-7.43 (m, 3H), 7.27-7.23 (m, 2H), 1.58-1.54 (m, 2H), 1.35-1.26 (m, 8H), 0.90 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 176.3, 136.7, 129.2, 128.9, 121.6, 43.9, 43.2, 25.5, 18.2, 14.7. HRMS calcd. (ESI) m/z for C₁₃H₁₈ClNNaO [M+Na]⁺: 262.0969, found: 262.0969.



N-(2-bromo-5-chlorophenyl)-2-(4-chlorophenyl)-2-methylpropanamide (6c)

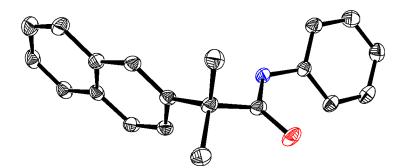
Yield = 62%, b/l = 97:3, ¹H NMR (400 MHz, CDCl₃) δ 8.43 (d, *J* = 2.4 Hz, 1H), 7.47 (s, 1H), 7.42-7.37 (m, 4H), 7.33 (d, *J* = 8.4 Hz, 1H), 6.90 (dd, *J* = 8.6, 2.4 Hz, 1H), 1.68 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 175.2, 142.4, 136.5, 134.3, 133.7, 132.7, 129.3, 128.1, 125.0, 121.2, 111.0, 48.2, 26.8. HRMS calcd. (ESI) m/z for C₁₆H₁₅BrClNNaO [M+Na]⁺: 409.9504, found: 409.9514.



3,3-dimethylindolin-2-one (6d)

Yield = 95%, b/l > 99:1; ¹H NMR (400 MHz, CDCl₃) δ 8.81 (s, 1H), 7.22-7.21 (m, 2H), 7.06-7.02 (m, 1H), 6.96-6.93 (m,1H), 1.41 (s, 6H); ¹³C NMR (101 MHz, CDCl₃) δ 184.3, 140.0, 136.1, 127.8, 122.7, 122.6, 110.0, 44.8, 24.5. HRMS calcd. (ESI) m/z for C₁₀H₁₁NNaO [M+Na]⁺: 184.0732, found: 184.0728.

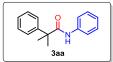
7. X-Ray Structure of 3qa.

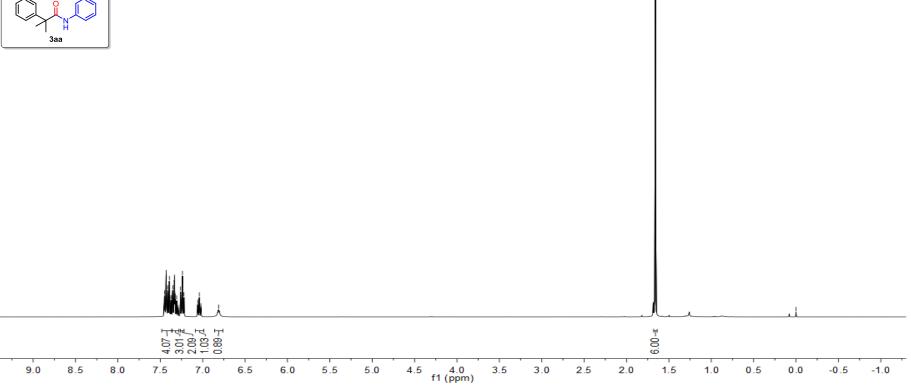


Dandamaisian	C-C = 0.0021 A			
Bond precision	Wavelength = 1.34139			
	$a = 9.145 (3)$ $\alpha = 90$			
Cell	b = 18.331 (6) β = 110.206 (12)			
	$c = 10.162 (3)$ $\gamma = 90$			
Temperature	150 K			
Volume	1598.7 (9)			
Space group	P 21/c			
Sum formula	C20 H19 N O			
Mr	289.36			
Dx, g cm ⁻³	1.202			
Ζ	4			
Mu (mm-1)	0.364			
F000	616.0			
h,k,lmax	11,22,12			
Nref	3032			
Tmin,Tmax	0.950,0.957			
Correction method= # Reported T Limits	Not given			
AbsCorr = MULTT-SCAN				
Data completeness	0.985			
Theta(max)	54.802			
R(reflections)	0.0539 (2495)			
wR2(reflections)	0.1982 (2988)			
S	0.864			
Npar	201			

8. Copies of ¹H , ¹³C, and ¹⁹F NMR Spectra

¹ H NMR Spectra (400 MHz, CDCl ₃) of compound 3aa	
7,255 7,244 7,444 7,444 7,444 7,444 7,423 7,423 7,423 7,423 7,423 7,423 7,423 7,423 7,423 7,423 7,423 337 7,423 337 7,735 337 7,735 337 7,735 337 7,735 337 7,735 337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 2,337 7,735 7,337 7,232 7,	38288222





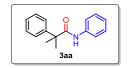
-1.660

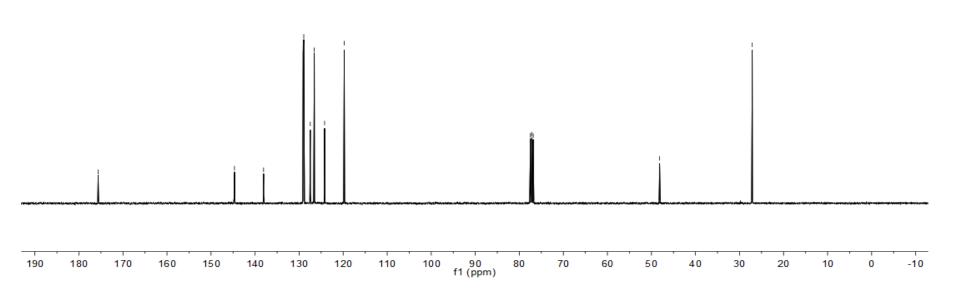
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¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3aa**

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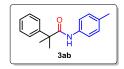


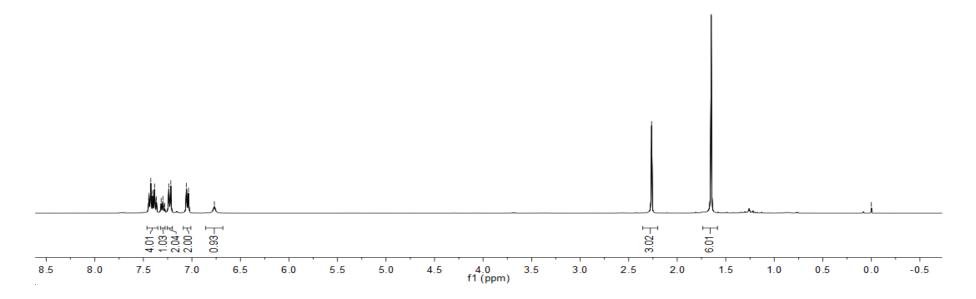
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ab**

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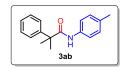
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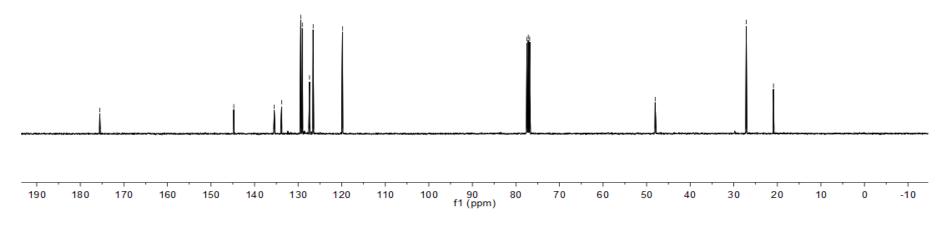


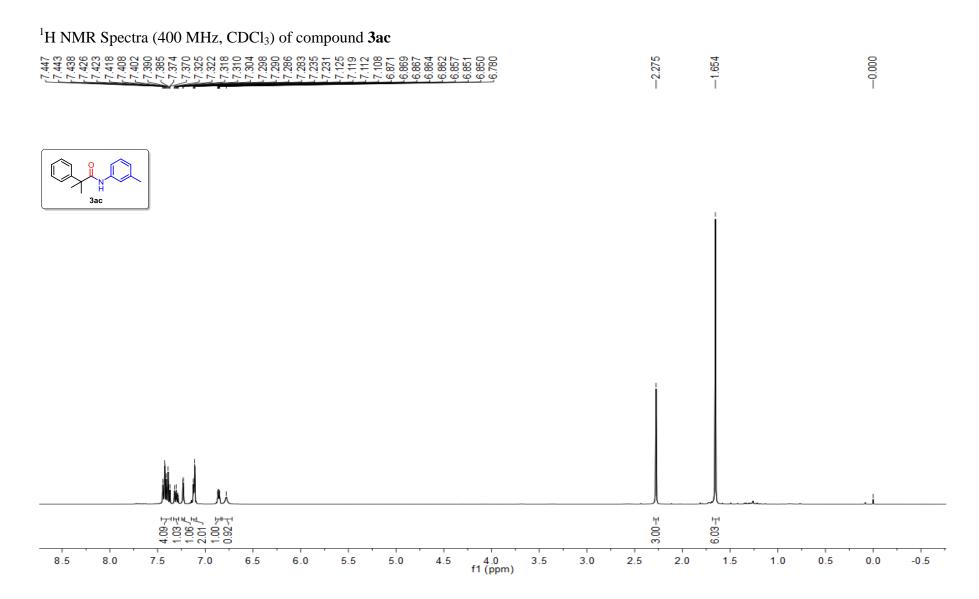


# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ab**

-175.526	-144.768 -144.768 -135.483 -129.396 -129.390 -127.390 -119.816	-77.478 -77.160 -76.842	-48.033	-27.131 -20.877
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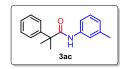


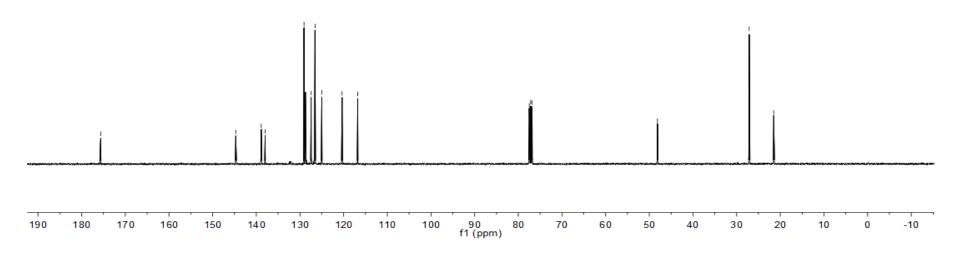




# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3a**

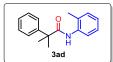
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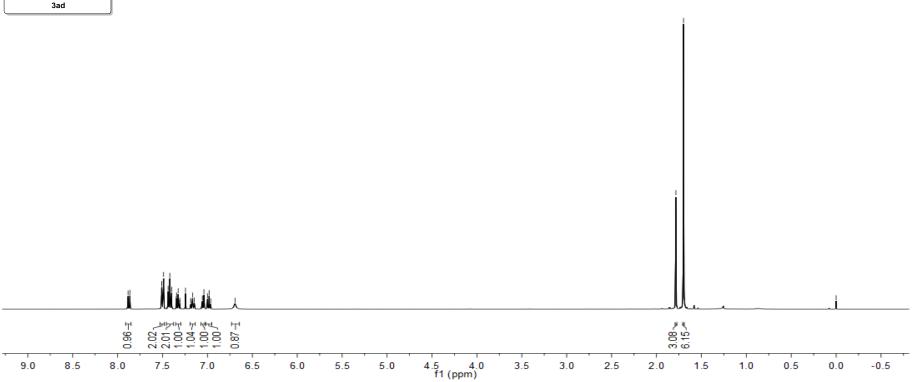




## 1 H NMR Spectra (400 MHz, CDCl₃) of compound **3ad**

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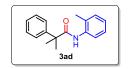


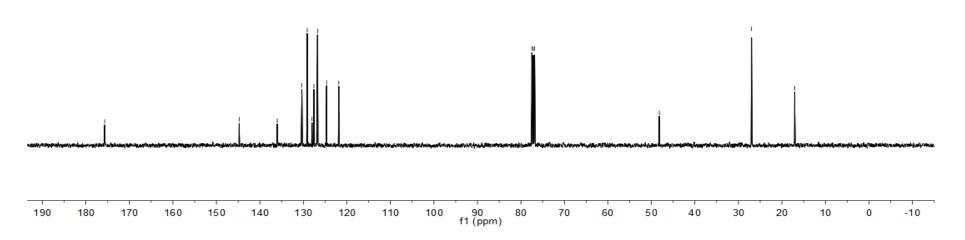


~1.784 ~1.699 000.0---

¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ad**

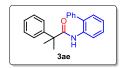


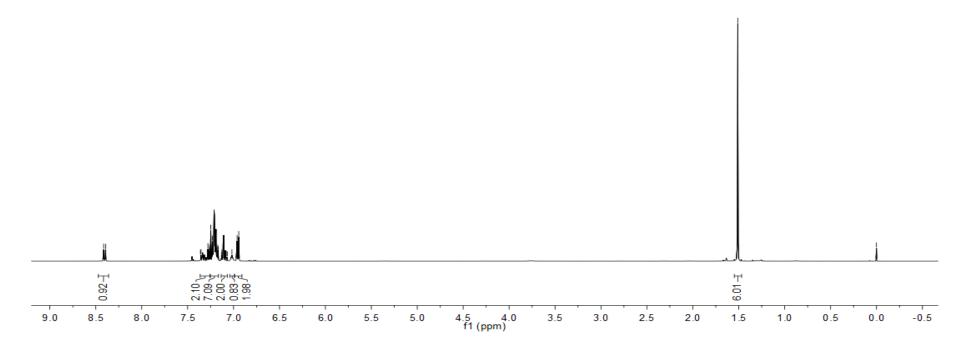




¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ae**

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88339 89339 80359 80559 80	
	<u> </u>



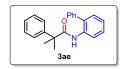


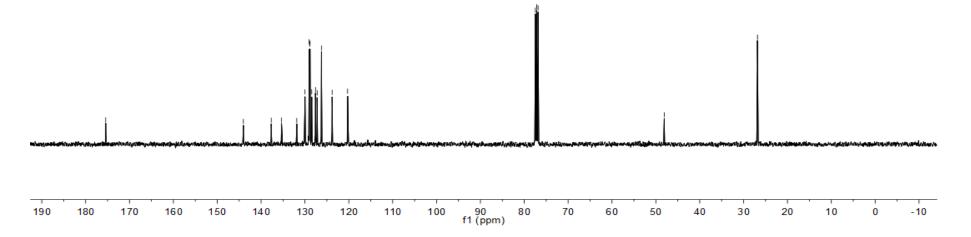
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-1.511

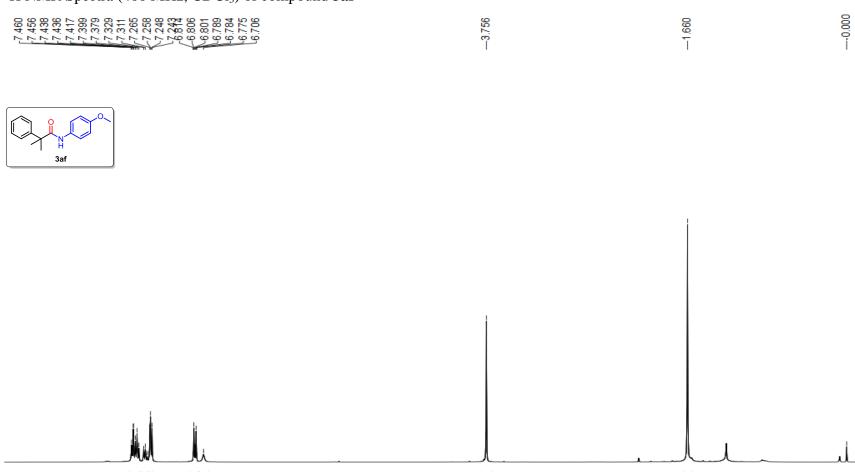
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ae**







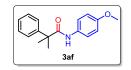
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3af**

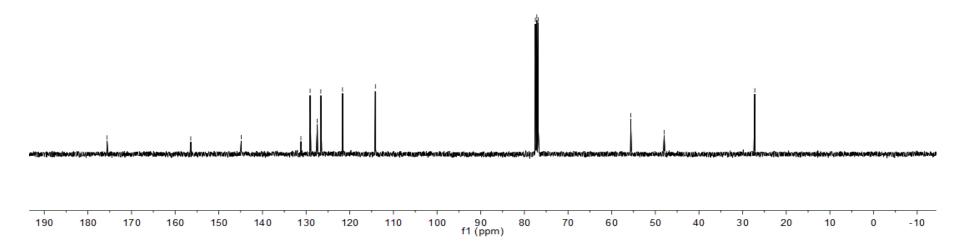


4.04 1.104 2.23 ⊯ 2.00 0.88 14 3.00 J 6.06-I 4.0 f1 (ppm) -0.5 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0

¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3af**

604	434	864	666 635 635 635 635 635 635 635 635 635	33	284	8	92	6
75.	20	44.	38.2333	4	6.8	5.6	2.9	7.2
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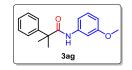


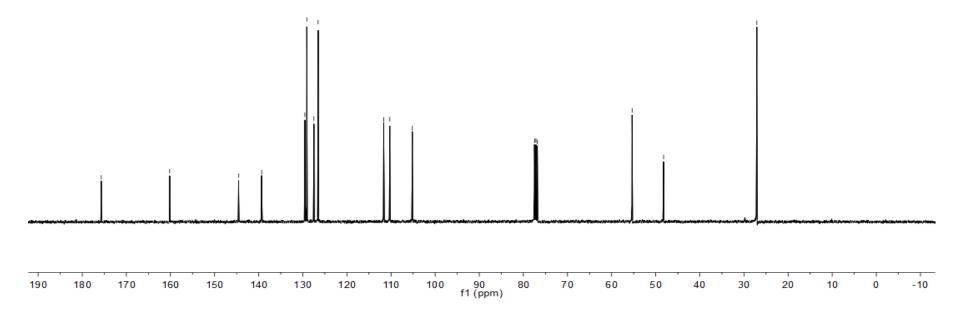


1 H NMR Spectra (400 MHz, CDCl₃) of compound **3ag** ---0.000 5588 5588 5589 5589 5589 5589 5588 5589 5588 55899 5589 5589 5589 5589 5589 5589 5589 5589 5589 5589 --3.757 -1.657 3ag 3.00 6.01 4 4.00 1.04 년 1.00 년 1.00 년 1.00 년 1.00 년 1.00 년 8.5 4.0 f1 (ppm) 7.0 6.5 6.0 5.5 4.5 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 8.0 7.5 5.0

¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ag**

75.695	60.189	44.565 30 378	6.52 6.52	11.668 10.292 05.183	7.478 7.160 6.842	5.349	8.212	7.093
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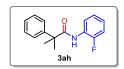


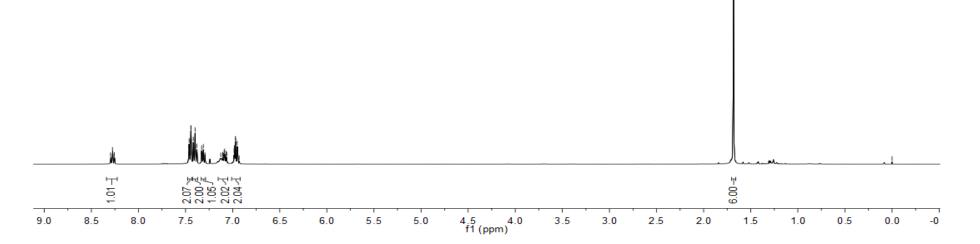


¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ah**

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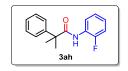
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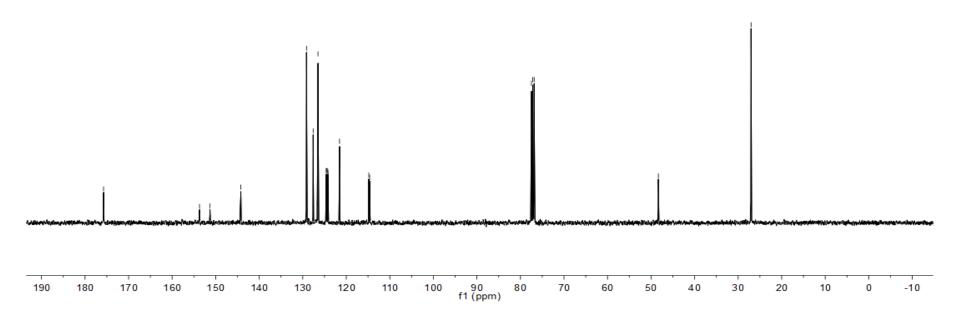




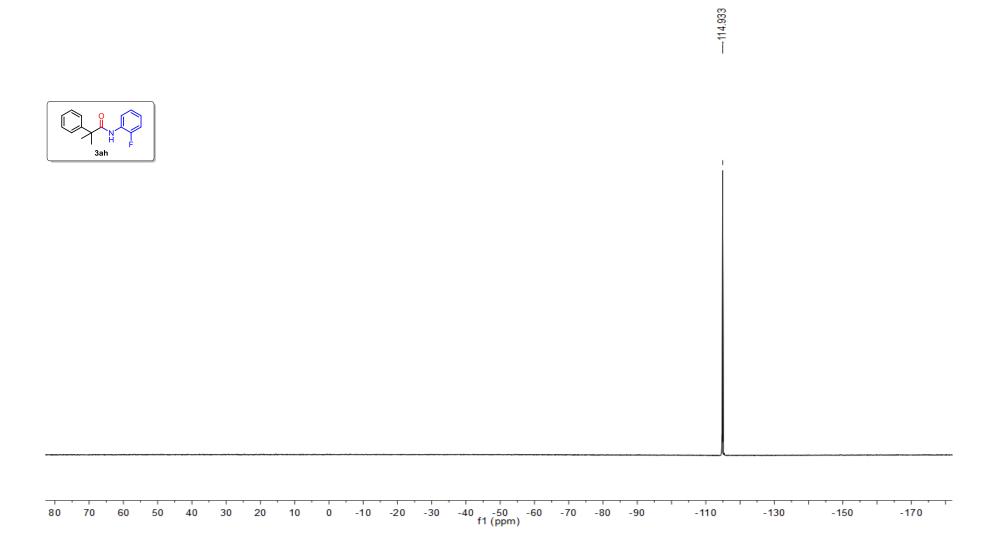
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ah**

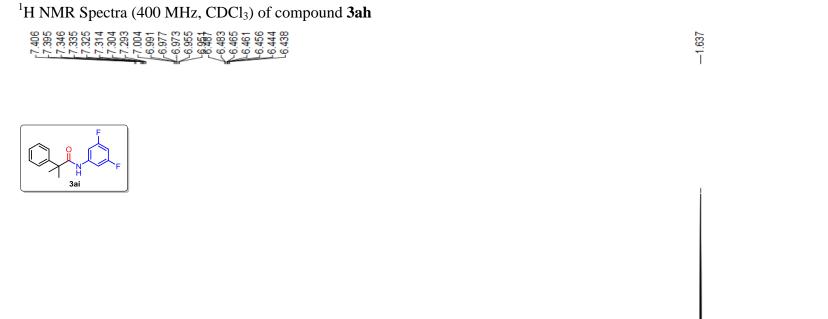
175.750	153.709 151.295	144.213	129.136 127.60495 124.596 124.596 124.596 124.596 124.596 114.632 114.632	77.478 77.160 76.842	48.319	27.027
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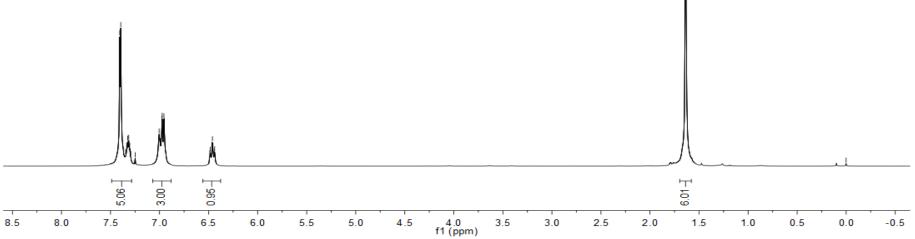




¹⁹F NMR Spectra (375 MHz, CDCl₃) of compound **3ah**



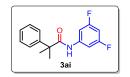


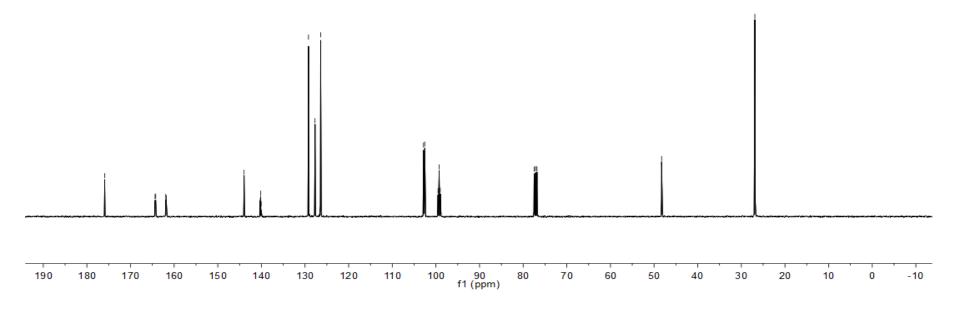


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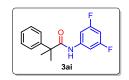
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ai**

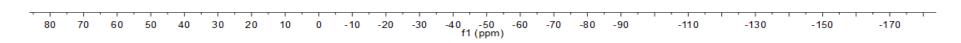
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¹⁹F NMR Spectra (375 MHz, CDCl₃) of compound **3ai**

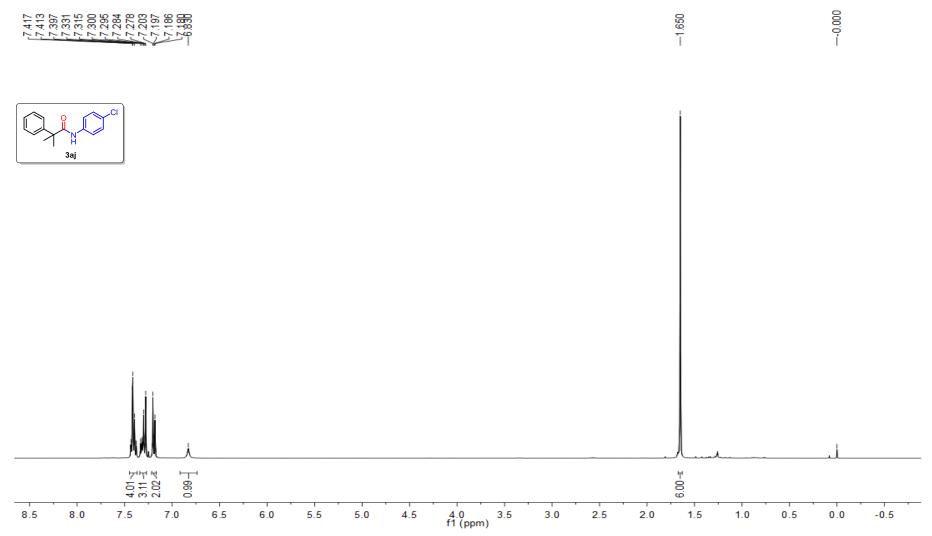




---- 108.954

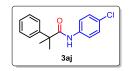
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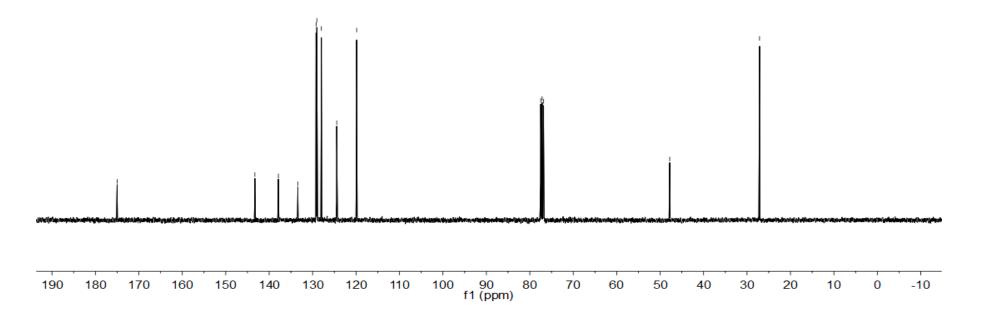
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3aj**



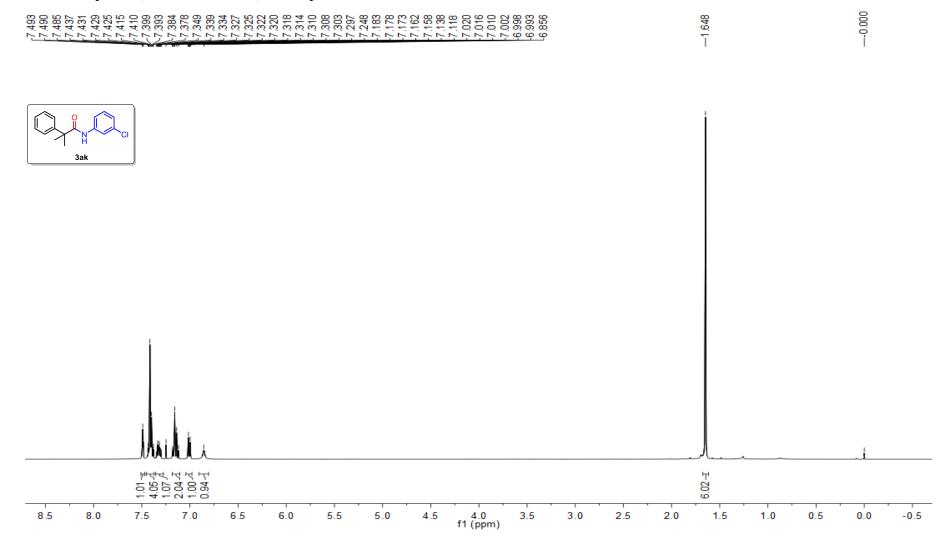
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3aj**

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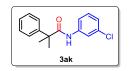


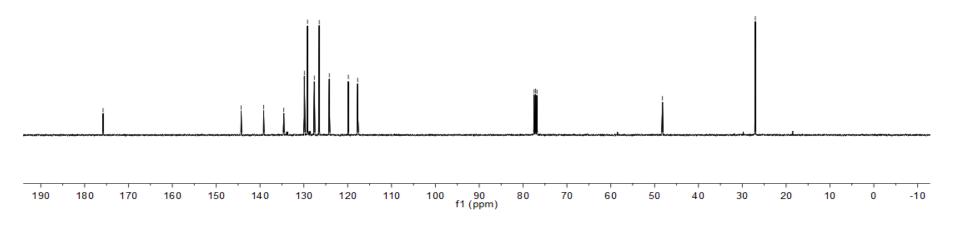
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ak**



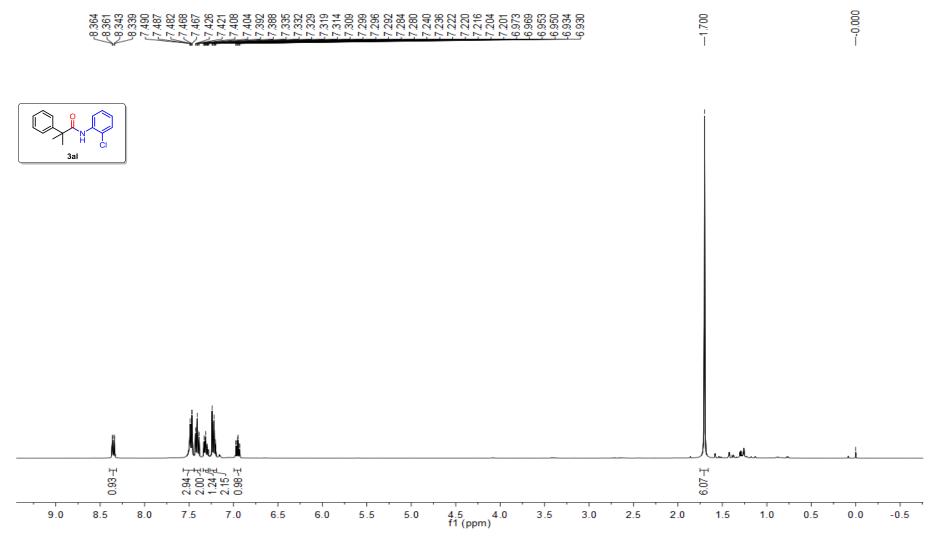
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ak**





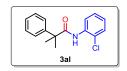


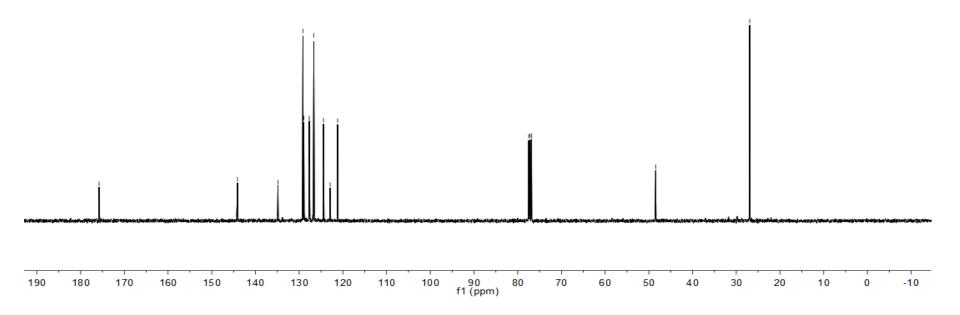
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3al**



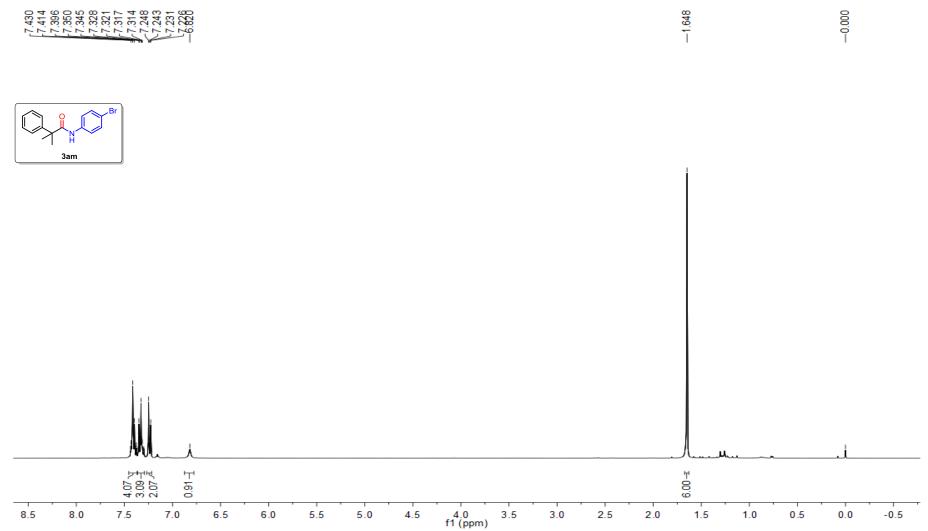
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3al**





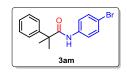


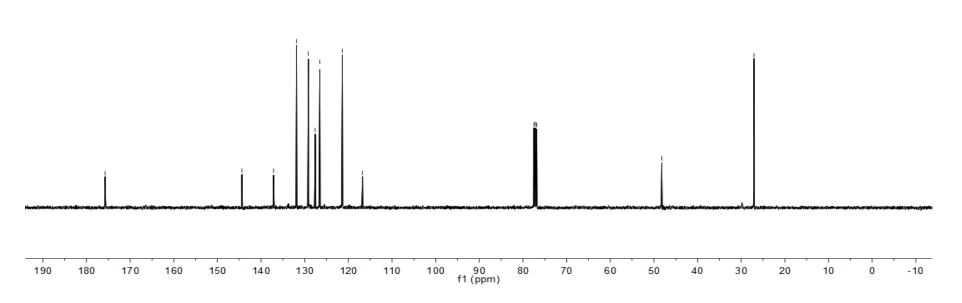
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3am**



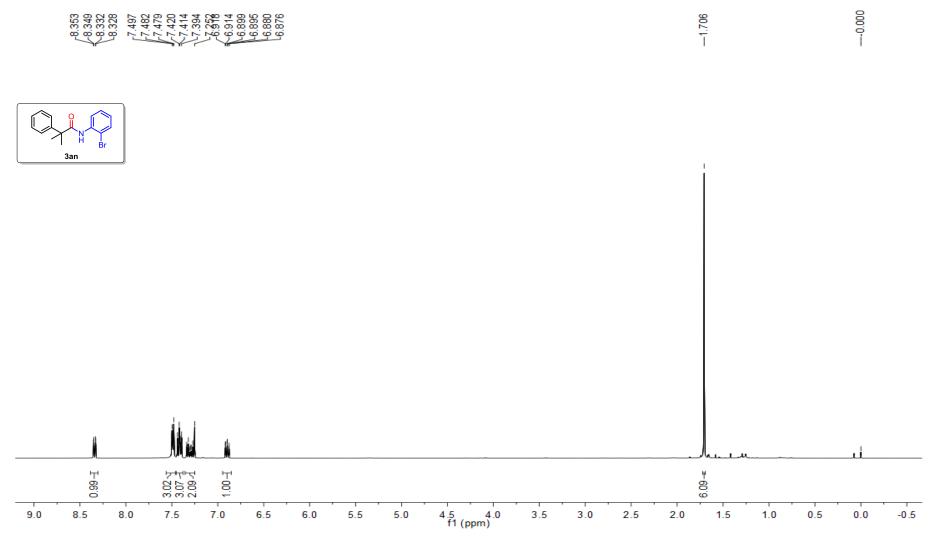
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3am**

		×137,142 131,875 131,875 137,609 121,366 −121,366 −121,366	77.478 77.160 76.843		-27.067
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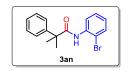


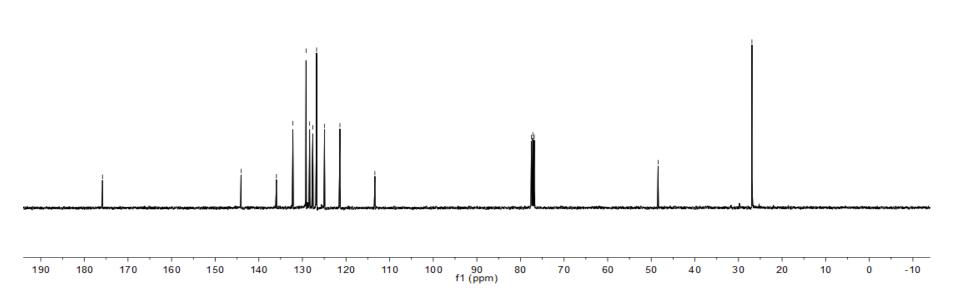
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3an**



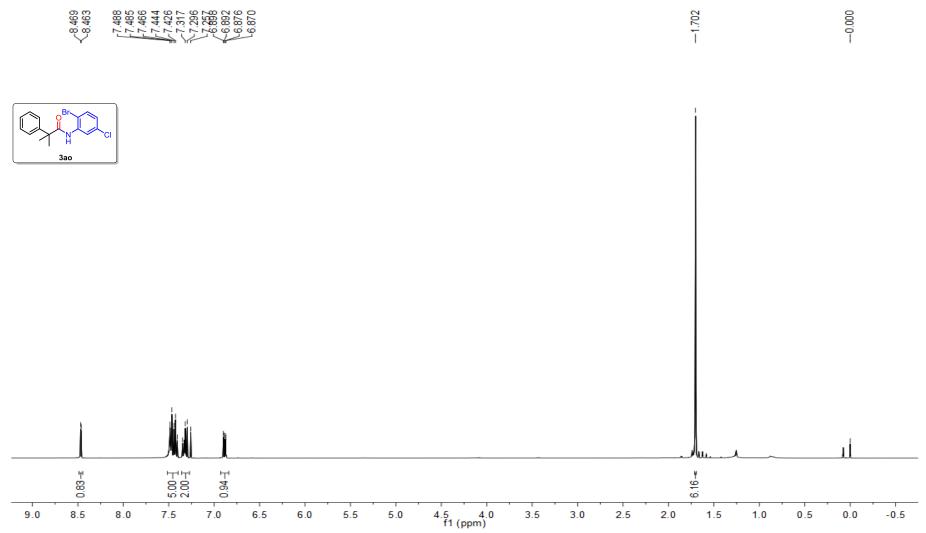
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3an**





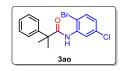


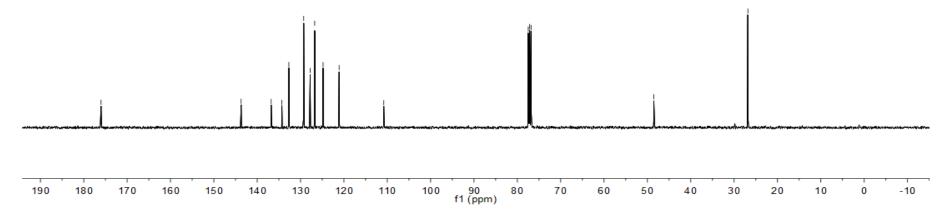
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ao**



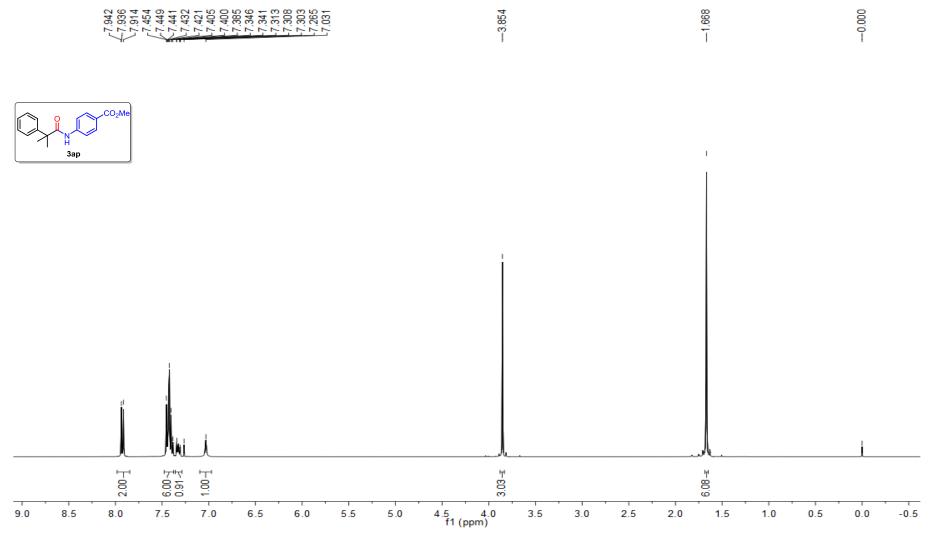
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ao**







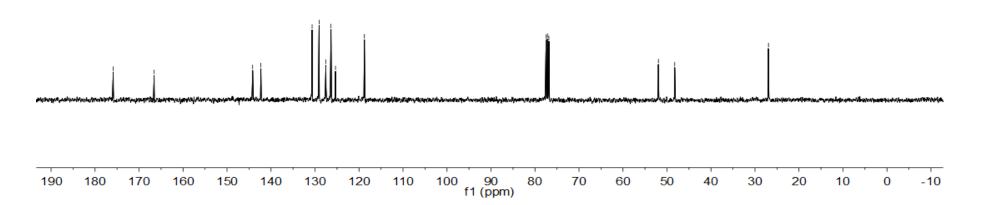
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ap**



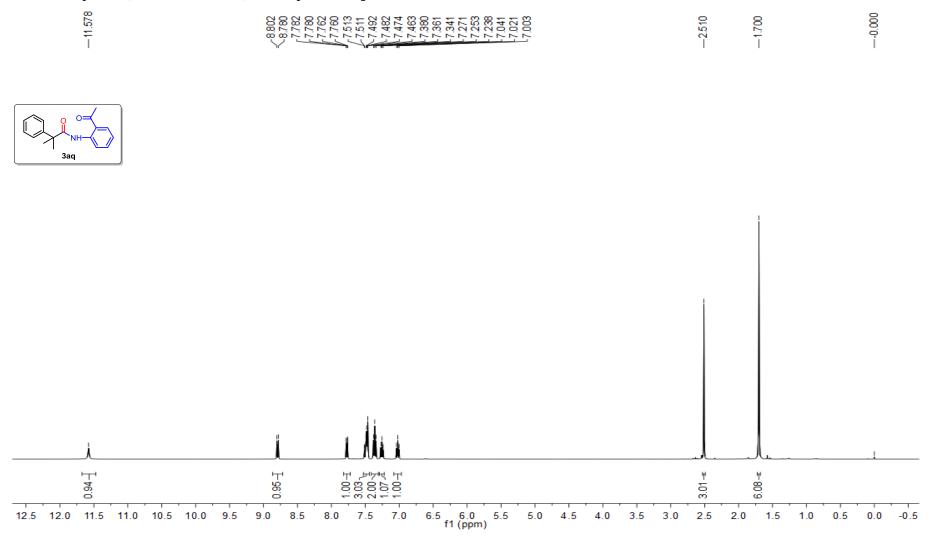
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ap**

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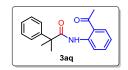


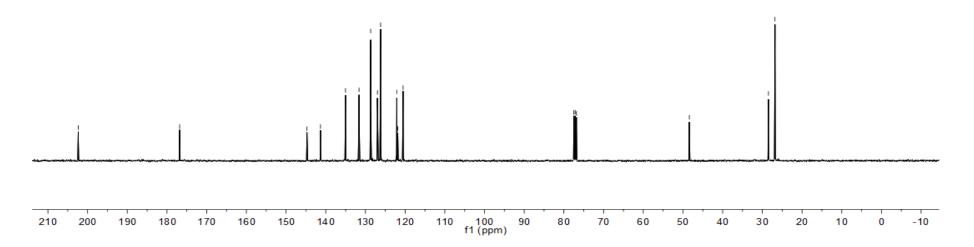
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3aq**



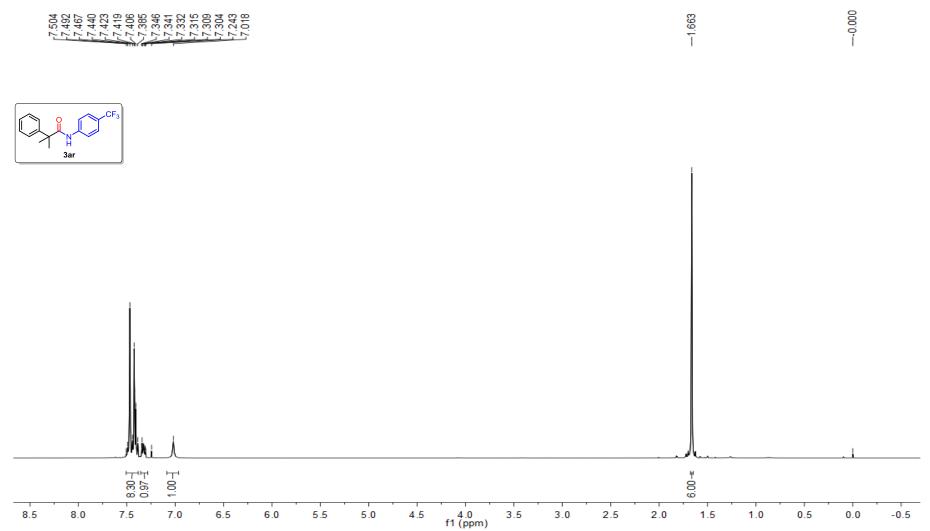
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3aq**

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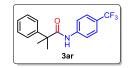


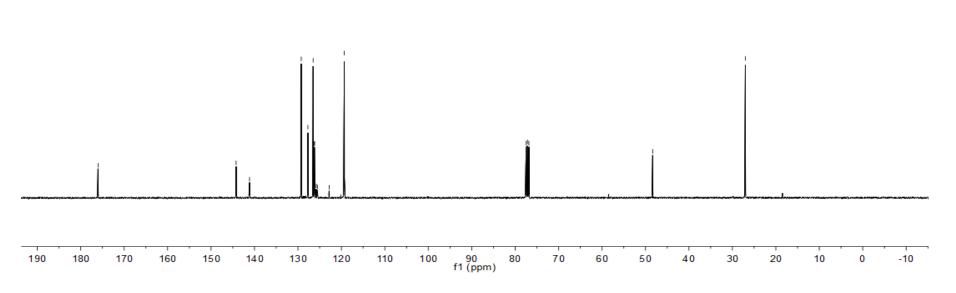
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ar**



¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ar**



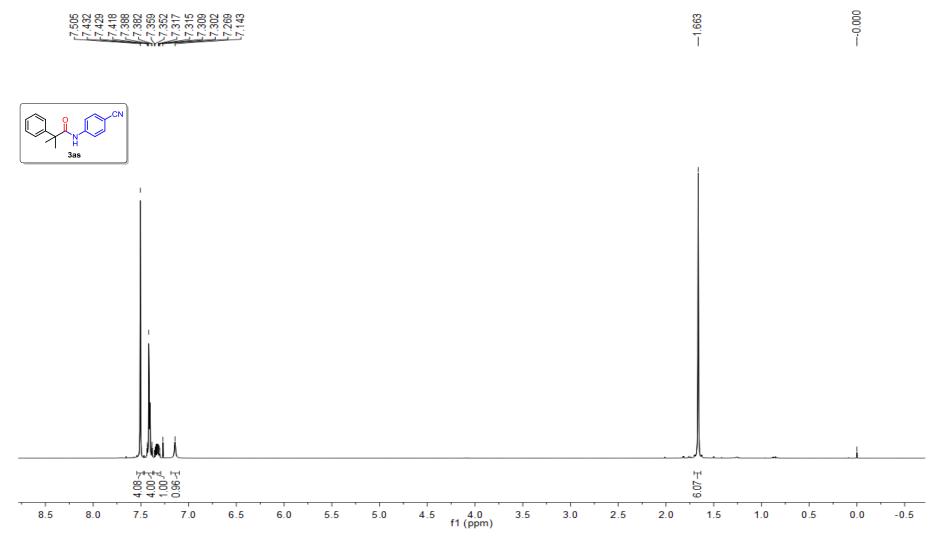




¹⁹F NMR Spectra (375 MHz, CDCl₃) of compound **3ar**

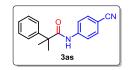
----62.416 Ó -110 50 40 30 20 -40 -50 -60 -70 -80 -90 f1 (ppm) -150 -10 -20 -30 80 70 60 10 -130 -170

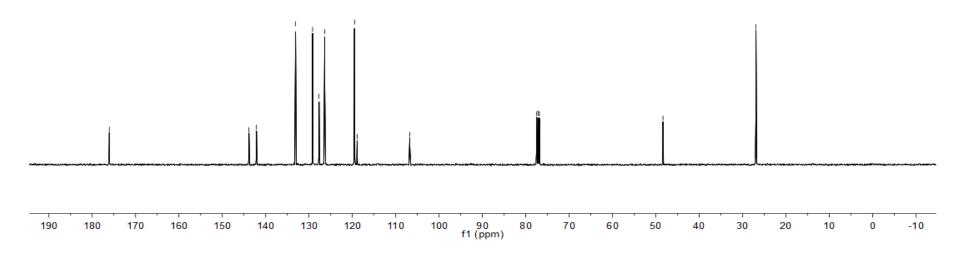
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3as**



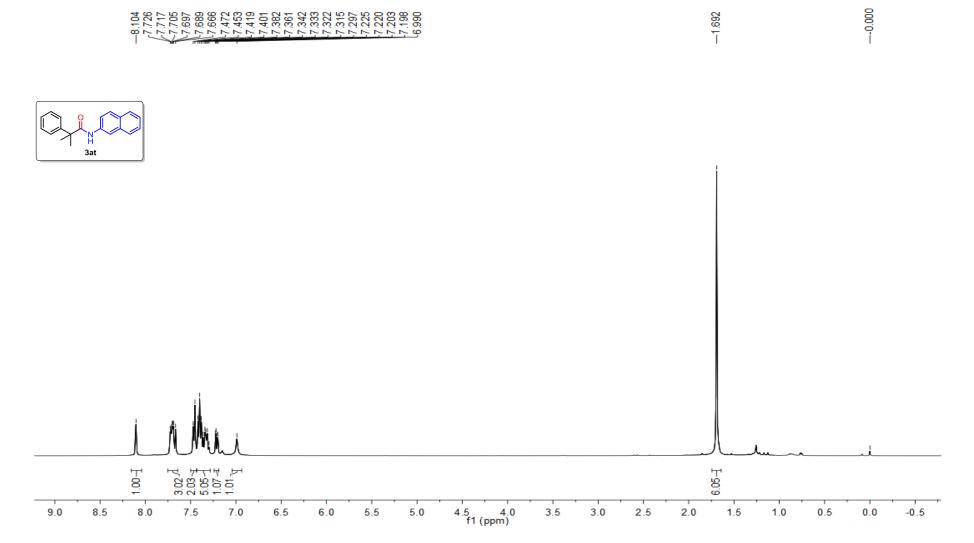
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3as**

76.053	43.853 42.121	33.101 29.171 27.689 26.376	19.503 18.890	06.750	7.478 7.160 6.841	8.343	6.891
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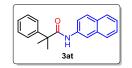


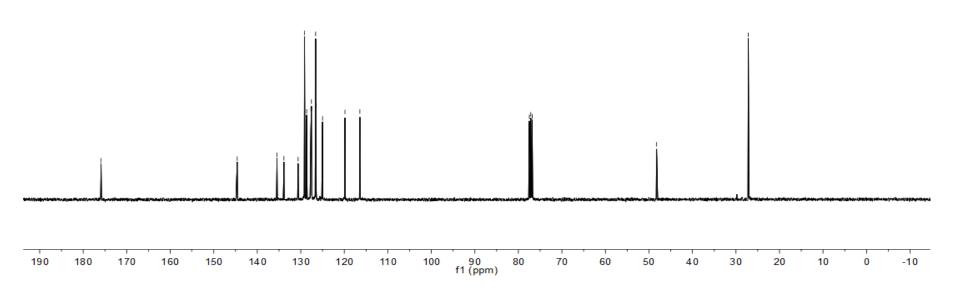
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3at**



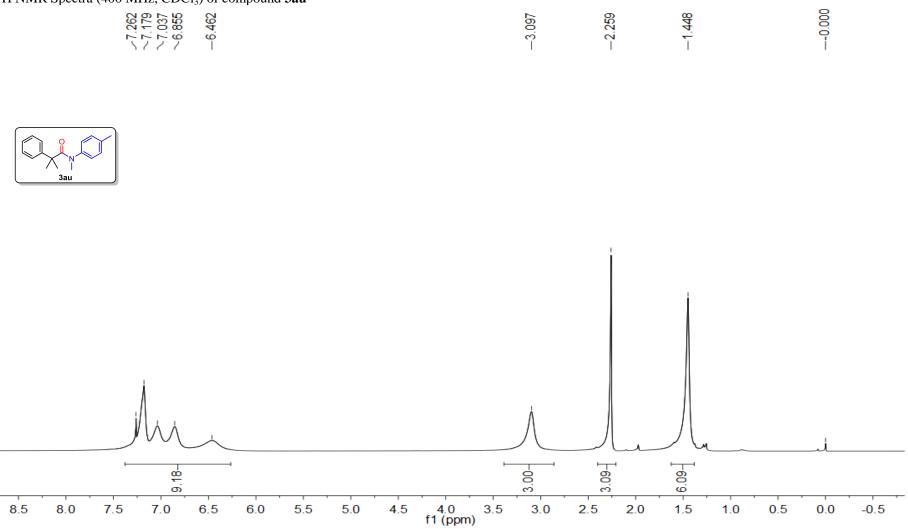
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3at**





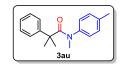


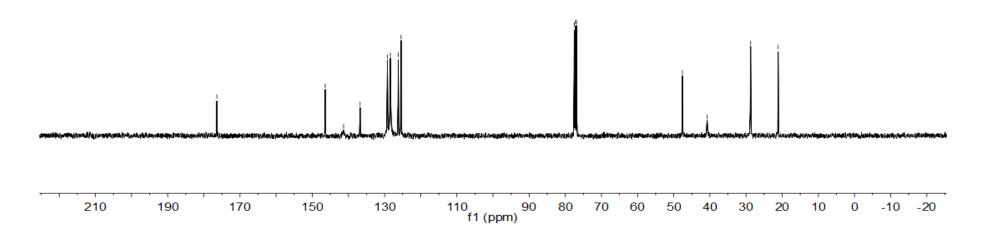
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3au**



¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3au**

176.397	146.425 141.332 136.762 129.214 129.218 126.218 126.218	77.515 77.198 76.880	47.619 40.763	28.734 21.116
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¹H NMR Spectra (600 MHz, CDCl₃) of compound **3av**

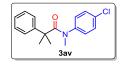
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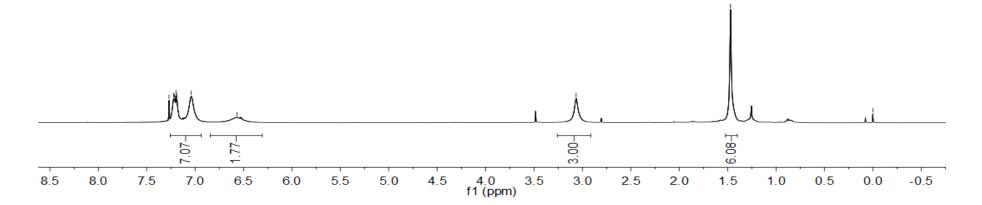


-3.064

-1.470

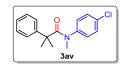
000.0----

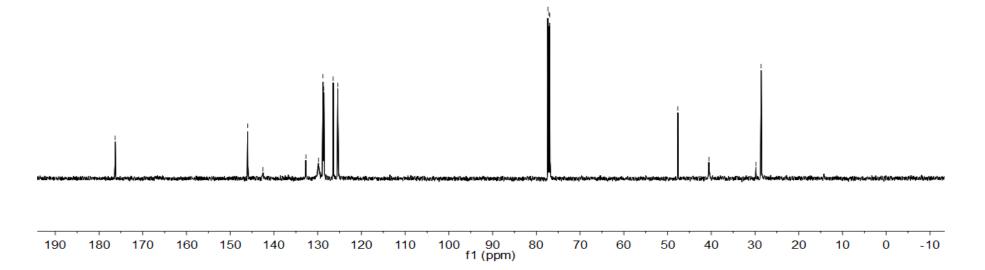




¹³C NMR Spectra (151 MHz, CDCl₃) of compound **3av**

176.303	145.989 142.506 132.699 128.603 126.463 125.383	77.372 77.160 76.948	17.658	10.556	29.794 28.606
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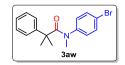


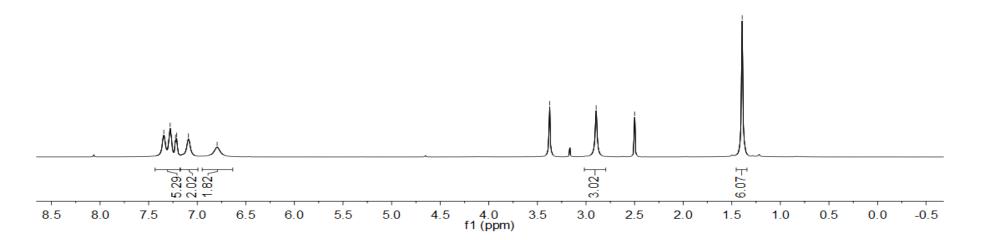


¹H NMR Spectra (600 MHz, d^6 -DMSO) of compound **3aw**

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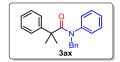


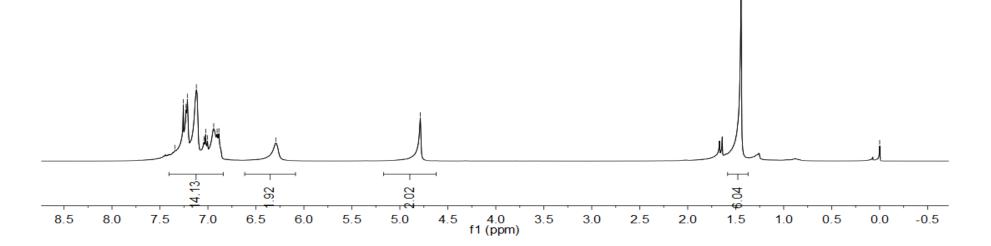
¹³C NMR Spectra (151 MHz, d^6 -DMSO) of compound **3aw**

-174.878		131.510 130.124 128.641 126.350 119.487				-47.022	39.797 1 39.659	29.520 28.380 				
Br Br 3aw												
					ere son and the source of the							
190 180 170 1	60 150 14	0 130 120 11	0 100 90 f1 (ppm)	80 70	60	50	40	30	20	10	0	-10

¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ax**

2256 2256 2228 2238 2233 2233 2904 004 2904 2904 2904 2904 2904 2904	





-4.787

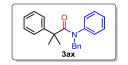
000.0---

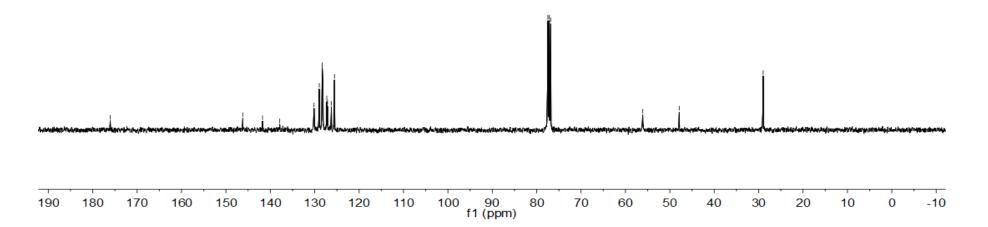
-1.445

S88

¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ax**

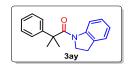
-176.070 -176.070 -176.070 -176.070 -146.194 -137.888 -132.8294 -125.552 -125.552 -125.552 -77.479 -77.479 -77.479 -77.479 -77.479 -77.479 -76.842	cn1.0c-	47.884	
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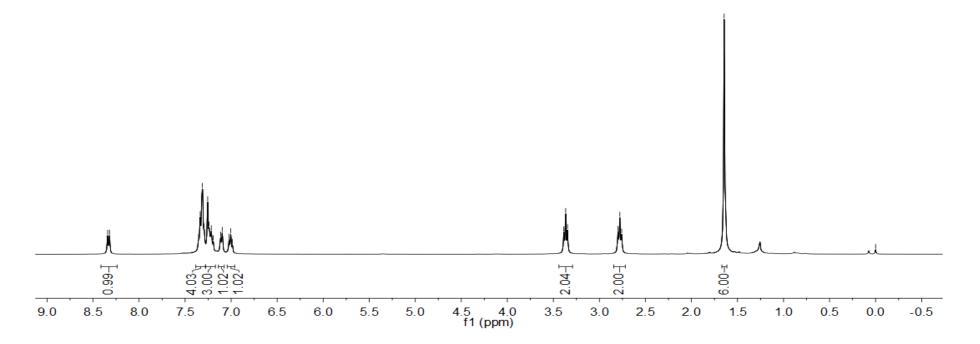




1 H NMR Spectra (400 MHz, CDCl₃) of compound **3ay**

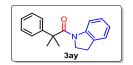
8.342 8.3354 8.3354 8.3354 7.12355 6.986 6.986 6.986 7.1255 7.123557 7.123557 7.123557 7.123557 7.1235577 7.1235777 7.1235777777777777777777777777777777777777	-3.386 -3.386 -3.346 -2.778 -2.778	-1.645	000.0

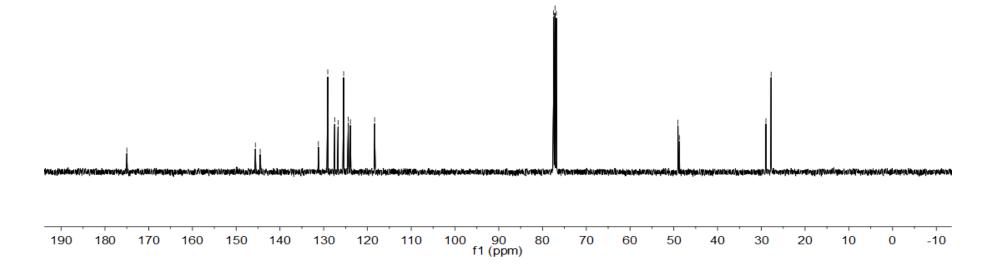




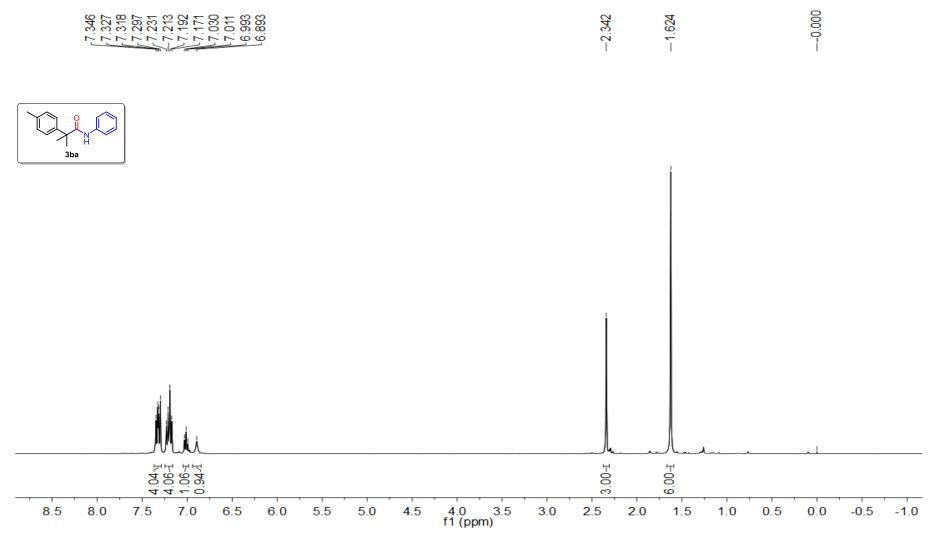
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ay**

- 174.992 144.518 144.518 121.218 126.725 118.362 118.362 118.362	77.477 77.160 76.842	49.045	28.948 27.766
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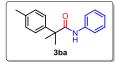


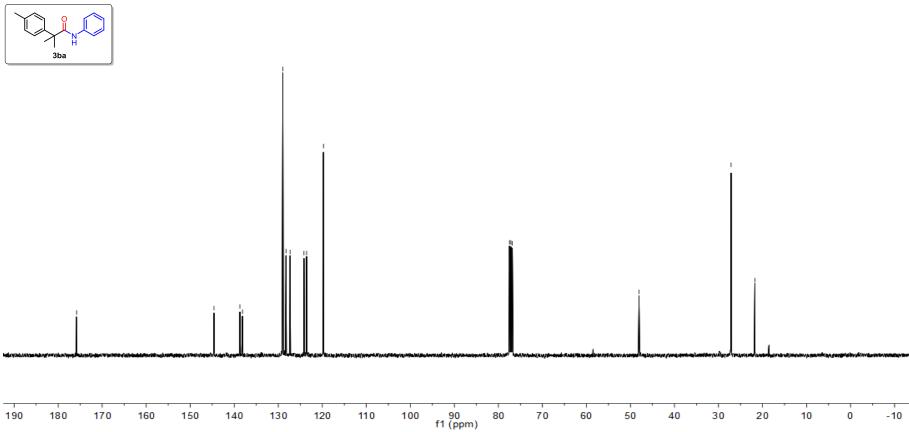
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ba**



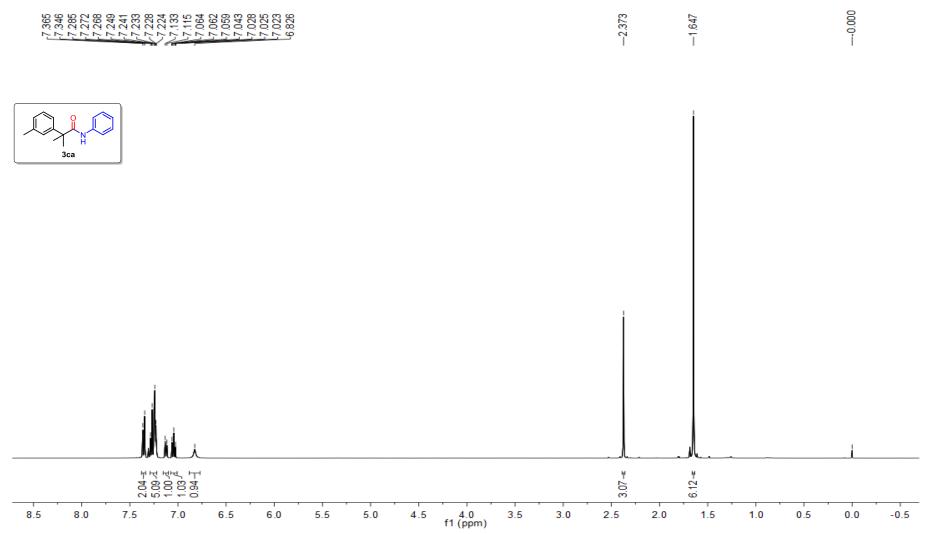
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ba**





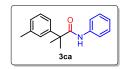


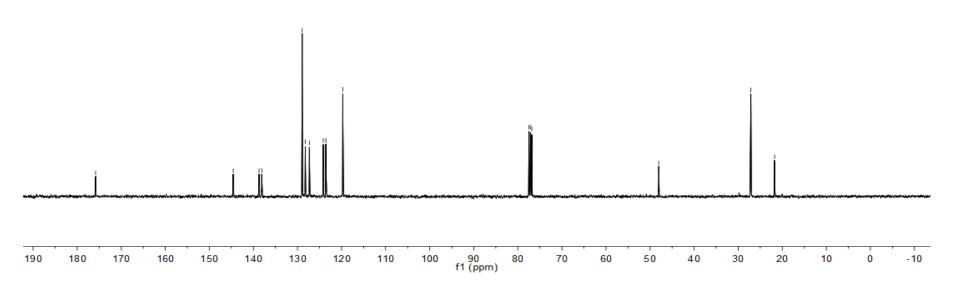
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ca**



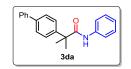
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ca**

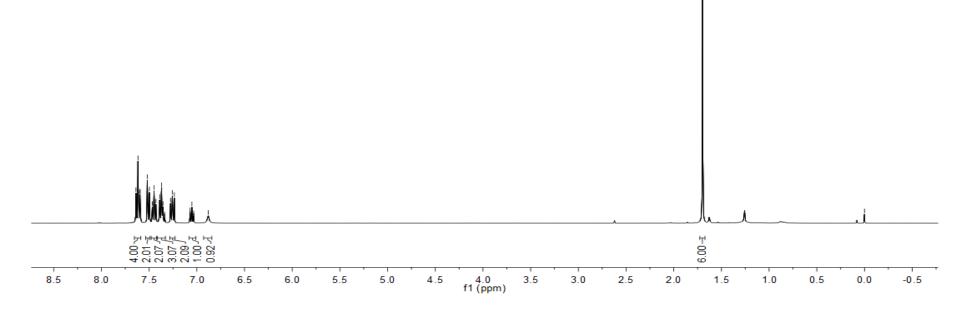
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		N N N	4	0 0
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¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ca**

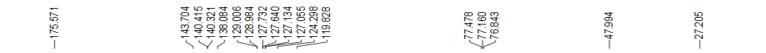


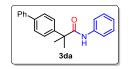


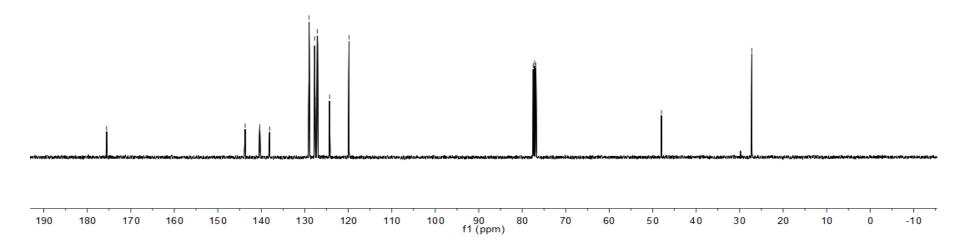
-0.000

-1.698

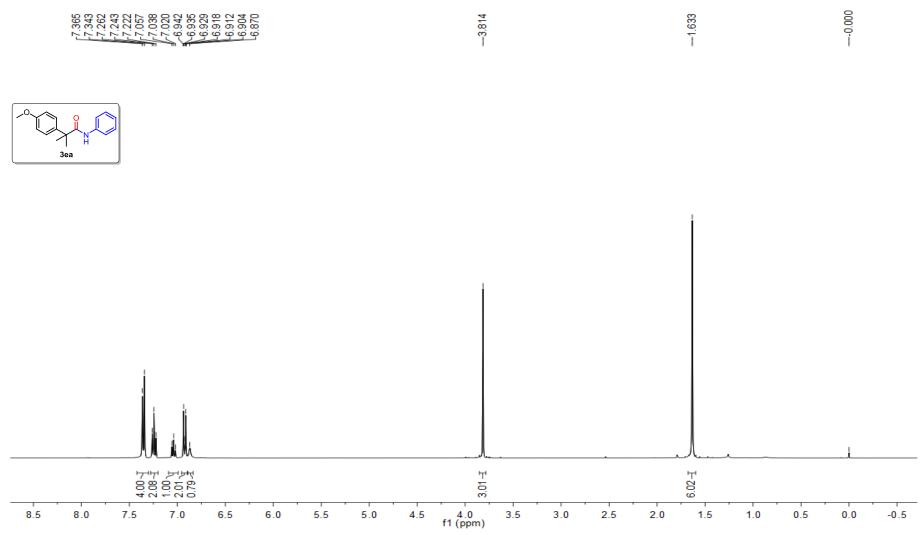
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3da**





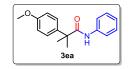


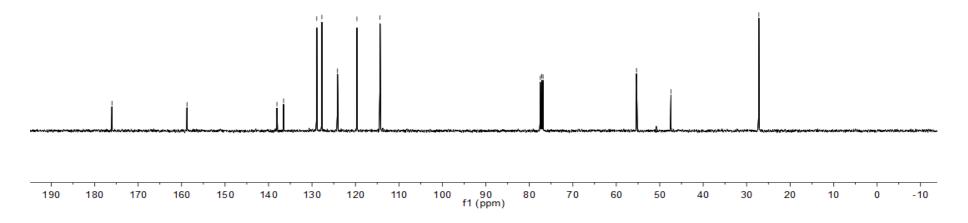
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ea**



¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ea**

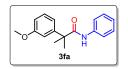
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0	N	00	$\omega \sim - \omega \omega$	P 0 4	4	CN I	0
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<u></u>	· · ·	~ ~	~~~~~			4	2
1	1	()				1	

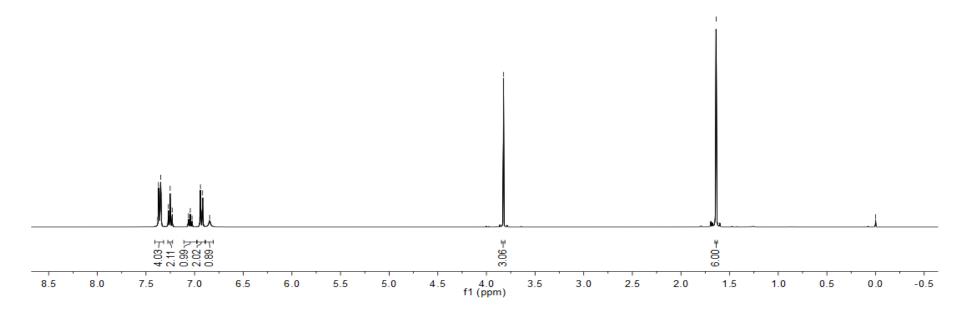




¹H NMR Spectra (400 MHz, CDCl₃) of compound **3fa**

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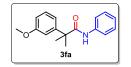
---3.824

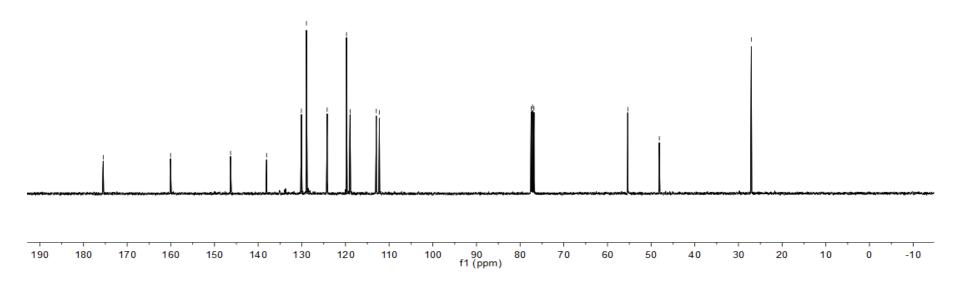
000.0----

--1.638

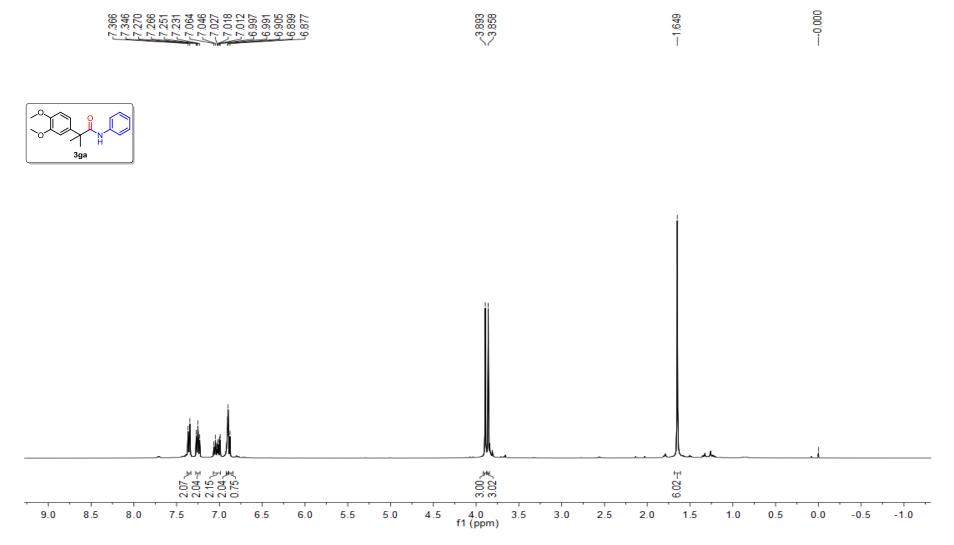
# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3fa**

175.485	160.055	146.313	138.065	130.109 128.941 128.201 119.764 118.948 112.253 112.253	77.478 77.160 76.842	55.352	48.132	27.055
			1	$1/1 \leq 1 \leq 1$	$\sim$	1	1	1



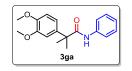


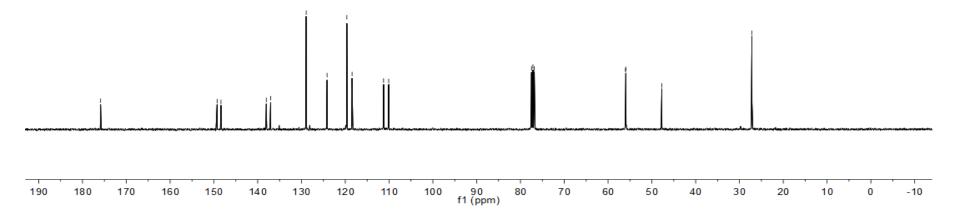
#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ga**



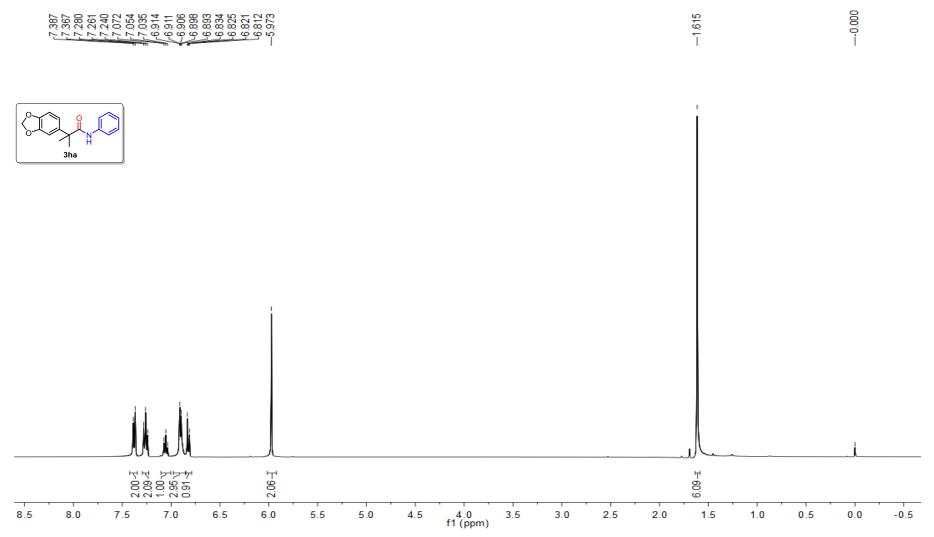
# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ga**

75.864	49.262 48.383	38.030 37.059	28.921 24.155 19.646 18.450	11.265 10.091	7.478 7.160 6.841	6.027 5.946	7.7.27	7.149
<u></u>	<u> </u>	<u></u>	~ ~ ~ ~	<u></u>		9.0	4	N
1	52	52	1155	52		Ý.	Ĩ	T.



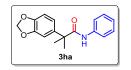


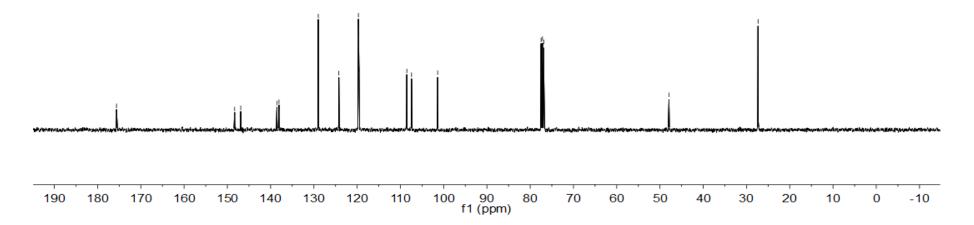
# ¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ha**

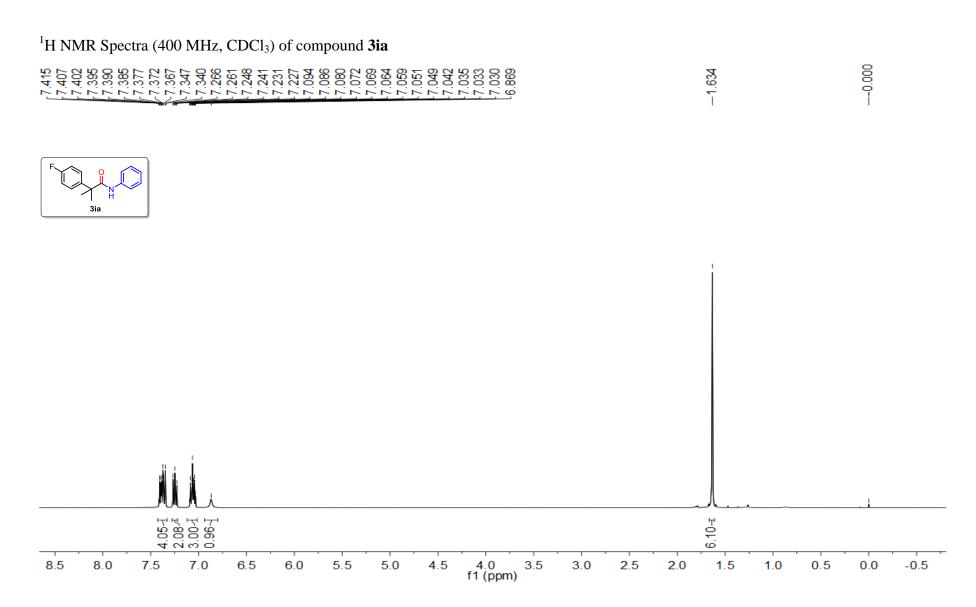


# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ha**

1		- /	1				
-175.616	-148.316 -146.910	138.553 138.071	-128.984 -124.228 -119.708 -119.558	-108.512 -107.432 -101.380	77.478 77.160 76.842	47.915	27.326
	57	$\leq$			$\sim$		

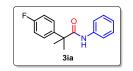


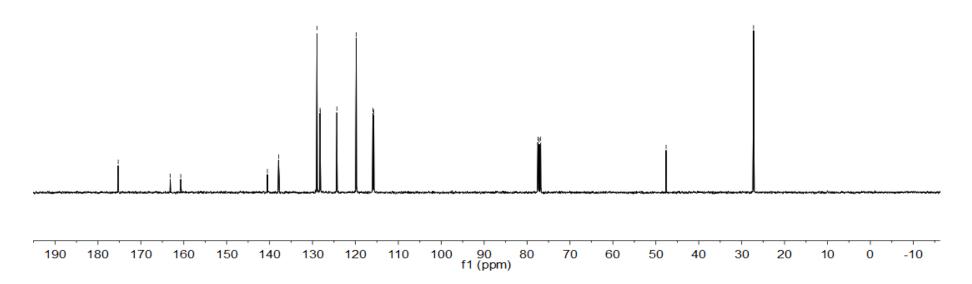




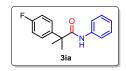
# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ia**

-175.274 -175.274 -160.699 -160.699 -137.915 -137.915 -137.915 -132.612 -132.6212 -1128.952 -1128.325 -1128.325 -1128.325 -1128.325 -128.325 -128.325 -128.325 -128.325 -128.325 -128.325 -128.325 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326 -128.326	-27.226
	1





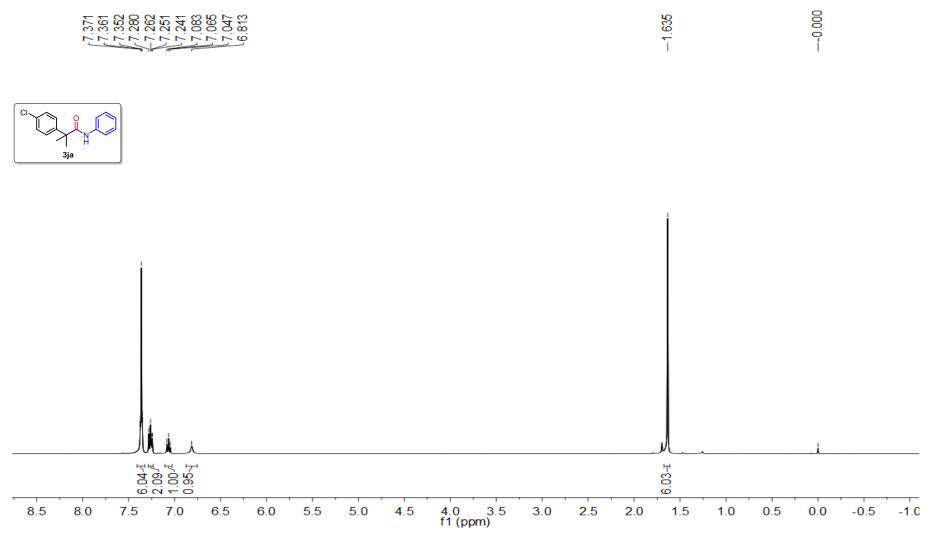
¹⁹F NMR Spectra (375 MHz, CDCl₃) of compound **3ia** 





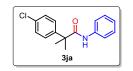
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80	70	60	50	40	30	20	10	0	-10	-20	-30	-40	-50	-70	-80	-90	-110	-130	-150	-170
	f1 (ppm)																			

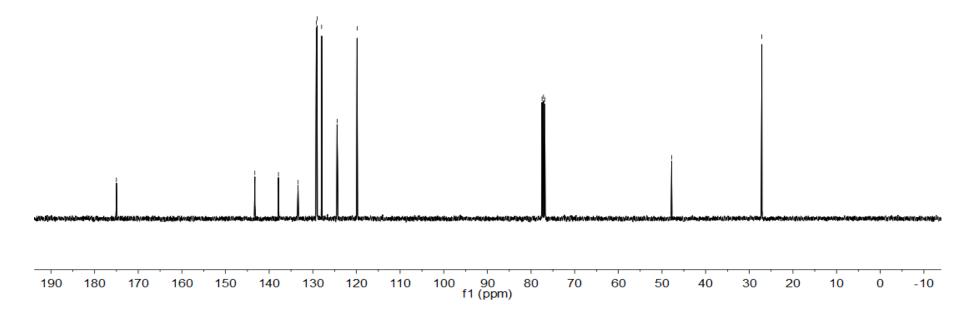
#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ja**



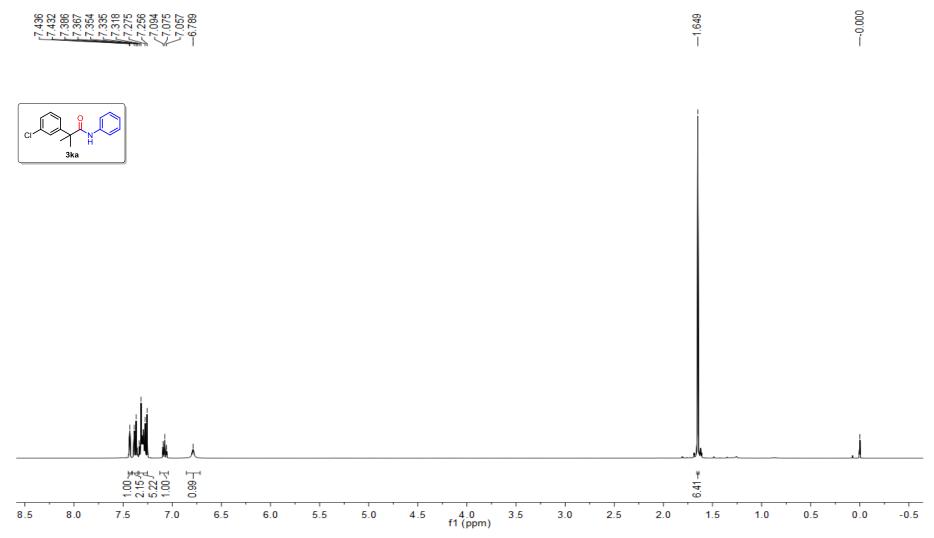
# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ja**

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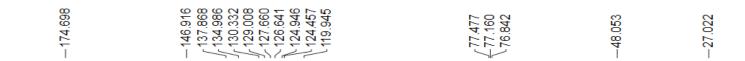


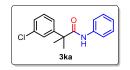


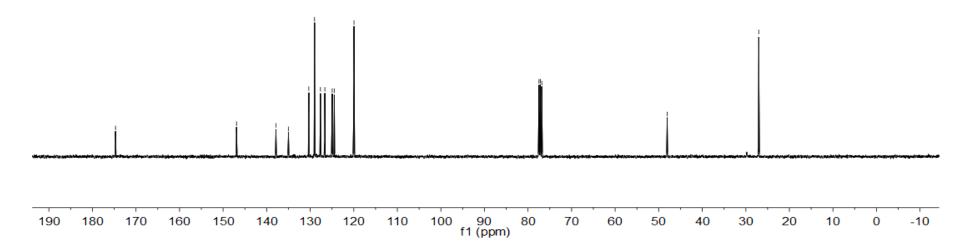
## ¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ka**



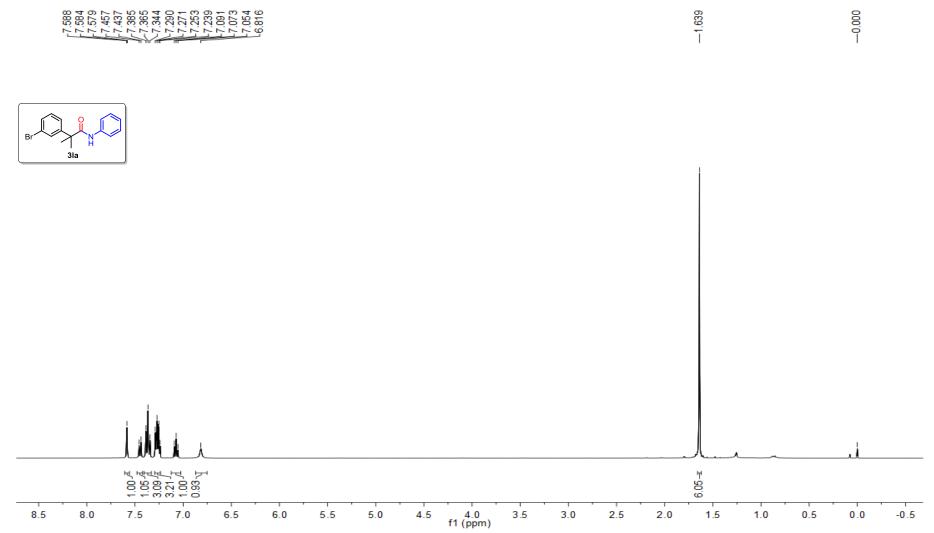
## ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ka**





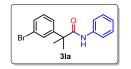


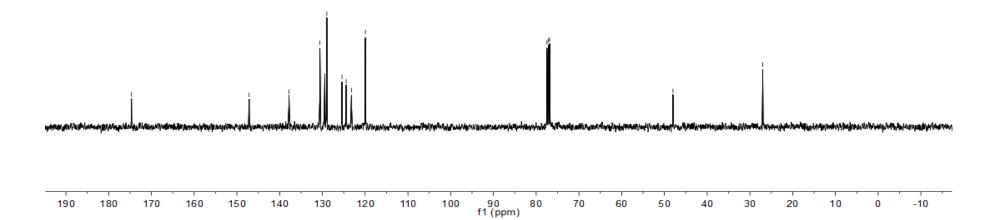
#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **3la**

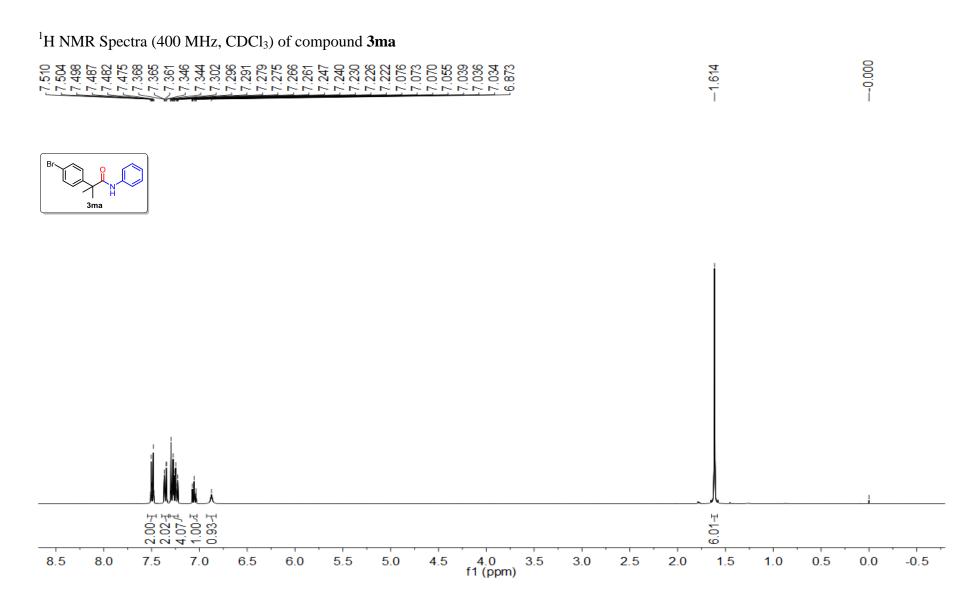


## ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3la**





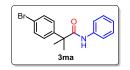


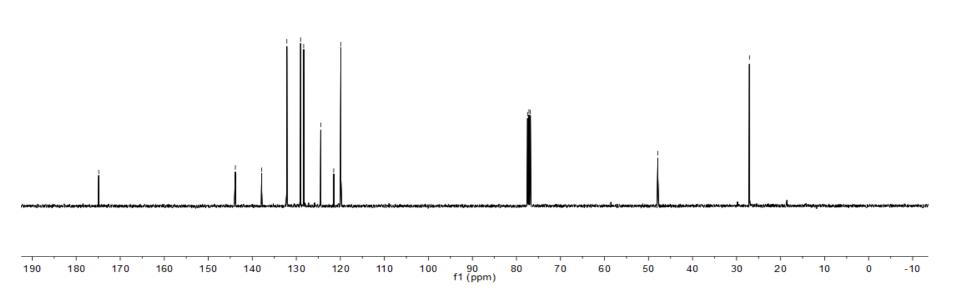


S115

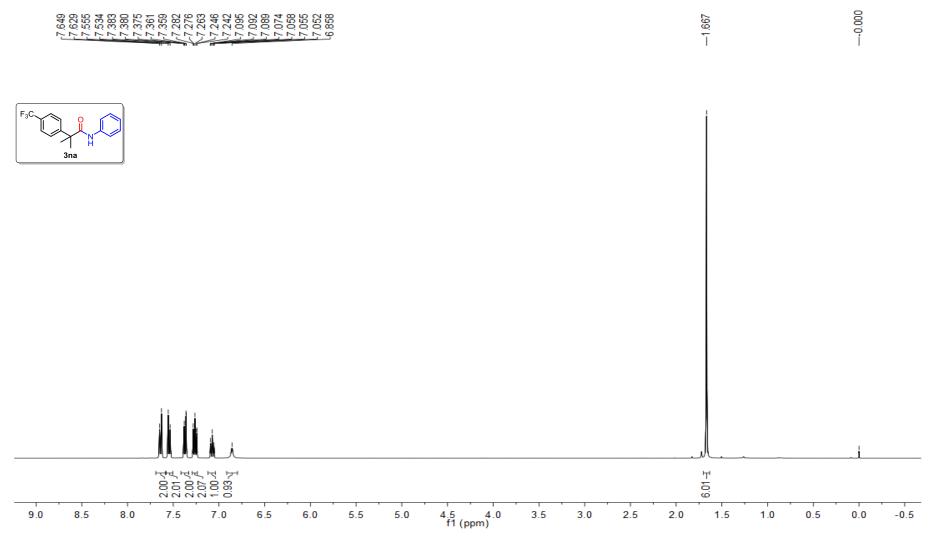
# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ma**

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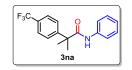


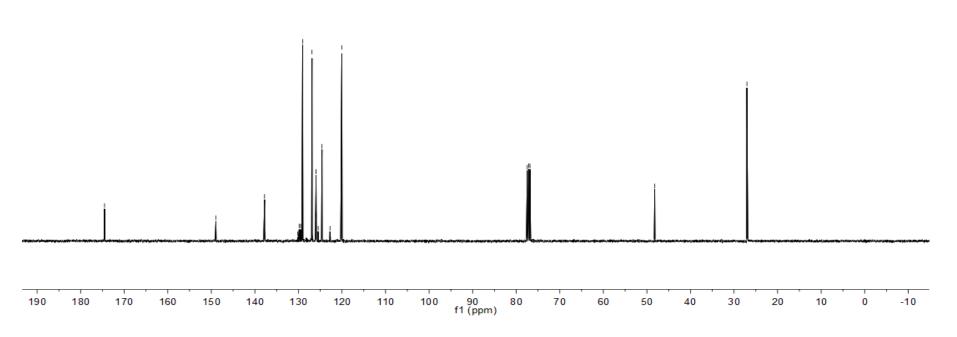
#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **3na**



# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3na**

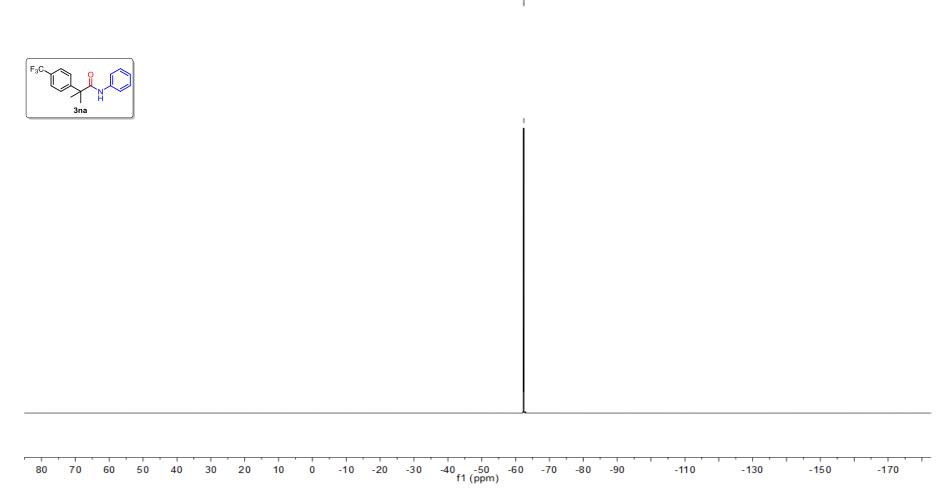
-174.513	-148.941	-137.779 130.151 130.151 129.603 128.885 128.885 128.885 128.983 128.983 128.983 128.983 128.983 122.757 122.757 122.757 122.037	77.477 77.160 √76.842	-48.206	-27.039	
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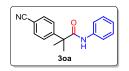
# ¹⁹F NMR Spectra (375 MHz, CDCl₃) of compound **3na**

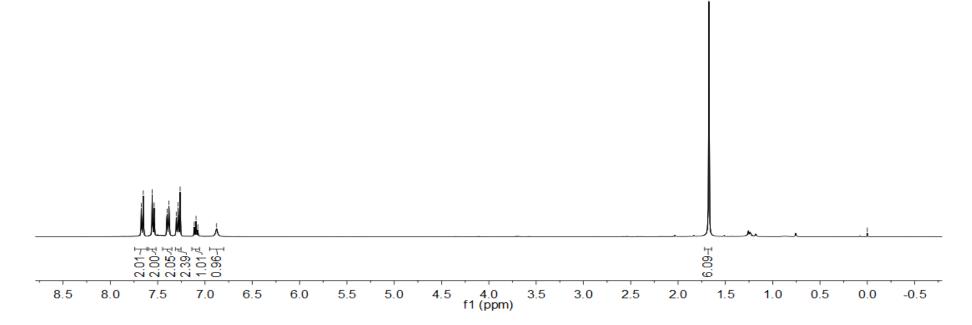
----62.416



## ¹H NMR Spectra (400 MHz, CDCl₃) of compound **30a**

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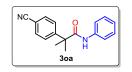


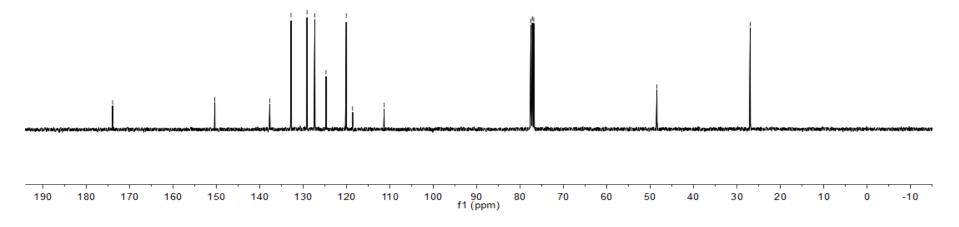
000.0—

-1.674

¹³C NMR Spectra (101 MHz, CDCl₃) of compound **30a**

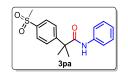
73.914	50.341	37.676 32.766 29.088 27.286 27.286 27.717 28.717 18.589	11.320	7.478 7.160 6.842	8.438	5.929
				NNN N	4	N
1		1 1 2 1 2 1 2 1				

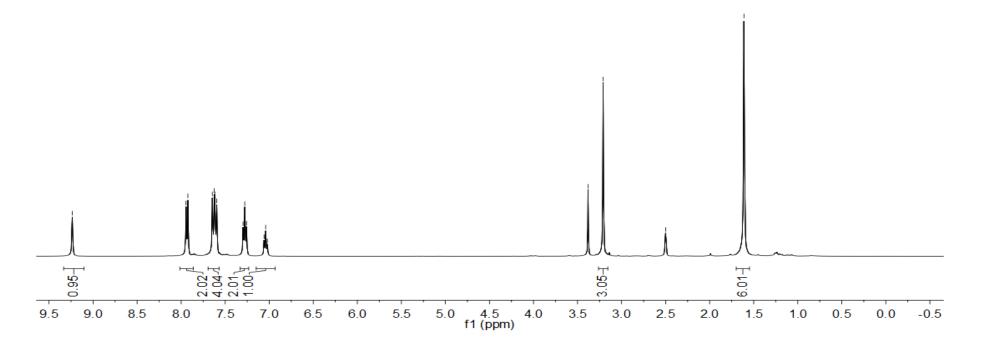




¹H NMR Spectra (400 MHz, d^6 -DMSO) of compound **3pa**

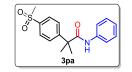
236	945 9245 0259 0224 0224 0224 0224 0224 0224 0224 022	381	200	611
o o	~~~~~~~~~~	0.0	0	<u></u>
I		1 1		1





¹³C NMR Spectra (101 MHz, C d^6 -DMSO) of compound **3pa**

910	676	079 947	458 988 988 387 387	4 6 0 7 7 0 8 8 9 4 6 0 7 0 8 8 2 4 6 0 7 0 8 8 2
173.	151.	139.	120.129.128	2838382444 288989892 689449777
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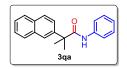


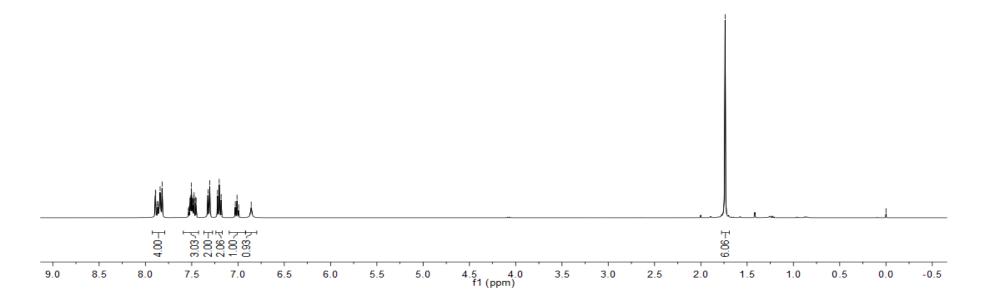
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190 180	170	160 150) 140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	- 10

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¹H NMR Spectra (400 MHz, CDCl₃) of compound **3qa**

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NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN



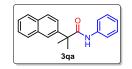


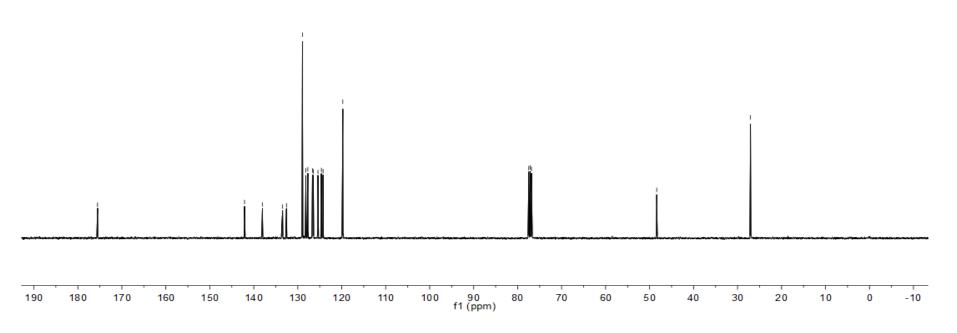
-1.738

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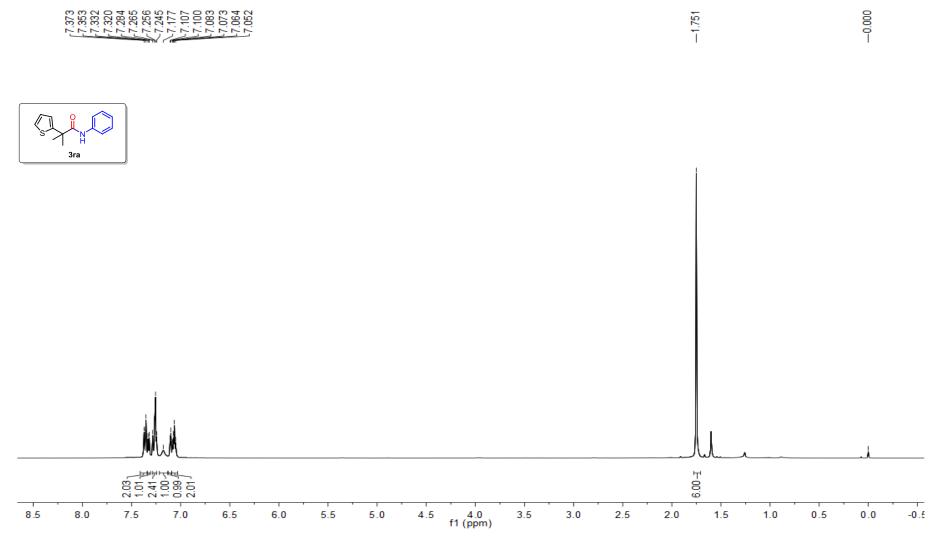
¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3qa**





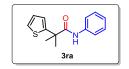


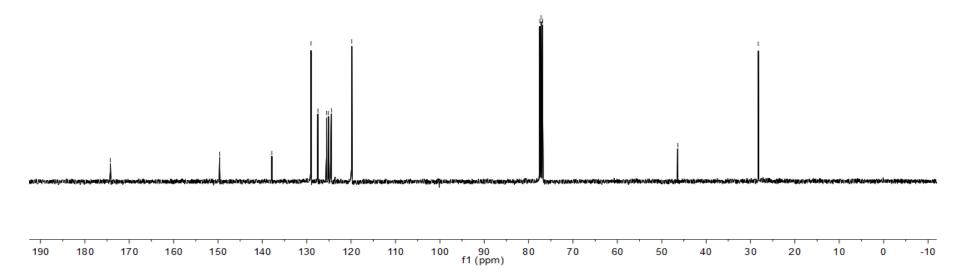
¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ra**



¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ra**







¹H NMR Spectra (600 MHz, CDCl₃) of compound **3sa**

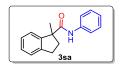
260

314 263

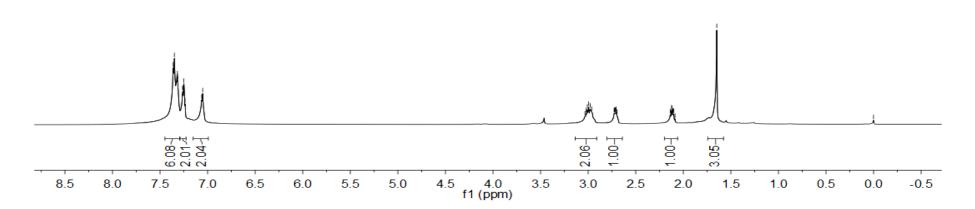
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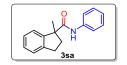


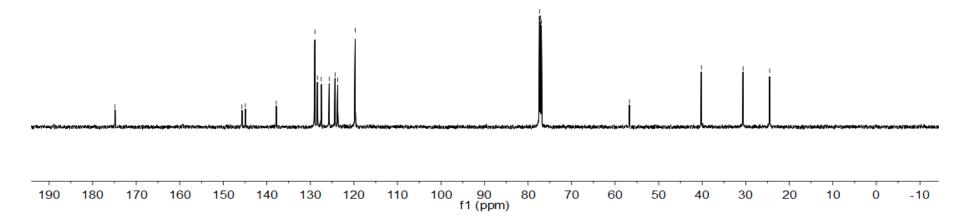
362 349



¹³C NMR Spectra (151 MHz, CDCl₃) of compound **3sa**

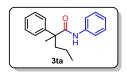
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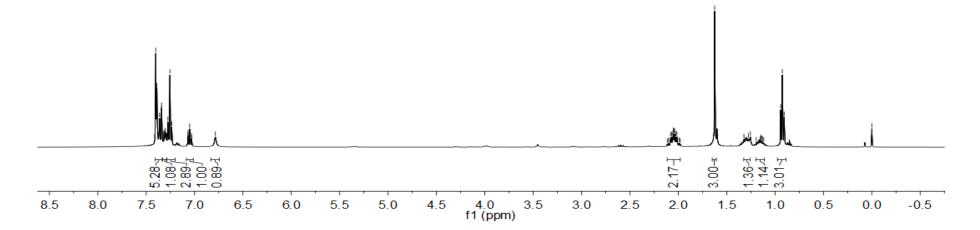




¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ta**

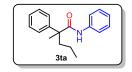
<u>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>	4286888486488	888 866 868 868 868 868 868 868 868 868
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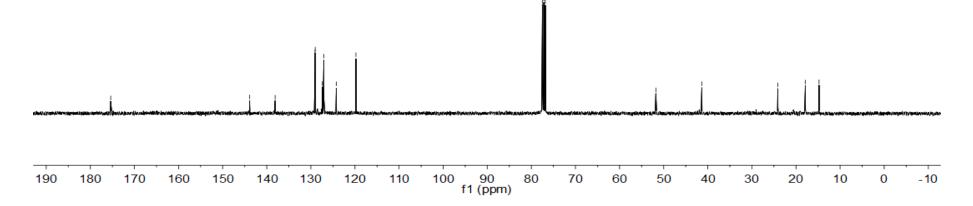




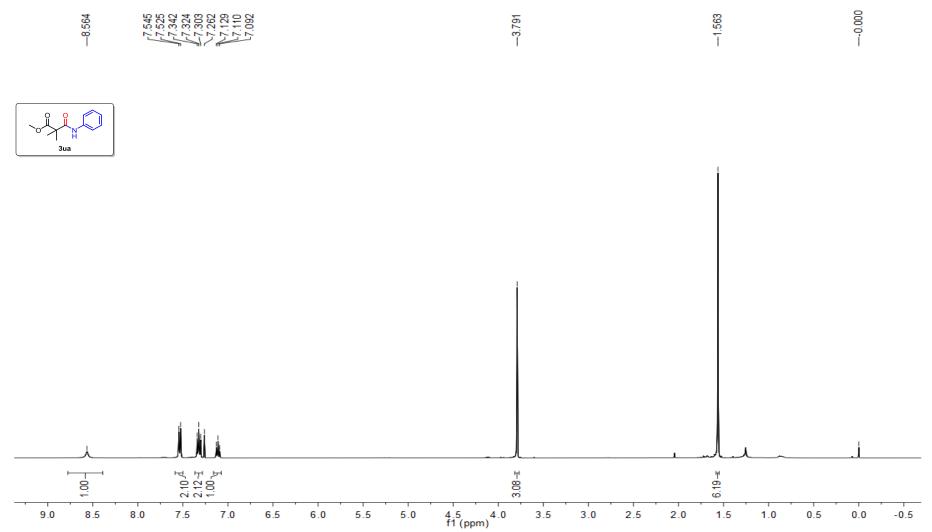
## ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ta**

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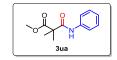


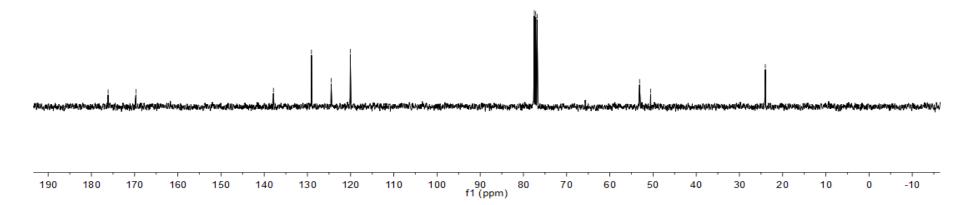
#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **3ua**



# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3ua**

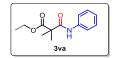
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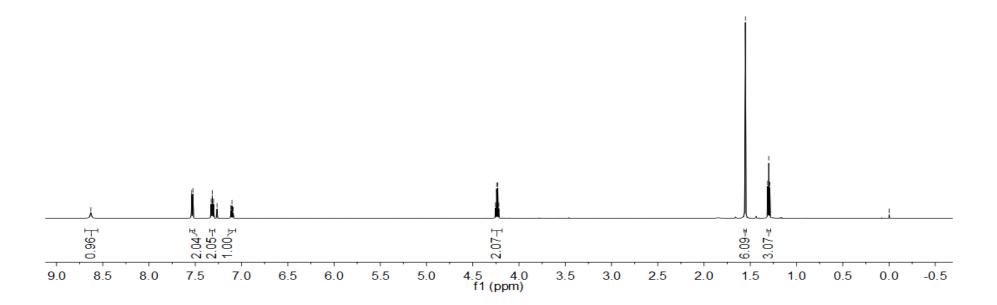




## ¹H NMR Spectra (600 MHz, CDCl₃) of compound **3ve**

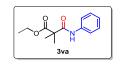
630	5540 538 3325 1116 091 091 091	253 242 218 218	553 312 289	000
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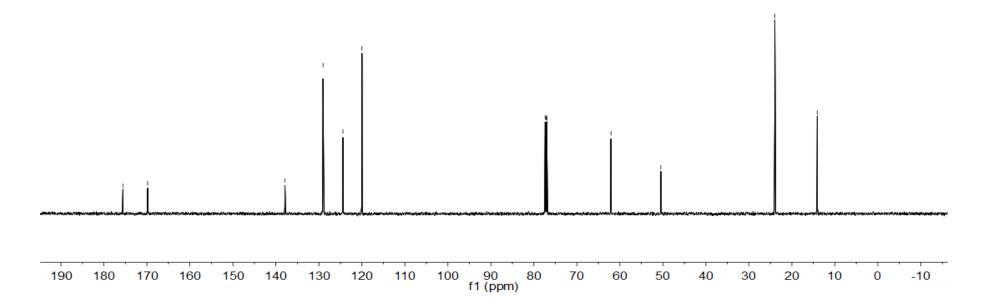




## ¹³C NMR Spectra (151 MHz, CDCl₃) of compound **3va**

— 175.578 — 169.823		+ 50.480	
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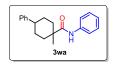


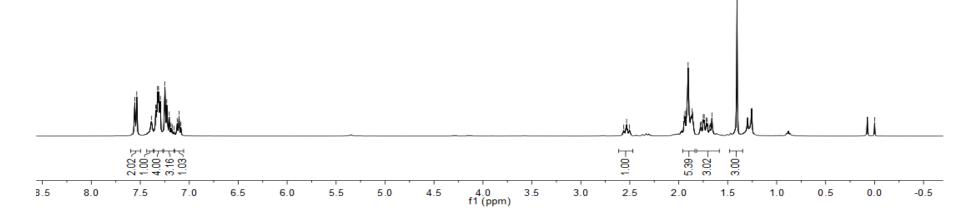


¹H NMR Spectra (400 MHz, CDCl₃) of compound **3wa** 

555 538 332 332 332 332 332 332 332 332 332 3	22863	123 155 187 086 086 086 086 086 086 086 086 086 086

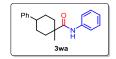
<b>2556</b> <b>2556</b> <b>2556</b> <b>2556</b> <b>2556</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566</b> <b>2566256</b> <b>2566</b> <b>2566</b> <b>2566256</b> <b>2566256</b> <b>2566</b> <b>2566256256</b> <b>2566</b> <b>2566256</b> <b>2566256</b> <b>2566</b> <b>2566</b> <b>2566256</b> <b>2566</b> <b>2566</b> <b>2566256</b> <b>2566</b> <b>2566256</b> <b>2566</b> <b>2566256256</b> <b>2566256256</b> <b>256625625625625625625625</b>	0.000
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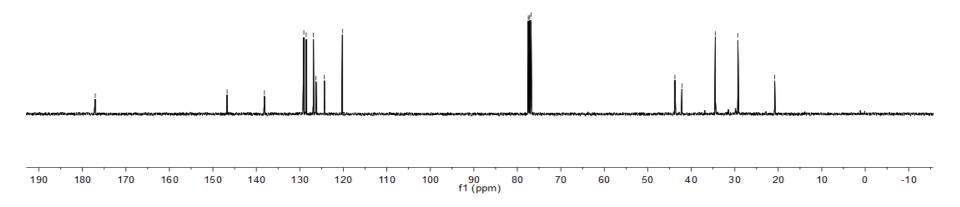




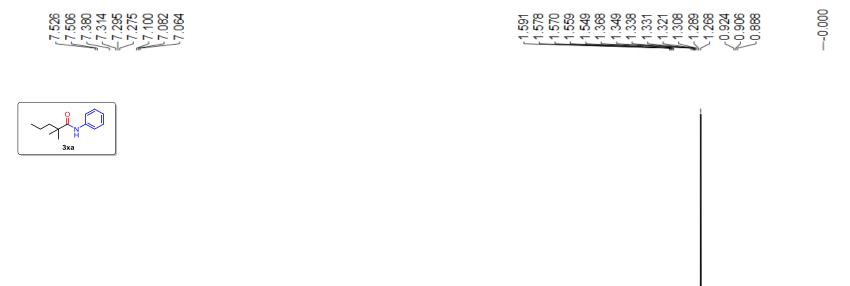
# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3wa**

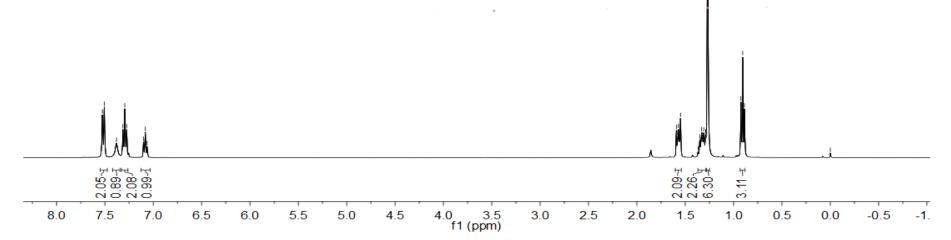
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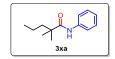
#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **3xa**

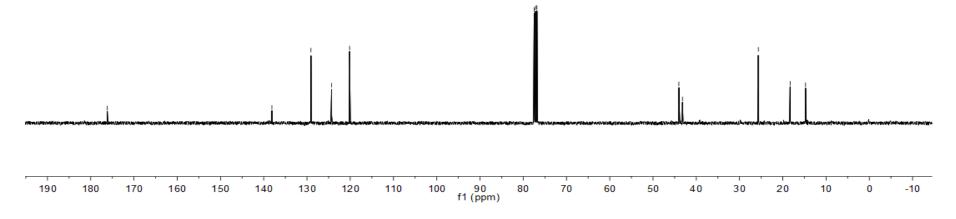




# ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **3xa**

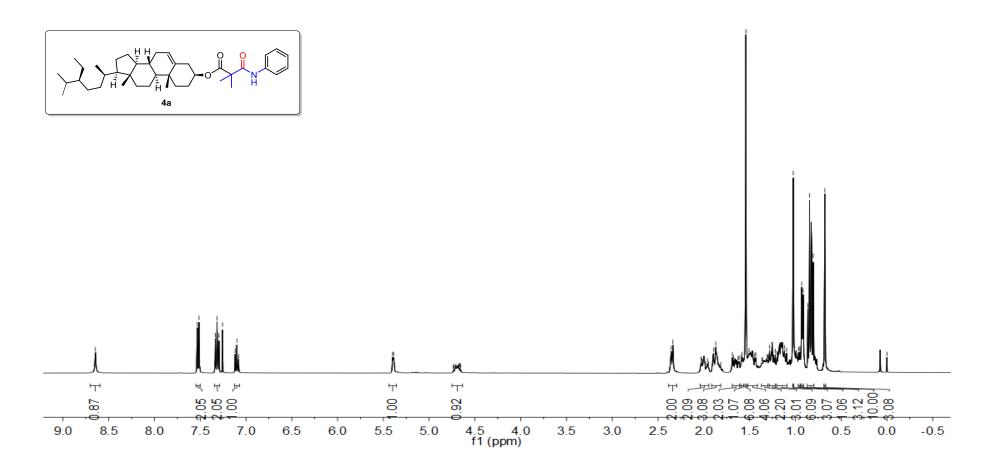
		-138.116	∼129.085 ∽124.327 ∽120.145	77.478 77.160 76.843	44.031	-25.654	—18.303 —14.742
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¹H NMR Spectra (400 MHz, CDCl₃) of compound **4a** 

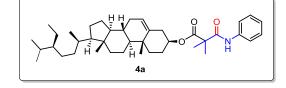
48884825086266888	88888872552 <u>8</u> 68 <u>6</u> 2 <del>5</del> 886	2219 2219 2219 2219 2219 2219 2219 2219
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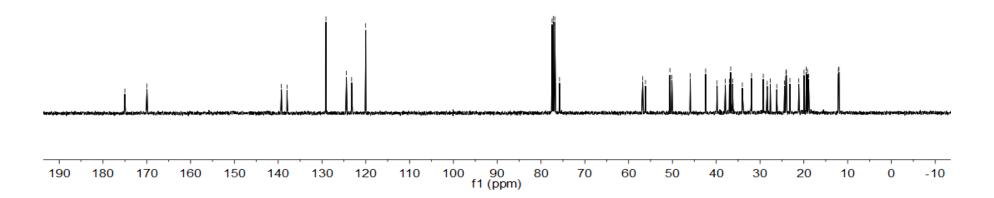


## ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **4a**

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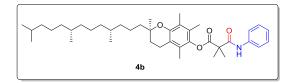


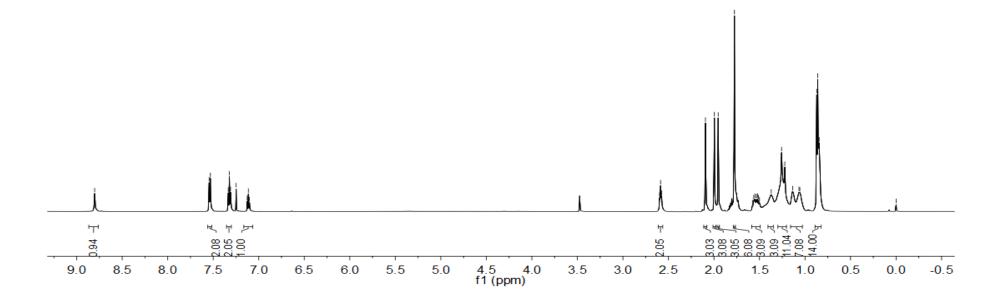


¹H NMP Spectra (600 MHz CDCL) of compound Ah

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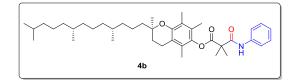
597 586 575	0996 0996 0996 0996 0996 0996 0996 0996
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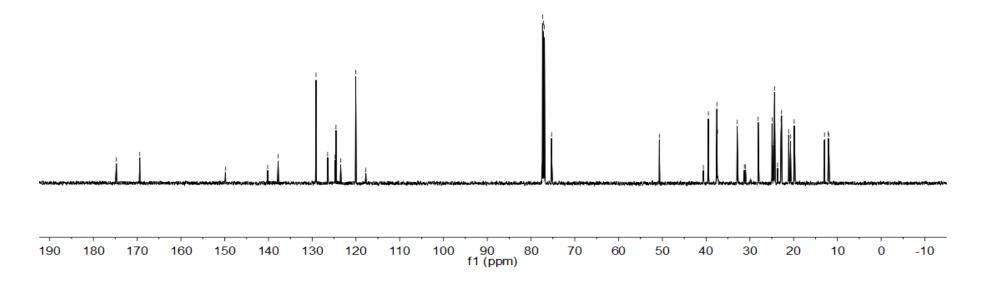




## ¹³C NMR Spectra (151 MHz, CDCl₃) of compound **4b**

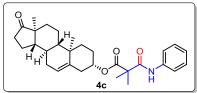
74.753 69.415	49.838 40.185 37.802	29.129 26.474 24.776 24.567 22.062 20.062 17.746	7.372 7.160 6.948 5.307	0.674	9.483 9.483 9.483 9.483 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.443 9.
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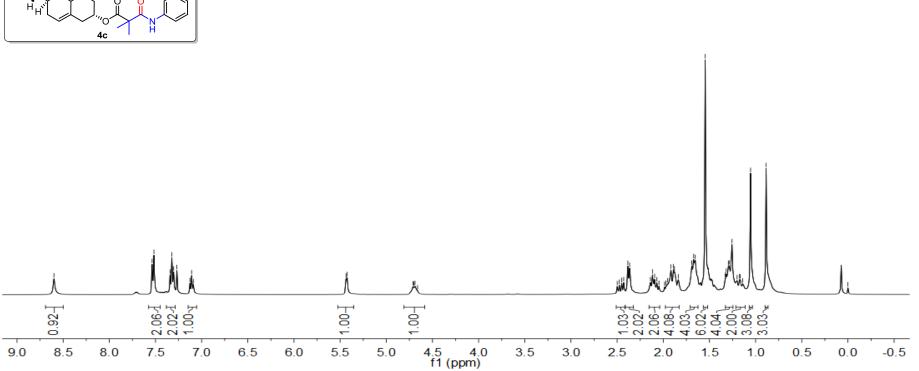




¹H NMR Spectra (400 MHz, CDCl₃) of compound **4c** 

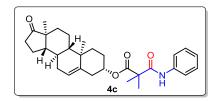
ດີ ທີ່ທີ່	7.1342 7.1333 7.127 7.106 7.106 7.090	<5.436 <5.425	4.711 4.700 4.689 4.661	002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 002560 0000000000
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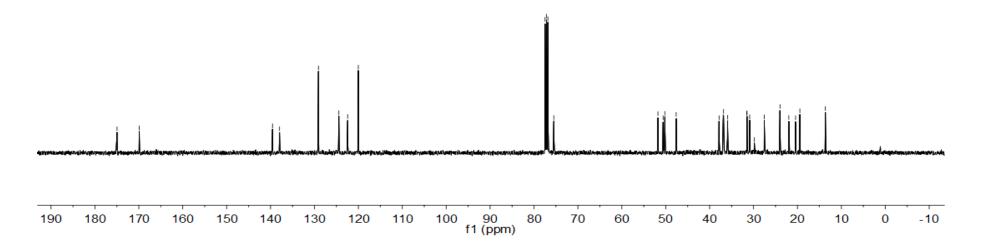




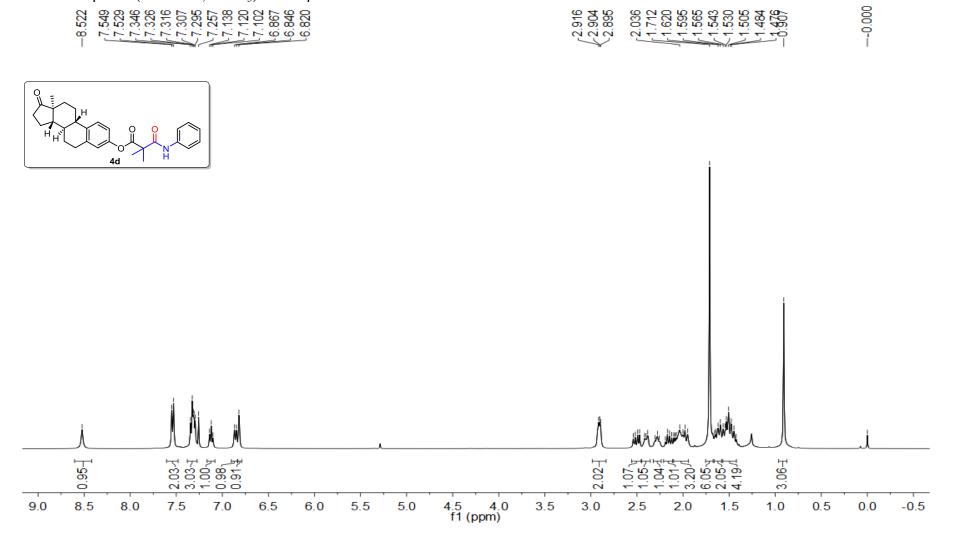
#### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **4c**

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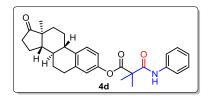


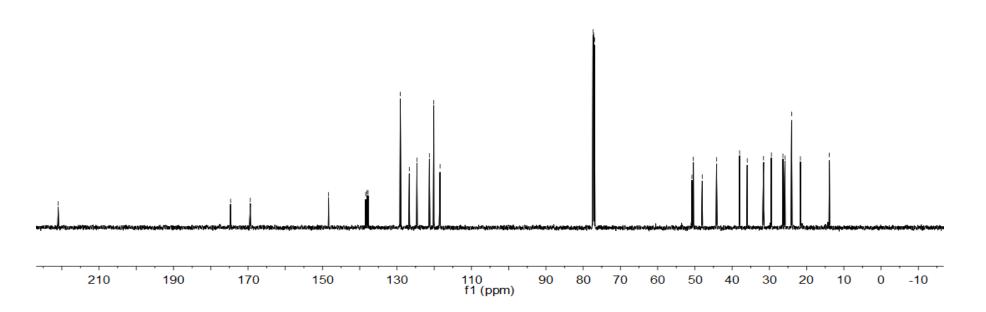
#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **4d**



### $|^{13}$ C NMR Spectra (151 MHz, CDCl₃) of compound **4d**

220.978	174.675 169.392	48.367 38.402 38.075 38.075 37.754 22.6678 22.6678 22.1294 20.121 18.432 18.432	77.371 77.160 76.949	50.812 50.812 44.189 55.933 55.933 55.816 55.816 55.816 55.816 51.664 13.902
CN		$\neg$		1010440000000000-
			$\rightarrow$	

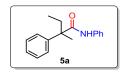


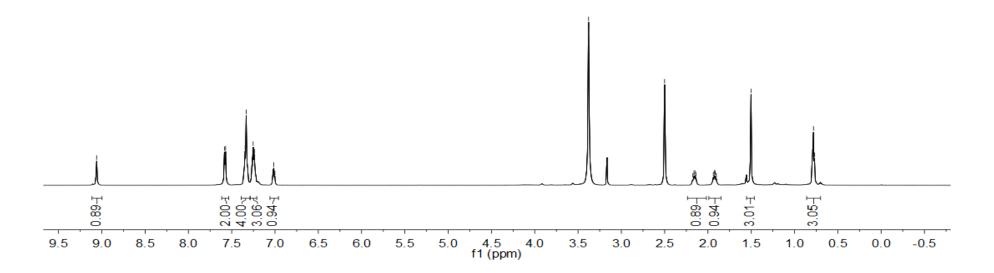


### ¹H NMR Spectra (600 MHz, $d^6$ -DMSO) of compound **5a**

0	4040004-0040
9	0 ~ 4 ~ 0 0 4 4 ~ 0 ~ - 0
0	000000000000000000000000000000000000000
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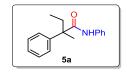
378	500 173 151 151 152 153 903 503 503	793 781 775 770
8	00000	0000
		$\sim$

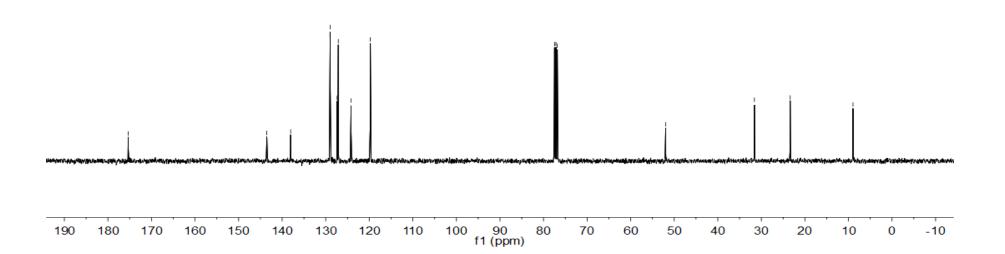


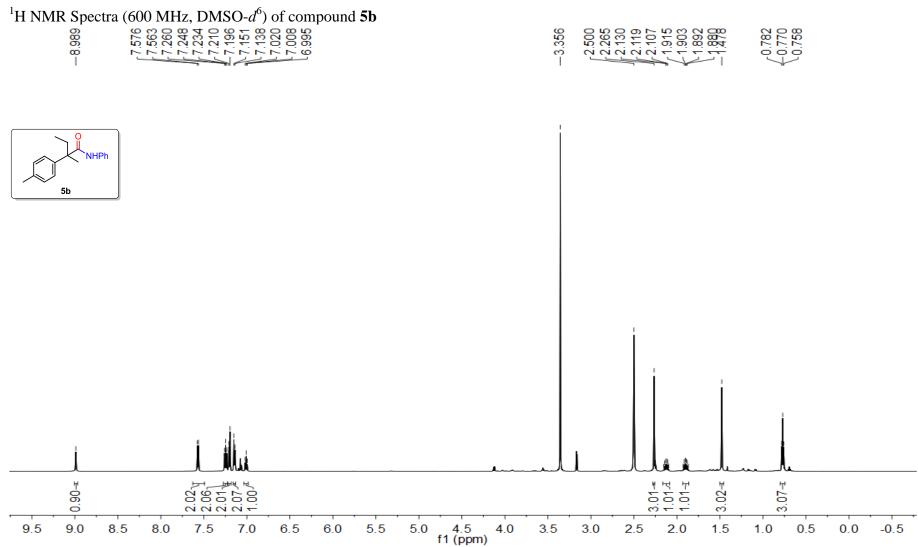


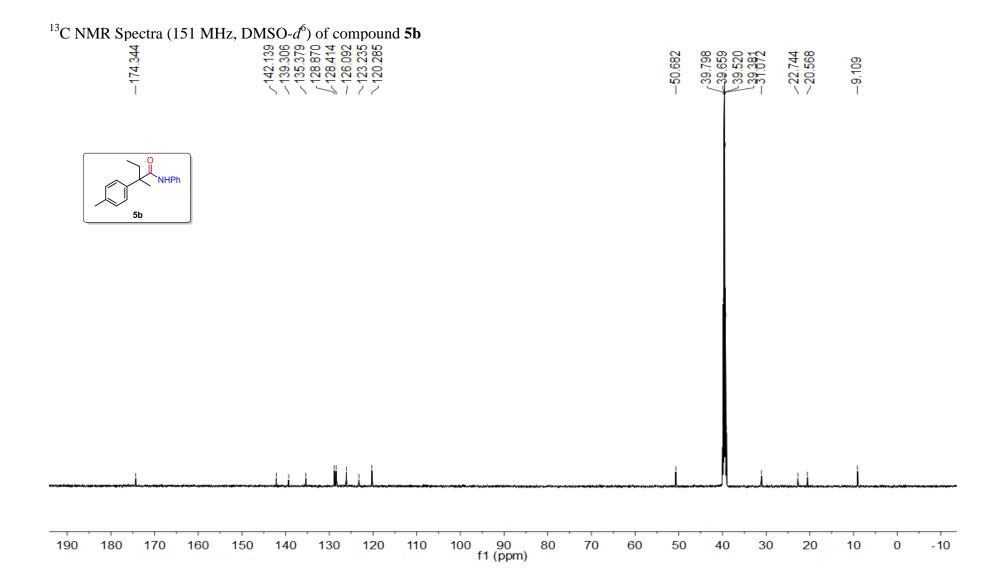
¹³ C NMR Spectra (101 MHz,	CDCl ₃ ) of compound <b>5a</b>
01	

- 175.342 - 143.526 - 138.046 - 138.046 128.977 128.977 124.180 119.760	77,477 77,160 76,842	-51.972	31.603 23.381	
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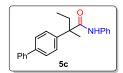


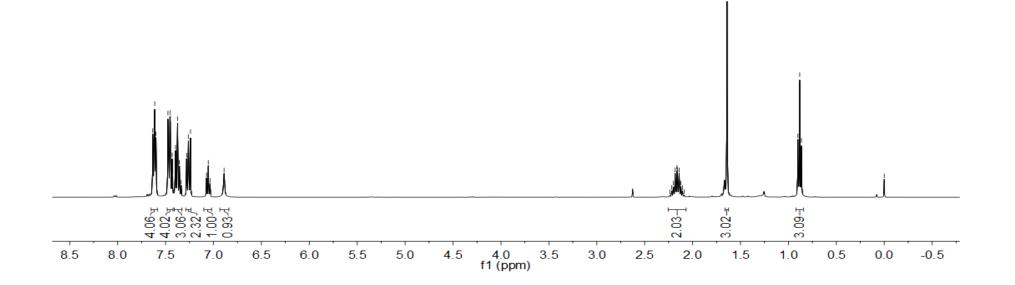




#### S151

¹ HNMR Spectre (100 MHz CDCL) of compound <b>5</b> 0			
7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.053 7.	-1.640 -1.640	0.901 0.883 0.864	0.00.0

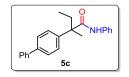


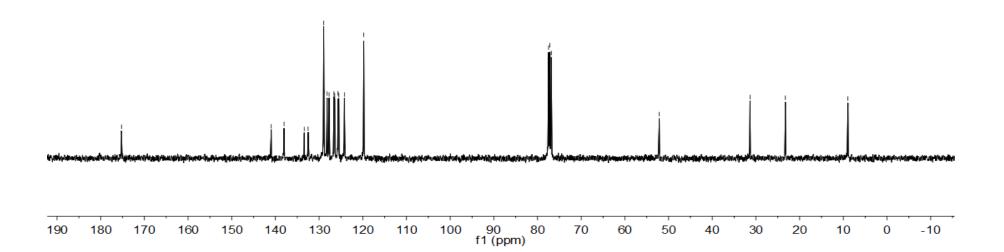


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#### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **5**c

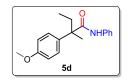
	-175.232	140.966 138.023 133.396 133.398 132.519 128.952 128.952 128.952 128.952 128.426 125.671 126.426 125.671 126.426 119.778	77.478 77.160 76.843	-52.144	-31.363	-23.268	-8.948
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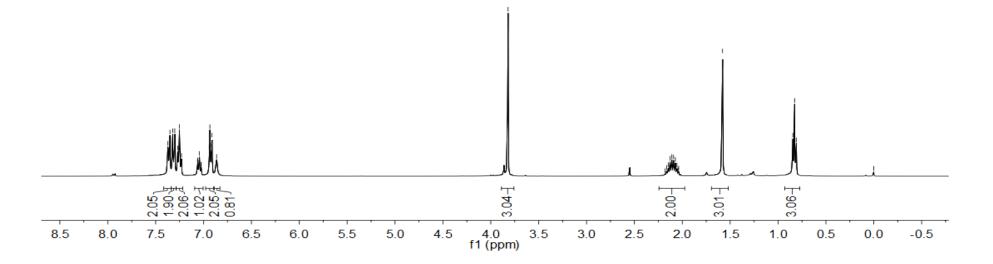




¹ H NMR Spectra (400 MHz, CDCl ₃ ) of compound <b>5d</b>	
2.372     2.325     2.325     2.325     2.325     2.325     2.325     2.325     2.325     2.325     2.325     2.325     2.325     2.325     2.32     2.32     2.32     2.32     2.32     2.32     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3     3.3	- 3.819

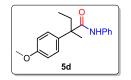
− 0 w ∩ − 0 − 0 w w ∞ 0	10 h 00	~
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	ထဲထဲထဲ	0
<u> 000000000</u>	000	0

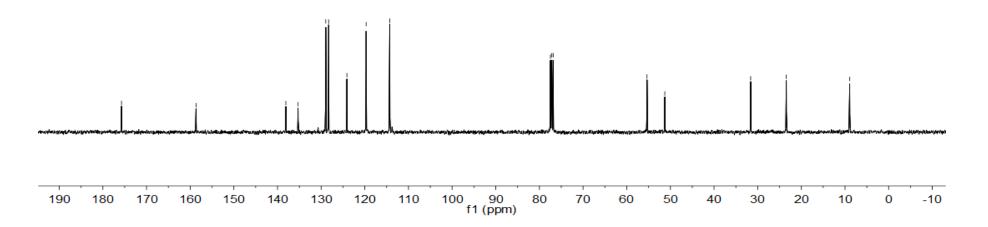




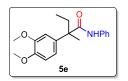
### $|^{13}$ C NMR Spectra (101 MHz, CDCl₃) of compound **5d**

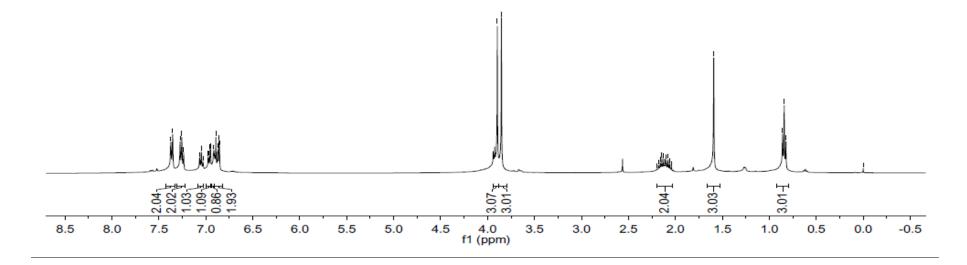
-175.726		× 138.088 138.088 138.088 138.279 1128.279 114.286 214.105 214.105 214.105	77,477 77,160 76,841	55.354 51.283		
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¹H NMR Spectra (400 MHz, CDCl₃) of compound **5e** 

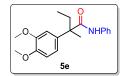


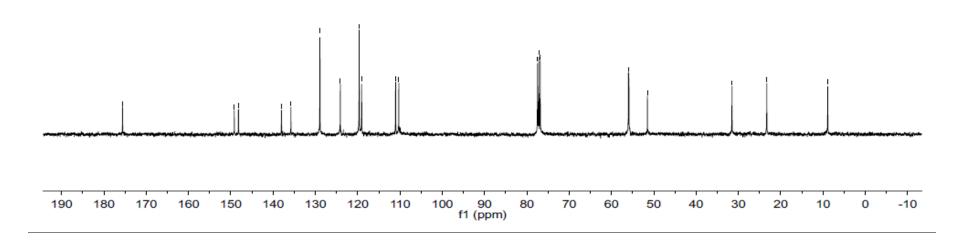


---0.000

0.860 0.841 0.823 ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **5e** 

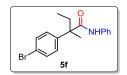
-175.575	-149.163 -148.177	-138.007 -135.782 -128.918 -124.097 -119.644	-111.031	r77.479 -77.160 -76.842	-55.980 -55.876 -51.499	-31.502	-23.285	-8.874
1	- NC				$\sim$		1	

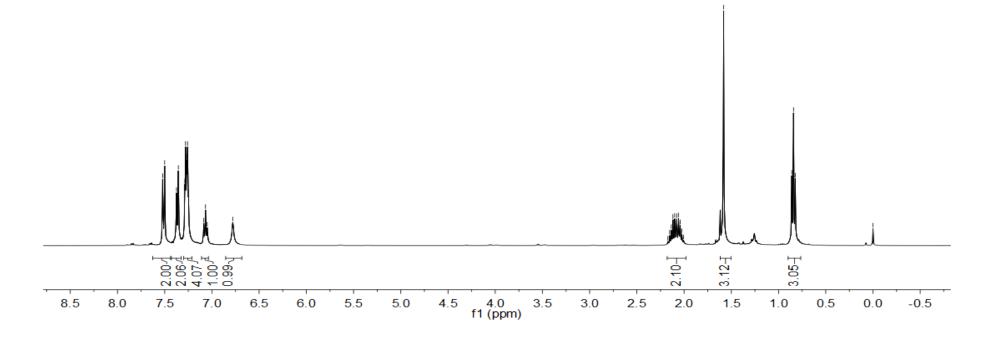




# ¹H NMR Spectra (400 MHz, CDCl₃) of compound **5f**

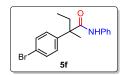
-1222222222222222222222222222222222222	-0.860 -0.841 -0.823	000.0
		Í

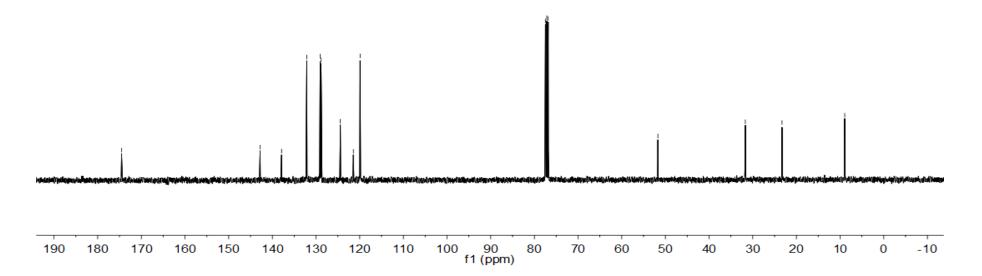




### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **5f**

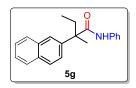
174.540	142.811 137.888 132.117 129.054 128.855 124.44 119.910	77.478 77.160 76.843	51.716	31.698 23.294	8.935
		$\checkmark$			

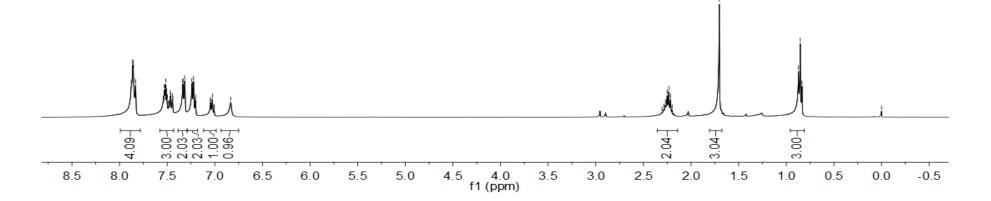




#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **5g**

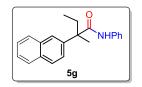
7 2853 7 853 7 853 862 862 862 862 862 862 862 862	2.286 2.286 2.251 2.296 2.296 2.296 2.296 2.296 2.296 2.296 2.296 2.296 2.296 2.296 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204 2.204	0.872 0.853 0.835	-0.00
			Í

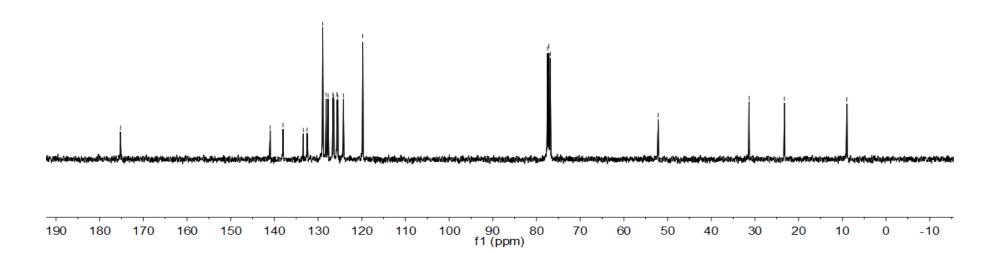




#### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **5g**

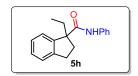
175.232	140.966 138.023 138.023 138.023 138.023 138.023 138.023 128.952 128.952 128.952 128.426 128.426 128.426 125.671 126.426 125.426 119.778 119.778	77.478 77.160 76.843	52.144	.31.363	23.268	.8.948

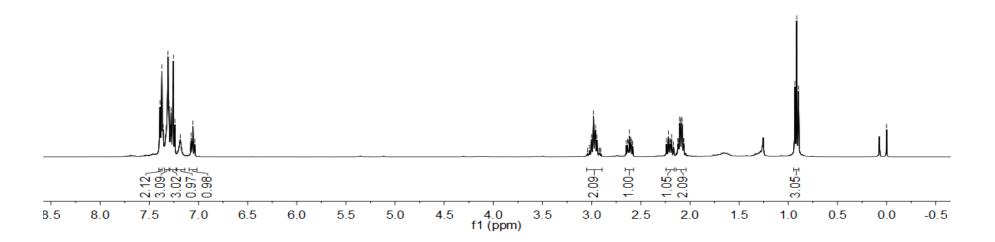


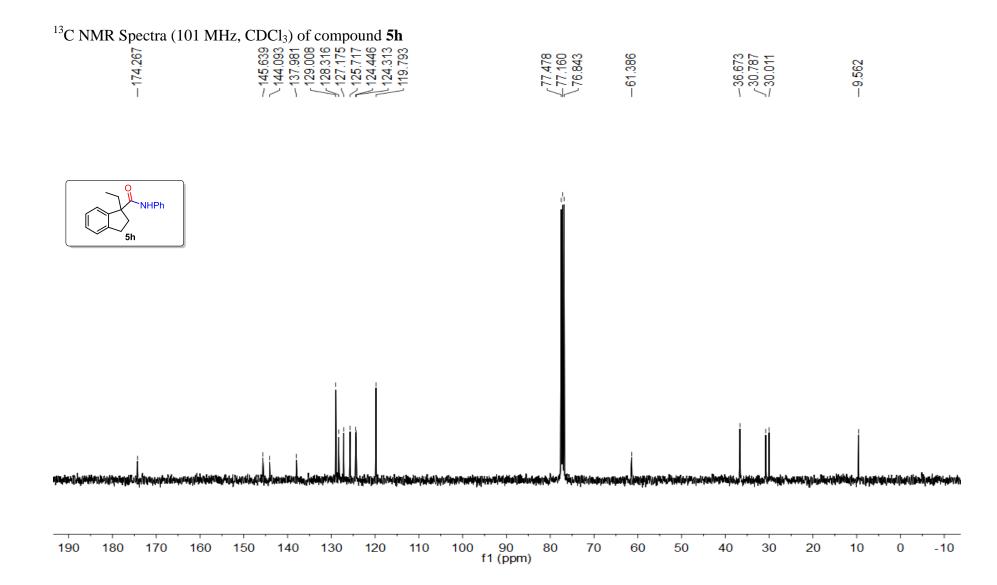


# 

3.042 3.022 3.022 3.022 3.022 2.961 2.963 2.596 2.596 2.596 2.596 2.596 2.596 2.596 2.596 2.596 2.596 2.596 2.596 2.596 2.596 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582 2.582	2 7 7 7 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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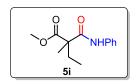


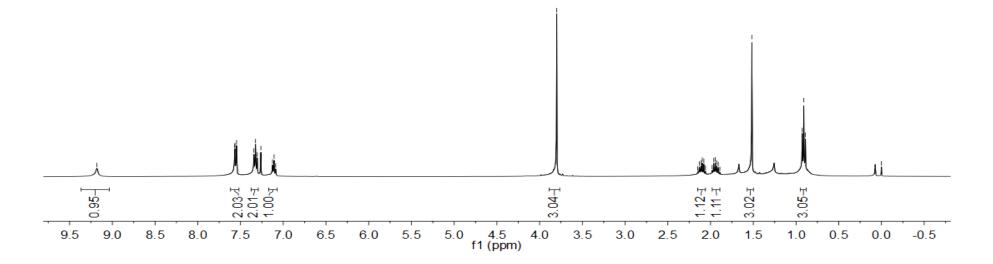




#### ¹H NMR Spectra (600 MHz, CDCl₃) of compound **5**i

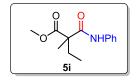
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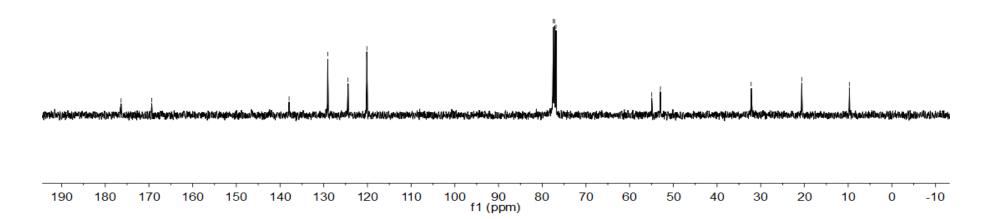




#### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **5**i

76.373	69.349 	37.925	29.074 24.445 20.133 20.133	7.478 7.160 6.843	4.947 2.964	2.195	0.610	.701
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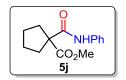


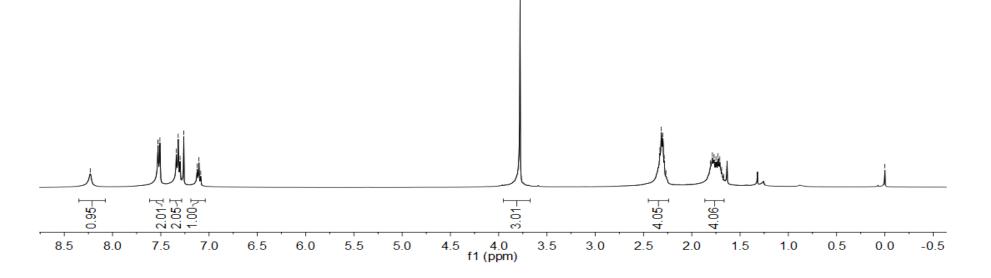


#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **5**j

230 252 252 252 252 252 252 252 252 252 25
0 NNNNNNNNN

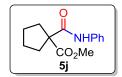


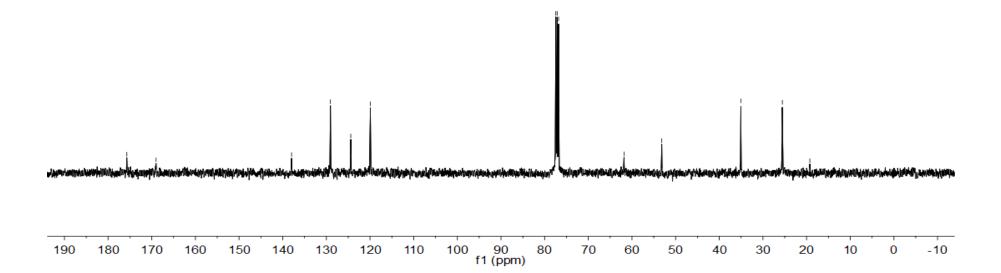




#### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **5**j

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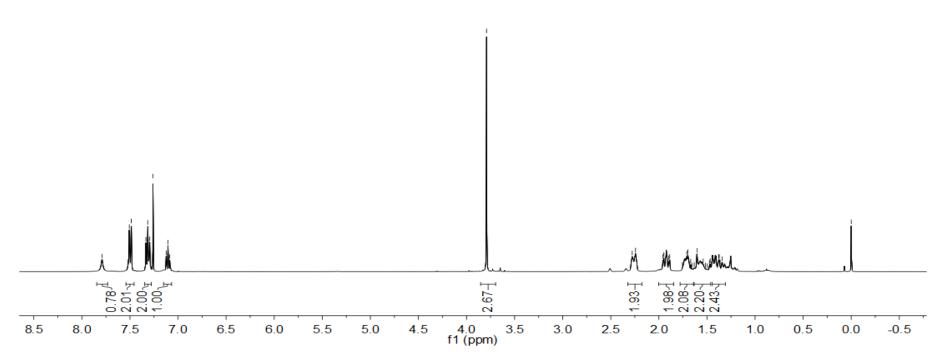


 1 H NMR Spectra (400 MHz, CDCl₃) of compound **5**k

790 2507 2503 2503 2503 2503 2503 2503 2503 2503

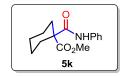
792	$\begin{array}{c} 3333334864545636666666666666666666666666$
с. 	NNE FEFEEFEEFEEFEEFEE

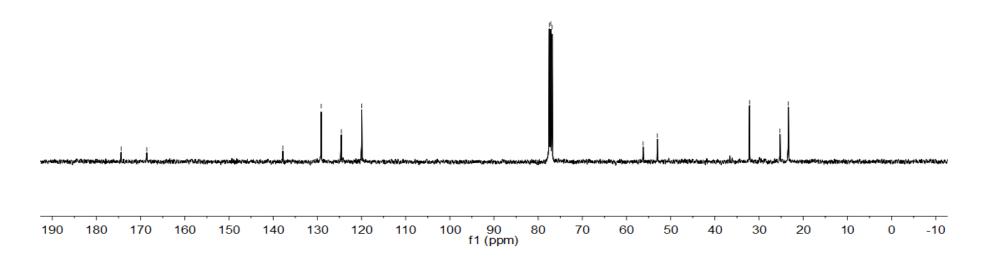




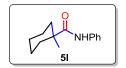
#### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **5**k

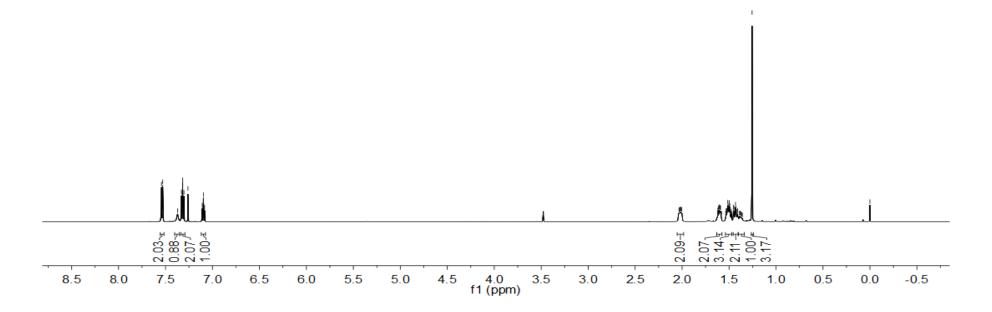
174.406	37.809 29.117 24.554 19.938	7.477 7.160 6.841	6.237 33.026	\$2.148 \$5.263 \$3.376
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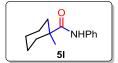
¹ H NMR Spectra (400 MHz, CDCl ₃ ) of compound <b>5</b> l		
73342	2.033 2.026 2.025 2.005	1.607 1.607 1.596 1.514 1.498 1.493 1.431 1.431 1.431 1.431 1.431

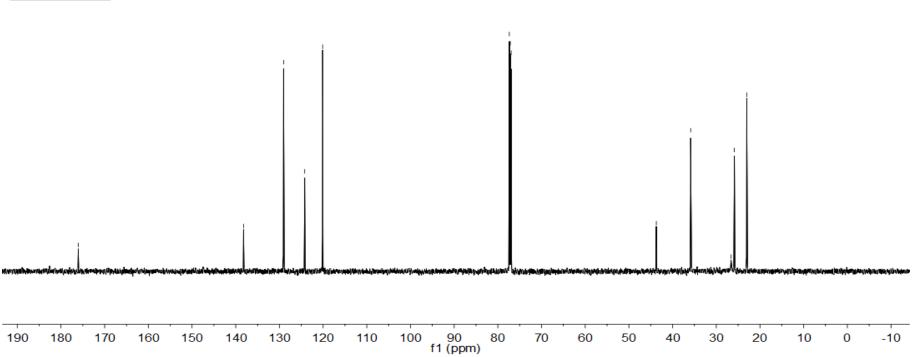




#### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **5**

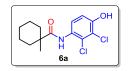
	- 176.035	- 138.218	~129.052 ~124.222 ~120.093	77.371 77.160 76.947	-43.722	-35.844	26.622 25.850 23.019
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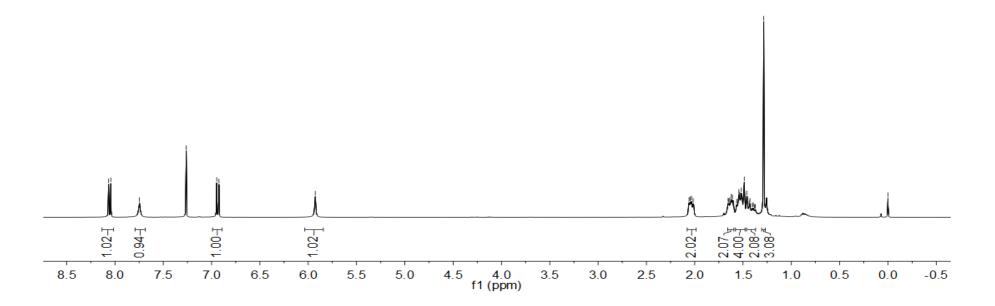


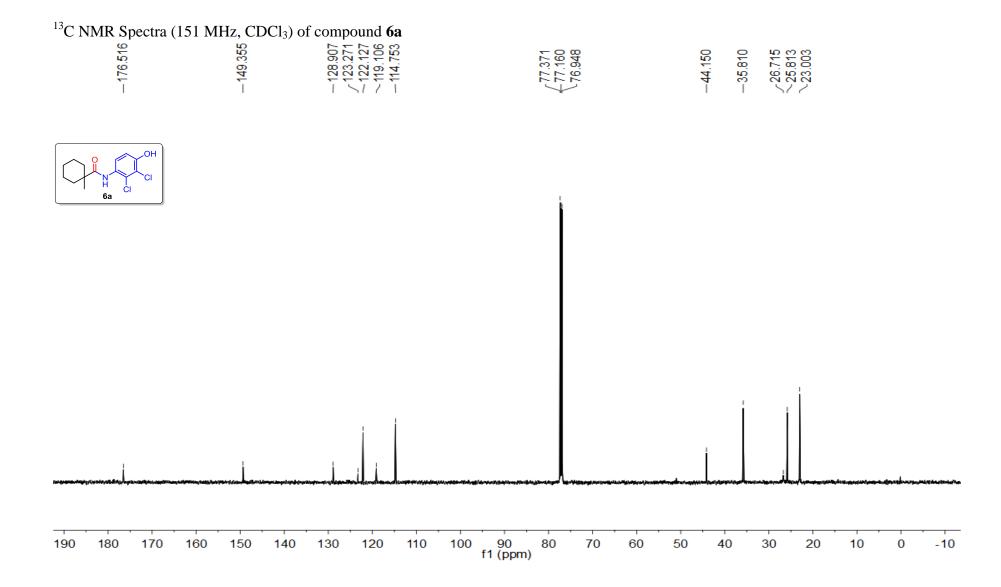


#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **6a**

066 043 746	262 947 924	927	016	621 552 552 5535 5535 5535 5535 5535 5535
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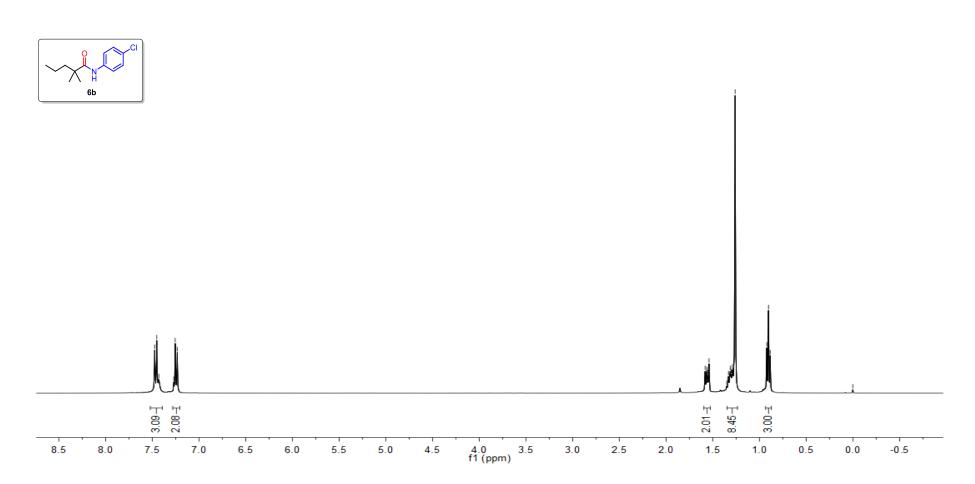






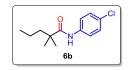
### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **6b**

47 4 45 2 26 9 2 26 9 2 2 2 3 7 4 2 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3	853 33250 853 853 853 332 853 332 853 332 853 332 853 332 132 853 332 853 853 853 853 853 853 853 853 853 853	8
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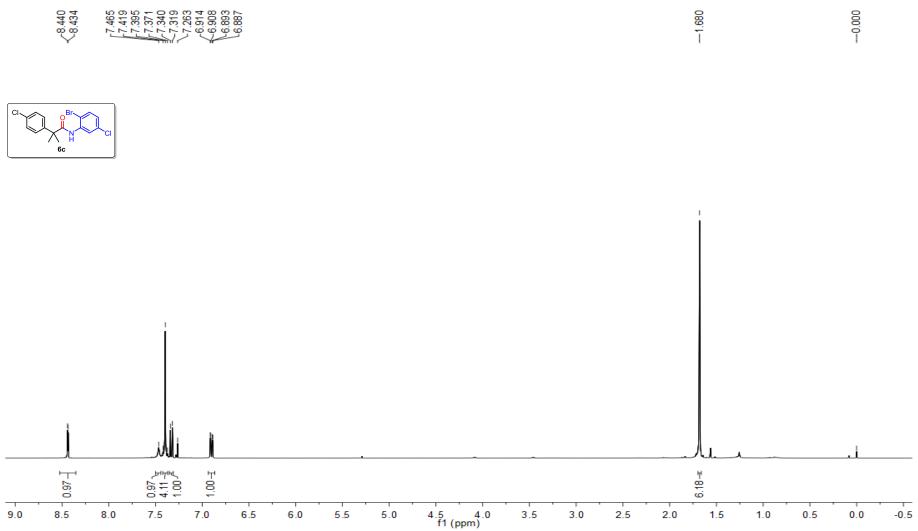
## ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **6b**

76.341	36.683 29.203 28.934 21.575	7.479 7.160 6.843	3.854 3.159	5.502	8.222 4.658
12		222	4 4	24	<u>4</u>
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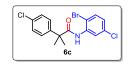
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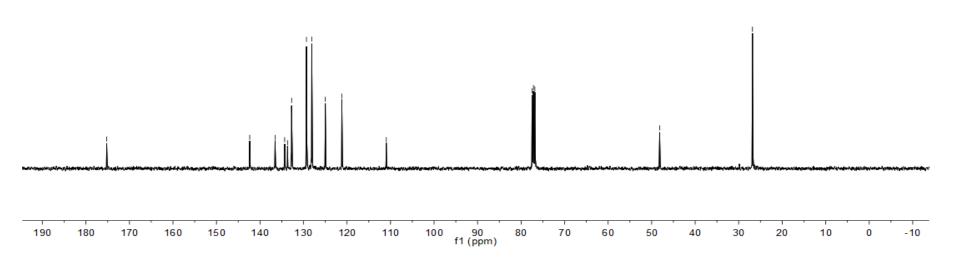
#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **6c**



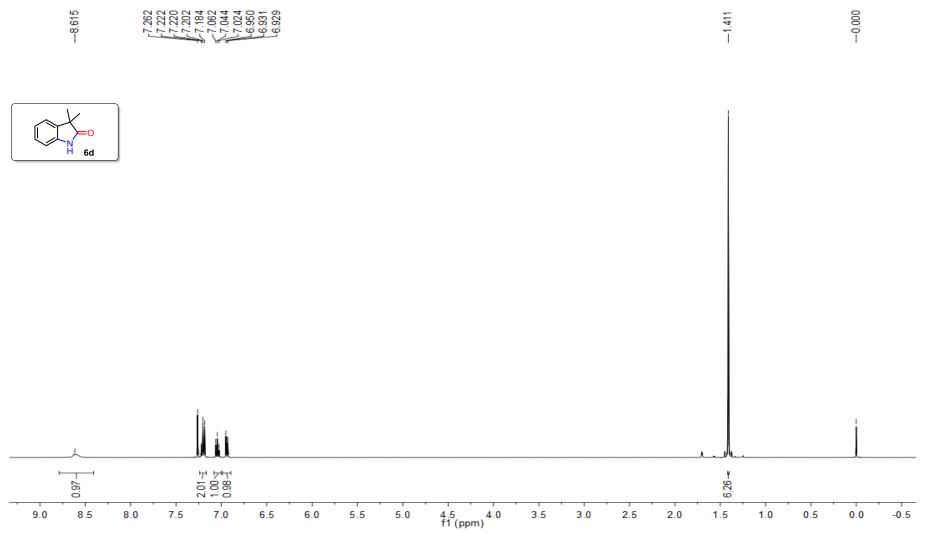
#### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **6c**







#### ¹H NMR Spectra (400 MHz, CDCl₃) of compound **6d**



### ¹³C NMR Spectra (101 MHz, CDCl₃) of compound **6d**

269	952	773 735 571	019	42 42	15	54
8	130	222	10.	77.4 77.1 76.8	27 00	24.4
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