Supporting Information

Practical Synthesis of Chiral $\beta$-Aryl-$\alpha$-Hydroxy Acids via Palladium-Catalyzed C(sp$^3$)–H Arylation of Lactic Acid

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General Information: Unless otherwise noted, all commercial materials were used without further purification. Anhydrous solvents obtained from Aladdin and Adamas were used directly without further purification, and solvents obtained from other commercial suppliers were used after purification as specified in *Purification of Laboratory Chemicals, 6th Ed.* Nuclear magnetic resonance (NMR) spectra were recorded with a Bruker AVANCE 400MHz instrument. $^1$H and $^{13}$C chemical shifts are reported in ppm downfield of tetramethylsilane and referenced to residual solvent peak (CHCl$_3$ = 7.26 ($^1$H NMR), DMSO = 2.50 ($^1$H NMR), CDCl$_3$ = 77.16 ($^{13}$C NMR)) unless otherwise noted. Multiplicities are reported using the following abbreviations: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad resonance. High-resolution mass spectra for new compounds were recorded at Mass Spectrometry Facilities, Zhejiang University. X-ray diffraction experiments were performed at X-Ray Facilities, Zhejiang University.
Experimental Procedures:

Preparation of Lactic Acid Substrates

(S)-2-Methoxy-N-(quinolin-8-yl)propanamide (1a)

To a stirred solution of (S)-2-methoxypropanoic acid \(^1\) (10.41 g, 100 mmol) in dry dichloromethane (300 mL), 4-methylmorpholine (NMM, 11.5 mL, 105 mmol) was added slowly at 0 °C. After the solution was stirred for five minutes, \textit{iso}-butyl carbonochloridate (13.3 mL, 105 mmol) was added dropwise slowly at 0 °C. The mixture was then stirred at room temperature for 1.5 h. A solution of 8-aminoquinoline (8.65 g, 60 mmol) in dry dichloromethane (50 mL) was slowly added to the reaction at 0 °C. After the reaction was stirred at room temperature overnight, the resulting mixture was then washed by aqueous HCl (100 mL, 0.1 M), saturated Na\(_2\)CO\(_3\) (100 mL), brine (100 mL), and dried over anhydrous MgSO\(_4\). Evaporation of organic solvent and purification by silica gel column chromatography in 6:3:1 petroleum ether: dichloromethane: ethyl acetate, afforded the pure 8-aminoquinoline amide 1a (13.12 g, 95%) as a white solid. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 10.80 (s, 1H), 8.86 (dd, \(J = 4.0, 1.6\) Hz, 1H), 8.80 (dd, \(J = 6.4, 2.4\) Hz, 1H), 8.16 (dd, \(J = 8.4, 1.6\) Hz, 1H), 7.57 – 7.52 (m, 2H), 7.46 (dd, \(J = 8.4, 4.4\) Hz, 1H), 3.99 (q, \(J = 6.8\) Hz, 1H), 3.58 (s, 3H), 1.55 (d, \(J = 6.8\) Hz, 3H); \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 170.89, 148.63, 138.92, 137.77, 136.20, 133.95, 129.51, 128.38, 128.03, 127.27, 126.60, 122.06, 121.69, 116.63, 84.55, 59.32, 39.58; HRMS (EI) \(m/z\): 230.1058(M\(^+\)), calc. for C\(_{13}\)H\(_{14}\)N\(_2\)O\(_2\): 230.1055.

(S)-2-Ethyloxy-N-(quinolin-8-yl)propanamide (1b)

The preparation of 1b followed the same procedure of 1a except using (S)-2-ethoxypropanoic acid instead of (S)-2-methoxypropanoic acid. The compound 1b was obtained as a light yellow solid. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 10.93 (s, 1H), 8.85 (dd, \(J = 4.0, 1.1\) Hz, 1H), 8.79 (dd, \(J = 6.6, 1.9\) Hz, 1H), 8.16 (dd, \(J = 8.2, 1.1\) Hz, 1H), 7.71 – 7.50 (m, 2H), 7.45 (dd, \(J = 8.2, 4.2\) Hz, 1H), 4.06 (q, \(J = 6.8\) Hz, 1H), 3.84 – 3.60 (m, 2H), 1.55 (d, \(J = 6.8\) Hz, 3H), 1.41 (t, \(J = 7.0\) Hz, 3H); \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 172.67, 148.64, 139.09, 136.29, 134.28, 128.14, 127.40, 121.93, 121.74, 116.59, 77.61, 66.28, 19.24, 15.54; HRMS (EI) \(m/z\): 244.1214(M\(^+\)), calc. for C\(_{14}\)H\(_{16}\)N\(_2\)O\(_2\): 244.1212.
Optimization of Reaction Conditions Mono-arylation of 1a

(1) Optimization of Base Additives (t-AmylOH used as solvent)

\[
\text{H} - \text{O}^- \quad \text{N}^+ \quad 1a + \text{Ar-I} \quad \text{1.5 eq} \quad 2a \xrightarrow{\text{10 mol\% Pd(OAc)}_{2}, \text{Base (1.5 eq)}} \text{Ar-O}^- \quad \text{3a} \quad \text{Ar-I} = \begin{array}{c} \text{MeO} \\ \text{NO}_2 \end{array}
\]

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<td>1</td>
<td>K$_2$CO$_3$</td>
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<td>KOAc</td>
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<tr>
<td>3</td>
<td>K$_3$PO$_4$</td>
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</tr>
<tr>
<td>4</td>
<td>LiOAc</td>
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</tr>
<tr>
<td>5</td>
<td>NaOAc</td>
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</tr>
<tr>
<td>6</td>
<td>Na$_2$CO$_3$</td>
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</tr>
<tr>
<td>7</td>
<td>CsOAc</td>
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<tr>
<td>8</td>
<td>Cs$_2$CO$_3$</td>
<td>18%</td>
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Reaction conditions: 1a (0.20 mmol, 1.0 eq), 2a (0.30 mmol, 1.5 eq), Pd(OAc)$_2$ (0.02 mmol, 10 mol%), base (0.30 mmol, 1.5 eq), t-AmylOH (2.0 ml), reaction for 24 hours at 85 °C and under N$_2$ atmosphere.

(2) Optimization of Silver(I) Salt Additives (t-AmylOH used as solvent)

\[
\text{H} - \text{O}^- \quad \text{N}^+ \quad 1a + \text{Ar-I} \quad \text{1.5 eq} \quad 2a \xrightarrow{\text{10 mol\% Pd(OAc)}_{2}, \text{Ag(I) salt (1.5 eq)}} \text{Ar-O}^- \quad \text{3a} \quad \text{Ar-I} = \begin{array}{c} \text{MeO} \\ \text{NO}_2 \end{array}
\]

<table>
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<th>Entry</th>
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<td>9</td>
<td>AgOPiv</td>
<td>trace</td>
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</table>

Reaction conditions: 1a (0.20 mmol, 1.0 eq), 2a (0.30 mmol, 1.5 eq), Pd(OAc)$_2$ (0.02 mmol, 10 mol%), silver salt (0.30 mmol, 1.5 eq), t-AmylOH (2.0 ml), reaction for 24 hours at 85 °C and under N$_2$ atmosphere.
(3) Optimization of Solvent (AgF used as silver salt additive)

\[
\begin{align*}
\text{Entry} & & \text{Solvent} & & \text{Yield 3a} \\
1 & & \text{\(\text{-AmylOH}\)} & & 65\% \\
2 & & \text{DCE} & & 51\% \\
3 & & \text{THF} & & 30\% \\
4 & & \text{1,4-dioxane} & & 18\% \\
5 & & \text{PhMe} & & 14\% \\
6 & & \text{MeCN} & & 0 \\
7 & & \text{DMF} & & 60\% \\
8 & & \text{DMAc} & & 54\% \\
9 & & \text{Acetone} & & 52\% \\
10 & & \text{MeOH} & & 64\% \\
11 & & \text{\(\text{-AmylOH}\), 3.0 equiv AgF was used;} & & 75\% \\
12 & & \text{\(\text{-AmylOH}\), 1.2 eq 2a was used;} & & 64\% \\
13 & & \text{\(\text{-AmylOH}\), reaction for 12 hours;} & & 81\% \text{d} \\
14 & & \text{DMSO} & & \text{trace} \\
15 & & \text{NMP} & & 45\% \\
\end{align*}
\]

Reaction conditions: \(1a\) (0.20 mmol, 1.0 eq), \(2a\) (0.30 mmol, 1.5 eq), \(\text{Pd(OAc)}_2\) (0.02 mmol, 10 mol%), AgF (0.30 mmol, 1.5 eq), solvent (2.0 ml), reaction for 24 hours at 85 °C and under \(\text{N}_2\) atmosphere. \(a\) 3.0 equiv AgF was used; \(b\) 1.2 eq \(2a\) was used; \(c\) reaction for 12 hours; \(d\) isolated yield.

\((S)-2\text{-Methoxy-3-(4-methoxy-3-nitrophenyl)-N-(quinolin-8-yl)}\)propanamide (3a)

The title compound was prepared under the optimized condition. The crude product was purified by silica gel column chromatography in 4:1 petroleum ether:ethyl acetate, providing \(3a\) as a white solid (61.5 mg, 81%). \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 10.65 (s, 1H), 8.79 (dd, \(J = 4.4, 2.0\) Hz, 1H), 8.77 – 8.72 (m, 1H), 8.12 (dd, \(J = 8.4, 1.6\) Hz, 1H), 7.84 (d, \(J = 2.4\) Hz, 1H), 7.54 – 7.49 (m, 2H), 7.45 – 7.41 (m, 2H), 6.90 (d, \(J = 8.4\) Hz, 1H), 4.03 (dd, \(J = 7.6, 3.6\) Hz, 1H), 3.82 (s, 3H), 3.53 (s, 3H), 3.24 (dd, \(J = 14.4, 3.6\) Hz, 1H), 3.07 (dd, \(J = 14.4, 7.6\) Hz, 1H). \(^1\)C NMR (101 MHz, CDCl\(_3\)) \(\delta\) 170.06, 151.79, 148.70, 139.27, 138.81, 136.20, 135.41, 133.62, 129.78, 127.99, 127.16, 126.76, 122.24, 121.74, 116.66, 113.37, 83.69, 59.19, 56.47, 37.72. HRMS (EI) \(m/z\): 381.1329 (M\(^+\)), calc. for C\(_{20}\)H\(_{19}\)N\(_3\)O\(_5\): 381.1325.
General Procedure (GP) for Mono-arylation of Lactic Acid Derivative

To a 30-mL resealable Schlenk flask was added 1a (46.1 mg, 0.2 mmol), Pd(OAc)$_2$ (4.5 mg, 0.02 mmol), aryl iodide (0.3 mmol), AgF (76.1 mg, 0.6 mmol), and t-AmylOH (2.0 mL). The Schlenk flask was charged with N$_2$. The mixture was stirred at 85 °C for 12 hours. After cooling to room temperature, the reaction was diluted with dichloromethane (5 mL), then filtered through a pad of Celite and washed by dichloromethane (20 mL). Evaporation of organic solvent and purification by column chromatography gave the corresponding product.

Scope of alkyl iodides:

(S)-2-Methoxy-3-phenyl-N-(quinolin-8-yl)propanamide (3b)

The compound 3b was prepared according to the GP and purified by column chromatography in toluene: ethyl acetate = 12:1. 3b was obtained as a light yellow solid (45.5 mg, 74%). $^1$H NMR (400
MHz, CDCl₃) δ 10.81 (s, 1H), 8.89 – 8.79 (m, 2H), 8.13 (dd, J = 8.3, 1.3 Hz, 1H), 7.59 – 7.50 (m, 2H), 7.43 (dd, J = 8.3, 4.2 Hz, 1H), 7.39 – 7.34 (m, 2H), 7.33 – 7.27 (m, 2H), 7.25 – 7.19 (m, 1H), 4.09 (dd, J = 8.7, 3.5 Hz, 1H), 3.49 (s, 2H), 3.33 (dd, J = 14.2, 3.4 Hz, 1H), 3.08 (dd, J = 14.2, 8.7 Hz, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 170.89, 148.63, 138.92, 137.77, 136.20, 133.95, 129.51, 128.38, 128.03, 127.27, 126.60, 122.06, 121.69, 116.63, 84.55, 59.32, 39.58; HRMS (EI) m/z: 306.1368 (M⁺); calc. for C₁₉H₁₈N₂O₂: 306.1368.

(S)-2-Methoxy-N-(quinolin-8-yl)-3-(p-tolyl)propanamide (3c)

The compound 3c was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3c was obtained as a colorless oil (45.8 mg, 72%). ¹H NMR (400 MHz, CDCl₃) δ 10.77 (s, 1H), 8.93 – 8.73 (m, 2H), 8.13 (dd, J = 8.2, 1.3 Hz, 1H), 7.60 – 7.48 (m, 2H), 7.42 (dd, J = 8.2, 4.2 Hz, 1H), 7.22 (d, J = 7.8 Hz, 2H), 7.08 (d, J = 7.7 Hz, 2H), 4.04 (dd, J = 8.6, 3.5 Hz, 1H), 3.48 (s, 3H), 3.26 (dd, J = 14.2, 3.3 Hz, 1H), 3.03 (dd, J = 14.2, 8.6 Hz, 1H), 2.28 (s, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 171.02, 148.63, 139.01, 136.21, 136.07, 134.68, 134.06, 129.39, 129.11, 128.08, 127.31, 122.03, 121.68, 116.71, 84.73, 59.29, 39.20, 21.13; HRMS (EI) m/z: 320.1523 (M⁺); calc. for C₂₀H₂₀N₂O₂: 320.1525.

(S)-2-Methoxy-N-(quinolin-8-yl)-3-(m-tolyl)propanamide (3d)

The compound 3d was prepared according to the GP and purified by column chromatography in toluene: ethyl acetate = 20:1. 3d was obtained as a colorless oil (46.3 mg, 72%). ¹H NMR (400 MHz, CDCl₃) δ 10.77 (s, 1H), 8.97 – 8.67 (m, 2H), 8.14 (dd, J = 8.2, 1.4 Hz, 1H), 7.63 – 7.48 (m, 2H), 7.43 (dd, J = 8.2, 4.2 Hz, 1H), 7.22 – 7.09 (m, 3H), 7.01 (d, J = 6.8 Hz, 1H), 4.06 (dd, J = 8.8, 3.4 Hz, 1H), 3.48 (s, 3H), 3.27 (dd, J = 14.2, 3.2 Hz, 1H), 3.01 (dd, J = 14.2, 8.8 Hz, 1H), 2.29 (s, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 171.06, 148.66, 139.07, 137.95, 137.78, 136.24, 134.10, 130.35, 128.31, 128.12, 127.39, 127.35, 126.53, 122.05, 121.71, 116.74, 84.77, 59.37, 39.71, 21.46; HRMS (EI) m/z: 320.1520 (M⁺); calc. for C₂₀H₂₀N₂O₂: 320.1525.

(S)-2-Methoxy-3-(4-methoxyphenyl)-N-(quinolin-8-yl)propanamide (3e)
The compound 3e was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3e was obtained as a colorless oil (36.8 mg, 55%). 1H NMR (400 MHz, CDCl3) δ 10.76 (s, 1H), 8.99 – 8.76 (m, 2H), 8.16 (d, J = 8.2 Hz, 1H), 7.61 – 7.51 (m, 2H), 7.45 (dd, J = 8.2, 4.2 Hz, 1H), 7.27 (d, J = 7.9 Hz, 2H), 6.83 (d, J = 8.0 Hz, 2H), 4.05 (dd, J = 8.1, 3.1 Hz, 1H), 3.77 (s, 3H), 3.51 (s, 3H), 3.26 (dd, J = 14.3, 3.1 Hz, 1H), 3.04 (dd, J = 14.3, 8.4 Hz, 1H); 13C NMR (101 MHz, CDCl3) δ 170.98, 158.36, 148.63, 138.95, 136.20, 133.99, 130.51, 129.73, 128.05, 127.28, 122.04, 121.68, 116.65, 113.78, 84.72, 59.28, 55.23, 38.65; HRMS (EI) m/z: 336.1479 (M+) calc. for C20H20N2O3: 336.1474.

(S)-2-Methoxy-3-(3-methoxyphenyl)-N-(quinolin-8-yl)propanamide (3f)

The compound 3f was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3f was obtained as a white solid (54.0 mg, 80%). 1H NMR (400 MHz, CDCl3) δ 10.78 (s, 1H), 8.98 – 8.71 (m, 2H), 8.15 (dd, J = 8.3, 1.5 Hz, 1H), 7.60 – 7.50 (m, 2H), 7.45 (dd, J = 8.2, 4.2 Hz, 1H), 7.20 (t, J = 7.8 Hz, 1H), 6.99 – 6.84 (m, 2H), 6.75 (dd, J = 8.2, 1.7 Hz, 1H), 4.08 (dd, J = 8.6, 3.4 Hz, 1H), 3.76 (s, 3H), 3.50 (s, 3H), 3.29 (dd, J = 14.2, 3.2 Hz, 1H), 3.04 (dd, J = 14.2, 8.7 Hz, 1H); 13C NMR (101 MHz, CDCl3) δ = 170.95, 159.70, 148.70, 139.42, 139.06, 136.27, 134.07, 129.37, 128.13, 127.35, 122.11, 121.99, 121.74, 116.74, 114.95, 112.41, 84.59, 59.40, 55.27, 39.73; HRMS (EI) m/z: 336.1476 (M+) calc. for C20H20N2O3: 336.1474.

(S)-2-Methoxy-3-(2-methoxyphenyl)-N-(quinolin-8-yl)propanamide (3g)

The compound 3g was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3g was obtained as a colorless oil (27.7 mg, 41%). 1H NMR (400 MHz, CDCl3) δ 10.76 (s, 1H), 8.99 – 8.68 (m, 2H), 8.14 (dd, J = 8.2, 1.4 Hz, 1H), 7.58 – 7.49 (m, 2H), 7.44 (dd, J = 8.2, 4.2 Hz, 1H), 7.32 – 7.25 (m, 1H), 7.20 (td, J = 8.0, 1.4 Hz, 1H), 6.89 (t, J = 7.4 Hz, 1H), 6.83 (d, J = 8.1 Hz, 1H), 4.19 (dd, J = 8.6, 4.3 Hz, 1H), 3.81 (s, 3H), 3.45 (s, 3H), 3.41 (dd, J = 14.0, 4.2 Hz, 1H), 3.02 (dd, J = 14.0, 8.6 Hz, 1H); 13C NMR (101 MHz, CDCl3) δ = 171.43, 157.82, 148.61, 139.05, 136.25, 134.31, 131.48, 128.12, 128.00, 127.39, 126.08, 121.86, 121.69, 120.45, 116.69, 110.35, 83.15, 59.22, 55.45, 34.67; HRMS (EI) m/z: 336.1474 (M+) calc. for C20H20N2O3: 336.1474.

(S)-3-(4-(tert-Butyl)phenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3h)

- 8 -
The compound 3h was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3h was obtained as a colorless oil (50.5 mg, 70%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.77 (s, 1H), 8.91 – 8.77 (m, 2H), 8.14 (dd, $J = 8.3$, 1.6 Hz, 1H), 7.59 – 7.50 (m, 2H), 7.43 (dd, $J = 8.3$, 4.2 Hz, 1H), 7.34 – 7.26 (m, 4H), 4.09 (dd, $J = 8.6$, 3.4 Hz, 1H), 3.51 (s, 3H), 3.29 (dd, $J = 14.3$, 3.4 Hz, 1H), 3.06 (dd, $J = 14.3$, 8.6 Hz, 1H), 1.28 (s, 9H); $^{13}$C NMR (100MHz, CDCl$_3$) δ 171.10, 149.33, 148.62, 138.95, 136.21, 134.69, 134.03, 129.14, 128.05, 127.30, 125.30, 122.02, 121.68, 116.63, 84.63, 59.29, 39.13, 34.44, 31.43; HRMS (EI) $m/z$: 362.1991 (M$^+$); calc. for C$_{23}$H$_{26}$N$_2$O$_2$: 362.1994.

(S)-3-(4-Fluorophenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3i)

The compound 3i was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3i was obtained as a white solid (51.1 mg, 79%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.72 (s, 1H), 8.82 (dd, $J = 4.0$, 1.2 Hz, 1H), 8.79 (dd, $J = 6.3$, 2.5 Hz, 1H), 8.15 (dd, $J = 8.2$, 1.0 Hz, 1H), 7.60 – 7.49 (m, 2H), 7.44 (dd, $J = 8.2$, 4.2 Hz, 1H), 7.32 – 7.23 (m, 2H), 6.95 (t, $J = 8.7$ Hz, 2H), 4.03 (dd, $J = 8.2$, 3.5 Hz, 1H), 3.50 (s, 3H), 3.26 (dd, $J = 14.3$, 3.4 Hz, 1H), 3.05 (dd, $J = 14.3$, 8.2 Hz, 1H); $^{13}$C NMR (101 MHz, CDCl$_3$) δ 170.68, 161.90(d, $J_{C-F} = 242.8$ Hz), 148.71, 139.01, 136.28, 133.95, 133.32(d, $J_{C-F} = 3.2$ Hz), 131.08(d, $J_{C-F} = 7.8$ Hz), 128.12, 127.32, 122.17, 121.76, 116.73, 115.19(d, $J_{C-F} = 21.0$ Hz), 84.47, 59.32, 38.63; HRMS (EI) $m/z$: 324.1271 (M$^+$); calc. for C$_{19}$H$_{17}$FN$_2$O$_2$: 324.1274.

(S)-3-(4-Chlorophenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3j)

The compound 3j was prepared according to the GP and purified by column chromatography in toluene: ethyl acetate = 12:1. 3j was obtained as a yellow solid (56.1 mg, 83%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.72 (s, 1H), 8.81 (dd, $J = 4.2$, 1.6 Hz, 1H), 8.79 (dd, $J = 6.6$, 2.4 Hz, 1H), 8.13 (dd, $J = 8.2$, 1.3 Hz, 1H), 7.59 – 7.48 (m, 2H), 7.43 (dd, $J = 8.2$, 4.2 Hz, 1H), 7.24 (q, $J = 8.4$ Hz, 4H), 4.03 (dd, $J = 8.2$, 3.5 Hz, 1H), 3.49 (s, 3H), 3.25 (dd, $J = 14.2$, 3.4 Hz, 1H), 3.04 (dd, $J = 14.2$, 8.2 Hz, 1H); $^{13}$C NMR (101 MHz, CDCl$_3$) δ 170.51, 148.70, 138.97, 136.25, 136.13, 133.89, 132.51, 130.98,
128.50, 128.09, 127.28, 122.18, 121.74, 116.72, 84.26, 59.31, 38.74; HRMS (EI) \textit{m/z}: 340.0976 (M⁺); calc. for C₁₀H₁₇ClN₂O₂: 340.0979.

\textit{(S)-3-(4-Bromophenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3k)}

![Structure of 3k]

The compound 3k was prepared according to the GP and purified by column chromatography in toluene: ethyl acetate = 20:1. 3k was obtained as a light yellow oil (53.5 mg, 70%). ¹H NMR (400 MHz, CDCl₃) δ 10.72 (s, 1H), 8.82 (dd, \(J = 4.1, 1.6\) Hz, 1H), 8.79 (dd, \(J = 6.4, 2.5\) Hz, 1H), 8.14 (dd, \(J = 8.3, 1.5\) Hz, 1H), 7.59 – 7.49 (m, 2H), 7.44 (dd, \(J = 8.2, 4.2\) Hz, 1H), 7.38 (d, \(J = 8.3\) Hz, 2H), 7.20 (d, \(J = 8.2\) Hz, 2H), 4.03 (dd, \(J = 8.2, 3.6\) Hz, 1H), 3.50 (s, 3H), 3.24 (dd, \(J = 14.2, 3.4\) Hz, 1H), 3.03 (dd, \(J = 14.2, 8.2\) Hz, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 170.48, 148.70, 138.98, 136.65, 136.24, 133.90, 131.45, 131.38, 128.09, 127.28, 122.18, 121.74, 120.64, 116.74, 84.19, 59.31, 38.81; HRMS (EI) \textit{m/z}: 384.0477 (M⁺); calc. for C₁₉H₁₇BrN₂O₂: 384.0473.

\textit{(S)-3-(4-Acetylphenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3l)}

![Structure of 3l]

The compound 3l was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3l was obtained as a white solid (48.3 mg, 69%). ¹H NMR (400 MHz, CDCl₃) δ 10.72 (s, 1H), 8.85 – 8.74 (m, 2H), 8.14 (dd, \(J = 8.3, 1.5\) Hz, 1H), 7.86 (d, \(J = 8.2\) Hz, 2H), 7.58 – 7.50 (m, 2H), 7.46 – 7.38 (m, 3H), 4.09 (dd, \(J = 8.2, 3.6\) Hz, 1H), 3.50 (s, 3H), 3.34 (dd, \(J = 14.1, 3.6\) Hz, 1H), 3.14 (dd, \(J = 14.1, 8.2\) Hz, 1H), 2.53 (s, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 197.96, 170.35, 148.68, 143.39, 138.92, 136.26, 135.68, 133.81, 129.83, 128.49, 128.05, 127.27, 122.22, 121.75, 116.70, 84.00, 59.34, 39.33, 26.65; HRMS (EI) \textit{m/z}: 348.1477 (M⁺); calc. for C₂₁H₂₀N₂O₃: 348.1474.

\textit{(S)-2-Methoxy-3-(4-nitrophenyl)-N-(quinolin-8-yl)propanamide (3m)}

![Structure of 3m]

The compound 3m was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3m was obtained as a light yellow solid (39.5 mg, 56%). ¹H NMR (400 MHz, CDCl₃) δ 10.68 (s, 1H), 8.80 (d, \(J = 2.7\) Hz, 1H), 8.78 – 8.65 (m, 1H), 8.15 (d, \(J = 8.2\) Hz, 1H), 8.11 (d, \(J = 8.4\) Hz, 2H), 7.55 (d, \(J = 4.5\) Hz, 2H), 7.51 – 7.39 (m, 3H), 4.11 (dd, \(J = 7.5,
3.6 Hz, 1H), 3.54 (s, 3H), 3.38 (dd, J = 14.0, 3.3 Hz, 1H), 3.21 (dd, J = 14.0, 7.7 Hz, 1H); \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) δ 169.92, 148.75, 147.03, 145.32, 138.95, 136.35, 133.67, 130.61, 128.12, 127.29, 123.58, 122.42, 121.85, 116.81, 83.63, 59.36, 39.01; HRMS (EI) m/z: 351.1220 (M\(^+\)); calc. for C\(_{19}\)H\(_{17}\)N\(_3\)O\(_4\): 351.1219.

(S)-3-(4-Cyanophenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3n)

The compound 3n was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3n was obtained as a colorless oil (14.0 mg, 21% under standard conditions; 32.4 mg, 49% under conditions of 2.0 equiv. Ag\(_2\)O and 2.0 mL DMF). \(^1\)H NMR (400 MHz, CDCl\(_3\)) δ 10.67 (s, 1H), 8.82 (dd, J = 4.0, 1.2 Hz, 1H), 8.76 (t, J = 4.4 Hz, 1H), 8.16 (dd, J = 8.0, 1.2 Hz, 1H), 7.55 – 7.53 (m, 4H), 7.48 – 7.42 (m, 3H), 4.08 (dd, J = 8.0, 4.0 Hz, 1H), 3.52 (s, 3H), 3.33 (dd, J = 14.0, 3.6 Hz, 1H), 3.16 (dd, J = 14.0, 8.0 Hz, 1H); \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) δ 170.03, 148.77, 143.22, 138.98, 136.36, 133.74, 132.18, 130.54, 128.15, 127.32, 122.39, 121.87, 119.09, 116.80, 110.69, 83.74, 59.36, 39.35; HRMS (EI) m/z: 331.1319 (M\(^+\)); calc. for C\(_{20}\)H\(_{17}\)N\(_3\)O\(_2\): 331.1321.

(S) -2-Methoxy-N-(quinolin-8-yl)-3-(4-(trifluoromethyl)phenyl)propanamide (3o)

The compound 3o was prepared according to the GP and purified by column chromatography in toluene: ethyl acetate = 12:1. 3o was obtained as a white solid (48.3 mg, 65%). \(^1\)H NMR (400 MHz, CDCl\(_3\)) δ 10.72 (s, 1H), 8.86 – 8.70 (m, 2H), 8.15 (dd, J = 8.2, 1.0 Hz, 1H), 7.59 – 7.48 (m, 4H), 7.47 – 7.40 (m, 3H), 4.08 (dd, J = 8.1, 3.5 Hz, 1H), 3.51 (s, 3H), 3.34 (dd, J = 14.2, 3.3 Hz, 1H), 3.14 (dd, J = 14.1, 8.2 Hz, 1H); \(^{13}\)C NMR (101 MHz, CDCl\(_3\)) δ 170.37, 148.74, 141.81, 138.98, 136.29, 133.85, 131.14, 129.99, 129.48, 129.16, 129.00 (q, J\(_{C-F}\) = 32.1 Hz), 128.12, 127.30, 125.30 (q, J\(_{C-F}\) = 3.6 Hz), 124.41 (q, J\(_{C-F}\) = 270.2 Hz), 122.28, 121.79, 116.76, 84.06, 59.36, 39.22; HRMS (EI) m/z: 374.1241 (M\(^+\)); calc. for C\(_{20}\)H\(_{17}\)F\(_3\)N\(_2\)O\(_2\): 374.1242.

(S)-Methyl 4-(2-methoxy-3-oxo-3-(quinolin-8-ylamino)propyl)benzoate (3p)
The compound 3p was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3p was obtained as a white solid (48.2 mg, 66%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.74 (s, 1H), 8.94 – 8.62 (m, 2H), 8.13 (dd, $J$ = 8.2, 1.1 Hz, 1H), 7.94 (d, $J$ = 8.1 Hz, 2H), 7.62 – 7.48 (m, 2H), 7.47 – 7.33 (m, 3H), 4.08 (dd, $J$ = 8.3, 3.5 Hz, 1H), 3.87 (s, 3H), 3.49 (s, 3H), 3.34 (dd, $J$ = 14.1, 3.3 Hz, 1H), 3.12 (dd, $J$ = 14.1, 8.4 Hz, 1H); $^{13}$C NMR (101 MHz, CDCl$_3$) δ 170.40, 167.14, 148.68, 143.18, 138.98, 136.24, 133.87, 129.70, 129.65, 128.63, 128.09, 127.27, 122.19, 121.71, 116.73, 84.11, 59.34, 52.05, 39.43; HRMS (EI) $m/z$: 364.1419 (M$^+$); calc. for C$_{21}$H$_{20}$N$_2$O$_4$: 364.1423.

(S)-3-(3,4-Dimethylphenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3q)

The compound 3q was prepared according to the GP and purified by column chromatography in toluene: ethyl acetate = 20:1. 3q was obtained as a colorless oil (50.5 mg, 76%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.76 (s, 1H), 9.00 – 8.67 (m, 2H), 8.15 (dd, $J$ = 8.2, 1.4 Hz, 1H), 7.62 – 7.50 (m, 2H), 7.45 (dd, $J$ = 8.2, 4.2 Hz, 1H), 7.17 – 6.96 (m, 3H), 4.06 (dd, $J$ = 8.7, 3.4 Hz, 1H), 3.49 (s, 3H), 3.24 (dd, $J$ = 14.2, 3.3 Hz, 1H), 3.00 (dd, $J$ = 14.2, 8.7 Hz, 1H), 2.20 (s, 6H); $^{13}$C NMR (101 MHz, CDCl$_3$) δ 171.20, 148.65, 139.08, 136.49, 136.25, 135.20, 134.74, 134.15, 130.86, 129.71, 128.13, 127.37, 126.85, 122.03, 121.71, 116.77, 84.88, 59.35, 39.34, 19.79, 19.44; HRMS (EI) $m/z$: 334.1685 (M$^+$); calc. for C$_{21}$H$_{22}$N$_2$O$_2$: 334.1681.

(S)-3-(3,4-Dimethoxyphenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3r)

The compound 3r was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3r was obtained as a colorless oil (52.2 mg, 71%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.72 (s, 1H), 9.00 – 8.63 (m, 2H), 8.14 (dd, $J$ = 8.2, 1.4 Hz, 1H), 7.62 – 7.48 (m, 2H), 7.45 (dd, $J$ = 8.2, 4.2 Hz, 1H), 6.95 – 6.80 (m, 2H), 6.76 (d, $J$ = 8.6 Hz, 1H), 4.04 (dd, $J$ = 8.1, 3.5 Hz, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 3.51 (s, 3H), 3.24 (dd, $J$ = 14.3, 3.4 Hz, 1H), 3.03 (dd, $J$ = 14.3, 8.1 Hz, 1H); $^{13}$C NMR (101 MHz, CDCl$_3$) δ 170.98, 148.81, 148.66, 147.81, 138.99, 136.25, 134.03, 130.22, 128.11, 127.29, 122.11, 121.74, 121.69, 116.66, 112.69, 111.14, 84.71, 59.32, 55.91, 55.88, 39.14; HRMS (EI) $m/z$: 366.1577 (M$^+$); calc. for C$_{21}$H$_{22}$N$_2$O$_2$: 366.1580.

(S)-2-Methoxy-5-(2-methoxy-3-oxo-3-(quinolin-8-ylamino)propyl)phenyl acetate (3s)
The compound 3s was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3s was obtained as a colorless oil (54.1 mg, 69%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.76 (s, 1H), 8.84 (dd, $J = 4.0$, 1.4 Hz, 1H), 8.80 (dd, $J = 6.4$, 2.3 Hz, 1H), 8.15 (dd, $J = 8.2$, 1.4 Hz, 1H), 7.58 – 7.51 (m, 2H), 7.45 (dd, $J = 8.2$, 4.2 Hz, 1H), 7.16 (dd, $J = 8.3$, 1.4 Hz, 1H), 7.06 (s, 1H), 6.86 (d, $J = 8.3$ Hz, 1H), 4.00 (dd, $J = 8.6$, 3.1 Hz, 1H), 3.78 (s, 3H), 3.49 (s, 3H), 3.23 (dd, $J = 14.3$, 2.8 Hz, 1H), 2.98 (dd, $J = 14.3$, 8.7 Hz, 1H), 2.29 (s, 3H); $^{13}$C NMR (101 MHz, CDCl$_3$) δ = 170.84, 169.14, 149.94, 148.71, 139.60, 139.06, 136.26, 134.03, 130.50, 128.13, 127.82, 127.33, 124.09, 122.12, 121.74, 116.76, 112.37, 84.61, 59.45, 56.01, 38.69, 20.79; HRMS (EI) $m/z$: 394.1526 (M$^+$); calc. for C$_{22}$H$_{22}$N$_2$O$_5$: 394.1529.

(S)-3-(4-(Benzyloxy)-3-nitrophenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3t)

The compound 3t was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3t was obtained as a colorless oil (57.5 mg, 63%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.66 (s, 1H), 8.81 (dd, $J = 4.0$, 1.1 Hz, 1H), 8.76 (dd, $J = 5.3$, 3.6 Hz, 1H), 8.14 (d, $J = 8.2$ Hz, 1H), 7.87 (s, 1H), 7.58 – 7.49 (m, 2H), 7.46 – 7.28 (m, 7H), 6.95 (d, $J = 8.5$ Hz, 1H), 5.17 – 5.02 (m, 2H), 4.04 (dd, $J = 7.3$, 3.4 Hz, 1H), 3.54 (s, 3H), 3.25 (dd, $J = 14.3$, 3.3 Hz, 1H), 3.08 (dd, $J = 14.3$, 7.6 Hz, 1H); $^{13}$C NMR (101 MHz, CDCl$_3$) δ = 170.84, 169.14, 149.94, 148.71, 139.60, 139.06, 136.26, 134.03, 130.50, 128.13, 127.82, 127.33, 124.09, 122.12, 121.74, 116.76, 112.37, 84.61, 59.45, 56.01, 38.69, 20.79; HRMS (EI) $m/z$: 457.1639 (M$^+$); calc. for C$_{26}$H$_{23}$N$_3$O$_5$: 457.1638.

(S)-3-(2,3-Dihydrobenzo[b][1,4]dioxin-6-yl)-2-methoxy-N-(quinolin-8-yl)propanamide (3u)

The compound 3u was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. 3u was obtained as a colorless oil (46.8 mg, 64%). $^1$H NMR (400 MHz, CDCl$_3$) δ 10.75 (s, 1H), 8.95 – 8.70 (m, 2H), 8.14 (dd, $J = 8.2$, 1.3 Hz, 1H), 7.60 – 7.49 (m, 2H), 7.44 (dd, $J = 8.2$, 4.2 Hz, 1H), 6.86 (s, 1H), 6.83 – 6.67 (m, 2H), 4.20 (s, 4H), 4.02 (dd, $J = 8.5$, 3.4 Hz, 1H), 3.50 (s, 3H), 3.19 (dd, $J = 14.3$, 3.2 Hz, 1H), 2.96 (dd, $J = 14.3$, 8.5 Hz, 1H); $^{13}$C
NMR (101 MHz, CDCl₃) δ 170.99, 148.66, 143.34, 142.35, 139.03, 136.25, 134.05, 131.02, 128.10, 127.34, 122.52, 122.05, 121.70, 118.24, 117.09, 116.75, 84.62, 64.43, 64.40, 59.32, 38.86; HRMS (EI) m/z: 364.1427 (M⁺); calc. for C₂₁H₂₀N₂O₄: 364.1423.

(S)-3-(4-(Hydroxymethyl)phenyl)-2-methoxy-N-(quinolin-8-yl)propanamide (3v)

The compound 3v was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 2:1. 3v was obtained as a light yellow solid (39.6 mg, 59%). ¹H NMR (400 MHz, CDCl₃) δ 10.75 (s, 1H), 8.96 – 8.63 (m, 2H), 8.15 (dd, J = 8.2, 1.0 Hz, 1H), 7.59 – 7.49 (m, 2H), 7.44 (dd, J = 8.2, 4.2 Hz, 1H), 7.32 (d, J = 7.9 Hz, 2H), 7.27 (d, J = 8.6 Hz, 2H), 4.63 (s, 2H), 4.05 (dd, J = 8.4, 3.5 Hz, 1H), 3.49 (s, 3H), 3.29 (dd, J = 14.2, 3.3 Hz, 1H), 3.07 (dd, J = 14.2, 8.5 Hz, 1H), 1.78 (brs, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 170.90, 148.73, 139.48, 139.05, 137.23, 136.29, 134.01, 129.79, 128.12, 127.36, 127.19, 122.14, 121.74, 116.78, 84.55, 65.29, 59.32, 39.24; HRMS (EI) m/z: 336.1475 (M⁺); calc. for C₂₀H₂₀N₂O₃: 336.1474.

(S)-2-Methoxy-N-(quinolin-8-yl)-3-(thiophen-2-yl)propanamide (3w)

The compound 3w was prepared according to the GP and purified by column chromatography in toluene: ethyl acetate = 20:1. 3w was obtained as a light yellow oil (37.4 mg, 60%). ¹H NMR (400 MHz, CDCl₃) δ 10.82 (s, 1H), 8.84 (d, J = 3.9 Hz, 1H), 8.81 (dd, J = 6.2, 2.4 Hz, 1H), 8.15 (d, J = 8.2 Hz, 1H), 7.61 – 7.50 (m, 2H), 7.45 (dd, J = 8.2, 4.2 Hz, 1H), 7.15 (d, J = 5.0 Hz, 1H), 7.03 – 6.93 (m, 1H), 6.94 – 6.82 (m, 1H), 4.06 (dd, J = 8.2, 3.2 Hz, 1H), 3.60 (s, 3H), 3.53 (dd, J = 15.3, 3.0 Hz, 1H), 3.32 (dd, J = 15.2, 8.3 Hz, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 170.29, 148.73, 139.48, 139.05, 136.27, 133.98, 128.12, 127.34, 126.74, 126.41, 124.54, 122.19, 121.76, 116.79, 84.03, 59.34, 33.65; HRMS (EI) m/z: 312.0929 (M⁺); calc. for C₁₇H₁₆N₂O₂S: 312.0932.

(S)-2-Methoxy-N-(quinolin-8-yl)-3-(1-tosyl-1H-indol-3-yl)propanamide (3x)
The compound $3x$ was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. $3x$ was obtained as a colorless oil (58.6 mg, 59%). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 10.79 (s, 1H), 8.83 (dd, $J = 4.1, 1.6$ Hz, 1H), 8.77 (dd, $J = 4.9, 4.0$ Hz, 1H), 8.14 (dd, $J = 8.3, 1.5$ Hz, 1H), 7.91 (d, $J = 7.9$ Hz, 1H), 7.67 – 7.56 (m, 4H), 7.56 – 7.49 (m, 2H), 7.44 (dd, $J = 8.2, 4.2$ Hz, 1H), 7.28 – 7.16 (m, 2H), 6.90 (d, $J = 8.1$ Hz, 2H), 4.13 (dd, $J = 7.3, 3.7$ Hz, 1H), 3.52 (s, 3H), 3.35 (dd, $J = 15.2, 3.5$ Hz, 1H), 3.20 (dd, $J = 15.2, 7.3$ Hz, 1H), 2.17 (s, 3H); $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ = 170.50, 148.80, 144.61, 138.99, 136.22, 135.36, 135.12, 133.94, 131.27, 129.69, 128.09, 127.31, 124.79, 124.65, 123.19, 122.15, 121.79, 119.81, 118.46, 116.77, 113.67, 82.89, 59.15, 28.33, 21.49; HRMS (EI) $m/z$: 499.1570 (M$^+$); calc. for C$_{28}$H$_{25}$N$_3$O$_4$S: 499.1566.

(S)-2-Methoxy-N-(quinolin-8-yl)-3-(4-(((2S,3R,4S,5R,6R)-3,4,5-tris(benzyloxy)-6-((benzyloxy)methyl)tetrahydro-2H-pyran-2-yl)oxy)phenyl)propanamide (3y)

The compound $3y$ was prepared according to the GP and purified by column chromatography in petroleum ether: ethyl acetate = 4:1. $3y$ was obtained as a white solid (117.0 mg, 67%). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 10.78 (s, 1H), 8.84 – 8.81 (m, 2H), 8.14 (dd, $J = 8.4, 1.2$ Hz, 1H), 7.58 – 7.52 (m, 2H), 7.43 (dd, $J = 8.0, 4.0$ Hz, 1H), 7.31 – 7.25 (m, 2H), 7.20 – 7.18 (m, 2H), 7.01 (d, $J = 8.4$ Hz, 2H), 5.02 (d, $J = 10.8$ Hz, 1H), 4.96 – 4.93 (m, 2H), 4.86 – 4.79 (m, 3H), 4.60 – 4.50 (m, 3H), 4.03 (dd, $J = 8.8, 3.6$ Hz, 1H), 3.78 (d, $J = 10.4$ Hz, 1H), 3.73 – 3.64 (m, 4H), 3.59 (dd, $J = 8.0, 4.0$ Hz, 1H), 3.49 (s, 3H), 3.27 (dd, $J = 14.0, 2.8$ Hz, 1H), 3.03 (dd, $J = 14.3, 8.4$ Hz, 1H); $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ = 170.94, 156.32, 148.69, 139.04, 138.65, 138.37, 138.26, 138.17, 136.26, 134.05, 132.05, 130.63, 128.53, 128.51, 128.49, 128.47, 128.33, 128.12, 128.07, 127.99, 127.92, 127.86, 127.76, 127.72, 127.34, 122.09, 121.74, 116.99, 116.91, 116.72, 102.01, 84.79, 84.71, 82.14, 77.85, 75.86, 75.23, 75.16, 75.11, 73.61, 68.98, 59.38, 38.84; HRMS (ESI) $m/z$: 867.3567 (MNa$^+$); calc. for C$_{53}$H$_{52}$N$_2$O$_8$: 867.3616.
(S)-tert-Butyl(2-methoxy-3-(4-methoxy-3-nitrophenyl)propanoyl)(quinolin-8-yl)carbamate (5a)

To a solution of 3a (152.6 mg, 0.4 mmol) in dry MeCN (4 mL) were added di-tert-butyl dicarbonate (Boc₂O, 261.9 mg, 1.2 mmol) and N,N-dimethylpyridin-4-amine (DMAP, 97.7 mg, 0.8 mmol). The mixture was stirred at room temperature for 4 hours. Then the reaction was diluted with dichloromethane (15 mL), washed by water (15 mL), brine (20 mL), and dried over anhydrous MgSO₄. Evaporation of organic solvent and purification by column chromatography in petroleum ether: ethyl acetate = 2:1 gave the product 5a as a white solid (146.3 mg, 76%).

\[
\begin{align*}
\text{O}_2\text{N} & \quad \text{MeO} & \quad \text{CO}_2\text{Me} \\
\text{O}_2\text{N} & \quad \text{PhO} & \quad \text{MeO} & \quad \text{CO}_2\text{Et}
\end{align*}
\]

(S)-2-Methoxy-3-(4-methoxy-3-nitrophenyl)propanoic acid (4a)

To a solution of 5a (48.1 mg, 0.1 mmol) in THF/H₂O (3:1, 0.5 mL) were added LiOH (4.8 mg, 0.2 mmol) and H₂O₂ (30%, 50 μL, 0.5 mmol). The mixture was stirred at room temperature for 4 hours. Then the reaction was acidified by HCl (0.5 M, 12 mL), diluted with ethyl acetate (15 mL), washed by water (15 mL), brine (20 mL), and dried over anhydrous MgSO₄. Evaporation of organic solvent and...
purification by column chromatography in petroleum ether: ethyl acetate = 1:1 gave the product 4a as a light yellow oil (25.5 mg, 100%) with 4b (24.1 mg, 100%) isolated. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.74 (d, $J = 1.7$ Hz, 1H), 7.44 (dd, $J = 8.5$, 1.8 Hz, 1H), 7.02 (d, $J = 8.6$ Hz, 1H), 3.99 (dd, $J = 7.4$, 4.2 Hz, 1H), 3.94 (s, 3H), 3.42 (s, 3H), 3.12 (dd, $J = 14.3$, 4.0 Hz, 1H), 3.01 (dd, $J = 14.4$, 7.5 Hz, 1H); $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 175.99, 152.13, 139.48, 135.54, 129.03, 126.57, 113.72, 80.63, 58.85, 56.68, 37.28; HRMS (EI) $m/z$: 255.0745 (M$^+$); calc. for C$_{11}$H$_{13}$NO$_6$: 255.0743.

**tert-Butyl quinolin-8-ylcarbamate (4b)**

\[
\begin{array}{c}
\text{N} \\
\text{O} \\
\text{O} \\
\end{array}
\]

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 9.02 (s, 1H), 8.79 (dd, $J = 4.1$, 1.5 Hz, 1H), 8.42 (d, $J = 7.4$ Hz, 1H), 8.13 (dd, $J = 8.2$, 1.4 Hz, 1H), 7.51 (t, $J = 8.0$ Hz, 1H), 7.46 – 7.35 (m, 2H), 1.58 (s, 9H); $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 153.05, 148.09, 138.41, 136.37, 135.35, 128.21, 127.49, 121.63, 120.28, 114.59, 80.54, 28.55; HRMS (EI) $m/z$: 244.1210 (M$^+$); calc. for C$_{14}$H$_{16}$N$_2$O$_2$: 244.1212.

1-Iodo-4-(3-(4-phenoxyphenoxy)propoxy)benzene (2z)

To a solution of 4-phenoxyphenol (1.86 g, 10 mmol) and 1,3-dibromopropane (10.09 g, 50 mmol) in anhydrous DMF (50 mL) was slowly added cesium carbonate (4.24 g, 13 mmol). The resulting suspension was heated at 65 °C overnight. After being allowed to cool to the room temperature, the reaction mixture was diluted with water (50 mL). Then the aqueous layer was extracted with Et$_2$O (3 × 50 mL). The organic layer was washed by brine (2 × 40 mL), and dried over anhydrous MgSO$_4$. Evaporation of organic solvent and purification by column chromatography in petroleum ether: ethyl acetate = 50:1 gave the product 1-(3-bromopropoxy)-4-phenoxybenzene as a yellow liquid.

To a solution of 4-iodophenol (1.32 g, 6 mmol) and 1-(3-bromopropoxy)-4-phenoxybenzene (2.03 g, 6.6 mmol) in anhydrous DMF (30 mL) was slowly added cesium carbonate (2.35 g, 7.2 mmol). The resulting suspension was heated at 65 °C overnight. After being allowed to cool to the room temperature, the reaction mixture was diluted with water (30 mL). Then the aqueous layer was extracted with Et$_2$O (3 × 40 mL). The organic layer was washed by brine (2 × 20 mL), and dried over anhydrous MgSO$_4$. Evaporation of organic solvent and purification by column chromatography in petroleum ether: ethyl acetate = 50:1 gave the product 2z as a white solid. $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 7.56 (d, $J = 8.5$ Hz, 2H), 7.31 (t, $J = 7.7$ Hz, 2H), 7.05 (t, $J = 7.0$ Hz, 2H), 7.00 – 6.93 (m, 4H), 6.90 (d, $J = 8.9$ Hz, 2H), 6.71 (d, $J = 8.5$ Hz, 2H), 4.14 (t, $J = 6.0$ Hz, 4H), 2.31 – 2.21 (m, 2H); $^{13}$C NMR (101 MHz, CDCl$_3$) $\delta$ 158.88, 158.58, 155.22, 150.39, 138.35, 129.74, 122.59, 117.75, 117.06, 115.65, 82.90, 77.48, 77.16, 76.84, 64.87, 64.67, 29.38; HRMS (EI) $m/z$: 446.0381 (M$^+$); calc. for C$_{21}$H$_{19}$IO$_3$: 446.0379.
(S)-2-Methoxy-3-(4-(3-(4-phenoxyphenoxy)propoxy)phenyl)-N-(quinolin-8-yl)propanamide (3z)

The compound 3z was prepared according to the GP (using 1a and 2z as substrates) and purified by column chromatography in petroleum ether: ethyl acetate = 2:1. 3z was obtained as a light yellow oil (72.5 mg, 66%). 1H NMR (400 MHz, CDCl3) δ 10.74 (s, 1H), 8.91 – 8.71 (m, 2H), 8.15 (d, J = 7.6 Hz, 1H), 7.63 – 7.49 (m, 2H), 7.44 (dd, J = 8.2, 4.2 Hz, 1H), 7.29 (t, J = 7.9 Hz, 2H), 7.25 (d, J = 9.8 Hz, 2H), 7.04 (t, J = 7.4 Hz, 1H), 7.01 – 6.91 (m, 4H), 6.88 (d, J = 8.9 Hz, 2H), 6.83 (d, J = 8.4 Hz, 2H), 4.12 (dd, J = 11.0, 5.6 Hz, 4H), 4.02 (dd, J = 8.3, 3.5 Hz, 1H), 3.49 (s, 3H), 3.24 (dd, J = 14.3, 3.3 Hz, 1H), 3.02 (dd, J = 14.3, 8.4 Hz, 1H), 2.23 (dt, J = 11.8, 5.8 Hz, 2H); 13C NMR (101 MHz, CDCl3) δ 170.97, 158.59, 157.68, 155.28, 150.26, 148.62, 138.98, 136.21, 134.03, 130.55, 129.87, 129.69, 128.07, 127.30, 122.51, 122.03, 121.67, 120.90, 117.68, 116.68, 115.62, 114.44, 84.73, 65.03, 64.40, 59.26, 38.65, 29.45; HRMS (EI) m/z: 548.2310 (M+); calc. for C34H32N2O5: 548.2311.
(S)-tert-Butyl-(2-methoxy-3-(4-(3-(4-phenoxyphenoxy)propoxy)phenyl)propanoyl)(quinolin-8-yl)carbamate (5b)

To a solution of 3z (53.5 mg, 0.1 mmol) in dry MeCN (1 mL) were added di-tert-butyl dicarbonate (Boc₂O, 65.5 mg, 0.3 mmol) and N,N-dimethylpyridin-4-amine (DMAP, 24.4 mg, 0.2 mmol). The mixture was stirred at room temperature for 8 hours. Then the reaction was diluted with dichloromethane (10 mL), washed by water (10 mL), brine (10 mL), and dried over anhydrous MgSO₄. Evaporation of organic solvent and purification by column chromatography in petroleum ether: ethyl acetate = 2:1 gave the product 5b as light yellow oil (53.2 mg, 82%). 1H NMR (400 MHz, CDCl3) δ 8.86 (s, 1H), 8.14 (d, J = 8.1 Hz, 1H), 7.80 (d, J = 8.1 Hz, 1H), 7.53 (t, J = 7.7 Hz, 1H), 7.43 (d, J = 7.2 Hz, 1H), 7.39 (dd, J = 7.9, 4.0 Hz, 1H), 7.36 – 7.22 (m, 4H), 7.14 – 6.72 (m, 9H), 5.25 (d, J = 7.2 Hz, 1H), 4.15 (dd, J = 11.7, 5.7 Hz, 4H), 3.57 – 3.16 (m, 4H), 2.96 (dd, J = 13.9, 9.0 Hz, 1H), 2.40 – 2.12 (m, 2H), 1.22 (s, 9H); 13C NMR (101 MHz, CDCl3) δ 175.86, 158.63, 157.60, 155.33, 152.90, 150.44, 150.23, 144.22, 136.63, 136.00, 130.85, 130.73, 129.70, 128.98, 128.21, 126.14, 122.51, 121.63, 120.94, 117.68, 115.64, 114.35, 82.90, 65.08, 64.44, 58.30, 38.80, 29.51, 27.70.
(S)-2-Methoxy-3-(4-(3-(4-phenoxyphenoxy)propoxy)phenyl)propanoic acid (4c)
To a solution of 5b (45.1 mg, 0.07 mmol) in THF/H₂O (3:1, 0.5 mL) were added LiOH (3.4 mg, 0.14 mmol) and H₂O₂ (30%, 35 μL, 0.35 mmol). The mixture was stirred at room temperature for 4 hours. Then the reaction was acidified by HCl (0.5 M, 10 mL), diluted with ethyl acetate (10 mL), washed by water (10 mL), brine (10 mL), and dried over anhydrous MgSO₄. Evaporation of organic solvent and purification by column chromatography in petroleum ether: ethyl acetate = 1:1 gave the product 4c as a light yellow oil (30.5 mg, 100%) with 4b (17.0 mg, 100%) isolated. ¹H NMR (400 MHz, CDCl₃) δ 7.30 (t, J = 7.9 Hz, 2H), 7.17 (d, J = 8.3 Hz, 2H), 7.04 (t, J = 7.3 Hz, 1H), 7.00 – 6.91 (m, 4H), 6.91 – 6.81 (m, 4H), 4.14 (t, J = 5.1 Hz, 4H), 3.98 (dd, J = 6.9, 4.1 Hz, 1H), 3.40 (s, 3H), 3.09 (dd, J = 14.2, 3.8 Hz, 1H), 2.97 (dd, J = 14.2, 7.6 Hz, 1H), 2.30 – 2.20 (m, 2H); ¹³C NMR (101 MHz, CDCl₃) δ 176.02, 158.62, 157.96, 155.30, 150.30, 130.57, 129.73, 128.75, 122.56, 120.95, 117.72, 115.65, 114.56, 81.56, 65.03, 64.47, 58.76, 37.83, 29.50; HRMS (ESI) m/z: 421.4 ([M-H]-); calc. for C₂₅H₂₅O₆⁻: 421.2.

4-(2-(4-Iodophenoxy)ethyl)phenyl methanesulfonate (2aa)

A mixture of 4-hydroxyphenethyl alcohol (2.76 g, 20 mmol) and triethylamine (8.8 mL, 63 mmol) in anhydrous dichloromethane (40 mL) was stirred at 0 °C. Then methane sulfonic chloride (4.0 ml, 50 mmol) was slowly added to the solution. After stirring for 30 minutes, the reaction was diluted with ethyl acetate (20 mL), washed by aqueous NH₄Cl (40 mL), brine (20 mL), and dried over anhydrous MgSO₄. After evaporation of organic solvent, the crude product was directly used for the next step without any purification.

The crude product 4-(2-((methylsulfonyl)oxy)ethyl)phenyl methanesulfonate (20 mmol) was dissolved in acetonitrile (30 mL). The resulting solution was then slowly added to a mixture of 4-iodophenol (11.0 g, 50 mmol) and potassium carbonate (8.29g, 60.0 mmol) in acetonitrile (50 mL). The reaction was heated at a refluxing temperature for 3.0 h. After being allowed to cool to room temperature, the reaction mixture was filtered through a pad of Celite. After the evaporation of the solvent, the mixture was diluted with dichloromethane (50 mL), washed by water (40 mL), brine (20 mL), and dried over anhydrous MgSO₄. Evaporation of the solvent and purification by column chromatography in petroleum ether: ethyl acetate = 3:1 gave the product 2aa as a white solid. ¹H NMR (400 MHz, CDCl₃) δ 7.54 (d, J = 8.8 Hz, 2H), 7.32 (d, J = 8.4 Hz, 2H), 7.23 (d, J = 8.8 Hz, 2H), 6.66 (d, J = 8.8 Hz, 2H), 4.13 (t, J = 6.8 Hz, 1H), 3.13 (s, 2H), 3.09 (t, J = 6.8 Hz, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 158.65, 148.05, 138.40, 137.80, 130.67, 122.18, 117.08, 83.09, 68.45, 37.48, 35.15; HRMS (EI) m/z: 417.9738 (M⁺); calc. for C₁₅H₁₃I₂O₄S: 417.9736.
(S)-4-((2-(4-(2-Ethoxy-3-oxo-3-(quinolin-8-ylamino)propyl)phenoxy)ethyl)phenyl methanesulfonate (3aa)

The compound 3aa was prepared according to the GP (using 1b and 2aa as substrates) and purified by column chromatography in petroleum ether: ethyl acetate = 2:1. 3aa was obtained as a light yellow oil (56.5 mg, 53%). $^1$H NMR (400 MHz, CDCl3) $\delta$ 10.92 (s, 1H), 8.91 – 8.70 (m, 2H), 8.13 (dd, $J = 8.2$, 1.0 Hz, 1H), 7.59 – 7.48 (m, 2H), 7.42 (dd, $J = 8.2$, 4.2 Hz, 1H), 7.31 (d, $J = 8.4$ Hz, 2H), $7.27 – 7.24$ (m, 2H), 7.21 (d, $J = 8.5$ Hz, 2H), 6.80 (d, $J = 8.4$ Hz, 2H), 4.12 (t, $J = 6.7$ Hz, 2H), 4.05 (dd, $J = 8.9$, 3.1 Hz, 1H), 3.64 (tt, $J = 14.0$, 7.0 Hz, 1H), 3.49 (dq, $J = 14.1$, 7.0 Hz, 1H), 3.23 (dd, $J = 14.2$, 3.0 Hz, 1H), 3.12 (s, 3H), 3.06 (t, $J = 6.7$ Hz, 2H), 2.97 (dd, $J = 14.2$, 9.0 Hz, 1H), 1.29 (t, $J = 7.0$ Hz, 3H); $^{13}$C NMR (101 MHz, CDCl3) $\delta$ 171.47, 157.40, 148.61, 147.96, 139.02, 138.13, 136.24, 134.15, 130.66, 130.64, 130.49, 128.10, 127.34, 122.04, 121.99, 121.72, 116.56, 114.42, 82.93, 68.25, 67.38, 39.04, 37.38, 35.24, 15.37; HRMS (EI) m/z: 534.1829 (M$^+$); calc. for C$_{29}$H$_{30}$N$_2$O$_6$S: 534.1825.

(S)-4-((2-(4-(3-(tert-Butoxycarbonyl)(quinolin-8-yl)amino)-2-ethoxy-3-oxopropyl)phenoxy)ethyl)phenyl methanesulfonate (5c)

To a solution of 3aa (53.5 mg, 0.1 mmol) in dry MeCN (1 mL) were added di-tert-butyl dicarbonate (Boc$_2$O, 65.5 mg, 0.3 mmol) and N,N-dimethylpyridin-4-amine (DMAP, 24.4 mg, 0.2 mmol). The mixture was stirred at room temperature for 8 hours. Then the reaction was diluted with dichloromethane (10 mL), washed by water (10 mL), brine (10 mL), and dried over anhydrous MgSO$_4$. Evaporation of organic solvent and purification by column chromatography in petroleum ether: ethyl acetate = 2:1 gave the product 5c as light yellow oil (44.0 mg, 69%). $^1$H NMR (400 MHz, CDCl3) $\delta$ 8.86 (dd, $J = 4.1$, 1.5 Hz, 1H), 8.16 (dd, $J = 8.2$, 1.4 Hz, 1H), 7.81 (d, $J = 8.2$ Hz, 1H), 7.53 (t, $J = 7.8$ Hz, 1H), 7.46 – 7.37 (m, 2H), 7.36 – 7.31 (m, 3H), 7.23 (d, $J = 8.6$ Hz, 2H), 6.84 (d, $J = 8.5$ Hz, 2H), 5.34 – 5.21 (m, 1H), 4.18 (t, $J = 6.7$ Hz, 2H), 3.66 (dq, $J = 14.0$, 7.0 Hz, 1H), 3.44 – 3.30 (m, 2H), 3.24 – 2.99 (m, 5H), 2.96 (dd, $J = 14.0$, 9.1 Hz, 1H), 1.22 (s, 9H), 1.11 (t, $J = 7.0$ Hz, 3H); $^{13}$C NMR (101 MHz, CDCl3) $\delta$ 176.34, 157.33, 152.99, 150.45, 148.02, 144.30, 138.26, 136.78, 136.01, 130.85, 130.73, 129.00, 128.19, 126.17, 122.08, 121.64, 114.33, 100.13, 82.86, 81.35, 68.34, 66.13, 38.90, 37.40, 35.34, 27.75, 15.34.

(S)-2-Ethoxy-3-(4-((methylsulfonyl)oxy)phenethoxy)phenyl)propanoic acid (4d)
To a solution of 5c (38.1 mg, 0.06 mmol) in THF/H2O (3:1, 0.5 mL) were added LiOH (2.9 mg, 0.12 mmol) and H2O2 (30%, 30 μL, 0.3 mmol). The mixture was stirred at room temperature for 4 hours. Then the reaction was acidified by HCl (0.5 M, 8 mL), diluted with ethyl acetate (10 mL), washed by water (10 mL), brine (10 mL), and dried over anhydrous MgSO4. Evaporation of organic solvent and purification by column chromatography in petroleum ether: ethyl acetate = 1:1 gave the product 4d as a light yellow oil (25.7 mg, 100%) with 4b (14.8 mg, 100%) isolated. 1H NMR (400 MHz, CDCl3) δ 7.33 (d, J = 8.4 Hz, 2H), 7.22 (d, J = 8.5 Hz, 2H), 7.15 (d, J = 8.4 Hz, 2H), 6.81 (d, J = 8.4 Hz, 2H), 4.14 (t, J = 6.7 Hz, 2H), 4.04 (dd, J = 7.3, 4.2 Hz, 1H), 3.60 (dt, J = 14.0, 7.0 Hz, 1H), 3.49 – 3.37 (m, 1H), 3.13 (s, 3H), 3.11 – 3.02 (m, 3H), 2.94 (dd, J = 14.1, 7.7 Hz, 1H), 1.17 (t, J = 6.9 Hz, 3H); 13C NMR (101 MHz, CDCl3) δ 175.13, 157.71, 147.98, 138.10, 130.70, 130.68, 128.10, 114.54, 79.89, 68.30, 66.97, 37.87, 37.42, 35.28, 15.18; HRMS (ESI) m/z: 407.5 ([M-H]-); calc. for C20H23O7S-: 407.2.
References

$^1$H NMR (400 MHz, CDCl$_3$) δ 10.82 (s, 1H), 8.88 (dd, $J = 4.2, 1.8$ Hz, 2H), 7.98 (s, 1H), 7.59-7.82 (m, 5H), 7.46-7.56 (m, 2H), 7.19 (s, 1H), 6.81 (dd, $J = 8.3, 1.8$ Hz, 2H), 5.45 (s, 2H), 4.23 (s, 2H), 3.90 (q, $J = 6.8$ Hz, 2H), 2.44 (s, 3H), 1.35 (s, 3H).

$^13$C NMR (100 MHz, CDCl$_3$) δ 172.02, 148.68, 138.84, 138.32, 134.16, 132.66, 132.45, 129.26, 128.16, 121.98, 121.60, 116.60, 79.22, 57.99, 38.45.
^1H NMR (400 MHz, CDCl₃) δ 10.53 (s, 1H), 8.83 (dd, J = 4.5, 1.1 Hz, 1H), 8.16 (dt, J = 4.9, 1.9 Hz, 2H), 8.06 (dd, J = 8.3, 1.1 Hz, 1H), 7.51 - 7.58 (m, 1H), 7.45 (dd, J = 8.3, 4.2 Hz, 1H), 4.06 (q, J = 6.8 Hz, 2H), 3.81 - 3.80 (m, 2H), 1.55 (d, J = 8.3 Hz, 3H), 1.41 (t, J = 7.0 Hz, 3H).

^13C NMR (101 MHz, CDCl₃) δ 172.87, 168.64, 159.89, 158.20, 154.48, 132.14, 127.40, 121.93, 121.74, 116.59, 77.61, 66.30, 60.24, 31.54.
$^1$H NMR (400 MHz, CDCl$_3$): 8 10.77 (s, 1H); 8.97 – 8.67 (m, 2H); 8.41 (d, $J$= 13.2, 7.4 Hz, 1H); 7.63 – 7.44 (m, 2H); 7.43 (d, $J$= 12.2, 4.2 Hz, 1H); 7.25 – 7.09 (m, 3H); 7.01 (d, $J$= 8.3 Hz, 1H); 4.86 (dd, $J$= 5.1, 3.4 Hz, 1H); 3.45 (s, 3H); 3.27 (dd, $J$= 14.2, 3.2 Hz, 1H); 3.91 (d, $J$= 14.2, 3.3 Hz, 1H); 3.29 (s, 3H).

[Graphical representation of NMR spectra with specific chemical shifts and coupling constants]
$^1$H NMR (400 MHz, CDCl₃): δ 10.76 (s, 1H), 8.99 – 8.76 (m, 2H), 8.16 (d, $J = 4.2$ Hz, 1H), 7.81 – 7.51 (m, 3H), 7.49 (s, 1H), 7.34 (s, 1H), 7.21 (d, $J = 8.0$ Hz, 1H), 4.45 (dd, $J = 4.1$, 3.1 Hz, 1H), 3.77 (s, 3H), 3.51 (s, 3H), 3.24 (dd, $J = 14.3$, 3.1 Hz, 1H), 2.94 (dd, $J = 14.3$, 8.4 Hz, 1H).

$^{13}$C NMR (100 MHz, CDCl₃): δ 170.90, 158.50, 148.67, 138.26, 133.91, 133.89, 128.04, 125.67, 124.00, 116.51, 115.70, 113.70, 113.49, 130.51, 136.72, 132.26, 128.84, 121.68, 116.65, 115.70, 54.72, 38.26, 38.67.
$^1$H NMR (400 MHz, CDCl$_3$): 6.10 (s, 3H), 8.52 (dd, $J =$ 4.0, 12.3 Hz, 1H), 8.00 (dd, $J =$ 6.5, 3.5 Hz, 1H), 8.15 (dd, $J =$ 9.2, 1.0 Hz, 1H), 7.60 - 7.49 (m, 3H), 7.44 (dd, $J =$ 6.2, 4.2 Hz, 1H), 7.32 - 7.28 (m, 2H), 6.95 (s, 1H), 7.87 (d, $J =$ 2.3 Hz, 1H); 4.03 (dd, $J =$ 8.2, 3.5 Hz, 1H), 3.90 (t, 3H), 3.28 (dd, $J =$ 14.3, 3.2 Hz, 1H), 3.05 (d, $J =$ 14.3, 1.2 Hz, 1H).

$^13$C NMR (101 MHz, CDCl$_3$): 170.68, 165.12, 166.69, 148.71, 139.01, 134.28, 133.95, 133.34, 133.31, 134.12, 131.04, 128.12, 127.32, 127.17, 122.76, 110.73, 113.20, 115.01, 84.47, 56.32, 18.63.
$^1$H NMR (400 MHz, CDCl$_3$) δ 10.48 (s, 1H), 8.30 (d, $J$ = 2.7 Hz, 1H), 8.03 (dd, $J$ = 8.2, 2.7 Hz, 1H), 7.81 (d, $J$ = 8.5 Hz, 2H), 7.51 (d, $J$ = 4.5 Hz, 2H), 7.51 - 7.39 (m, 3H), 4.81 (dd, $J$ = 7.5, 3.2 Hz, 1H), 3.45 (s, 3H), 3.00 (dd, $J$ = 14.0, 3.2 Hz, 1H), 3.19 (s, 2H), 1.21 (s, 3H).

$^1^3$C NMR (100 MHz, CDCl$_3$) δ 149.22, 148.75, 147.03, 141.32, 131.89, 131.85, 131.67, 130.61, 129.12, 127.28, 123.58, 122.42, 121.85, 116.81, 83.69, 39.16, 39.98.
$^1$H NMR (400 MHz, CDCl$_3$): δ 10.73 (s, 1H), 8.86 – 8.79 (m, 2H), 8.16 (dd, $^J$ = 4.2, 1.0 Hz, 1H), 7.59 – 7.44 (m, 3H), 7.47 – 7.40 (m, 3H), 7.08 (dd, $^J$ = 8.1, 3.3 Hz, 1H), 7.31 (t, 3H), 3.34 (dd, $^J$ = 14.2, 3.3 Hz, 1H), 3.11 (dd, $^J$ = 14.1, 8.2 Hz, 1H).

$^{13}$C NMR (101 MHz, CDCl$_3$): δ 175.77, 145.74, 144.81, 138.50, 133.29, 131.85, 129.99, 129.46, 129.49, 129.84, 128.12, 127.30, 132.56, 131.89, 131.36, 131.33, 127.31, 127.56, 125.85, 126.44, 135.91, 131.78, 122.81, 122.38, 121.79, 116.74, 84.64, 59.34, 10.22.
$^1$H NMR (400 MHz, CDCl$_3$) δ 10.74 (s, 1H), 8.40-8.42 (m, 3H), 8.11 (dd, J=8.2, 3.1 Hz, 2H), 7.84 (d, J=8.1 Hz, 2H), 7.68-7.56 (m, 2H), 7.47-7.33 (m, 2H), 4.99 (dd, J=6.3, 3.3 Hz, 1H), 3.18 (q, 2H), 3.40 (s, 2H), 3.24 (d, J=14.1 Hz, 1H), 3.12 (dd, J=14.1, 8.4 Hz, 1H).

$^1$C NMR (100 MHz, CDCl$_3$) δ 178.0, 150.0, 148.0, 148.0, 134.0, 134.0, 129.0, 129.0, 128.6, 128.6, 128.6, 123.0, 127.3, 117.1, 116.7, 64.1, 59.7, 55.3, 39.4.
$^1$H NMR (400 MHz, CDCl$_3$) δ 10.76 (s, 1H), 9.30 – 8.67 (m, 2H), 8.15 (dd, J = 8.2, 1.6 Hz, 1H), 7.52 – 7.50 (m, 2H), 7.45 (dd, J = 8.2, 1.6 Hz, 1H), 7.31 – 7.24 (m, 2H), 7.06 (m, 2H), 4.05 (dd, J = 8.7, 3.4 Hz, 1H), 3.49 (s, 3H), 2.24 (dd, J = 14.2, 3.4 Hz, 1H), 2.20 (s, 6H).

$^1$C NMR (101 MHz, CDCl$_3$) δ 171.70, 148.65, 139.04, 138.40, 138.33, 137.20, 134.74, 134.15, 130.68, 128.71, 128.13, 127.37, 126.81, 122.03, 121.71, 116.77, 84.88, 59.35, 39.34, 18.79, 19.44.
$^1$H NMR (400 MHz, CDCl3): δ 10.66 (s, 1H), 8.81 (dd, $J_{2}=4.0$, 1.3 Hz, 1H), 8.56 (dd, $J_{2}=3.5$, 3.5 Hz, 1H), 8.54 (d, $J_{2}=5.2$ Hz, 1H), 7.87 (t, 1H), 7.34 (d, $J_{2}=7.2$ Hz, 2H), 7.48 (t, $J_{2}=7.2$ Hz, 2H), 6.95 (d, $J_{2}=8.3$ Hz, 1H), 5.17 (s, 2H), 4.04 (dd, $J_{2}=2.3$, 3.5 Hz, 1H), 3.54 (s, 3H), 3.32 (dd, $J_{2}=14.3$, 3.3 Hz, 1H), 3.08 (dd, $J_{2}=14.3$, 7.6 Hz, 1H).

$^13$C NMR (101 MHz, CDCl3): δ 170.11, 139.82, 148.76, 140.02, 138.95, 158.24, 137.79, 123.21, 123.75, 120.24, 128.74, 128.24, 138.89, 127.26, 127.94, 126.76, 122.27, 121.78, 118.78, 112.15, 59.78, 71.31, 59.24, 139.90.
$^1$H NMR (400 MHz, CDCl$_3$): δ 10.75 (s, 1H), 8.97 – 8.76 (m, 2H), 8.14 (dd, J = 8.2, 1.3 Hz, 1H), 7.60 – 7.49 (m, 2H), 7.44 (dd, J = 8.2, 4.2 Hz, 1H), 6.81 (s, 1H), 6.43 – 6.37 (m, 3H), 6.39 (t, J = 4.8 Hz, 2H, J = 8.2, 3.1 Hz, 1H), 3.19 (dd, J = 14.3, 3.1 Hz, 1H), 2.96 (dd, J = 14.3, 8.5 Hz, 1H).

$^1$H NMR (400 MHz, CDCl$_3$): δ 10.75 (s, 1H), 8.97 – 8.76 (m, 2H), 8.14 (dd, J = 8.2, 1.3 Hz, 1H), 7.60 – 7.49 (m, 2H), 7.44 (dd, J = 8.2, 4.2 Hz, 1H), 6.81 (s, 1H), 6.43 – 6.37 (m, 3H), 6.39 (t, J = 4.8 Hz, 2H, J = 8.2, 3.1 Hz, 1H), 3.19 (dd, J = 14.3, 3.1 Hz, 1H), 2.96 (dd, J = 14.3, 8.5 Hz, 1H).

$^1$H NMR (400 MHz, CDCl$_3$): δ 10.75 (s, 1H), 8.97 – 8.76 (m, 2H), 8.14 (dd, J = 8.2, 1.3 Hz, 1H), 7.60 – 7.49 (m, 2H), 7.44 (dd, J = 8.2, 4.2 Hz, 1H), 6.81 (s, 1H), 6.43 – 6.37 (m, 3H), 6.39 (t, J = 4.8 Hz, 2H, J = 8.2, 3.1 Hz, 1H), 3.19 (dd, J = 14.3, 3.1 Hz, 1H), 2.96 (dd, J = 14.3, 8.5 Hz, 1H).
$^1$H NMR (500 MHz, CDCl$_3$) δ 10.75 (s, 1H), 8.86 – 8.46 (m, 2H), 5.50 (s, 2H), 4.25 (s, 2H), 3.25 (s, 3H), 2.13 (s, 3H), 1.94 (s, 3H), 1.39 (s, 9H), 1.32 (s, 9H), 1.09 (s, 3H), 0.78 (s, 3H).

$^1$C NMR (101 MHz, CDCl$_3$) δ 170.45, 144.80, 132.30, 131.29, 130.13, 129.74, 129.12, 127.37, 127.80, 126.80, 122.14, 112.11, 110.11, 108.72, 104.52, 101.12, 84.59, 55.59, 52.99, 42.15, 39.86, 39.24.
$^1$H NMR (400 MHz, CDCl3): δ 7.74 (d, J = 8.7 Hz, 1H), 7.44 (dd, J = 8.5, 1.5 Hz, 1H), 7.32 (d, J = 8.6 Hz, 1H), 7.30 (d, J = 7.4, 4.2 Hz, 1H), 3.94 (s, 3H), 3.42 (s, 1H), 3.32 (dd, J = 14.3, 4.0 Hz, 1H), 1H). 3H (d, J = 14.6, 7.3 Hz, 1H).

$^{13}$C NMR (101 MHz, CDCl3): δ 175.99, 152.11, 139.45, 133.54, 129.03, 126.57, 113.72, 88.60, 56.78, 44.45.
$^1$H NMR (400 MHz, CDCl3): 8.92 (s, 1H), 8.79 (dd, J = 4.1, 13 Hz, 1H), 8.42 (d, J = 7.4 Hz, 1H), 8.31 (dd, J = 8.9 Hz, 1H), 8.14 (d, J = 1.4 Hz, 1H), 7.51 (t, J = 8.0 Hz, 1H), 7.46 – 7.35 (m), 7.25, 1.51 (o, 2H).

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$^1$H NMR (400 MHz, CDCl3): 8.82, 8.80, 8.79, 8.31, 8.14, 7.53, 7.51, 7.49, 7.44, 7.42, 7.41, 7.40, 5.28.
$^1$H NMR (400 MHz, CDCl$_3$): δ 7.56 (d, J = 8.3 Hz, 2H), 7.51 (d, J = 7.3 Hz, 2H), 7.05 (d, J = 7.9 Hz, 2H), 7.00 (d, J = 8.5 Hz, 2H), 6.93 (m, 4H), 6.80 (d, J = 8.9 Hz, 2H), 6.71 (d, J = 8.5 Hz, 2H). 4.14 (q, J = 6.5 Hz, 4H), 2.31 – 2.25 (m, 2H).

$^13$C NMR (100 MHz, CDCl$_3$): δ 158.88, 138.35, 138.35, 128.74, 122.59, 129.94, 117.75, 117.06, 115.65, 82.90, 77.48, 77.16, 76.84, 64.37, 64.47, 26.38.
$^1H$ NMR (400 MHz, CDCl$_3$): δ 7.54 (d, $J=8.9$ Hz, 2H), 7.32 (d, $J=8.5$ Hz, 2H), 7.23 (d, $J=8.6$ Hz, 2H), 6.88 (d, $J=8.9$ Hz, 2H), 4.13 (q, $J=6.7$ Hz, 2H), 3.31 (p, 2H), 1.09 (t, $J=6.7$ Hz, 2H).

$^13C$ NMR (101 MHz, CDCl$_3$): δ 138.65, 148.07, 138.40, 137.80, 136.87, 132.18, 131.70, 131.55, 130.68, 128.97, 127.92. 

A (s) 7.54
B (s) 7.73
C (s) 7.23
D (d) 6.66
E (s) 4.13
F (s) 3.13
G (s) 3.09
$^{13}$C NMR (101 MHz, CDCl$_3$) δ 176.34, 157.13, 152.99, 130.45, 148.92, 144.30, 138.30, 136.78, 136.01, 130.85, 136.73, 129.00, 128.10, 128.17, 128.80, 124.34, 114.53, 100.13, 82.54, 81.53, 68.54, 60.13, 30.30, 37.49, 35.34, 27.73, 15.34.

$^{1}H$ NMR (400 MHz, CDCl$_3$) δ 8.64 (dt, J = 4.1, 1.5 Hz, 1H), 8.16 (dd, J = 5.1, 1.4 Hz, 1H), 7.51 (d, J = 1.3 Hz, 1H), 7.58 (t, J = 7.8 Hz, 1H), 7.46 – 7.37 (m, 1H), 7.28 – 7.21 (m, 2H), 7.22 (d, J = 8.9 Hz, 2H), 6.84 (d, J = 8.9 Hz, 2H), 5.23 (m, 1H), 4.19 (q, J = 6.7 Hz, 2H), 3.66 (q, J = 4.0, 0.7 Hz, 1H), 1.44 – 3.19 (m, 20H).

8.34 – 2.90 (m, 38H), 3.36 (dd, J = 14.0, 8.1 Hz, 1H), 1.22 (s, 9H), 1.11 (s, J = 7.0 Hz, 3H).
$^1$H NMR (500 MHz, CDCl$_3$) δ 7.33 (d, $\text{J} = 8.4$ Hz, 2H), 7.22 (d, $\text{J} = 8.5$ Hz, 2H), 7.15 (d, $\text{J} = 8.4$ Hz, 2H), 8.11 (d, $\text{J} = 8.4$ Hz, 2H), 4.14 (t, $\text{J} = 7.3$ Hz, 2H), 4.06 (dd, $\text{J} = 14.0$, 7.0 Hz, 2H), 3.49 – 3.37 (m, 6H), 2.24 – 2.09 (m, 4H), 1.31 (s, 3H), 1.11 – 1.02 (m, 6H), 2.84 (d, $\text{J} = 14.1$, 1.7 Hz, 2H), 1.17 (t, $\text{J} = 6.9$ Hz, 3H).

$^13$C NMR (101 MHz, CDCl$_3$) δ 15.77, 71.73, 147.08, 130.79, 136.82, 130.92, 114.54, 79.89, 66.30, 66.87, 37.87, 37.42, 35.38, 15.12.