Supporting Information

Hydrogen Bond Directed Aerobic Oxidation of Amines by Photoredox Catalysis

Hongyu Wang,** Yunquan Man,† Kaiye Wang, Xiuyan Wan, Lili Tong, Na Li and Bo Tang*

College of Chemistry, Chemical Engineering and Materials Science, Collaborative Innovation Center of Functionalized Probes for Chemical Imaging in Universities of Shandong, Key Laboratory of Molecular and Nano Probes, Ministry of Education, Institute of Molecular and Nano Science, Shandong Normal University, Jinan 250014, P. R. China.

Table of Contents

General information ..................................................................................................................2
The preparation of substrates ................................................................................................2
Characterization data for the substrates .............................................................................4
General procedures of the oxidation of amines by photoredox catalysis. .......................17
The gram scale reaction ......................................................................................................19
The preparation of fenofibrate .............................................................................................19
Characterization data for the products ...............................................................................20
Table S1. Optimization of the reaction conditions .............................................................33
Scheme S1. Reduction and Hydrolysis Experiments of 2a .................................................33
Figure S1. Determination of the reaction intermediate ......................................................34
Figure S2. Fluorescence quenching experiments ..............................................................35
Figure S3. Control experiments for **O₂ sensitization .......................................................35
Crystal data and structure refinement for 2j (CCDC 1833871) ........................................36
References .........................................................................................................................37
¹H, ¹³C and ¹⁹F-NMR spectra .............................................................................................38

s-1
General information

The commercial materials and photocatalyst were purchased from Adamas-beta®, Shanghai Energy® and Tianjin Heowns®. Solvents for conjugate addition reactions were treated by the standard methods. Reactions were powered by magnetic stirrers. Flash column chromatography was carried out on silica gel (300–400 mesh) using a forced flow of eluent. For TLC, silica gel plates were used and visualized by fluorescence quenching under UV light. All the NMR spectra were recorded on a Bruker NMR spectrometers. Chemical shifts (δ) for 1H NMR (400 Hz), 13C NMR (100 Hz) were given in ppm. Data were reported as follows: chemical shift, intergration, multiplicity (s = single, d = doublet, t = triplet, q = quartet, br = broad, m = multiplet) and coupling constants (Hz). High resolution mass spectra (HRMS) were recorded on a Bruker Daltonics maXis UHR-TOF MS. Melting points were determined on a SGW X-4 microscope melting point apparatus and were uncorrected. X-ray crystallography analysis was performed on a Bruker X8 APEX X-ray diffractometer. High resolution mass spectra (HRMS) were recorded on a Bruker Daltonics maXis UHR-TOF MS. Fluorescence spectra were obtained with FLS-920 Edinburgh Fluorescence Spectrometer and 1.0 cm quartz cells at the slits of 15 nm and without in situ excitation. The blue light source (465nm) was provided by WATTECS WP-TEC-1020 parallel reactor.

The preparation of substrates

General procedures for the synthesis of 1 (GP1).

![Chemical Structure](image)

To a solution of pyrrolidine (1.1 mmol) in dichloromethane (15 mL), the isocyanate (1 mmol) was added into the mixture at 0 °C, then the mixture was stirred for 10 min at room temperature. After that, the solvent was evaporated to dryness under reduced pressure and purified via flash chromatography to obtained the corresponding compounds.

General procedures for the synthesis of 3 (Gp 2).
In an oven-dried round flask under Ar atmosphere, a mixture of the aryl nitrile (1 mmol) and the Grignard reagent (1.2 mmol) was stirred in dry THF (10 mL) at 70 °C for 2-8 h. The reaction mixture was cooled to room temperature and quenched by dry MeOH (10 mL) at 0 °C. After being stirred vigorously for 10 min, the sodium borohydride was added slowly and the mixture was heated at 60 °C until the imine was disappeared determined by TLC. The volatile materials were evaporated under vacuum and purified by flash column chromatography. The amine was dissolved in DCM (15 mL) and the isocyanate was added at 0 °C, the reaction was stirred for 10 min at room temperature. The solvent was evaporated to dryness under reduced pressure and purified via flash chromatography to obtain the corresponding compounds.

General procedures for the synthesis of 5 (Gp 3).

To a solution of benzylamine (1.1 mmol) in dichloromethane (15 mL), the 1-isocyanato-3,5-bis(trifluoromethyl)benzene (1 mmol) was added into the mixture at 0 °C, the reaction was stirred for 10 min at room temperature. After that, the solvent was evaporated to dryness under reduced pressure and purified via flash chromatography to obtain the compound.

The synthesis of N-(4-bromophenyl)-2-(4-methoxyphenyl)-N-methylpyrrolidine-1-carboxamide (1cc).
To a solution of urea (1 mmol) in tetrahydrofuran (15 mL), the sodium hydride (2.5 mmol) and potassium iodide (0.2 mmol) was added at 0 °C, then the iodomethane (1.8 mmol) and KI (0.1 mmol) was added and the reaction was stirred at room temperature until finished (determined by TLC analysis). The solvent was evaporated to dryness under reduced pressure, and purified via flash chromatography to obtain the compound. White solid; 83% yield, 322 mg; m.p. 183-185 °C; 1H NMR (400 MHz, CDCl3) δ 7.45-7.43 (d, J = 8 Hz, 2H), 7.10-7.08 (d, J = 8 Hz, 2H), 6.91-6.85 (m, 4H), 4.71-4.68 (m, 1H), 3.80 (s, 3H), 3.08 (s, 3H), 3.01-2.94 (m, 1H), 2.23-2.19 (m, 1H), 1.84-1.64 (m, 3H); 13C NMR (100 MHz, CDCl3) δ 159.47, 158.51, 145.24, 136.14, 132.31, 127.42, 126.63, 117.68, 113.76, 62.13, 55.29, 50.27, 39.00, 35.86, 25.09; HRMS (ESI) m/z calcd for C19H21BrN2NaO2+: (M+Na)+: 411.0679; found: 411.0672.

The synthesis of (2-(4-methoxyphenyl)pyrrolidin-1-yl)(phenyl)methanone (1bb).

![Diagram](image)

To a solution of 4-bromobenzoyl chloride (1.1 mmol) in dichloromethane (15 mL), triethylamine (2.2 mmol) and pyrrolidine (1.0 mmol) were sequentially added into the mixture. The mixture was stirred at room temperature until the completion of the reaction determined by TLC analysis. The crude product was purified by flash chromatography on silica gel (eluent: PE/EtOAc from 5:1 to 2:1) affording to the corresponding compounds. White solid; 93% yield, 364 mg; m.p. 143-145 °C; 1H NMR (400 MHz, DMSO) δ 169.81, 168.78, 158.61, 158.51, 135.97, 135.84, 135.64, 135.10, 131.46, 131.08, 129.17, 128.38, 126.91, 126.67, 124.44, 123.76, 113.97, 65.89, 62.99, 60.64, 55.31, 51.04, 47.17, 35.91, 34.73, 25.29, 21.64, 15.32; HRMS (ESI) m/z calcd for C18H19NNaO2+: [(M+Na)+]: 304.1308; found: 304.1319.

**Characterization data for the substrates.**

**N-(4-bromophenyl)-2-phenylpyrrolidine-1-carboxamide (1a)**

![Diagram](image)

The product was prepared according to the Gp 1. White solid; 92% yield, 316 mg; m.p. 189-191 °C; 1H NMR (400 MHz, CDCl3) δ 7.42-7.38 (t, J = 8 Hz, 2H), 7.34-7.25 (m, 5H), 7.03-7.01 (d, J = 8 Hz, 2H), 6.03 (s, 1H), 4.86-4.84 (m, 1H), 3.85-
3.71 (m, 2H), 2.50-2.41 (m, 1H), 2.05-1.91 (m, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ 153.92, 142.42, 138.16, 131.59, 129.28, 128.06, 125.85, 120.74, 115.02, 61.39, 47.57, 36.95, 23.19; HRMS (ESI) m/z calcd for C$_{17}$H$_{17}$BrN$_2$NaO$^+$ [(M+Na)$^+$]: 367.0416; found: 367.0417.

**N-(4-bromophenyl)-2-(p-tolyl)pyrrolidine-1-carboxamide (1b)**

The product was prepared according to the Gp 1. White solid; 95% yield, 340 mg; m.p. 156-158 °C; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.28-7.24 (m, 2H), 7.19 (s, 4H), 7.04-7.02 (d, $J = 8$ Hz, 2H), 6.10(s, 1H), 4.81-4.78 (m, 1H), 3.83-3.77 (m, 1H), 3.74-3.68 (m, 1H), 2.47-2.39 (m, 1H), 2.36 (s, 3H), 2.02-1.87 (m, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ 153.98, 139.37, 138.27, 137.84, 131.56, 129.95, 125.78, 120.72, 114.91, 61.18, 47.53, 37.06, 23.16, 21.14; HRMS (ESI) m/z calcd for C$_{18}$H$_{19}$BrN$_2$NaO$^+$ [(M+Na)$^+$]: 381.0573; found: 381.0581.

**N-(4-bromophenyl)-2-(4-methoxyphenyl)pyrrolidine-1-carboxamide (1c)**

The product was prepared according to the Gp 1. White solid; 92% yield, 364 mg; m.p. 118-120 °C; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.29-7.21 (m, 4H), 7.05-7.02 (d, $J = 12$ Hz, 2H), 6.93-6.91 (d, $J = 8$ Hz, 2H), 6.11 (1H, s), 4.80-4.77 (d, $J = 4$ Hz, 1H), 3.81-3.68 (m, 4H), 2.46-2.38 (m, 1H), 2.04-1.86 (m, 1H); $^{13}$C NMR (100 MHz, DMSO) δ 159.36, 154.01, 138.25, 134.23, 131.57, 127.05, 120.71, 114.91, 114.64, 60.88, 55.37, 47.49, 37.13, 23.14; HRMS (ESI) m/z calcd for C$_{18}$H$_{19}$BrN$_2$O$_2$+ [(M+H)$^+$]: 397.0522; found: 397.0506.

**N-(4-bromophenyl)-2-(4-trifluoromethyl)phenyl)pyrrolidine-1-carboxamide (1d)**

The product was prepared according to the Gp 1. White solid; 96% yield, 396 mg; m.p. 173-175 °C; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.62-7.60 (d, $J = 8$ Hz, 2H), 7.39-7.37 (d, $J = 8$ Hz, 2H), 7.32-7.30 (d, $J = 8$ Hz, 2H), 7.17-7.15 (d, $J = 8$ Hz, 2H), 6.16(s, 1H), 5.06-5.03 (q, $J = 4$ Hz, 1H), 3.77-3.67 (m, 2H), 2.48-2.39 (m, 1H), 2.03-1.96 (m, 2H), 1.94-1.87(m,1H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ 153.67, 147.08, 137.89, 131.70, 125.97, 125.94, 125.87, 125.38, 122.68, 121.04, 115.45, 60.88, 47.35, 35.79, 23.43; $^{19}$F NMR (376 MHz, CDCl$_3$) δ -62.45; HRMS (ESI) m/z calcd for C$_{18}$H$_{16}$BrF$_3$N$_2$NaO$^+$ [(M+Na)$^+$]: 435.0290; found: 435.0267.

**N-(4-bromophenyl)-2-(4-fluorophenyl)pyrrolidine-1-carboxamide (1e)**

The product was prepared according to the Gp 1. White solid;94% yield, 340 mg; m.p. 167-169 °C; $^1$H NMR (400 MHz, CDCl$_3$) δ 7.30-7.24 (m, 4H), 7.10-7.05 (m, 4H), 6.08(s, 1H), 4.90-4.88 (m, 1H), 3.79-3.68 (m, 2H), 2.46-2.38 (m, 1H), 2.02-1.86 (m, 3H), 2.36 (s, 3H), 2.02-1.87 (m, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ 163.46, 161.01, 153.81, 138.36, 138.04, 131.65, 127.41, 127.33, 120.85, 116.15, 115.94, 115.20, 60.66, 47.44, 36.61, 23.20; $^{19}$F NMR (376 MHz, CDCl$_3$) δ -114.27; HRMS (ESI) m/z calcd for C$_{17}$H$_{16}$BrFN$_2$NaO$^+$ [(M+Na)$^+$]: 385.0322; found: 385.0329.
N-(4-bromophenyl)-2-(4-chlorophenyl)pyrrolidine-1-carboxamide (1f)

The product was prepared according to the Gp 1. White solid; 92% yield, 348 mg; m.p. 175-177 °C; 1H NMR (400 MHz, CDCl3) δ 7.35-7.28 (m, 4H), 7.22-7.20 (d, J = 8 Hz, 2H), 7.12-7.10 (d, J = 8 Hz, 2H), 6.11 (s, 1H), 4.91-4.88 (m, 1H), 3.76-3.67 (m, 2H), 2.45-2.36 (m, 1H), 2.03-1.84 (m, 3H); 13C NMR (100 MHz, DMSO) δ 153.75, 141.26, 138.00, 133.47, 131.66, 129.22, 127.09, 120.93, 115.28, 60.68, 47.41, 36.32, 23.26; HRMS (ESI) m/z calcd for C_{17}H_{17}BrClN_{2}O⁺ [(M+H)⁺]: 379.0207; found: 379.0209.

N,2-bis(4-bromophenyl)pyrrolidine-1-carboxamide (1g)

The product was prepared according to the Gp 1. White solid; 89% yield, 376 mg; m.p. 176-178 °C; 1H NMR (400 MHz, CDCl3) δ 7.69 (s, 1H), 7.48-7.45 (m, 4H), 7.34-7.31 (d, J = 12 Hz, 2H), 7.24-7.22 (d, J = 8 Hz, 2H), 5.14-5.11 (q, J = 4 Hz, 1H), 3.83-3.78 (m, 1H), 3.69-3.63 (m, 1H), 2.42-2.33 (m, 1H), 1.99-1.91 (m, 2H), 1.86-1.80 (m, 1H); 13C NMR (100 MHz, CDCl3) δ 153.52, 144.01, 139.99, 131.16, 131.11, 127.87, 120.92, 119.72, 113.49, 60.15, 46.89, 34.82, 23.30; HRMS (ESI) m/z calcd for C_{17}H_{16}Br_{2}N_{2}NaO⁺ [(M+Na)⁺]: 444.9522; found: 444.9534.

N-(4-bromophenyl)-2-(3-flurophenyl)pyrrolidine-1-carboxamide (1h)

The product was prepared according to the Gp 1. White solid; 92% yield, 333 mg; m.p. 173-175 °C; 1H NMR (400 MHz, CDCl3) δ 7.37-7.28 (m, 3H), 7.13-7.11 (d, J = 8 Hz, 2H), 7.08-7.06 (d, J = 8 Hz, 1H), 7.01-6.97 (m, 2H), 6.11 (s, 1H), 4.94-4.91 (q, J = 4Hz, 1H), 3.75-3.71 (m, 2H), 2.47-2.38 (m, 1H), 2.02-1.88 (m, 3H); 13C NMR (100 MHz, CDCl3) δ 164.50, 162.04, 153.75, 145.59, 138.00, 131.66, 130.74, 121.32, 120.94, 115.29, 114.83, 114.62, 112.83, 112.61, 60.82, 47.41, 36.21, 23.28; 19F NMR (376 MHz, CDCl3) δ -111.67; HRMS (ESI) m/z calcd for C_{17}H_{16}Br_{2}F_{2}NaO⁺ [(M+Na)⁺]: 385.0322; found: 385.0329.

N-(4-bromophenyl)-2-(3-chlorophenyl)pyrrolidine-1-carboxamide (1i)

The product was prepared according to the Gp 1. White solid; 95% yield, 356 mg; m.p. 192-194 °C; 1H NMR (400 MHz, DMSO-d6) δ 8.38 (s, 1H), 7.47-7.45 (d, J = 8 Hz, 2H), 7.38-7.36 (d, J = 8 Hz, 2H), 7.34-7.32 (d, J = 8 Hz, 1H), 7.27-7.24 (d, J = 12 Hz, 2H), 7.19-7.17 (d, J = 8 Hz, 1H), 5.08-5.05 (m, J = 4 Hz, 1H), 3.59-3.53 (q, J = 8 Hz, 1H), 3.34-3.25 (m, 1H), 1.93-1.81 (m, 2H), 1.77-1.71 (m, 1H); 13C NMR (100 MHz, DMSO) δ 154.02, 147.71, 140.27, 133.37, 131.45, 130.54, 126.83, 125.87, 124.71, 121.69, 113.59, 60.25, 47.44, 34.83, 23.77; HRMS (ESI) m/z calcd for C_{17}H_{17}BrClN_{2}O⁺ [(M+H)⁺]: 379.0207; found: 379.0209.

N-(4-bromophenyl)-2-(m-tolyl)pyrrolidine-1-carboxamide (1j)
The product was prepared according to the Gp 1. White solid; 96% yield, 344 mg; m.p. 195-197 °C; 1H NMR (400 MHz, (CD$_3$)$_2$CO) δ 7.82 (s, 1H), 7.01-6.99 (d, J = 8 Hz, 2H), 6.92-6.90 (d, J = 8 Hz, 2H), 6.75-6.72 (t, J = 6 Hz, 1H), 6.57-6.52 (m, 3H), 4.62-4.60 (m, 1H), 3.33-3.28 (m, 1H), 3.13-3.07 (q, J = 8 Hz, 1H), 1.87-1.77 (m, 4H), 1.46-1.39 (m, 2H), 1.31-1.25 (m, 1H); 13C NMR (100 MHz, (CD$_3$)$_2$CO) δ 153.50, 144.48, 139.95, 137.16, 130.97, 128.06, 127.07, 126.12, 122.55, 121.13, 112.97, 59.98, 46.93, 34.64, 23.14, 21.16; HRMS (ESI) m/z calcd for C$_{18}$H$_{19}$BrN$_2$NaO$^+$ [(M+Na)$^+$]: 381.0573; found: 381.0581.

N-(4-bromophenyl)-2-(2-fluorophenyl)pyrrolidine-1-carboxamide (1k)

The product was prepared according to the Gp 1. White solid; 95% yield, 344 mg; m.p. 177-179 °C; 1H NMR (400 MHz, DMSO-d6) δ 8.41 (s, 1H), 7.48-7.46 (d, J = 8 Hz, 2H), 7.38-7.36 (d, J = 8 Hz, 2H), 7.29-7.24 (m, 1H), 7.18-7.13 (m, 3H), 5.28-5.26 (m, 1H), 3.81-3.76 (m, 1H), 3.59-3.53 (q, J = 8 Hz, 1H), 2.35-2.26 (m, 1H), 1.98-1.72 (m, 3H); 13C NMR (100 MHz, DMSO) δ 160.92, 158.50, 153.84, 140.30, 131.42, 128.84, 128.75, 127.37, 124.57, 121.78, 115.76, 115.55, 113.60, 55.29, 47.16, 33.41, 23.74; 19F NMR (376 MHz, DMSO) δ -118.62; HRMS (ESI) m/z calcd for C$_{17}$H$_{18}$BrF$_2$NaO$^+$ [(M+Na)$^+$]: 385.0322; found: 385.0329.

N-(4-bromophenyl)-2-phenylpiperidine-1-carboxamide (1l)

The product was prepared according to the Gp 1. White solid; 93% yield, 333 mg; m.p. 187-189 °C; 1H NMR (400 MHz, DMSO-d6) δ 8.72 (s, 1H), 7.50-7.48 (d, J = 8 Hz, 2H), 7.41-7.36 (m, 4H), 7.26-7.22 (m, 3H), 5.54 (s, 1H), 4.08-4.04 (m, 1H), 2.83-2.76 (t, J = 14 Hz, 1H), 2.40-2.37 (d, J = 12 Hz, 1H), 1.87-1.79 (m, 1H), 1.61-1.23 (m, 4H); 13C NMR (100 MHz, DMSO) δ 155.67, 140.69, 140.59, 131.45, 129.07, 126.87, 126.79, 122.00, 113.56, 52.85, 40.67, 28.26, 25.71, 19.65; HRMS (ESI) m/z calcd for C$_{18}$H$_{19}$BrN$_2$NaO$^+$ [(M+Na)$^+$]: 381.0573; found: 381.0575.

N-(3-bromophenyl)-2-phenylpyrrolidine-1-carboxamide (1m)

The product was prepared according to the Gp 1. White solid; 87% yield, 300 mg; m.p. 177-179 °C; 1H NMR (400 MHz, CDCl$_3$) δ 7.44-7.38 (m, 3H), 7.34-7.29 (m, 3H), 7.07-7.00 (m, 3H), 6.10 (s, 1H), 4.86-4.85 (m, 1H), 3.83-3.71 (m, 2H), 2.48-2.40 (m, 1H), 2.02-1.91 (m, 3H); 13C NMR (100 MHz, CDCl$_3$) δ 153.79, 142.39, 140.38, 129.96, 129.28, 128.06, 125.81, 125.56, 122.40, 122.01, 117.61, 61.37, 47.56, 36.82, 23.19; HRMS (ESI) m/z calcd for C$_{17}$H$_{17}$BrN$_2$NaO$^+$ [(M+Na)$^+$]: 367.0416; found: 367.0418.

N-(3-bromophenyl)-2-(4-fluorophenyl)pyrrolidine-1-carboxamide (1n)

The product was prepared according to the Gp 1. White solid; 89% yield, 336 mg; m.p. 173-175 °C; 1H NMR (400 MHz, CDCl$_3$) δ 7.50 (s, 1H), 7.28-7.25 (m, 2H), 7.10-7.02 (m, 5H), 6.10 (s, 1H), 4.91-4.89 (m, 1H), 3.79-3.69 (m, 2H),

S-7
The product was prepared according to the Gp 1. White solid; 90% yield, 322 mg; m.p. 176-178 °C; \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.43 (s, 1H), 7.31-7.27 (d, \(J = 8\) Hz, 1H), 7.15-7.09 (m, 3H), 7.07-7.01 (m, 3H), 6.09 (s, 1H), 4.80-4.79 (m, 1H), 3.83-3.71 (m, 2H), 2.47-2.42 (m, 1H), 2.37 (s, 3H), 2.05-1.90 (m, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 153.85, 142.32, 140.43, 139.14, 129.95, 129.17, 128.92, 126.44, 125.51, 122.91, 122.40, 121.97, 117.55, 61.39, 47.59, 36.99, 23.19, 21.58; HRMS (ESI) \(m/z\) calcd for C\(_{18}\)H\(_{10}\)BrN\(_2\)NaO\(^{+}\) [(M+Na\(^{+}\)]: 381.0573; found: 381.0569.

N-(2-bromophenyl)-2-(4-chlorophenyl)pyrrolidine-1-carboxamide (1s)

The product was prepared according to the Gp 1. White solid; 90% yield, 310 mg; m.p. 187-189 °C; \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 8.22-8.20 (d, \(J = 8\) Hz, 1H), 7.37-7.24 (m, 6H), 7.21-7.17 (t, \(J = 8\) Hz, 1H), 6.79-6.75 (t, \(J = 8\) Hz, 1H), 6.71 (s, 1H), 4.95-4.93 (m, 1H), 3.81-3.77 (m, 2H), 2.46-2.38 (m, 1H), 2.04-1.87 (m, 3H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 153.67, 142.35, 137.19, 131.90, 129.08, 128.11, 127.83, 125.98, 123.25, 120.83, 112.49, 61.29, 47.62, 36.75, 22.94; HRMS (ESI) \(m/z\) calcd for C\(_{17}\)H\(_{17}\)BrN\(_2\)NaO\(^{+}\) [(M+Na\(^{+}\)]: 367.0416; found: 367.0420.

N-(2-bromophenyl)-2-(4-chlorophenyl)pyrrolidine-1-carboxamide (1s)
The product was prepared according to the Gp 1. White solid; 90% yield, 340 mg; m.p. 188-190 °C; 1H NMR (400 MHz, CDCl₃) δ 8.22-8.20 (d, J = 8 Hz, 1H), 7.40-7.38 (d, J = 8 Hz, 1H), 7.35-7.33 (d, J = 8 Hz, 2H), 7.26-7.20 (m, 3H), 6.84-6.80 (t, J = 8 Hz, 1H), 6.72 (s, 1H), 4.99-4.97 (m, 1H), 3.81-3.77 (t, J = 8 Hz, 2H), 2.49-2.40 (m, 1H), 2.05-1.86 (m, 3H); 13C NMR (100 MHz, CDCl₃) δ 153.50, 141.08, 136.91, 133.41, 131.90, 129.13, 128.22, 127.28, 123.42, 120.76, 112.55, 60.72, 47.47, 36.41, 23.05; HRMS (ESI) m/z calcd for C₁₇H₁₇BrClN₂O⁺ [(M+H)⁺]: 379.0207; found: 379.0243.

N-(4-chlorophenyl)-2-phenylpyrrolidine-1-carboxamide (1t)
The product was prepared according to the Gp 1. White solid; 89% yield, 267 mg; m.p. 153-155 °C; 1H NMR (400 MHz, CDCl₃) δ 7.41-7.37 (t, J = 8 Hz, 2H), 7.34-7.29 (m, 2H), 7.14-7.06 (m, 1H), 6.09 (s, 1H), 4.86-4.85 (d, J = 4 Hz, 1H), 3.83-3.70 (m, 2H), 2.50-2.40 (m, 1H), 2.04-1.90 (m, 3H); 13C NMR (100 MHz, CDCl₃) δ 154.00, 142.46, 137.66, 129.25, 128.66, 128.03, 127.49, 125.84, 120.46, 61.34, 47.56, 36.89, 23.19; HRMS (ESI) m/z calcd for C₁₇H₁₇BrClN₂O⁺ [(M+Na)⁺]: 323.0922; found: 323.0921.

N-(4-fluorophenyl)-2-phenylpyrrolidine-1-carboxamide (1u)
The product was prepared according to the Gp 1. White solid; 82% yield, 233 mg; m.p. 172-174 °C; 1H NMR (400 MHz, CDCl₃) δ 8.18 (s, 1H), 7.46-7.43 (t, J = 8 Hz, 2H), 7.32-7.29 (t, J = 12 Hz, 2H), 7.21-7.18 (m, 3H), 7.05-7.00 (t, J = 10 Hz, 2H), 5.10-5.08 (m, 1H), 3.77-3.74 (m, 1H), 3.58-3.52 (m, 1H), 2.35-2.24 (m, 1H), 1.92-1.68 (m, 3H); 13C NMR (100 MHz, CDCl₃) δ 158.88, 156.51, 154.24, 145.01, 137.23, 128.59, 126.81, 125.94, 121.58, 121.50, 115.25, 115.01, 60.41, 47.30, 35.03, 23.57; 19F NMR (376 MHz, CDCl₃) δ -121.90; HRMS (ESI) m/z calcd for C₁₇H₁₇FN₂NaO⁺ [(M+Na)⁺]: 307.1217; found: 307.1227.

N-(3,5-bis(trifluoromethyl)phenyl)-2-phenylpyrrolidine-1-carboxamide (1v)
The product was prepared according to the Gp 1. White solid; 90% yield, 360 mg; m.p. 165-167 °C; 1H NMR (400 MHz, CDCl₃) δ 8.96 (s, 1H), 8.27 (s, 2H), 7.55 (s, 1H), 7.34-7.30 (t, J = 8 Hz, 2H), 7.23-7.19 (m, 3H), 5.14-5.13 (m, 1H), 3.85-3.80 (m, 1H), 3.66-3.60 (m, 1H), 2.37-2.27 (m, 1H), 1.96-1.88 (m, 2H), 1.81-1.76 (m, 1H); 13C NMR (100 MHz, CDCl₃) δ 153.69, 144.52, 143.09, 131.24, 130.92, 130.59, 130.27, 128.63, 126.89, 125.86, 125.22, 122.51, 118.99, 114.24, 60.75, 47.42, 34.95, 23.55; 19F NMR (376 MHz, CDCl₃) δ -61.78; HRMS (ESI) m/z calcd for C₁₉H₁₆F₃N₂NaO⁺ [(M+Na)⁺]: 425.1059; found: 425.1089.

1-(4-bromophenyl)-3-(1-phenylpropyl)urea (3a)
The product was prepared according to the Gp 2. White solid; 95% yield; m.p. 171-173 °C; 1H NMR (400 MHz, DMSO-d₆) δ 8.54 (s, 1H), 7.38-7.21 (m, 9H), 6.72-6.70 (d, J = 8 Hz, 1H), 4.62-4.57 (q, J = 8 Hz, 1H), 1.74-1.67 (m,
2H), 0.86-0.82 (t, J = 8 Hz, 3H); $^{13}$C NMR (100 MHz, DMSO-d6) δ154.85, 144.36, 140.26, 131.82, 128.72, 127.13, 126.75, 119.84, 112.72, 55.02, 30.05, 11.17; HRMS (ESI) m/z calcd for C₁₀H₁₇BrN₃O⁺ [(M+Na)⁺]: 355.0416; found: 355.0443.

1-(4-bromophenyl)-3-(1,2-diphenylethyl)urea (3b)

The product was prepared according to the **Gp 2**. White solid; 73% yield; m.p. 178-180 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.57 (s, 1H), 7.36-7.15 (m, 14H), 6.75-6.73 (d, J = 8 Hz, 1H), 5.01-4.95 (q, J = 8 Hz, 1H), 3.02-3.00 (d, J = 8 Hz, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 154.65, 143.99, 140.15, 138.84, 131.80, 129.68, 128.55, 119.88, 112.79, 55.13, 43.08; HRMS (ESI) m/z calcd for C₂₁H₁₉BrN₂NaO⁺ [(M+Na)⁺]: 417.0573; found: 417.0579.

1-benzhydryl-3-(4-bromophenyl)urea (3c)

The product was prepared according to the **Gp 2**. White solid; 89% yield; m.p. 250-252 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.63 (s, 1H), 7.41-7.30 (m, 12H), 7.27-7.22 (m, 3H), 5.98-5.96 (d, J = 8 Hz, 1H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 154.58, 143.50, 140.07, 131.89, 128.97, 127.44, 127.39, 119.94, 112.99, 57.32; HRMS (ESI) m/z calcd for C₂₀H₁₇BrN₂NaO⁺ [(M+Na)⁺]: 403.0416; found: 403.0419.

1-(4-bromophenyl)-3-(phenyl(p-tolyl)methyl)urea (3d)

The product was prepared according to the **Gp 2**. White solid; 84% yield; m.p. 233-235 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.62 (s, 1H), 7.40-7.14 (m, 14H), 5.93-5.91 (d, J = 8 Hz, 1H), 2.26 (s, 3H); $^{13}$C NMR (100 MHz, DMSO) δ 154.56, 143.72, 140.53, 140.09, 136.56, 131.89, 129.49, 128.91, 127.35, 127.31, 119.89, 112.94, 57.02, 21.09; HRMS (ESI) m/z calcd for C₂₁H₁₉BrN₂NaO⁺ [(M+Na)⁺]: 417.0573; found: 417.0582.

1-(4-bromophenyl)-3-((4-methoxyphenyl)(phenyl)methyl)urea (3e)

The product was prepared according to the **Gp 2**. White solid; 78% yield, 320 mg; m.p. 177-179 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.61 (s, 1H), 7.45-7.44 (d, J = 4 Hz, 1H), 7.38-7.20 (m, 10H), 7.17-7.15 (d, J = 8 Hz, 1H), 6.92-6.90 (d, J = 8 Hz, 2H), 5.91-5.89 (d, J = 8 Hz, 1H), 3.72 (s, 3H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 158.65, 154.53, 143.72, 140.53, 135.51, 131.88, 128.89, 128.59, 127.24, 120.67, 119.88, 114.31, 112.91, 56.67, 55.53; HRMS (ESI) m/z calcd for C₂₁H₁₉BrN₂NaO⁺ [(M+Na)⁺]: 433.0527; found: 433.0527.

1-(4-bromophenyl)-3-((4-fluorophenyl)(phenyl)methyl)urea (3f)

The product was prepared according to the **Gp 2**. White solid; 83% yield; m.p. 219-221 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.63 (s, 1H), 7.40-7.31 (m, 10H), 7.28-7.23 (m, 2H), 7.20-7.16 (t, J = 8 Hz, 2H), 6.00-5.98 (d, J = 8 Hz, 1H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 162.79,
The product was prepared according to the Gp 2. White solid; 87% yield; m.p. 241-243 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.63 (s, 1H), 7.56-7.54 (d, $J = 8$ Hz, 2H), 7.36-7.24 (m, 10H), 6.07-6.05 (d, $J = 8$ Hz, 1H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 154.56, 148.40, 142.46, 139.95, 131.90, 129.19, 128.77-120.67 (q, $J = 270$ Hz), 128.17, 128.02, 127.85, 127.66, 125.87, 120.67, 119.99, 113.09, 57.12; $^{19}$F NMR (376 MHz, DMSO) δ -60.85; HRMS (ESI) m/z calcld for C$_{20}$H$_{16}$BrClN$_2$NaO$_2^+$ [(M+Na)$^+$]: 471.0290; found: 471.0297.

1-(4-bromophenyl)-3-(phenyl(4-trifluoromethyl)phenyl)methyl)urea (3i)

The product was prepared according to the Gp 2. White solid; 81% yield; m.p. 217-219 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.67 (s, 1H), 7.57-7.55 (d, $J = 8$ Hz, 2H), 7.45-7.46 (d, $J = 8$ Hz, 2H), 7.27-7.24 (m, 3H), 2.33 (s, 3H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 154.54, 143.61, 143.45, 140.09, 138.08, 131.89, 128.94, 128.89, 128.10, 127.93, 127.38, 127.32, 124.50, 119.89, 112.94, 57.27, 21.57; HRMS (ESI) m/z calcld for C$_{21}$H$_{19}$BrN$_2$NaO$_2^+$ [(M+Na)$^+$]: 417.0573; found: 417.0558.

1-(4-bromophenyl)-3-(phenyl(m-toly)l)methyl)urea (3j)

The product was prepared according to the Gp 2. White solid; 87% yield, 341 mg; m.p. 215-217 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.67 (s, 1H), 7.48-7.46 (d, $J = 8$ Hz, 2H), 7.31-7.24 (m, 8H), 7.17-7.10 (m, 3H), 5.97-5.95 (m, 1H), 2.33 (s, 3H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 154.54, 143.61, 143.45, 140.09, 138.08, 131.89, 128.94, 128.89, 128.10, 127.93, 127.38, 127.32, 124.50, 119.89, 112.94, 57.27, 21.57; HRMS (ESI) m/z calcld for C$_{21}$H$_{19}$BrN$_2$NaO$_2^+$ [(M+Na)$^+$]: 417.0573; found: 417.0558.
The product was prepared according to the Gp 2. White solid; 78% yield, 356 mg; m.p. 242-244 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 8.63 (s, 1H), 7.53 (s, 1H), 7.46-7.45 (d, J = 4 Hz, 1H), 7.41-7.27 (m, 12H), 5.99-5.97 (d, J = 8 Hz, 1H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 154.55, 146.48, 142.77, 139.98, 131.89, 131.20, 130.29, 129.88, 129.13, 127.74, 127.49, 126.47, 122.28, 120.00, 113.07, 56.85; HRMS (ESI) m/z calc for C$_{20}$H$_{16}$Br$_2$NaO$^+$ [(M+Na)$^+$]: 480.9522; found: 480.9515.

1-(4-bromophenyl)-3-(phenyl(o-tolyl)methyl)urea (3l)

The product was prepared according to the Gp 2. White solid; 78% yield, 307 mg; m.p. 242-244 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 8.58 (s, 1H), 7.40-7.34 (m, 6H), 7.28-7.24 (m, 3H), 7.21-7.17 (m, 4H), 7.11-7.09 (d, J = 8 Hz, 1H), 6.14-6.12 (d, J = 8 Hz, 1H), 2.28 (s, 3H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 154.46, 142.56, 141.40, 140.07, 135.80, 131.89, 130.89, 128.95, 127.68, 127.50, 127.01, 126.55, 119.88, 112.95, 54.02, 19.52; HRMS (ESI) m/z calc for C$_{21}$H$_{19}$Br$_2$NaO$^+$ [(M+Na)$^+$]: 417.0573; found: 417.0571.

1-(4-bromophenyl)-3-(naphthalen-1-yl(phenyl)methyl)urea (3m)

The product was prepared according to the Gp 2. White solid; 78% yield; m.p. 273-275 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 8.62 (s, 1H), 8.08-8.06 (m, 1H), 7.98-7.96 (m, 1H), 7.90-7.88 (d, J = 8 Hz, 1H), 7.55-7.51 (m, 3H), 7.43-7.35 (m, 9H), 7.29-7.26 (m, 2H), 6.74-6.72 (d, J = 8 Hz, 1H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 154.45, 142.77, 140.04, 138.84, 134.02, 131.91, 130.92, 129.17, 129.04, 128.31, 127.85, 127.66, 126.87, 126.24, 125.89, 124.98, 124.07, 119.92, 113.02, 53.98; HRMS (ESI) m/z calc for C$_{24}$H$_{19}$Br$_2$NaO$^+$ [(M+Na)$^+$]: 453.0573; found: 453.0563.

1-(4-bromophenyl)-3-(naphthalen-2-yl(phenyl)methyl)urea (3n)

The product was prepared according to the Gp 2. White solid; 95% yield; m.p. 216-218 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 8.69 (s, 1H), 7.90-7.86 (m, 4H), 7.53-7.35 (m, 12H), 7.28-7.24 (m, 1H), 6.16-6.14 (m, 3H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 154.64, 143.30, 141.03, 140.08, 133.29, 132.53, 131.91, 129.04, 128.66, 128.20, 127.99, 127.58, 126.83, 126.40, 126.00, 125.42, 119.94, 113.00, 57.46; HRMS (ESI) m/z calc for C$_{26}$H$_{19}$Br$_2$NaO$^+$ [(M+Na)$^+$]: 453.0573; found: 453.0589.

1-(bis(4-methoxyphenyl)methyl)-3-(4-bromophenyl)urea (3o)

The product was prepared according to the Gp 2. White solid; 76% yield; m.p. 201-203 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 8.58 (s, 1H), 7.40-7.34 (m, 4H), 7.20-7.17 (d, J = 12 Hz, 4H), 7.08-7.06 (d, J = 8 Hz, 1H), 6.91-6.89 (d, J = 8 Hz, 4H), 5.86-5.84 (d, J = 8 Hz, 1H), 3.72 (s, 6H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 158.57, 154.51, 140.14, 135.86, 131.87, 128.44, 119.86, 114.24, 112.87, 56.04, 55.53; HRMS
(ESI) m/z calcd for C_{22}H_{21}BrN_2NaO_3^+ [(M+Na)^+]: 463.0628; found: 463.0621.

1-(bis(4-fluorophenyl)methyl)-3-(4-bromophenyl)urea (3p)

The product was prepared according to the Gp 2. White solid; 82% yield; m.p. 242-244 °C; 1H NMR (400 MHz, DMSO-d6) δ 8.61 (s, 1H), 7.40-7.33 (m, 8H), 7.25-7.16 (m, 5H), 6.00-5.98 (d, J = 8 Hz, 1H); 13C NMR (100 MHz, DMSO-d6) δ 162.83, 160.41, 154.52, 140.00, 139.59, 139.56, 131.89, 129.39, 119.99, 115.85, 115.64, 113.05, 55.94; 19F NMR (376 MHz, DMSO) δ -115.71; HRMS (ESI) m/z calcd for C_{29}H_{15}BrF_2N_2NaO^+ [(M+Na)^+]: 439.0228; found: 439.0240.

1-(4-bromophenyl)-3-((4-chlorophenyl)(4-methoxyphenyl)methyl)urea (3q)

The product was prepared according to the Gp 2. White solid; 78% yield; m.p. 221-223 °C; 1H NMR (400 MHz, DMSO-d6) δ 8.60 (s, 1H), 7.41-7.30 (m, 2H), 7.22-7.16 (m, 2H), 6.93-6.90 (d, J = 12 Hz, 2H), 5.92-5.90 (d, J = 8 Hz, 1H), 3.73 (s, 3H); 13C NMR (100 MHz, DMSO-d6) δ 158.80, 154.52, 140.00, 139.59, 139.56, 131.89, 129.39, 119.99, 115.85, 115.64, 129.06, 128.81, 128.71, 119.94, 114.42, 112.99, 56.13, 55.57; HRMS (ESI) m/z calcd for C_{29}H_{15}BrClN_2NaO^+ [(M+Na)^+]: 467.0132; found: 467.0151.

1-benzyl-3-(3,5-bis(trifluoromethyl)phenyl)urea (5a)

The product was prepared according to the Gp 3. White solid; 92% yield; 333 mg; m.p. 187-189 °C; 1H NMR (400 MHz, DMSO-d6) δ 9.37 (s, 1H), 8.10 (s, 2H), 7.55(s, 1H), 7.35-7.29 (m, 4H), 7.26-7.22 (m, 1H), 7.04-7.01 (t, J = 6 Hz, 1H), 4.33-4.31 (t, J = 8Hz, 1H); 13C NMR (100 MHz, DMSO-d6) δ 155.32, 143.04, 140.43, 131.54-130.57(q, J = 32 Hz), 128.74, 127.56, 127.21, 125.18, 122.47, 43.25; 19F NMR (376 MHz, DMSO) δ -61.72; HRMS (ESI) m/z calcd for C_{16}H_{12}F_{8}N_{2}NaO^+ [(M+Na)^+]: 385.0746; found: 385.0740.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(4-fluorobenzyl)urea (5b)

The product was prepared according to the Gp 3. White solid; 89% yield, 338 mg; m.p. 217-219 °C; 1H NMR (400 MHz, DMSO-d6) δ 9.39 (s, 1H), 8.10 (s, 2H), 7.53(s, 1H), 7.36-7.33 (t, J = 6 Hz, 2H), 7.17-7.12 (t, J = 10 Hz, 2H), 7.05-7.02 (t, J = 6 Hz, 1H), 4.31-4.29 (d, J = 8 Hz, 2H); 13C NMR (100 MHz, DMSO-d6) δ 162.82, 160.41, 155.30, 143.00, 136.68, 131.53-130.56 (q, J = 33 Hz), 129.59, 129.51, 127.88-119.75(q, J = 271 Hz), 117.77, 117.73, 115.54, 115.33, 113.92, 42.92; 19F NMR (376 MHz, DMSO-d6) δ -61.82, -116.31; HRMS (ESI) m/z calcd for C_{16}H_{11}F_{7}N_{2}NaO^+ [(M+Na)^+]: 403.0652; found: 403.0670.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(4-chlorobenzyl)urea (5c)
The product was prepared according to the Gp 3. White solid; 
88% yield, 348 mg; m.p. 227-229 °C; 1H NMR (400 MHz, 
DMSO-d6) δ 9.42 (s, 1H), 8.10 (s, 2H), 7.53 (s, 1H), 7.39-7.37 
(d, J = 8 Hz, 2H), 7.34-7.31 (d, J = 12 Hz, 2H), 7.08-7.05 (t, J 
= 6 Hz, 1H), 4.31-4.30 (d, J = 4 Hz, 2H); 13C NMR (100 MHz, 
DMSO-d6) δ 155.33, 142.98, 139.59, 131.74, 131.54-130.57 (q, 
J = 33 Hz), 129.41, 128.66, 127.87-119.75 (q, J = 271 Hz), 
117.79, 113.96, 42.61; 19F NMR (376 MHz, DMSO-d6) δ -61.79; HRMS (ESI) m/z calcd for C18H11F6ClN2NaO+ [(M+Na)+]: 419.0356; found: 419.0375.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(4-bromobenzyl)urea (5d)

The product was prepared according to the Gp 3. White solid; 
92% yield, 405 mg; m.p. 231-233 °C; 1H NMR (400 MHz, 
DMSO-d6) δ 9.45 (s, 1H), 8.10 (s, 2H), 7.54-7.50 (m, 3H), 
7.28-7.25 (d, J = 12 Hz, 2H), 7.10-7.07 (t, J = 6 Hz, 1H), 
4.29-4.28 (t, J = 8Hz, 1H); 13C NMR (100 MHz, DMSO-d6) 
δ 155.34, 142.98, 140.04, 131.59, 131.53-130.56 (q, 
J = 33 Hz, 1C), 129.79, 125.17, 122.46, 120.18, 117.83, 42.66; 19F NMR (376 MHz, DMSO-d6) δ -61.76; HRMS (ESI) m/z calcd for C16H11BrF6N2NaO+ [(M+Na)+]: 462.9851; found: 462.9779.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(4-methylbenzyl)urea (5e)

The product was prepared according to the Gp 3. White solid; 
96% yield, 360 mg; m.p. 195-197 °C; 1H NMR (400 MHz, 
DMSO-d6) δ 9.33 (s, 1H), 8.10 (s, 2H), 7.53(s, 1H), 7.20-7.18 
(t, J = 8 Hz, 2H), 7.14-7.12 (t, J = 8 Hz, 2H), 6.98-6.95 (t, J = 6 Hz, 1H), 4.28-4.26 (d, J = 8 Hz, 2H), 2.27 (s, 3H); 13C NMR 
(100 MHz, DMSO-d6) δ 155.27, 143.04, 137.34, 136.27, 
131.54-130.57 (q, J = 32 Hz, 1C), 129.28, 127.57, 125.18, 
122.47, 117.75, 43.00, 21.10; 19F NMR (376 MHz, DMSO-d6) δ -61.79; HRMS (ESI) m/z calcd for C17H15F6N2O+ [(M+H)+]: 377.1083; found: 377.1099.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(4-methoxybenzyl)urea (5f)

The product was prepared according to the Gp 3. White solid; 
96% yield, 355 mg; m.p. 184-186 °C; 1H NMR (400 MHz, 
DMSO-d6) δ 9.32 (s, 1H), 8.11 (s, 2H), 7.55(s, 1H), 7.26-7.23 
(d, J = 8 Hz, 2H), 6.96-6.93 (t, J = 8 Hz, 1H), 6.91-6.89 (d, J = 8 Hz, 2H), 4.26-4.25 (t, J = 4Hz, 1H), 3.74 
(s, 3H); 13C NMR (100 MHz, DMSO-d6) δ 158.69, 155.23, 
143.04, 132.30, 131.53-130.56 (q, J = 32 Hz, 1C), 128.97, 
128.47, 125.18, 122.47, 119.76, 117.74, 114.16, 55.50, 42.72; 19F NMR (376 MHz, DMSO-d6) δ -61.77; HRMS (ESI) m/z calcd for C17H15F6N2O2+ [(M+H)+]: 393.1032; found: 393.1045.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(4-(trifluoromethyl)benzyl)urea (5g)
The product was prepared according to the Gp 3. White solid; 94% yield, 404 mg; m.p. 209-211 °C; 1H NMR (400 MHz, DMSO-d6) δ 9.53 (s, 1H), 8.13 (s, 2H), 7.72-7.70 (d, J = 8 Hz, 2H), 7.57-7.55 (d, J = 8 Hz, 2H), 7.53 (s, 1H), 7.20-7.17 (t, J = 6 Hz, 1H), 4.44-4.42 (d, J = 8 Hz, 2H); 13C NMR (100 MHz, DMSO-d6) δ 155.39, 145.54, 142.94, 131.52-130.55;q, J = 32 Hz), 128.11, 127.72, 126.16, 125.66-125.55(q, J = 4 Hz), 125.16, 123.45, 122.45, 42.90; 19F NMR (376 MHz, DMSO-d6) δ -60.87, -61.82; HRMS (ESI) m/z calcd for C17H11F2N2NaO+ [(M+Na)⁺]: 453.0620; found: 453.0653.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(3-fluorobenzyl)urea (5h)

The product was prepared according to the Gp 3. White solid; 95% yield, 361 mg; m.p. 194-196 °C; 1H NMR (400 MHz, DMSO-d6) δ 9.45 (s, 1H), 8.13 (s, 2H), 7.55(s, 1H), 7.42-7.36 (q, J = 8 Hz, 1H), 7.18-7.05 (m, 2H), 4.37-4.36 (d, J = 4 Hz, 2H); 13C NMR (100 MHz, DMSO-d6) δ 163.92, 161.50, 155.34, 143.67-143.62(q, J = 7 Hz, J = 1290 Hz, 1C), 142.97, 131.54-130.57(q, J = 32 Hz, 1C), 125.17, 123.48, 122.46, 114.23, 114.01, 113.80, 42.77; 19F NMR (376 MHz, DMSO-d6) δ -61.84, -113.64; HRMS (ESI) m/z calcd for C16H11F2N2NaO+ [(M+Na)⁺]: 403.0652; found: 403.0599.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(3-chlorobenzyl)urea (5i)

The product was prepared according to the Gp 3. White solid; 94% yield, 372 mg; m.p. 170-172 °C; 1H NMR (400 MHz, DMSO-d6) δ 9.44 (s, 1H), 8.10 (s, 2H), 7.53 (s, 1H), 7.37-7.34 (m, 2H), 7.30-7.26 (m, 2H), 7.12-7.09 (t, J = 6 Hz, 1H), 4.33-4.32 (d, J = 4 Hz, 2H); 13C NMR (100 MHz, DMSO-d6) δ 155.33, 143.22, 142.96, 133.44, 131.54-130.57(q, J = 32 Hz, 1C), 130.62, 127.30, 127.12, 126.21, 125.17, 122.46, 117.81, 42.73; 19F NMR (376 MHz, DMSO-d6) δ -61.82; HRMS (ESI) m/z calcd for C16H11ClN2NaO+ [(M+Na)⁺]: 419.0356; found: 419.0375.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(3-bromobenzyl)urea (5j)

The product was prepared according to the Gp 3. White solid; 92% yield, 405 mg; m.p. 157-159 °C; 1H NMR (400 MHz, DMSO-d6) δ 9.45 (s, 1H), 8.12 (s, 2H), 7.56-7.52 (d, J = 16 Hz, 2H), 7.47-7.44 (m, 1H), 7.35-7.29 (m, 2H), 7.13-7.10 (t, J = 6 Hz, 1H), 4.34-4.33 (d, J = 4Hz, 2H); 13C NMR (100 MHz, DMSO-d6) δ 155.31, 143.49, 142.95, 131.54-130.57(q, J = 32 Hz, 1C), 130.95, 130.20, 130.04, 126.63, 125.17, 122.46, 122.08, 42.69; 19F NMR (376 MHz, DMSO-d6) δ -61.79; HRMS (ESI) m/z calcd for C16H11BrF6N2NaO+ [(M+Na)⁺]: 462.9851; found: 462.9787.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(3-methoxybenzyl)urea (5k)
The product was prepared according to the Gp 3. White solid; 96% yield, 376 mg; m.p. 149-151 °C; $^1$H NMR (400 MHz, CDCl$_3$) δ 9.38 (s, 1H), 8.12 (s, 2H), 7.55 (s, 1H), 7.28-7.24 (t, $J = 8$ Hz, 1H), 7.04-7.01 (t, $J = 6$ Hz, 1H), 6.91-6.89 (m, 2H), 6.84-6.82 (d, $J = 8$ Hz, 1H), 4.32-4.31 (d, $J = 8$ Hz, 2H), 3.75 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ 159.78, 155.29, 143.02, 142.04, 131.54-130.57 (q, $J = 32$ Hz, 1C), 129.83, 125.17, 122.47, 119.76, 119.69, 117.78, 113.26, 112.51; $^{19}$F NMR (376 MHz, CDCl$_3$) δ -61.80; HRMS (ESI) $m/z$ calcld for C$_{17}$H$_{14}$F$_{6}$N$_2$O$_2$Na$^+$ [(M+Na)$^+$]: 415.0852; found: 415.0793.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(2-methoxybenzyl)urea (5l)

The product was prepared according to the Gp 3. White solid; 94% yield, 368 mg; m.p. 175-177 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 9.39 (s, 1H), 8.09 (s, 2H), 7.54 (s, 1H), 7.28-7.23 (m, 2H), 7.02-7.00 (d, $J = 8$ Hz, 1H), 6.95-6.91 (t, $J = 8$ Hz, 1H), 6.82-6.79 (t, $J = 6$ Hz, 1H), 4.31-4.29 (d, $J = 8$ Hz, 2H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 157.19, 155.23, 143.00, 131.56-130.59 (q, $J = 32$ Hz, 1C), 128.65, 128.33, 127.88, 127.62, 125.17, 122.46, 120.61, 119.75, 117.60, 113.90, 110.92, 55.77, 38.69; $^{19}$F NMR (376 MHz, DMSO-d$_6$) δ -61.80; HRMS (ESI) $m/z$ calcld for C$_{17}$H$_{14}$F$_{6}$N$_2$O$_2$Na$^+$ [(M+Na)$^+$]: 415.0852; found: 415.0805.

1-(2,6-difluorobenzyl)-3-(4-(trifluoromethyl)phenyl)urea (5m)

The product was prepared according to the Gp 3. White solid; 96% yield, 376 mg; m.p. 166-168 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 8.92 (s, 1H), 7.60-7.55 (m, 4H), 7.44-7.37 (m, 1H), 7.13-7.09 (t, $J = 8$ Hz, 2H), 6.81-6.78 (t, $J = 6$ Hz, 1H), 4.42-4.40 (d, $J = 8$ Hz, 2H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 162.55, 160.18, 154.84, 144.39, 130.30, 126.43, 123.71, 122.09, 121.77, 121.45, 121.14, 117.68, 115.32, 112.14, 111.89, 31.45; $^{19}$F NMR (376 MHz, CDCl$_3$) δ -60.03, -115.15; HRMS (ESI) $m/z$ calcld for C$_{17}$H$_{14}$F$_{6}$N$_2$O$^+$ [(M+Na)$^+$]: 353.0684; found: 353.0693.

1-(4-chlorophenyl)-3-(3,5-difluorobenzyl)urea (5n)

The product was prepared according to the Gp 3. White solid; 97% yield, 380 mg; m.p. 207-209 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 9.59 (s, 1H), 7.41-7.35 (m, 3H), 7.26-7.24 (d, $J = 8$ Hz, 2H), 7.12-7.08 (t, $J = 8$ Hz, 2H), 6.66-6.63 (t, $J = 6$ Hz, 1H), 4.39-4.37 (d, $J = 8$ Hz, 2H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 162.55, 160.10, 155.01, 139.68, 130.25, 128.93, 125.11, 119.55, 115.46, 112.13, 111.88, 31.45; $^{19}$F NMR (376 MHz, CDCl$_3$) δ -115.16; HRMS (ESI) $m/z$ calcld for C$_{14}$H$_{11}$ClF$_{2}$N$_2$O$^+$ [(M+Na)$^+$]: 319.0420; found: 319.0428.
The product was prepared according to the Gp 3. White solid; 98% yield, 384 mg; m.p. 178-180 °C; $^1$H NMR (400 MHz, DMSO-d6) $\delta$ 8.94 (s, 1H), 7.53-7.51 (d, $J$ = 8 Hz, 2H), 7.46-7.44 (d, $J$ = 8 Hz, 1H), 7.42-7.40 (d, $J$ = 8 Hz, 1H), 7.36-7.28 (m, 2H), 7.25-7.22 (d, $J$ = 8 Hz, 2H), 6.77-6.74 (t, $J$ = 6 Hz, 1H), 4.39-4.38 (d, $J$ = 4 Hz, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) $\delta$ 155.47, 142.56, 140.13, 137.65, 132.44, 129.56, 129.03, 127.65, 122.09, 119.21, 41.21; $^{19}$F NMR (376 MHz, CDCl3) $\delta$ -57.20; HRMS (ESI) m/z calcd for C$_{15}$H$_{12}$ClF$_3$N$_2$NaO$_2$ $^+$ [(M+Na)$^+$]: 367.0432; found: 367.0422.

1-(2-chlorobenzyl)-3-(4-chlorophenyl)urea (5p)

The product was prepared according to the Gp 3. White solid; 94% yield; m.p. 193-195 °C; $^1$H NMR (400 MHz, DMSO-d6) $\delta$ 8.86 (s, 1H), 7.46-7.40 (m, 3H), 7.36-7.26 (m, 2H), 6.75-6.72 (t, $J$ = 6 Hz, 1H), 4.39-4.37 (d, $J$ = 8 Hz, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) $\delta$ 155.44, 139.81, 137.66, 132.46, 129.56, 129.31, 129.03, 128.95, 127.65, 125.12, 119.63, 41.22; HRMS (ESI) m/z calcd for C$_{14}$H$_{12}$Cl$_2$N$_2$NaO$^+$ [(M+Na)$^+$]: 317.0219; found: 317.0217.

**General procedures of the oxidation of amines by photoredox catalysis.**

General procedures for the synthesis of 2 (Gp 4).
To a solution of substrate (0.05 mmol) in acetone (2 mL), the catalyst (5 mol%) was added into the mixture. The mixture was stirred at room temperature utilizing blue LED until the completion of the reaction determined by TLC analysis. The crude product was purified by flash chromatography on silica gel (eluent: PE/EtOAc from 5:1 to 2:1) affording to the compounds.

**General procedures for the synthesis of 4 (Gp 5).**

To a solution of substrate (0.05 mmol) in acetone (2 mL), the catalyst (5 mol%) was added into the mixture. Then the mixture was stirred at room temperature utilizing blue LED until the completion of the reaction determined by TLC analysis. The crude product was purified by flash chromatography on silica gel (eluent: PE/EtOAc from 10:1 to 5:1) affording to the compounds.

**General procedures for the synthesis of 6 (Gp 6).**

To a solution of substrate (0.05 mmol) in CHCl₃ (2 mL), the catalyst (5 mol%) was added into the mixture. The mixture was stirred at room temperature utilizing blue LED until the completion of the reaction determined by TLC analysis. The crude product was purified by flash chromatography on silica gel (eluent: PE/EtOAc from 10:1 to 5:1) affording to the compounds.
The gram scale reaction

To a solution of Mes-AcrClO₄ (5 mol%, 60mg) in CHCl₃ (40 mL) and acetone (10 mL) [Acetone was used for promoting the dissolution of 5m], 5m (3.1 mmol, 1.03g.) was added into the mixture which was equipped with an O₂ balloon. The mixture was stirred at room temperature utilizing blue LED until the completion of the reaction determined by TLC analysis. The crude product was purified by flash chromatography on silica gel (eluent: PE/EtOAc from 5:1 to 2:1) affording to the corresponding compounds.

The preparation of fenofibrate

4q (0.3 mmol) were weighed into an oven-dried 50 mL flask containing anhydrous THF (15 mL), BBr₃ (1 mmol) was added into the mixture at -78 °C. The resulting mixture was warmed to room temperature and stirred for 2 h. H₂O was then added dropwise to quench the reaction at 0 °C. Then the volatile fraction was removed in vacuo. The residue was purified by flash chromatography on silica gel (eluent: PE/EtOAc from 5:1 to 1:1). The above collected solid was dissolved in
isopropyl alcohol (10 mL), and then KHCO₃ (0.5 mmol) was slowly added into the mixture, which was stirred for 10 min at room temperature. After that, isopropyl 2-bromo-2-methylpropanoate (0.5 mmol) was added into the mixture, and the solution was heated to reflux temperature for 60 h. After the completion of the reaction, the volatile fraction was removed in vacuo. The residue was purified by flash chromatography on silica gel (eluent: PE/EtOAc from 5:1 to 2:1) affording the fenofibrate as a white solid (82 mg, 85%).

**(4-chlorophenyl)(4-hydroxyphenyl)methanone**  
White solid, 92% yield, 63 mg; ¹H NMR (400 MHz, CDCl₃) δ 7.77-7.75 (d, J = 8 Hz, 2H), 7.72-7.70 (d, J = 8 Hz, 2H), 7.47-7.45 (d, J = 8 Hz, 2H), 6.93-6.91 (d, J = 8 Hz, 2H), 6.04 (s, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 194.63, 160.09, 138.47, 136.41, 132.83, 131.19, 129.84, 128.58, 115.32.

**Fenofibrate**  
White solid; 85% yield, 62 mg; ¹H NMR (400 MHz, CDCl₃) δ 7.74 (d, J = 8 Hz, 2H), 7.62 (d, J = 8 Hz, 2H), 6.88-6.86 (d, J = 8 Hz, 2H), 5.12-5.05 (m, 1H), 1.66 (s, 6H), 1.21-1.20 (d, J = 4 Hz, 6H); ¹³C NMR (100 MHz, CDCl₃) δ 194.23, 173.08, 159.74, 138.34, 136.43, 131.94, 131.15, 130.22, 128.53, 117.26, 79.43, 69.34, 25.37, 21.53.

**Characterization data for the products**

**(1-(4-bromophenyl)-3-(4-oxo-4-phenylbutyl) urea (2a)**

The product was prepared according to the Gp 4.  
White solid; 73% yield, 13.7 mg; m.p. 173-175 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 8.55 (s, 1H), 6.98-7.96 (s, 2H), 7.65-7.62 (t, J = 6 Hz, 1H), 7.55-7.51 (t, J = 8 Hz, 1H), 7.37 (s, 4H), 6.30-6.27 (t, J = 6 Hz, 1H), 3.18-3.13 (q, J = 8 Hz, 2H), 3.09-3.05 (t, J = 8 Hz, 2H), 1.83-1.76 (m, 2H); ¹³C NMR (100 MHz, DMSO-d₆) δ 200.11, 155.53, 140.45, 137.13, 133.54, 131.75, 129.15, 128.31, 120.01, 112.65, 39.09, 35.75, 24.89; HRMS (ESI) m/z calcd for C₁₇H₁₇BrN₂NaO₂⁺ [(M+Na)⁺]: 383.0366; found: 383.0375.

**(1-(4-bromophenyl)-3-(4-oxo-4-(p-tolyl)butyl)urea (2b)**

The product was prepared according to the Gp 4.  
White solid; 55% yield, 10.3 mg; m.p. 177-179 °C; ¹H NMR (400 MHz, DMSO-d₆) δ 8.57 (s, 1H), 7.87-7.85 (d, J = 8 Hz, 2H), 7.38-7.36 (m, 4H), 7.33-7.31 (d, J = 8 Hz, 2H), 6.28-6.25 (t, J = 6 Hz, 1H), 3.16-3.11 (q, J = 8 Hz, 2H), 3.04-3.00 (t, J = 8 Hz, 2H), 2.37 (s, 3H), 1.80-1.73 (m, 2H); ¹³C NMR (100 MHz, DMSO-d₆) δ 199.64, 155.50, 143.86, 140.44, 134.64, 131.76, 129.69, 128.44, 119.99,
112.63, 39.11, 35.62, 24.97, 21.60; HRMS (ESI) m/z calcd for C_{18}H_{10}BrN_{2}NaO_{2}^{+} [(M+Na)^{+}]: 397.0522; found: 397.0481.

1-(4-bromophenyl)-3-(4-(4-methoxyphenyl)-4-oxobutyl)urea (2c)

The product was prepared according to the Gp 4. White solid; 81% yield, 16.6 mg; m.p. 171-173 °C; \(^{1}\)H NMR (400 MHz, DMSO-d6) \(\delta\) 8.57 (s, 1H), 7.95-7.93 (d, \(J = 8\) Hz, 2H), 7.36 (s, 4H), 7.04-7.02 (d, \(J = 8\) Hz, 2H), 6.28-6.25 (t, \(J = 6\) Hz, 1H), 3.83 (s, 3H), 3.16-3.11 (q, \(J = 8\) Hz, 2H), 3.01-2.97 (t, \(J = 8\) Hz, 2H), 1.80-1.73 (m, 2H); \(^{13}\)C NMR (100 MHz, DMSO-d6) \(\delta\) 198.49, 163.48, 155.51, 140.45, 131.76, 130.63, 130.05, 119.99, 114.31, 112.63, 55.97, 35.36, 25.09; HRMS (ESI) m/z calcd for C_{18}H_{15}BrN_{2}NaO_{2}^{+} [(M+Na)^{+}]: 413.0471; found: 413.0471.

1-(4-bromophenyl)-3-(4-oxo-4-(4-(trifluoromethyl)phenyl)butyl)urea (2d)

The product was prepared according to the Gp 4. White solid; 55% yield, 11.8 mg; m.p. 170-172 °C; \(^{1}\)H NMR (400 MHz, DMSO-d6) \(\delta\) 8.59 (s, 1H), 8.15-8.13 (d, \(J = 8\) Hz, 2H), 7.90-7.88 (d, \(J = 8\) Hz, 2H), 7.38-7.33 (m, 4H), 6.29-6.26 (t, \(J = 6\) Hz, 1H), 3.18-3.11 (m, 4H), 1.84-1.77 (m, 2H); \(^{13}\)C NMR (100 MHz, DMSO-d6) \(\delta\) 199.57, 155.51, 140.43, 140.27, 133.32-132.37 (q, \(J = 33\) Hz), 131.99, 131.74, 129.13, 128.32-120.20 (q, \(J = 270\) Hz), 126.17, 120.20, 119.96, 112.63, 38.94, 36.10, 24.66; \(^{19}\)F NMR (376 MHz, CDCl3) \(\delta\) -112.35; HRMS (ESI) m/z calcd for C_{18}H_{15}BrF_{3}N_{2}NaO_{2}^{+} [(M+Na)^{+}]: 451.0239; found: 451.0253.

1-(4-bromophenyl)-3-(4-(4-fluorophenyl)-4-oxobutyl)urea (2e)

The product was prepared according to the Gp 4. White solid; 79% yield, 14.9 mg; m.p. 190-192 °C; \(^{1}\)H NMR (400 MHz, DMSO-d6) \(\delta\) 8.57 (s, 1H), 8.07-8.03 (s, 2H), 7.36-7.33 (m, 6H), 6.28-6.25 (t, \(J = 6\) Hz, 1H), 3.17-3.12 (q, \(J = 8\) Hz, 2H), 3.07-3.04 (t, \(J = 6\) Hz, 2H), 1.82-1.75 (m, 2H); \(^{13}\)C NMR (100 MHz, DMSO-d6) \(\delta\) 198.71, 155.51, 140.44, 133.85, 131.75, 131.25, 119.99, 116.24, 116.02, 112.64, 39.05, 35.69, 24.85; \(^{19}\)F NMR (376 MHz, CDCl3) \(\delta\) -106.35; HRMS (ESI) m/z calcd for C_{17}H_{16}Br FN_{2}NaO_{2}^{+} [(M+Na)^{+}]: 401.0271; found: 401.0256.

1-(4-bromophenyl)-3-(4-(4-chlorophenyl)-4-oxobutyl)urea (2f)

The product was prepared according to the Gp 4. White solid; 86% yield, 16.9 mg; m.p. 162-164 °C; \(^{1}\)H NMR (400 MHz, DMSO-d6) \(\delta\) 8.57 (s, 1H), 7.98-7.96 (d, \(J = 8\) Hz, 2H), 7.60-7.58 (d, \(J = 8\) Hz, 2H), 7.36 (s, 4H), 6.27-6.25 (t, \(J = 4\) Hz, 1H), 3.17-3.12 (q, \(J = 8\) Hz, 2H), 3.07-3.04 (t, \(J = 8\) Hz, 2H), 1.81-1.74 (m, 2H); \(^{13}\)C NMR (100 MHz, DMSO-d6) \(\delta\) 199.13, 155.51, 140.44, 138.43, 135.79, 131.75, 130.25, 129.26, 119.99, 112.64, 39.02, 35.77, 24.80; HRMS (ESI) m/z calcd for C_{17}H_{16}BrClN_{2}NaO_{2}^{+} [(M+Na)^{+}]: 416.9976; found: 416.9962.

1-(4-bromophenyl)-3-(4-(4-bromophenyl)-4-oxobutyl)urea (2g)
The product was prepared according to the **Gp 4**. White solid; 69% yield, 15.1 mg; m.p. 178-180 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 8.58 (s, 1H), 7.90-7.88 (s, 2H), 7.74-7.72 (t, $J = 6$ Hz, 1H), 7.38-7.33 (m, 4H), 6.28-6.25 (t, $J = 6$ Hz, 1H), 3.17-3.12 (q, $J = 8$ Hz, 2H), 3.07-3.03 (t, $J = 8$ Hz, 2H), 1.81-1.74 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) $\delta$ 199.35, 155.51, 140.43, 136.11, 132.21, 131.75, 130.36, 127.60, 119.99, 112.65, 39.01, 35.74, 24.78; HRMS (ESI) m/z calcd for C$_{17}$H$_{16}$Br$_2$N$_2$O$_2$ $^+$: [(M+Na)$^+$]: 460.9471; found: 460.9484.

1-(4-bromophenyl)-3-(4-(3-fluorophenyl)-4-oxobutyl)urea (2h)

The product was prepared according to the **Gp 4**. White solid; 39% yield, 7.4 mg; m.p. 184-186 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 8.59 (s, 1H), 7.83-7.81 (d, $J = 8$ Hz, 1H), 7.73-7.71 (d, $J = 8$ Hz, 1H), 7.61-7.56 (m, 1H), 7.51-7.48 (m, 4H), 6.26-6.25 (t, $J = 6$ Hz, 1H), 3.17-3.12 (q, $J = 8$ Hz, 2H), 3.10-3.06 (t, $J = 8$ Hz, 2H), 1.81-1.74 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) $\delta$ 199.09, 167.42, 163.88, 161.44, 155.50, 140.44, 139.39, 131.99, 131.75, 131.34, 129.13, 124.55, 120.55, 120.34, 119.97, 114.90, 114.68, 112.63; $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -112.35; HRMS (ESI) m/z calcd for C$_{17}$H$_{16}$Br$_2$NaO$_2$ $^+$ [(M+Na)$^+$]: 401.0271; found: 401.0279.

1-(4-bromophenyl)-3-(4-(3-chlorophenyl)-4-oxobutyl)urea (2i)

The product was prepared according to the **Gp 4**. White solid; 58% yield, 11.4 mg; m.p. 166-168 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 8.60 (s, 1H), 7.96-7.91 (m, 2H), 7.72-7.70 (d, $J = 8$ Hz, 1H), 7.58-7.54 (t, $J = 8$ Hz, 1H), 7.37-7.33 (m, 4H), 6.29-6.26 (t, $J = 6$ Hz, 1H), 3.16-3.07 (m, 4H), 1.81-1.74 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) $\delta$ 199.10, 155.50, 140.44, 138.98, 134.11, 133.24, 131.75, 131.19, 128.00, 126.99, 119.97, 112.62, 38.97, 35.90, 24.70; HRMS (ESI) m/z calcd for C$_{17}$H$_{16}$BrCl$_2$NaO$_2$ $^+$ [(M+Na)$^+$]: 416.9976; found: 416.9949.

1-(4-bromophenyl)-3-(4-oxo-4-(m-tolyl)butyl)urea (2j)

The product was prepared according to the **Gp 4**. White solid; 50% yield, 9.4 mg; m.p. 151-153 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 8.58 (s, 1H), 7.77-7.75 (m, 2H), 7.46-7.39 (m, 2H), 7.38-7.34 (m, 4H), 6.29-6.27 (m, 1H), 3.17-3.12 (q, $J = 8$ Hz, 2H), 3.06-3.03 (t, $J = 8$ Hz, 2H), 1.81-1.74 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) $\delta$ 200.21, 155.51, 140.45, 138.49, 137.17, 134.13, 131.76, 129.05, 128.74, 125.55, 119.98, 112.63, 39.08, 35.78, 24.90, 21.35; HRMS (ESI) m/z calcd for C$_{18}$H$_{19}$Br$_2$NaO$_2$ $^+$ [(M+Na)$^+$]: 397.0522; found: 397.0481.

1-(4-bromophenyl)-3-(4-(2-fluorophenyl)-4-oxobutyl)urea (2k)

The product was prepared according to the **Gp 4**. White solid; 39% yield, 7.4 mg; m.p. 184-186 °C; $^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 8.59 (s, 1H), 7.83-7.81 (d, $J = 8$ Hz, 1H), 7.73-7.71 (d, $J = 8$ Hz, 1H).
1-(4-bromophenyl)-3-(5-(4-methoxyphenyl)-5-oxopentyl)urea (2l)

The product was prepared according to the Gp 4. White solid; 32% yield; m.p. 186-188 °C, 6.0 mg; 1H NMR (400 MHz, DMSO-d6) δ 8.59 (s, 1H), 7.98-7.96 (d, J = 8 Hz, 2H), 7.65-7.61 (t, J = 8 Hz, 1H), 7.54-7.50 (t, J = 8 Hz, 2H), 7.40-7.35 (m, 4H), 6.24-6.21 (t, J = 6 Hz, 1H), 6.14-6.09 (q, J = 8 Hz, 2H), 3.08-3.04 (t, J = 8 Hz, 2H), 1.67-1.60 (m, 2H), 1.52-1.45 (m, 2H); 13C NMR (100 MHz, DMSO-d6) δ 200.48, 155.46, 140.48, 137.13, 133.56, 130.97, 112.58, 39.23, 38.01, 29.74, 21.61; HRMS (ESI) m/z calcd for C19H21BrN2O2Na+: 401.0271; found: 401.0273.

1-(3-bromophenyl)-3-(4-oxo-4-phenylbutyl)urea (2m)

The product was prepared according to the Gp 4. White solid; 45% yield, 8.1 mg; m.p. 177-179 °C; 1H NMR (400 MHz, DMSO-d6) δ 8.65 (s, 1H), 7.98-7.96 (d, J = 8 Hz, 2H), 7.80 (s, 1H), 7.65-7.62 (m, 1H), 7.54-7.51 (t, J = 6 Hz, 1H), 7.22-7.14 (m, 1H), 7.06-7.04 (d, J = 8 Hz, 2H), 6.34-6.31 (t, J = 6 Hz, 1H), 3.18-3.13 (q, J = 8 Hz, 2H), 3.09-3.05 (t, J = 8 Hz, 2H), 1.82-1.75 (m, 2H); 13C NMR (100 MHz, DMSO-d6) δ 200.08, 155.43, 142.72, 137.09, 133.56, 130.97, 129.16, 128.31, 123.85, 122.11, 120.26, 116.81, 39.07, 35.71, 24.83; HRMS (ESI) m/z calcd for C17H17BrN2O2Na+: 383.0366; found: 383.0273.

1-(3-bromophenyl)-3-(4-(4-fluorophenyl)-4-oxobutyl)urea (2n)

The product was prepared according to the Gp 4. White solid; 51% yield, 9.6 mg; m.p. 172-174 °C; 1H NMR (400 MHz, DMSO-d6) δ 8.65 (s, 1H), 8.06-8.03 (d, J = 8 Hz, 2H), 7.79 (s, 1H), 7.37-7.32 (d, J = 10 Hz, 2H), 7.22-7.14 (m, 2H), 7.06-7.04 (m, 2H), 6.33-6.30 (t, J = 6 Hz, 1H), 3.17-3.12 (q, J = 8 Hz, 2H), 3.07-3.04 (t, J = 6 Hz, 2H), 1.82-1.75 (m, 2H); 13C NMR (100 MHz, DMSO-d6) δ 198.68, 166.65, 164.15, 155.43, 142.71, 133.87, 131.34, 131.25, 130.97, 123.85, 122.10, 120.25, 116.80, 116.24, 116.02, 39.03, 35.65, 24.80; 19F NMR (376 MHz, CDCl3) δ -106.33; HRMS (ESI) m/z calcd for C17H16BrF3N2O2Na+: 401.0271; found: 401.0176.

1-(3-bromophenyl)-3-(4-(4-chlorophenyl)-4-oxobutyl)urea (2o)

5-23
The product was prepared according to the Gp 4.
White solid; 38% yield, 7.5 mg; m.p. 175-177 °C;  
$^1$H NMR (400 MHz, DMSO-d6) δ 8.65 (s, 1H), 7.90-7.88 (d, $J = 8$ Hz, 2H), 7.79 (s, 4H), 7.74-7.72 (d, $J = 8$ Hz, 2H), 7.21-7.13 (m, 2H), 7.06-7.04 (m, 2H), 6.33-6.30 (t, $J = 6$ Hz, 1H), 3.17-3.12 (q, $J = 8$ Hz, 2H), 3.07-3.03 (t, $J = 8$ Hz, 2H), 1.81-1.74 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 199.64, 155.50, 143.86, 140.44, 134.64, 131.76, 129.69, 128.44, 119.99, 119.36, 39.11, 35.62, 24.97, 21.60; HRMS (ESI) m/z calcd for C$_{17}$H$_{16}$BrClN$_2$NaO$_2^+$ [(M+Na)$^+$]: 416.9976; found: 416.9994.

1-(3-bromophenyl)-3-(4-(4-bromophenyl)-4-oxobutyl)urea (2p)

The product was prepared according to the Gp 4.
White solid; 47% yield, 10.8 mg; m.p. 193-195 °C;  
$^1$H NMR (400 MHz, DMSO-d6) δ 8.66 (s, 1H), 7.98-7.96 (d, $J = 8$ Hz, 2H), 7.79 (m, 4H), 7.60-7.58 (d, $J = 8$ Hz, 2H), 7.21-7.14 (m, 2H), 7.06-7.04 (m, 1H), 6.33-6.31 (t, $J = 6$ Hz, 1H), 3.17-3.12 (q, $J = 8$ Hz, 2H), 3.08-3.04 (t, $J = 8$ Hz, 2H), 1.81-1.74 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 199.11, 155.43, 142.71, 138.43, 135.77, 130.97, 130.25, 129.25, 123.85, 122.10, 120.25, 116.80, 39.00, 35.72, 24.74; HRMS (ESI) m/z calcd for C$_{17}$H$_{16}$BrClN$_2$NaO$_2^+$ [(M+Na)$^+$]: 460.9471; found: 460.9507.

1-(4-bromophenyl)-3-(4-oxo-4-(p-tolyl)butyl)urea (2q)

The product was prepared according to the Gp 4.
White solid; 48% yield, 9.0 mg; m.p. 169-171 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.67 (s, 1H), 7.81-7.75 (m, 3H), 7.45-7.38 (m, 2H), 7.22-7.20 (m, 1H), 7.18-7.14 (t, $J = 8$ Hz, 1H), 7.06-7.04 (d, $J = 8$ Hz, 1H), 6.35-6.32 (t, $J = 6$ Hz, 1H), 3.17-3.12 (q, $J = 8$ Hz, 2H), 3.06-3.03 (t, $J = 6$ Hz, 2H), 2.37 (s, 3H), 1.82-1.75 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 200.19, 155.43, 142.73, 138.48, 137.16, 134.13, 130.97, 129.04, 128.75, 125.55, 123.85, 122.11, 120.24, 116.80, 39.07, 35.76, 24.87, 21.36.; HRMS (ESI) m/z calcd for C$_{18}$H$_{15}$BrN$_2$NaO$_2^+$ [(M+Na)$^+$]: 397.0522; found: 397.0427.

1-(2-bromophenyl)-3-(4-oxo-4-phenylbutyl)urea (2r)

The product was prepared according to the Gp 4.
White solid; 49% yield, 8.82 mg; m.p. 183-185 °C; $^1$H NMR (400 MHz, DMSO-d6) δ 8.05-8.03 (d, $J = 8$ Hz, 1H), 7.99-7.97 (d, $J = 8$ Hz, 2H), 7.79 (s, 1H), 7.66-7.62 (t, $J = 8$ Hz, 1H), 7.56-7.51 (m, 3H), 7.28-7.24 (t, $J = 8$ Hz, 1H), 7.17-7.14 (t, $J = 6$ Hz, 1H), 6.90-6.86 (t, $J = 8$ Hz, 1H), 3.20-3.15 (q, $J = 6$ Hz, 2H), 3.11-3.08 (t, $J = 6$ Hz, 2H), 1.84-1.77 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) δ 200.06, 155.24, 138.28, 137.10, 133.58, 132.76, 129.18, 128.39, 128.32, 123.56, 121.93, 112.60, 39.06, 35.75, 24.76; HRMS (ESI) m/z calcd for C$_{17}$H$_{15}$BrN$_2$O$_2^+$ [(M+Na)$^+$]: 383.0366; found: 383.0273.

1-(2-bromophenyl)-3-(4-(4-chlorophenyl)-4-oxobutyl)urea (2s)

5-24
The product was prepared according to the Gp 4. White solid; 38% yield, 7.5 mg; m.p. 184-186 °C; \(^1\)H NMR (400 MHz, DMSO-d6) δ 8.04-8.02 (d, J = 8 Hz, 1H), 7.99-7.97 (d, J = 8 Hz, 2H), 7.78 (s, 1H), 7.61-7.58 (d, J = 12 Hz, 2H), 7.55-7.53 (d, J = 8 Hz, 1H), 7.27-7.24 (t, J = 6 Hz, 1H), 7.16-7.13 (t, J = 6 Hz, 1H), 6.90-6.86 (t, J = 8 Hz, 1H), 3.19-3.14 (q, J = 6 Hz, 2H), 3.10-3.06 (t, J = 8 Hz, 2H), 1.83-1.76 (m, 2H); \(^13\)C NMR (100 MHz, DMSO-d6) δ 199.09, 155.23, 138.45, 138.26, 135.77, 132.76, 130.26, 129.27, 128.38, 123.56, 121.91, 112.58, 39.00, 35.78, 24.69; HRMS (ESI) m/z calcd for C\(_{17}\)H\(_{16}\)BrClN\(_2\)NaO\(_2\)\(^+\) [(M+Na\(^+\)]: 416.9976; found: 416.9984.

1-(4-chlorophenyl)-3-(4-oxo-4-phenylbutyl)urea (2t)

The product was prepared according to the Gp 4. White solid; 62% yield, 9.8 mg; m.p. 134-136 ºC; \(^1\)H NMR (400 MHz, DMSO-d6) δ 8.58 (s, 1H), 7.98-7.96 (s, 2H), 7.65-7.62 (t, J = 6 Hz, 1H), 7.55-7.51 (t, J = 8 Hz, 1H), 7.42-7.40 (d, J = 8 Hz, 2H), 7.26-7.23 (d, J = 12 Hz, 2H), 6.29-6.26 (t, J = 6 Hz, 1H), 3.18-3.13 (q, J = 8 Hz, 2H), 3.09-3.05 (t, J = 8 Hz, 2H), 1.82-1.75 (m, 2H); \(^13\)C NMR (100 MHz, DMSO-d6) δ 200.12, 155.55, 140.03, 137.11, 133.56, 129.17, 128.88, 128.31, 124.81, 119.55, 39.08, 35.74, 24.88; HRMS (ESI) m/z calcd for C\(_{17}\)H\(_{17}\)ClN\(_2\)NaO\(_2\)\(^+\) [(M+Na\(^+\)]: 339.0871; found: 339.0846.

1-(4-bromophenyl)-3-(4-oxo-4-phenylbutyl)urea (2u)

The product was prepared according to the Gp 4. White solid; 30% yield, 9.0 mg; m.p. 115-117 ºC; \(^1\)H NMR (400 MHz, CDCl\(_3\)) δ 7.96-7.94 (d, J = 8 Hz, 2H), 7.59-7.56 (t, J = 6 Hz, 1H), 7.48-7.44 (t, J = 8 Hz, 2H), 7.31-7.27 (m, 2H), 7.00-6.96 (t, J = 8 Hz, 2H), 6.90-6.77 (brs, 1H), 5.09-5.07 (t, J = 8 Hz, 1H), 3.33-3.28 (q, J = 8 Hz, 2H), 3.08-3.05 (t, J = 8 Hz, 2H), 2.02-1.95 (m, 2H); \(^13\)C NMR (100 MHz, CDCl\(_3\)) δ 200.53, 160.47, 158.06, 156.08, 136.58, 134.62, 133.40, 128.69, 128.09, 124.87, 122.93, 115.88, 115.66, 40.07, 35.68, 24.31; \(^19\)F NMR (376 MHz, CDCl\(_3\)) δ -123.50; HRMS (ESI) m/z calcd for C\(_{17}\)H\(_{17}\)F\(_2\)NaO\(_2\)\(^+\) [(M+Na\(^+\)]: 323.1166; found: 323.1178.

1-(3,5-bis(trifluoromethyl)phenyl)-3-(4-oxo-4-phenylbutyl)urea (2v)

The product was prepared according to the Gp 4. White solid; 40% yield, 13.7 mg; m.p. 124-126 ºC; \(^1\)H NMR (400 MHz, CDCl\(_3\)) δ 7.96-7.88 (m, 4H), 7.59-7.56 (t, J = 6 Hz, 1H), 7.50-7.41 (m, 4H), 5.80-5.77 (t, J = 8 Hz, 1H), 3.36-3.31 (q, J = 8 Hz, 2H), 3.13-3.09 (t, J = 8 Hz, 2H), 2.07-2.00 (m, 2H); \(^13\)C NMR (100 MHz, CDCl\(_3\)) δ 201.59, 155.48, 140.98, 136.29, 133.79, 132.49-131.51 (q, J = 33 Hz), 128.80, 128.10, 126.23-120.19 (q, J = 271 Hz), 118.44, 115.43, 39.92, 35.47, 24.32; \(^19\)F NMR (376 MHz, CDCl\(_3\)) δ -63.09; HRMS (ESI) m/z calcd for C\(_{19}\)H\(_{18}\)F\(_6\)N\(_2\)NaO\(_2\)\(^+\) [(M+Na\(^+\)]: 441.1008; found: 441.1054.

1-(4-bromophenyl)-3-(4-(4-methoxyphenyl)-4-oxobutyl)-1-methylurea (2cc)
The product was prepared according to the **Gp 4**. White solid; 39% yield, 8.3 mg; m.p. 170-172 °C; **1H NMR** (400 MHz, CDCl₃) δ 7.91-7.89 (d, J = 8 Hz, 2H), 7.53-7.50 (d, J = 12 Hz, 2H), 7.10-7.08 (d, J = 8 Hz, 2H), 6.95-6.92 (d, J = 12 Hz, 2H), 4.56-4.53 (t, J = 6 Hz, 1H), 3.88 (s, 3H), 3.29-3.24 (q, J = 8 Hz, 2H), 3.95-2.92 (t, J = 8 Hz, 2H), 1.91-1.84 (m, 2H); **13C NMR** (100 MHz, CDCl₃) δ 198.50, 163.49, 157.03, 142.43, 133.11, 130.34, 129.72, 129.00, 120.74, 113.70, 55.49, 40.72, 37.11, 35.58, 24.25; HRMS (ESI) m/z calcd for C₁₉H₂₁BrN₂NaO₃⁺ [(M+Na)⁺]: 427.0628; found: 427.0554.

**4-bromo-N-(4-(4-methoxyphenyl)-4-oxobutyl)benzamide (2bb)**

The product was prepared according to the **Gp 4**. White solid; 40% yield, 7.1 mg; m.p. 162-164 °C; **1H NMR** (400 MHz, CDCl₃) δ 7.96-7.93 (d, J = 12 Hz, 2H), 7.67-7.65 (d, J = 12 Hz, 2H), 7.56-7.54 (d, J = 8 Hz, 2H), 6.94-6.92 (m, 3H), 3.87 (s, 3H), 3.55-3.51 (q, J = 8 Hz, 2H), 3.13-3.09 (t, J = 8 Hz, 2H), 2.13-2.06 (m, 2H); **13C NMR** (100 MHz, CDCl₃) δ 199.34, 166.44, 163.71, 133.29, 131.68, 130.40, 129.57, 128.54, 125.93, 113.79, 55.51, 40.37, 36.24, 23.14; HRMS (ESI) m/z calcd for C₁₅H₁₉BrNO₃⁺ [(M+H)⁺]: 376.0543; found: 376.0556.

**Propiophenone (4a)**

The product was prepared according to the **Gp 5**. Colorless oil; 42% yield, 3.3 mg; **1H NMR** (400 MHz, CDCl₃) δ 7.98-7.96 (d, J = 8 Hz, 2H), 7.58-7.54 (t, J = 8 Hz, 1H), 7.48-7.44 (t, J = 8 Hz, 2H), 3.04-2.99 (m, 2H), 1.25-1.21 (t, J = 8 Hz, 3H); **13C NMR** (100 MHz, CDCl₃) δ 200.88, 136.89, 132.91, 128.57, 127.99, 31.81, 8.26.

**1,2-diphenylethan-1-one (4b)**

The product was prepared according to the **Gp 5**. White solid; 86% yield, 8.4 mg; **1H NMR** (400 MHz, CDCl₃) δ 8.03-8.01 (d, J = 8 Hz, 2H), 7.57-7.53 (t, J = 8 Hz, 1H), 7.46-7.44 (m, 2H), 7.35-7.31 (t, J = 8 Hz, 2H), 7.28-7.25 (m, 3H), 4.29 (s, 2H); **13C NMR** (100 MHz, CDCl₃) δ 197.72, 136.58, 134.53, 133.21, 129.49, 128.67, 128.65, 128.51, 126.92, 45.53.

**benzophenone (4c)**

The product was prepared according to the **Gp 5**. White solid; 88% yield, 8 mg; **1H NMR** (400 MHz, CDCl₃) δ 7.82-7.80 (d, J = 8 Hz, 4H), 7.61-7.57 (d, J = 8 Hz, 2H), 7.50-7.46 (t, J = 8 Hz, 1H); **13C NMR** (100 MHz, CDCl₃) δ 196.82, 137.58, 132.46, 130.10, 128.31.

**phenyl(p-tolyl)methanone (4d)**

The product was prepared according to the **Gp 5**. White solid; 86% yield, 8.4 mg; **1H NMR** (400 MHz, CDCl₃) δ 7.79-7.77 (d, J = 8 Hz, 2H), 7.73-7.71 (d, J = 8 Hz, 2H), 7.59-7.56 (t, J = 6 Hz, 1H), 7.49-7.45 (t, J = 6 Hz, 2H), 7.29-7.27 (d, J = 8 Hz, 2H), 2.44 (s, 3H); **13C NMR** (100 MHz, CDCl₃) δ 196.57, 143.29, 137.93, 134.85, 132.21, 130.35, 129.97, 129.00, 128.24, 21.71.
(4-methoxyphenyl)(phenyl)methanone (4e)

The product was prepared according to the Gp 5. White solid; 91% yield, 9.6 mg; ¹H NMR (400 MHz, CDCl₃) δ 7.84-7.82 (d, J = 8 Hz, 2H), 7.77-7.75 (d, J = 8 Hz, 2H), 7.58-7.55 (t, J = 6 Hz, 1H), 7.49-7.45 (t, J = 6 Hz, 2H), 6.97-6.95 (d, J = 8 Hz, 2H), 3.88 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 195.62, 163.22, 138.26, 132.60, 131.94, 130.12, 130.13, 128.38, 115.58, 115.37; ¹⁹F NMR (376 MHz, CDCl₃) δ -107.08.

(4-fluorophenyl)(phenyl)methanone (4f)

The product was prepared according to the Gp 5. White solid; 87% yield, 8.7 mg; ¹H NMR (400 MHz, CDCl₃) δ 7.87-7.83 (m, 2H), 7.78-7.76 (d, J = 8 Hz, 2H), 7.62-7.58 (t, J = 8 Hz, 1H), 7.51-7.47 (t, J = 6 Hz, 2H), 7.18-7.14 (d, J = 8 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃) δ 195.30, 166.65, 164.13, 137.49, 133.81, 132.64, 130.16, 129.90, 128.38, 115.58, 115.37; ¹⁹F NMR (376 MHz, CDCl₃) δ -107.08.

(4-chlorophenyl)(phenyl)methanone (4g)

The product was prepared according to the Gp 5. White solid; 98% yield, 10.6 mg; ¹H NMR (400 MHz, CDCl₃) δ 7.78-7.76 (d, J = 8 Hz, 2H), 7.69-7.67 (d, J = 8 Hz, 2H), 7.64-7.58 (m, 3H), 7.51-7.47 (t, J = 8 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃) δ 195.66, 137.16, 136.30, 132.71, 131.63, 131.59, 129.96, 128.43, 127.54.

(4-bromophenyl)(phenyl)methanone (4h)

The product was prepared according to the Gp 5. White solid; 81% yield, 10.5 mg; ¹H NMR (400 MHz, CDCl₃) δ 7.78-7.75 (m, 4H), 7.62-7.58 (t, J = 8 Hz, 1H), 7.51-7.45 (m, 4H); ¹³C NMR (100 MHz, CDCl₃) δ 195.52, 138.91, 137.23, 135.86, 132.67, 131.48, 129.95, 128.65, 128.42.

phenyl(4-(trifluoromethyl)phenyl)methanone (4i)

The product was prepared according to the Gp 5. White solid; 84% yield, 10.5 mg; ¹H NMR (400 MHz, CDCl₃) δ 7.91-7.89 (d, J = 8 Hz, 2H), 7.82-7.80 (d, J = 8 Hz, 2H), 7.77-7.75 (t, J = 4 Hz, 1H), 7.65-7.62 (d, J = 6 Hz, 2H), 7.53-7.49 (t, J = 8 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃) δ 195.58, 140.71, 136.72, 133.88, 133.56, 133.12, 130.16, 130.13, 128.55, 125.38, 125.03, 122.32; ¹⁹F NMR (376 MHz, CDCl₃) δ -63.16.

phenyl(m-tolyl)methanone (4j)

The product was prepared according to the Gp 5. White solid; 82% yield, 8.0 mg; ¹H NMR (400 MHz, CDCl₃) δ 7.81-7.79 (d, J = 8 Hz, 2H), 7.63-7.57 (m, 3H), 7.50-7.47 (t, J = 6 Hz, 2H), 7.42-7.37 (m, 2H), 2.43 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 197.02, 138.18, 137.75, 137.62, 133.22, 132.36, 130.48, 130.07, 128.26, 128.10, 127.39, 21.40.

(3-bromophenyl)(phenyl)methanone (4k)
The product was prepared according to the Gp 5. White solid; 72% yield, 9.4 mg; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.95-7.91 (m, 1H), 7.80-7.78 (d, $J = 8$ Hz, 2H), 7.73-7.71 (d, $J = 8$ Hz, 2H), 7.64-7.60 (t, $J = 8$ Hz, 1H), 7.52-7.48 (t, $J = 8$ Hz, 2H), 7.39-7.35 (t, $J = 8$ Hz, 1H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 195.19, 139.46, 136.90, 135.30, 132.88, 132.81, 130.05, 129.90, 128.58, 128.49, 122.59.

**phenyl(o-tolyl)methanone (4i)**

The product was prepared according to the Gp 5. White solid; 76% yield, 7.4 mg; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.81-7.80 (d, $J = 4$ Hz, 2H), 7.60-7.57 (t, $J = 6$ Hz, 1H), 7.48-7.44 (d, $J = 8$ Hz, 2H), 7.41-7.37 (t, $J = 8$ Hz, 1H), 7.32-7.25 (m, 3H), 2.33 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 198.68, 138.60, 137.72, 136.77, 133.16, 131.01, 130.26, 130.15, 128.54, 128.47, 125.21, 20.02.

**naphthalen-1-yl(phenyl)methanone (4m)**

The product was prepared according to the Gp 5. White solid; 32% yield, 3.7 mg; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.11-8.09 (d, $J = 8$ Hz, 1H), 8.02-8.00 (d, $J = 8$ Hz, 1H), 7.94-7.92 (d, $J = 8$ Hz, 1H), 7.88-7.86 (d, $J = 8$ Hz, 2H), 7.62-7.45 (m, 7H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 198.07, 138.30, 136.33, 133.26, 131.29, 130.95, 130.44, 128.46, 128.42, 127.81, 127.28, 126.48, 125.69, 125.03, 124.35.

**naphthalen-2-yl(phenyl)methanone (4n)**

The product was prepared according to the Gp 5. White solid; 76% yield, 8.8 mg; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 8.27 (s, 1H), 7.95-7.91 (m, 4H), 7.88-7.85 (d, $J = 6$ Hz, 2H), 7.64-7.60 (m, 2H), 7.57-7.50 (m, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 196.82, 137.89, 135.28, 134.81, 132.64, 132.42, 132.25, 131.92, 130.13, 129.44, 128.37, 128.33, 127.85, 126.83, 125.81.

**bis(4-methoxyphenyl)methanone (4o)**

The product was prepared according to the Gp 5. White solid; 69% yield, 8.3 mg; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.80-7.78 (d, $J = 4$ Hz, 4H), 6.98-6.95 (d, $J = 12$ Hz, 4H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 194.50, 162.82, 132.55, 115.68, 181.46; $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -105.74.

**bis(4-fluorophenyl)methanone (4p)**

The product was prepared according to the Gp 5. White solid; 92% yield, 10 mg; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.83-7.80 (m, 4H), 7.19-7.15 (m, 4H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 193.82, 166.66, 164.13, 133.71, 132.55, 132.46, 115.68, 1 815.46; $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -105.74.

**(4-chlorophenyl)(4-methoxyphenyl)methanone (4q)**

The product was prepared according to the Gp 5. White solid; 79% yield, 9.7 mg; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.81-7.79 (d, $J = 8$ Hz, 2H), 7.72-7.70 (d, $J = 8$ Hz, 2H), 7.46-7.44 (d, $J = 8$ Hz, 2H), 6.96-6.95 (d, $J = 8$ Hz, 2H), 5.28.
3.89 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 194.30, 163.39, 138.28, 136.55, 132.47, 131.17, 129.79, 128.53, 113.69, 55.55.

**N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)benzamide (6a)**

The product was prepared according to the Gp 6. White solid; 80% yield, 14.3 mg; m.p. 177-179 °C; $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 11.54 (s, 1H), 9.97 (s, 1H), 8.07-8.02 (m, 4H), 7.68-7.65 (m, 2H), 7.55-7.51 (m, 2H); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 169.12, 152.21, 138.75, 133.97, 132.98-131.98 (q, $J = 33$ Hz), 131.43, 129.03, 127.90, 127.12, 124.41, 121.70, 120.01, 117.71; $^{19}$F NMR (376 MHz, CDCl$_3$) $\delta$ -62.91; HRMS (ESI) $m/z$ calcd for C$_{16}$H$_9$F$_6$N$_2$O$_3$+ [(M+Na)$^+$]: 399.0539; found: 399.0579.

**N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-4-fluorobenzamide (6b)**

The product was prepared according to the Gp 6. White solid; 72% yield, 13 mg; m.p. 210-212 °C; $^1$H NMR (400 MHz, Acetone-d6) $\delta$ 11.36 (s, 1H), 10.22 (s, 1H), 8.38 (s, 2H), 8.24-8.20 (m, 2H), 7.76 (s, 1H), 7.33; $^1$H NMR (400 MHz, Acetone-d6) $\delta$ 167.85, 167.01, 164.50, 151.25, 140.11, 132.23, 131.90, 131.57, 131.24, 131.21, 131.11, 128.66, 124.80, 122.10, 120.03, 116.62, 115.86, 115.64; $^{19}$F NMR (376 MHz, Acetone-d6) $\delta$ -63.93, -107.08; HRMS (ESI) $m/z$ calcd for C$_{16}$H$_9$F$_6$N$_2$O$_3$+ [(M+Na)$^+$]: 417.0444; found: 417.0422.

**N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-4-bromo-N-methylbenzamide (6c)**

The product was prepared according to the Gp 6. White solid; 75% yield, 15.4 mg; m.p. 198-200 °C; $^1$H NMR (400 MHz, Acetone-d6) $\delta$ 11.32 (s, 1H), 10.28 (s, 1H), 8.38 (s, 2H), 8.15-8.13 (d, $J = 8$ Hz, 2H), 7.76 (s, 1H), 7.63-7.61 (d, $J = 8$ Hz, 2H); $^{13}$C NMR (100 MHz, Acetone-d6) $\delta$ 167.97, 151.16, 140.08, 139.08, 132.23-131.24 (q, $J = 33$ Hz), 130.97, 130.02, 128.93, 127.50-119.39 (q, $J = 271$ Hz), 120.05, 116.62; $^{19}$F NMR (376 MHz, Acetone-d6) $\delta$ -63.52; HRMS (ESI) $m/z$ calcd for C$_{16}$H$_9$ClF$_6$N$_2$O$_3$+ [(M+Na)$^+$]: 433.0149; found: 433.0130.

**N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-4-bromobenzamide (6d)**

The product was prepared according to the Gp 6. White solid; 67% yield, 12.9 mg; m.p. 215-217 °C; $^1$H NMR (400 MHz, Acetone-d6) $\delta$ 11.31 (s, 1H), 10.27 (s, 2H), 8.39 (s, 2H), 8.07-8.05 (d, $J = 8$ Hz, 2H), 7.80-7.77 (m, 3H); $^{13}$C NMR (100 MHz, Acetone-d6) $\delta$ 168.13, 151.12, 140.09, 132.23-131.24 (q, $J = 33$ Hz), 131.96, 131.42, 130.11, 127.70, 127.50-119.39 (q, $J = 271$ Hz), 120.01, 116.62; $^{19}$F NMR (376 MHz, Acetone-d6) $\delta$ -63.52; HRMS (ESI) $m/z$ calcd for C$_{16}$H$_9$BrF$_6$N$_2$O$_3$+ [(M+Na)$^+$]: 476.9644; found: 476.9622.

**N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-4-methylbenzamide (6e)**
The product was prepared according to the Gp 6. White solid; 71% yield, 9.9 mg; m.p. 187-189 °C; 1H NMR (400 MHz, DMSO-d6) δ 11.23 (s, 1H), 11.17 (s, 1H), 8.36 (s, 2H), 7.97-7.95 (d, J = 8 Hz, 2H), 7.80 (s, 1H), 7.38-7.36 (d, J = 8 Hz, 2H), 2.40 (s, 3H); 13C NMR (100 MHz, DMSO-d6) δ 168.78, 152.09, 144.16, 140.34, 131.71-130.73 (q, J = 33 Hz), 130.09, 129.65, 129.12, 128.90, 127.73-119.60 (q, J = 271 Hz), 125.02, 122.31, 120.61, 116.95, 21.57; 19F NMR (376 MHz, DMSO-d6) δ -61.54; HRMS (ESI) m/z calc’d for C17H12F6N2NaO2+ [(M+Na)⁺]: 413.0695; found: 413.0641.

N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-4-methoxybenzamide (6f)

The product was prepared according to the Gp 6. White solid; 61% yield, 12.4 mg; m.p. 186-188 °C; 1H NMR (400 MHz, DMSO-d6) δ 11.50 (s, 1H), 10.02 (s, 1H), 8.38 (s, 2H), 8.15-8.13 (d, J = 8 Hz, 2H), 7.75 (s, 1H), 7.11-7.09 (d, J = 8 Hz, 2H), 3.92 (s, 3H); 13C NMR (100 MHz, DMSO-d6) δ 168.13, 163.99, 151.48, 140.28, 132.21-131.22 (q, J = 33 Hz), 130.38, 129.09, 127.53-119.42 (q, J = 271 Hz), 124.82, 124.01, 122.12, 119.88, 116.43, 114.01, 55.16; 19F NMR (376 MHz, DMSO-d6) δ -63.52; HRMS (ESI) m/z calc’d for C17H12F6N2NaO3+ [(M+Na)⁺]: 429.0644; found: 429.0629.

N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-4-(trifluoromethyl)benzamide (6g)

The product was prepared according to the Gp 6. White solid; 78% yield, 17.3 mg; m.p. 208-210 °C; 1H NMR (400 MHz, Acetone-d6) δ 11.14 (s, 1H), 10.30 (s, 1H), 8.27 (s, 2H), 8.20-8.18 (d, J = 8 Hz, 2H), 7.82-7.80 (d, J = 8 Hz, 2H), 7.65 (s, 1H); 13C NMR (100 MHz, Acetone-d6) δ 167.97, 151.02, 140.02, 136.09, 133.95, 133.63, 132.23-131.24 (q, J = 33 Hz), 129.10, 127.49-119.39 (q, J = 271 Hz), 125.68, 125.20, 122.50, 120.08, 116.80; 19F NMR (376 MHz, Acetone-d6) δ -63.51, 63.66; HRMS (ESI) m/z calc’d for C17H9F7N2NaO2+ [(M+Na)⁺]: 467.0413; found: 467.0496.

N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-3-fluorobenzamide (6h)

The product was prepared according to the Gp 6. White solid; 73% yield, 14.4 mg; m.p. 170-172 °C; 1H NMR (400 MHz, Acetone-d6) δ 11.29 (s, 1H), 10.27 (s, 1H), 8.38 (s, 2H), 7.99-7.97 (d, J = 8 Hz, 2H), 7.88-7.85 (d, J = 8 Hz, 2H), 7.77 (s, 1H), 7.67-7.62 (m, 1H), 7.50-7.46 (t, J = 8 Hz, 1H); 13C NMR (100 MHz, Acetone-d6) δ 167.65, 163.79, 161.34, 151.07, 140.05, 134.57, 132.24-131.25 (q, J = 33 Hz), 130.86, 127.50-119.39 (q, J = 271 Hz), 124.24, 120.29, 120.07, 116.69, 115.15, 114.91; 19F NMR (376 MHz, Acetone-d6) δ -63.92, -112.27; HRMS (ESI) m/z calc’d for C16H7F7N2NaO2+ [(M+Na)⁺]: 417.0444; found: 417.0403.

N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-3-chlorobenzamide (6i)

s-30
The product was prepared according to the Gp 6. White solid; 74% yield, 15.2 mg; m.p. 160-162 °C; 1H NMR (400 MHz, Acetone-d6) δ 11.27 (s, 1H), 10.30 (s, 1H), 8.38 (s, 2H) , 8.12-8.11 (t, J = 2 Hz, 2H), 8.08-8.06 (m, 1H), 7.77 (s, 1H), 7.74-7.71 (m, 1H), 7.64-7.60 (t, J = 8 Hz, 1H); 13C NMR (100 MHz, Acetone-d6) δ 167.68, 151.04, 140.04, 134.28, 134.25, 133.11, 132.24-131.25 (q, J = 33 Hz), 130.53, 128.11, 127.50-119.39 (q, J = 270 Hz), 126.72, 124.79, 122.09, 120.04, 116.70; 19F NMR (376 MHz, Acetone-d6) δ -63.52; HRMS (ESI) m/z calcd for C_{16}H_{10}ClF_{6}N_{2}NaO_{2}^+ [(M+Na)^+]: 433.0149; found: 433.0111.

N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-4-bromo-N-methylbenzamide (6j)

The product was prepared according to the Gp 6. White solid; 84% yield, 19.1 mg; m.p. 168-170 °C; 1H NMR (400 MHz, Acetone-d6) δ 11.27 (s, 1H), 10.31 (s, 1H), 8.38 (s, 2H) , 8.26-8.25 (t, J = 2 Hz, 2H), 8.12-8.10 (d, J = 8 Hz, 1H), 7.88-7.86 (d, J = 8 Hz, 1H), 7.76 (s, 1H), 7.57-7.53 (t, J = 8 Hz, 1H); 13C NMR (100 MHz, Acetone-d6) δ 167.59, 151.03, 140.04, 136.07, 134.43, 132.24-131.24 (q, J = 33 Hz), 131.02, 130.74, 127.50-119.39 (q, J = 270 Hz), 127.14, 122.18, 120.06, 116.66; 19F NMR (376 MHz, Acetone-d6) δ -63.52; HRMS (ESI) m/z calcd for C_{16}H_{10}BrF_{6}N_{2}NaO_{2}^+ [(M+Na)^+]: 476.9644; found: 476.9580.

N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-3-methoxybenzamide (6k)

The product was prepared according to the Gp 6. White solid; 80% yield, 16.2 mg; m.p. 152-154 °C; 1H NMR (400 MHz, CDCl3) δ 11.46 (s, 1H), 9.78-9.72 (m, 1H), 8.06 (s, 2H), 7.64 (s, 1H), 7.58-7.56 (d, J = 2 Hz, 1H) , 7.50 (s, 1H), 7.44-7.40 (t, J = 8 Hz, 1H), 7.19-7.17 (d, J = 2 Hz, 1H) , 3.84 (s, 3H); 13C NMR (100 MHz, CDCl3) δ 168.83, 160.10, 151.98, 138.72, 132.76, 132.97-131.97 (q, J = 33 Hz), 130.08, 127.12-118.98 (q, J = 270 Hz), 120.00, 119.57, 117.69, 113.19; 19F NMR (376 MHz, CDCl3) δ -62.95; HRMS (ESI) m/z calcd for C_{17}H_{12}F_{6}N_{2}NaO_{2}^+ [(M+Na)^+]: 429.0644; found: 429.0598.

N-((3,5-bis(trifluoromethyl)phenyl)carbamoyl)-2-methoxybenzamide (6l)

The product was prepared according to the Gp 6. White solid; 55% yield, 7.1 mg; m.p. 154-156 °C; 1H NMR (400 MHz, CDCl3) δ 11.36 (s, 1H), 10.14 (s, 1H) , 8.23-8.20 (d, J = 12 Hz, 1H), 8.10 (s, 2H), 7.64-7.59 (m, 2H), 7.19-7.15 (t, J = 8 Hz, 1H), 7.09-7.07 (d, J = 2 Hz, 1H) , 4.09 (s, 3H); 13C NMR (100 MHz, CDCl3) δ 166.51, 158.04, 151.05, 139.13, 135.57, 132.85-131.85 (q, J = 33 Hz), 132.70, 127.21-119.07 (q, J = 271 Hz), 121.92, 119.81, 118.74, 117.29, 111.89; 19F NMR (376 MHz, CDCl3) δ -63.01; HRMS (ESI) m/z calcd for C_{17}H_{12}F_{6}N_{2}NaO_{2}^+ [(M+Na)^+]: 429.0644; found: 429.0599.

2,6-difluoro-N-((4-((trifluoromethyl)phenyl)carbamoyl)benzamide (6m)
The product was prepared according to the Gp 6. White solid; 75% yield, 11.2 mg; $^1$H NMR (400 MHz, DMSO-d6) $\delta$ 11.54 (s, 1H), 10.42 (s, 1H), 7.82-7.80 (d, $J = 12$ Hz, 2H), 7.73-7.71 (d, $J = 12$ Hz, 2H), 7.68-7.61 (m, 1H), 7.29-7.25 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) $\delta$ 162.57, 160.33, 157.91, 150.45, 141.56, 133.75, 130.08, 128.78, 126.59, 124.92, 124.60, 124.29, 123.97, 120.69, 120.48, 112.73; $^{19}$F NMR (376 MHz, DMSO-d6) $\delta$ -59.07, -114.19.

N-((4-chlorophenyl)carbamoyl)-2,6-difluorobenzamide (6n)

The product was prepared according to the Gp 6. White solid; 64% yield, 5.6 mg; $^1$H NMR (400 MHz, DMSO-d6) $\delta$ 11.46 (s, 1H), 10.23 (s, 1H), 7.73-7.71 (d, $J = 8$ Hz, 2H), 7.28-7.24 (m, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) $\delta$ 162.52, 160.32, 157.90, 150.41, 136.80, 133.69, 129.24, 128.17, 122.22, 112.48; $^{19}$F NMR (376 MHz, DMSO-d6) $\delta$ -115.10.

2-chloro-N-((4-(trifluoromethoxy)phenyl)carbamoyl)benzamide (6o)

The product was prepared according to the Gp 6. White solid; 56% yield, 10 mg; $^1$H NMR (400 MHz, DMSO-d6) $\delta$ 11.31 (s, 1H), 10.52 (s, 1H), 7.73-7.71 (d, $J = 8$ Hz, 2H), 7.64-7.62 (d, $J = 8$ Hz, 1H), 7.59-7.55 (m, 2H), 7.49-7.45 (t, $J = 8$ Hz, 1H), 7.38-7.36 (d, $J = 8$ Hz, 2H); $^{13}$C NMR (100 MHz, DMSO-d6) $\delta$ 169.00, 150.96, 144.47, 137.18, 135.02, 132.50, 130.23, 130.18, 129.56, 127.69, 122.27, 121.90; $^{19}$F NMR (376 MHz, DMSO-d6) $\delta$ -57.13.

2-chloro-N-((2-chlorophenyl)carbamoyl)benzamide (6p)

The product was prepared according to the Gp 6. White solid; 62% yield, 6.8 mg; $^1$H NMR (400 MHz, DMSO-d6) $\delta$ 11.27 (s, 1H), 10.47 (s, 1H), 7.59-7.52 (m, 2H), 7.48-7.40 (m, 3H); $^{13}$C NMR (100 MHz, DMSO-d6) $\delta$ 173.74, 155.62, 141.69, 139.80, 137.23, 134.98, 134.93, 134.30, 134.05, 133.73, 132.75, 132.43, 127.64, 126.75.
Table S1. Optimization of the reaction conditions.*

<table>
<thead>
<tr>
<th>Entry</th>
<th>photocatalyst</th>
<th>solvent</th>
<th>yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,4,6-triphenylpyridine tetrafluoroborate</td>
<td>acetone</td>
<td>19%</td>
</tr>
<tr>
<td>2</td>
<td>2,4,6-triphenylpyridine tetrafluoroborate</td>
<td>CHCl₃</td>
<td>42%</td>
</tr>
<tr>
<td>3</td>
<td>3-Me-4-ACrCl₂</td>
<td>CHCl₃</td>
<td>80%</td>
</tr>
<tr>
<td>4</td>
<td>[Ru(phen)₂Cl₂]Br₂</td>
<td>CHCl₃</td>
<td>NR</td>
</tr>
<tr>
<td>5</td>
<td>[Ir(ppy)₂(acac)]PF₆</td>
<td>CHCl₃</td>
<td>NR</td>
</tr>
</tbody>
</table>

*The reactions were carried out with 5a (0.05 mmol) in the presence of a catalyst (5 mol%) in solvent (1 mL). Yield of 6a are isolated yields. NR: no reaction

Scheme S1. Reduction and Hydrolysis Experiments of 2a

The procedure of the reduction reaction:

To a solution of 2a (0.2 mmol) in methanol (10 mL), iodine was added into the mixture (0.05 equiv.). After that, the mixture was cooled to 0 °C, and then the sodium borohydride was slowly added into the solution. The mixture was stirred at room temperature until the completion of the reaction determined by TLC analysis. The crude product was purified by flash chromatography on silica gel affording to the compound. 1-(4-bromophenyl)-3-(4-hydroxy-4-phenylbutyl)urea

White solid; 87% yield, 364 mg; m.p. 156-158 °C; ¹H NMR (400 MHz, CDCl₃) δ 8.55 (s, 1H), 7.38-7.36 (m, 4H), 7.32-7.31 (m, 4H), 7.23-7.19 (m, 1H), 6.19-6.16 (t, J = 6 Hz, 1H), 5.20-5.19 (d, J = 4 Hz, 1H), 4.56-4.52 (m, 1H), 3.10-3.05 (q, J = 8 Hz, 1H),
1.63-1.47 (s, 3H), 1.41-1.34 (m, 1H); $^{13}$C NMR (100 MHz, CDCl$_3$) δ 155.42, 146.84, 140.48, 131.77, 128.39, 127.05, 126.21, 119.89, 112.57, 72.48, 39.46, 37.20, 26.80; HRMS (ESI) m/z calcd for C$_{17}$H$_{20}$BrN$_2$O$_2$ [(M+H)$^+$]: 363.0703; found: 363.0679.

The procedure of the hydrolysis reaction:

2a (0.1mol) were weighed into an 50 mL flask, and then 50% aqueous sulfuric acid (10 mL) was added into the flask. The solution was heated to 140 °C stirring for 2 h. After the completion of the reaction, the mixture was cooled to room temperature and neutralized with saturated sodium bicarbonate solution. Then the solution was extracted with ethyl acetate (20 mL, two times) and purified by flash chromatography.

4-amino-1-phenylbutan-1-one

Yellow oil; 80% yield, 13.1 mg; $^1$H NMR (400 MHz, DMSO-d$_6$) δ 7.84-7.82 (d, J = 8 Hz, 2H), 7.46-7.42 (m, 3H), 3.96-3.92 (t, J = 8 Hz, 2H), 1.98-1.90 (m, 2H), 1.31-1.19 (brs, 2H); $^{13}$C NMR (100 MHz, DMSO-d$_6$) δ 172.70, 134.86, 130.68, 128.88, 127.91, 61.36, 34.97, 22.75, 23.14; HRMS (ESI) m/z calcd for C$_{10}$H$_{14}$NO [(M+H)$^+$]: 164.1070; found: 164.1077.

Figure S1. Determination of the reaction intermediate.

N-(4-bromophenyl)-2-phenylpyrrolidine-1-carboxamide (2a, 17.3 mg, 0.05 mmol) and acetone (2.0 mL) were added to an oven-dried reaction tube with magnetic stirring bar, then the 2,2,6,6-tetramethylpiperidinooxy (TEMPO, 2equiv., 0.1mmol, 15.6mg) and 2,4,6-Triphenylpyrylium fluoroborate (1 equiv., 20 mg) was added. The tube was exposed to blue LED (420–425 nm, 10 W) irradiation at room tem with stirring for 1h under the air, after that the reaction mixture was diluted with methanol and determined by high resolution mass spectrometer.
Figure S2. Fluorescence quenching experiments.

Fluorescence quenching studies were conducted using FLS-920 Edinburgh Fluorescence Spectrometer. The photocatalyst 2,4,6-Triphenylpyrylium tetrafluoroborate (5.0 µM in acetone) and increasing concentrations of quencher 1a (N-(4-bromophenyl)-2-phenylpyrrolidine-1-carboxamide) (50, 100, 150, 200, 250, 450 µM in acetone) were added into a screwtop 1.0 cm quartz cuvette. Each sample was irradiated at 360 nm and the emission spectrum was recorded. Plots of intensity of emission (462 nm) vs concentration of quencher are shown according to the Stern-Volmer equation.6

Figure S3. Control experiments for 1^O_2 sensitization.

The reaction was carried out with 1a (0.05 mmol), TPP (5 mol%) in the dichloromethane (2 mL) at 35 ºC under 10 W blue LED irradiation.

TPP/DCM system, which is a well-known singlet oxygen generation system, was also tested in the model reaction, but no desired product 2a was obtained after stirring for 8 h.
### Crystal data and structure refinement for 2j (CCDC 1833871)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empirical formula</td>
<td>C36H38Br2N4O4</td>
</tr>
<tr>
<td>Formula weight</td>
<td>750.52</td>
</tr>
<tr>
<td>Temperature</td>
<td>173(2) K</td>
</tr>
<tr>
<td>Wavelength</td>
<td>1.54184 Å</td>
</tr>
<tr>
<td>Crystal system, space group</td>
<td>Triclinic, ( P-1 )</td>
</tr>
<tr>
<td>Unit cell dimensions</td>
<td>( a = 9.5585(4) ) Å, ( \alpha = 84.171(4) ) deg. ( b = 11.0081(5) ) Å, ( \beta = 85.069(4) ) deg. ( c = 16.9501(8) ) Å, ( \gamma = 70.438(4) ) deg.</td>
</tr>
<tr>
<td>Volume</td>
<td>1669.30(14)</td>
</tr>
<tr>
<td>Z, Calculated density</td>
<td>2, 1.493 Mg/m(^3)</td>
</tr>
<tr>
<td>Absorption coefficient</td>
<td>3.447 mm(^{-1})</td>
</tr>
<tr>
<td>F(000)</td>
<td>768</td>
</tr>
<tr>
<td>Theta range for data collection</td>
<td>4.275 to 71.198 deg.</td>
</tr>
<tr>
<td>Limiting indices</td>
<td>(-11 \leq h \leq 6, -13 \leq k \leq 10, -20 \leq l \leq 20)</td>
</tr>
<tr>
<td>Reflections collected / unique</td>
<td>10598 / 6311 [R(int) = 0.0172]</td>
</tr>
<tr>
<td>Completeness to theta = 67.684</td>
<td>99.5%</td>
</tr>
<tr>
<td>Absorption correction</td>
<td>multi-scan</td>
</tr>
<tr>
<td>Refinement method</td>
<td>Full-matrix least-squares on ( F^2 )</td>
</tr>
<tr>
<td>Data / restraints / parameters</td>
<td>6311 / 0 / 429</td>
</tr>
<tr>
<td>Goodness-of-fit on ( F^2 )</td>
<td>1.058</td>
</tr>
<tr>
<td>Final R indices [I&gt;2sigma(I)]</td>
<td>R1 = 0.0409, wR2 = 0.1141</td>
</tr>
<tr>
<td>R indices (all data)</td>
<td>R1 = 0.0470, wR2 = 0.1200</td>
</tr>
<tr>
<td>Largest diff. peak and hole</td>
<td>0.308 and -0.808 e.A(^{-3})</td>
</tr>
</tbody>
</table>
References


$^1$H, $^{13}$C and $^{19}$F-NMR spectra

$^1$H and $^{13}$C-NMR spectra of 1a.
$^1$H and $^{13}$C-NMR spectra of 1b.
$^1$H and $^{13}$C-NMR spectra of 1c.
$^{1}$H, $^{13}$C and $^{19}$F-NMR spectra of 1d.
$^1$H, $^{13}$C and $^{19}$F- NMR spectra of 1e.
$^1$H and $^{13}$C-NMR spectra of 1f.
$^1$H and $^{13}$C-NMR spectra of 1g.
$^1$H, $^{13}$C and $^{19}$F-NMR spectra of 1h.
$^1\text{H}$ and $^{13}\text{C}$-NMR spectra of II.
$^1$H and $^{13}$C-NMR spectra of 1j.
$^1$H and $^{13}$C-NMR spectra of 1k.
\(^1\)H and \(^{13}\)C-NMR spectra of 1l.
$\text{H and }^{13}\text{C-NMR spectra of } 1\text{m}.\]
$^1$H and $^{13}$C-NMR spectra of 1n.
$^1$H and $^{13}$C-NMR spectra of 1o.
$^1$H and $^{13}$C-NMR spectra of 1p.
$^1$H and $^{13}$C-NMR spectra of 1q.
$^1$H and $^{13}$C-NMR spectra of 1r.
$^1$H and $^{13}$C-NMR spectra of 1s.
$^1$H and $^{13}$C-NMR spectra of It.
$^{1}$H and $^{13}$C-NMR spectra of 1u.
$^1$H and $^{13}$C-NMR spectra of 1v.
$^1$H and $^{13}$C-NMR spectra of 3a.
$^1$H and $^{13}$C-NMR spectra of 3b.
$^1$H and $^{13}$C-NMR spectra of 3c.
$^1$H and $^{13}$C-NMR spectra of 3d.
$^1$H and $^{13}$C-NMR spectra of 3e.
$^1$H and $^{13}$C-NMR spectra of 3f.
$^{1}$H and $^{13}$C-NMR spectra of 3g.
$^1$H and $^{13}$C-NMR spectra of 3h.
$^1$H and $^{13}$C-NMR spectra of 3i.
$^1$H and $^{13}$C-NMR spectra of 3j.
$^1$H and $^{13}$C-NMR spectra of 3k.
$^{1}H$ and $^{13}C$-NMR spectra of 3l.
$^1$H and $^{13}$C-NMR spectra of 3m.
$^1$H and $^{13}$C-NMR spectra of 3n.
$^1$H and $^{13}$C-NMR spectra of 3o.
$^1$H and $^{13}$C-NMR spectra of 3p.
$^1$H and $^{13}$C-NMR spectra of 3q.
$^1$H and $^{13}$C-NMR spectra of 5a.
$^1$H and $^{13}$C-NMR spectra of 5b.
$^1$H and $^{13}$C-NMR spectra of 5c.
$^1$H and $^{13}$C-NMR spectra of 5d.
$^1$H and $^{13}$C-NMR spectra of 5e.
$^1$H and $^{13}$C-NMR spectra of 5f.
$^1$H and $^{13}$C-NMR spectra of 5g.
$^1$H and $^{13}$C-NMR spectra of 5h.
$^1\text{H}$ and $^{13}\text{C}$-NMR spectra of 5i.
$^1$H and $^{13}$C-NMR spectra of 5j.
$^1$H and $^{13}$C-NMR spectra of 5k.
\(^1\)H and \(^1\)C-NMR spectra of 5l.
$^1$H and $^{13}$C-NMR spectra of 5m.
$^1$H and $^{13}$C-NMR spectra of 5n.
$^1$H and $^{13}$C-NMR spectra of 50.
$^1$H and $^{13}$C-NMR spectra of 5p.
$^1$H and $^{13}$C-NMR spectra of 1cc.
$^1$H and $^{13}$C-NMR spectra of 2a.
$^{1}$H and $^{13}$C-NMR spectra of 2b.
$^1$H and $^{13}$C-NMR spectra of 2c.
$^1$H and $^{13}$C-NMR spectra of 2d.
$^1$H and $^{13}$C-NMR spectra of 2e.
$^1$H and $^{13}$C-NMR spectra of 2f.
$^1$H and $^{13}$C-NMR spectra of 2g.
$^{1}$H and $^{13}$C-NMR spectra of 2h.
$^1$H and $^{13}$C-NMR spectra of 2i.
$^1$H and $^{13}$C-NMR spectra of 2j.
$^1$H and $^{13}$C-NMR spectra of 2k.
$^1$H and $^{13}$C-NMR spectra of 2l.
$^1$H and $^{13}$C-NMR spectra of 2m.
$^1$H and $^{13}$C-NMR spectra of 2n.
$^1$H and $^{13}$C-NMR spectra of 20.
$^1$H and $^{13}$C-NMR spectra of 2p.
$^1$H and $^{13}$C-NMR spectra of 2q.
$^1$H and $^{13}$C-NMR spectra of 2r.
$^1$H and $^{13}$C-NMR spectra of 2s.
$^1$H and $^{13}$C-NMR spectra of 2t.
$^1$H and $^{13}$C-NMR spectra of 2u.
$^1$H and $^{13}$C-NMR spectra of 2v.
$^1$H and $^{13}$C-NMR spectra of 2cc.
$^1$H and $^{13}$C-NMR spectra of 4-amino-1-phenylbutan-1-one
$^{1}$H and $^{13}$C-NMR spectra of 4a.
$^{1}$H and $^{13}$C-NMR spectra of 4b.
$^{1}H$ and $^{13}C$-NMR spectra of 4c.
\(^1\)H and \(^{13}\)C-NMR spectra of 4d.
$^1$H and $^{13}$C-NMR spectra of 4e.
$^1$H and $^{13}$C-NMR spectra of 4f.
$^1$H and $^{13}$C-NMR spectra of 4g.
$^1$H and $^{13}$C-NMR spectra of 4h.
$^{1}$H and $^{13}$C-NMR spectra of 4i.
$^1$H and $^{13}$C-NMR spectra of 4j.
$^1$H and $^{13}$C-NMR spectra of 4k.
$^1$H and $^{13}$C-NMR spectra of 4l.
$^1$H and $^{13}$C-NMR spectra of 4m.
$^1$H and $^{13}$C-NMR spectra of 4n.
$^1$H and $^{13}$C-NMR spectra of 40.
$^1$H and $^{13}$C-NMR spectra of 4p.
$^1$H and $^{13}$C-NMR spectra of 4q.
\(^1\)H and \(^{13}\)C-NMR spectra of 6a.
$^1$H and $^{13}$C-NMR spectra of 6b.
$^1$H and $^{13}$C-NMR spectra of 6c.
\(^1\)H and \(^{13}\)C-NMR spectra of 6d.
$^1$H and $^{13}$C-NMR spectra of 6e.
$^1$H and $^{13}$C-NMR spectra of 6f.
$^{1}$H and $^{13}$C-NMR spectra of 6g.
$^1$H and $^{13}$C-NMR spectra of 6h.
$^1$H and $^{13}$C-NMR spectra of 6i.
$^1$H and $^{13}$C-NMR spectra of 6j.
$^1$H and $^{13}$C-NMR spectra of 6k.
$^1$H and $^{13}$C-NMR spectra of 6l.
$^1$H and $^{13}$C-NMR spectra of 6m.
$^1$H and $^{13}$C-NMR spectra of 6n.
$^1$H and $^{13}$C-NMR spectra of 60.

---

S-173
$^1$H and $^{13}$C-NMR spectra of 6p.
$^1$H and $^{13}$C-NMR spectra of 2bb.
$^1$H and $^{13}$C-NMR spectra of 1bb.
$^1$H and $^{13}$C-NMR spectra of 1-(4-bromophenyl)-3-(4-hydroxy-4-phenylbutyl)urea.