Supporting Information for

1,3-Iodo-Amination of 2-Methyl Indoles as C_{sp2}– C_{sp3} Dual Functionalization with Iodine Reagent

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Table of contents

1. General Methods. .......................................................... S2

2. Procedure for Preparation of Indolyl(phenyl)iodonium Imides (2a) (Scheme 1; eq. 3). .......... S2

3. Procedure for Iodo-amination of Indolyl(phenyl)iodonium Imides (2a) (Scheme 1; eq. 4). .... S4

4. General Procedure for Direct Iodo-amination of 2-Methyl Indole Derivatives (1) with PhI(OAc)_2 and DIH (Method A) (Scheme 2; eq. 5, Table 1, and Table 2). ........................................ S6

5. General Procedure for Direct Iodo-amination of 2-Methyl Indole Derivatives (1) with DIH (Method B) (Scheme 2; eq. 6, Table 1, and Table 2). ........................................ S6

6. Derivatization of 2-Aminomethyl-3-iodo indole Derivatives (3b) (Scheme 5). ......................... S15

7. ^1H and ^13C NMR Spectra of Materials .................................................................................. S23
1. General Methods. $^1$H NMR spectra were measured on a JEOL ECS-400 (400 MHz) spectrometer at ambient temperature. Data were recorded as follows: chemical shift in ppm from internal tetramethylsilane on the $\delta$ scale, multiplicity ($s$ = singlet; $d$ = doublet; $t$ = triplet; $q$ = quartet; sep = septet; $m$ = multiplet; $br$ = broad), coupling constant (Hz), integration, and assignment. $^{13}$C NMR spectra were measured on a JEOL ECS-400 (100 MHz) spectrometer. Chemical shifts were recorded in ppm from the solvent resonance employed as the internal standard (deuterochloroform at 77.0 ppm). High-resolution mass spectra were recorded by Thermo Fisher Scientific Exactive Orbitrap mass spectrometers. Infrared (IR) spectra were recorded on a JASCO FT/IR 4100 spectrometer. Single crystal X-ray diffraction data were collected at 173K on a Bruker SMART APEX II CCD diffractometer with Mo K$\alpha$ ($\lambda$ = 0.71073) radiation and graphite monochromator. For thin-layer chromatography (TLC) analysis throughout this work, Merck precoated TLC plates (silica gel 60GF254 0.25 mm) were used. The products were purified by neutral column chromatography on silica gel (Kanto Chemical Co., Inc. silica gel 60N, Prod. No. 37560-84; Merck silica gel 60, Prod. No. 1.09385.9929). Visualization was accomplished by UV light (254 nm), anisaldehyde, KMnO$_4$, and phosphomolybdic acid. In experiments that required dry solvents such as CH$_2$Cl$_2$, MeCN, CHCl$_3$, and THF were distilled in prior to use.

2. Procedure for Preparation of Indolyl(phenyl)iodonium Imides (2a) (Scheme 1; eq. 3).

A mixture of PhI(OAc)$_2$ (193.3 mg, 0.60 mmol) and Ts$_2$NH (195.2 mg, 0.60 mmol) in CH$_2$Cl$_2$ (5 mL) was stirred at room temperature for 30 min under argon atmosphere. Then, $N$-pivaloly 2-methyl indol (1a) (107.65 mg, 0.50 mmol) was added, and the solution was stirred at room temperature for 2 h. Volatile solvents were removed under reduced pressure. AcOEt (6 mL) was added to the residue, and ether was added dropwise until the solution became cloudy. Then the mixture was sonicated until a white solid appeared and then ether (2 mL) was added to the solution. The precipitated solid was washed with a mixture of AcOEt and hexane (2:1) (15 mL) to give desired product 2a (322.6 mg, 87 % yield).

\[
\text{Ph} - I - \text{NTs}_2
\]

\[
\text{4-Methyl-N-((2-methyl-1-pivaloyl-1H-indol-3-yl)(phenyl)-}^{3}\text{-iodanyl})-N\text{-tosylbenzenesulfonamide (2a):}
\]

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 1.32 (s, 9H), 2.25 (s, 6H), 2.68 (s, 3H), 6.91 (d, $J$ = 8.1 Hz, 4H), 7.21-7.26 (m, 1H), 7.27-7.34 (m, 4H), 7.45 (d, $J$ = 8.1 Hz, 4H), 7.43-7.48 (m, 1H), 7.49-7.53 (m, 1H), 7.86-7.91 (m, 2H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 14.4, 21.3 (2C), 27.9 (3C), 44.8, 82.0, 112.2, 115.9, 119.4, 123.5, 124.5, 126.7 (4C), 127.6, 128.4 (4C), 131.4, 131.7 (2C), 131.9, 132.4, 132.8 (4C), 133.1, 133.6, 137.4 (2C), 137.9.
133.5 (2C), 135.8, 140.5 (2C), 141.2 (2C), 143.1, 185.2. IR (neat) 1730, 1451, 1263, 1131, 1082, 1035, 814, 746, 669 cm$^{-1}$. MS (ESI) calcd for C$_{34}$H$_{35}$IN$_2$NaO$_5$S$_2$ [M+Na]$^+$ 765.0924, found 765.0908.

**Crystal data of 2a:** Formula C$_{34}$H$_{35}$IN$_2$O$_5$S$_2$, colorless, crystal dimensions 0.20 × 0.20 × 0.10 mm$^3$, Triclinic, space group P -1, a = 12.2348(9) Å, b = 13.7713(10) Å, c = 21.3593(15) Å, α = 74.8147(9) °, β = 78.2115(10) °, γ = 80.1920(9) °, V = 3373.8(4) Å$^3$, Z = 4, ρ$_{calc}$ = 1.462 g cm$^{-3}$, F(000) = 1512, μ(MoKα) = 1.115 mm$^{-1}$, T = 173 K. 19506 reflections collected, 14722 independent reflections with I > 2σ(I) (2θ$_{max}$ = 27.56°), and 805 parameters were used for the solution of the structure. The non-hydrogen atoms were refined anisotropically. $R_1 = 0.0409$ and $wR_2 = 0.1113$. GOF = 1.044. Crystallographic data (excluding structure factors) for the structure reported in this paper have been deposited with the Cambridge Crystallographic Data Centre as supplementary publication no. CCDC-1532903. Copies of the data can be obtained free of charge on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK [Fax: int. code + 44(1223)336-033; E-mail: deposit@ccdc.cam.ac.uk].

*Figure S1.* ORTEP drawing of 2a (dimer structure).
3. Procedure for Iodo-amination of Indolyl(phenyl)iodonium Imides (2a) (Scheme 1; eq. 4).

To a solution of 4-methyl-N-(phenyl(1-pivaloyl-2-methyl-1H-indol-3-yl)-\(\lambda^3\)-iodanyl)-\(N\)-tosylbenzenesulfonamide (2a) (74.3 mg, 0.10 mmol) in CH\(_2\)Cl\(_2\) (1.0 mL) was added 1,3-diiodo-5,5-dimethylhydantoin (22.8 mg, 0.060 mmol). The mixture was stirred at room temperature for 7 h under argon atmosphere. Then, saturated Na\(_2\)SO\(_3\) aqueous solution (10 mL) was added to the reaction mixture, and the product was extracted with AcOEt (15 mL \(\times\) 3). The combined extracts were washed by water (10 mL) and brine (10 mL), and dried over Na\(_2\)SO\(_4\). The organic phase was concentrated under reduced pressure and the crude product was purified by silica gel column chromatography (eluent: hexane/AcOEt = 5/1), to give the desired product 3a (61.1 mg, 92% yield).

**Table S1.** Screening for Halogen Reagent and Solvent for Halo-amination of 2a.
<table>
<thead>
<tr>
<th>Entry</th>
<th>Halogen reagent (equiv.)</th>
<th>Solvent</th>
<th>Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DBH (0.6)</td>
<td>CH₂Cl₂</td>
<td>54</td>
</tr>
<tr>
<td>2</td>
<td>DBH (0.6)</td>
<td>CH₂Cl₂</td>
<td>67</td>
</tr>
<tr>
<td>3</td>
<td>DBH (0.6)</td>
<td>THF</td>
<td>7 (81)²</td>
</tr>
<tr>
<td>4</td>
<td>DBH (0.6)</td>
<td>MeCN</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>DBH (0.6)</td>
<td>CHCl₃</td>
<td>33</td>
</tr>
<tr>
<td>6</td>
<td>NBS (1.2)</td>
<td>CH₂Cl₂</td>
<td>70</td>
</tr>
<tr>
<td>7</td>
<td>NBA (1.2)</td>
<td>CH₂Cl₂</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>NBP (1.2)</td>
<td>CH₂Cl₂</td>
<td>74 (3)³</td>
</tr>
<tr>
<td>9</td>
<td>NIS (1.2)</td>
<td>CH₂Cl₂</td>
<td>83</td>
</tr>
<tr>
<td>10</td>
<td>DIH (0.6)</td>
<td>CH₂Cl₂</td>
<td>85</td>
</tr>
</tbody>
</table>

² The reaction was carried out without dark conditions. ³ Number in parentheses indicates the yield of N-pivaloyl 2-methyl-3-bromo indole.

\[
\text{Formula } \text{C}_{28}\text{H}_{30}\text{IN}_2\text{O}_5\text{S}_2 \quad [\text{M+H}]^+ 665.0635, \text{ found } 665.0641.
\]

**Crystal data for 3a:**  Formula \( \text{C}_{28}\text{H}_{29}\text{IN}_2\text{O}_5\text{S}_2 \), colorless, crystal dimensions \( 0.20 \times 0.20 \times 0.20 \text{ mm}^3 \). Monoclinic, space group \( P 1 21/c \), \( a = 11.244(3) \text{ Å}, b = 10.311(3) \text{ Å}, c = 24.381(7) \text{ Å}, \alpha = 90.00 \degree, \beta = 100.978(4) \degree, \gamma = 90.00 \degree, V = 2774.9(13) \text{ Å}^3 \), \( Z = 4 \), \( \rho_{\text{calc}} = 1.591 \text{ g cm}^{-3} \), \( F(000) = 1344 \), \( \mu(\text{MoK}\alpha) = 1.346 \text{ mm}^{-1} \), \( T = 173 \text{ K} \). 15287 reflections collected, 6332 independent reflections with \( I > 2\sigma(I) \). \( 20_{\text{max}} = 27.69\degree \), and 348 parameters were used for the solution of the structure. The non-hydrogen atoms were refined anisotropically. \( R_1 = 0.0402 \) and \( wR_2 = 0.1056 \). GOF = 1.039. Crystallographic data (excluding structure factors) for the structure reported in this paper have been deposited with the Cambridge Crystallographic Data Centre as supplementary publication no. CCDC-1532904. Copies of the data can be obtained free of charge on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK [Fax: int. code + 44(1223)336-033; E-mail: deposit@ccdc.cam.ac.uk].
4. **General procedure for Direct Iodo-amination of 2-Methyl Indole Derivatives (1) with PhI(OAc)$_2$ and DIH (Method A) (Scheme 2; eq. 5, Table 1, and Table 2).**

A mixture of PhI(OAc)$_2$ (38.7 mg, 0.12 mmol), T$_2$S$_2$NH (39.1 mg, 0.12 mmol) in CH$_2$Cl$_2$ (1.0 mL) was stirred at room temperature for 30 min under argon atmosphere. Then, N-pivaloyl 2-methyl indole (1a) (21.5 mg, 0.10 mmol) was added, and the solution was stirred at room temperature for 2 h. To the solution was added NaHCO$_3$ (22.1 mg, 0.24 mmol), and the obtained mixture was stirred at room temperature for 10 min, followed by addition of 1,3-diiodo-5,5-dimethylhydantoin (22.8 mg, 0.060 mmol). The mixture was stirred at room temperature for 5 h under argon atmosphere. Saturated Na$_2$SO$_3$ aqueous solution (10 mL) was added to the reaction mixture, and the product was extracted with AcOEt (15 mL × 3). The combined extracts were washed by water (10 mL) and brine (10 mL), and dried over Na$_2$SO$_4$. The organic phase was concentrated under reduced pressure and the crude product was purified by silica gel column chromatography (eluent: hexane/AcOEt = 5/1), to give the desired product 3a (63.8 mg, 96% yield).

5. **General procedure for Direct Iodo-amination of 2-Methyl Indole Derivatives (1) with DIH (Method B) (Scheme 2; eq. 6, Table 1, and Table 2).**

To a solution of N-pivaloyl 2-methyl indole (1a) (21.5 mg, 0.10 mmol) in CH$_2$Cl$_2$ (1.0 mL) was added 1,3-diiodo-5,5-dimethylhydantoin (60.8 mg, 0.16 mmol), and the mixture was stirred at room temperature for 7 h under argon atmosphere. Saturated Na$_2$SO$_3$ aqueous solution (10 mL) was added to the reaction mixture, and the product was extracted with AcOEt (15 mL × 3). The combined extracts were washed with water (10 mL) and brine (10 mL), and dried over Na$_2$SO$_4$. The organic phase was concentrated under reduced pressure and the crude product was purified by silica gel column chromatography (eluent: hexane/AcOEt = 5/1), to give the desired product 2a.
N-((3-Iodo-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3b): 
\(^1\)H NMR (400 MHz, CDCl$_3$) \(\delta\) 1.49 (s, 9H), 3.23 (s, 6H), 5.18 (s, 2H), 7.24-7.30 (m, 1H), 7.31-7.37 (m, 1H), 7.39-7.44 (m, 1H), 7.47-7.51 (m, 1H). \(^{13}\)C NMR (100 MHz, CDCl$_3$) \(\delta\) 28.2 (3C), 43.7 (2C), 44.2, 45.6, 70.6, 113.4, 122.2, 122.5, 125.0, 130.2, 132.7, 135.6, 184.4. IR (neat) 1692, 1363, 1154, 1004, 529 cm$^{-1}$. MS (ESI) calcd for C$_{16}$H$_{21}$ClIN$_2$O$_5$S$_2$ [M+Cl]$^-$ 546.9631, found 546.9641.

N-((3-Iodo-1-pivaloyl-1H-indol-2-yl)methyl)-N-(phenylsulfonyl)benzenesulfonamide (3c):
\(^1\)H NMR (400 MHz, CDCl$_3$) \(\delta\) 1.42 (s, 9H), 5.30 (s, 2H), 6.90-7.00 (m, 4H), 7.20-7.37 (m, 4H), 7.72-7.81 (m, 4H). \(^{13}\)C NMR (100 MHz, CDCl$_3$) \(\delta\) 28.1 (3C), 44.4, 46.9, 72.5, 112.8, 121.9, 122.2, 125.0, 127.9 (4C), 128.5 (4C), 130.1, 130.7, 133.5 (2C), 135.6, 139.6 (2C), 183.7. IR (neat) 1731, 1374, 1167, 999, 546 cm$^{-1}$. MS (ESI) calcd for C$_{26}$H$_{24}$IN$_2$O$_5$S$_2$ [M+H]$^+$ 637.0033, found 637.0034.

4-Fluoro-N-((4-fluorophenyl)sulfonyl)-N-((3-iodo-1-pivaloyl-1H-indol-2-yl)methyl)benzenesulfonamide (3d):
\(^1\)H NMR (400 MHz, CDCl$_3$) \(\delta\) 1.41 (s, 9H), 5.27 (s, 2H), 6.90-7.00 (m, 4H), 7.20-7.37 (m, 4H), 7.72-7.81 (m, 4H). \(^{13}\)C NMR (100 MHz, CDCl$_3$) \(\delta\) 28.1 (3C), 44.5, 47.0, 72.3, 112.7, 115.8 (d, \(J_{C-F} = 23.0\) Hz, 4C), 121.8, 122.5, 125.2, 130.0, 130.2, 130.9 (d, \(J_{C-F} = 9.6\) Hz, 4C), 135.5 (d, \(J_{C-F} = 3.8\) Hz, 2C), 135.7, 165.6 (d, \(J_{C-F} = 257.7\) Hz, 2C), 183.7. \(^{19}\)F NMR (369 MHz, CDCl$_3$) \(\delta\) -102.9 IR (neat) 1745, 1590, 1492, 1384, 1173, 997, 547 cm$^{-1}$. MS (ESI) calcd for C$_{26}$H$_{24}$F$_2$IN$_2$O$_5$S$_2$ [M+H]$^+$ 673.0134, found 673.0132.
**N-((3-Iodo-1-pivaloyl-1H-indol-2-yl)methyl)-4-methyl-N-(methylsulfonyl)benzenesulfonamide (3e):**  
\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 1.43 (s, 9H), 2.27 (s, 3H), 3.36 (s, 3H), 5.19 (s, 2H), 6.94-7.01 (m, 2H), 7.20-7.26 (m, 1H), 7.29-7.34 (m, 3H), 7.51-7.58 (m, 2H).  
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 21.5, 28.1 (3C), 44.4, 44.6, 46.1, 71.3, 113.0, 121.9, 122.3, 124.9, 128.1 (2C), 129.0 (2C), 130.2, 131.5, 135.5, 135.6, 144.8, 184.0. IR (neat) 1686, 1364, 1163, 962, 558 cm\(^{-1}\). MS (ESI) calcd for C\(_{22}\)H\(_{28}\)IN\(_2\)O\(_3\)S\(_2\) [M+H]\(^+\) 589.0322, found 589.0326.

**N-(Benzylsulfonyl)-N-((3-iodo-1-pivaloyl-1H-indol-2-yl)methyl)-1-phenylmethanesulfonamide (3f):**  
\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 1.37 (s, 9H), 4.28 (br, 2H), 4.52 (s, 4H), 7.21-7.42 (m, 13H), 7.46 (d, \(J = 7.8\) Hz, 1H).  
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 28.0 (3C), 44.0, 47.3, 62.9 (2C), 69.9, 113.0 122.1, 122.4, 125.1, 126.7 (2C), 128.9 (4C), 129.4 (2C), 130.0, 131.2 (4C), 132.6, 135.5, 183.9. IR (neat) 1691, 1377, 1158, 997, 544 cm\(^{-1}\). MS (ESI) calcd for C\(_{29}\)H\(_{30}\)IN\(_2\)O\(_3\)S\(_2\) [M+H]\(^+\) 665.0635, found 665.0644.

**N-((3-Iodo-1-pivaloyl-1H-indol-2-yl)methyl)-N-(propylsulfonyl)propane-1-sulfonamide (3g):**
\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 0.96 (t, \(J = 7.5\) Hz, 6H), 1.47 (s, 9H), 1.76-1.88 (m, 4H), 3.23-3.30 (m, 4H), 5.17 (s, 2H), 7.24-7.30 (m, 1H), 7.31-7.37 (m, 1H), 7.38-7.44 (m, 1H), 7.46-7.53 (m, 1H).  
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 12.7 (2C), 16.6 (2C), 28.1 (3C), 44.2, 46.2, 58.5 (2C), 70.8, 113.2, 122.2, 122.4, 125.1, 130.1, 132.9, 135.7, 184.2. IR (neat) 2970, 1703, 1370, 1151, 999, 571 cm\(^{-1}\). MS (ESI) calcd for C\(_{20}\)H\(_{30}\)IN\(_2\)O\(_3\)S\(_2\) [M+H]\(^+\) 569.0635, found 569.0641.

**N-((3-Iodo-6-methyl-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3h):**  
\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 1.47 (s, 9H), 2.49 (s, 3H), 3.21 (s, 6H), 5.16 (s, 2H), 7.09 (d, \(J = 8.2\) Hz, 1H), 7.19 (s, 1H), 7.35 (d, \(J = 8.2\) Hz, 1H).  
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 22.0,
28.2 (3C), 43.7 (2C), 44.2, 45.7, 70.6, 113.3, 121.7, 124.2, 128.1, 131.7, 135.2, 136.0, 184.4. IR (neat) 1706, 1358, 1153, 965, 531 cm⁻¹. MS (ESI) calcd for C₁₇H₂₅ClIN₂O₅S₂ [M+Cl]⁻ 560.9787, found 560.9794.

![Image of a chemical structure](image-url)

**N-((6-Chloro-3-iodo-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3i):** ¹H NMR (400 MHz, CDCl₃) δ 1.47 (s, 9H), 3.23 (s, 6H), 5.14 (s, 2H), 7.24 (dd, J = 8.5, 1.8 Hz, 1H), 7.39 (s, 1H), 7.41 (d, J = 8.5 Hz, 1H). ¹³C NMR (100 MHz, CDCl₃) δ 28.2 (3C), 43.7 (2C), 44.3, 45.5, 69.8, 113.2, 123.1, 123.2, 128.8, 131.1, 133.3, 135.7, 183.8. IR (neat) 1712, 1358, 1153, 962, 531 cm⁻¹. MS (ESI) calcd for C₁₆H₂₀ClIN₂O₅S₂ [M+Cl]⁻ 580.9241, found 580.9251.

![Image of a chemical structure](image-url)

**N-((6-Fluoro-3-iodo-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3j):** ¹H NMR (400 MHz, CDCl₃) δ 1.48 (s, 9H), 3.23 (s, 6H), 5.15 (s, 2H), 7.04 (td, J = 9.2, 2.0 Hz, 1H), 7.13 (dd, J = 10.0, 2.0 Hz, 1H), 7.43 (dd, J = 9.2, 5.6 Hz, 1H). ¹³C NMR (100 MHz, CDCl₃) δ 28.1 (3C), 43.6 (2C), 44.2, 45.6, 70.1, 100.2 (d, Jₕ₋ₓ = 28.6 Hz), 111.3 (d, Jₕ₋ₓ = 24.8 Hz), 123.3 (d, Jₕ₋ₓ = 10.5 Hz), 126.6, 133.1 (d, Jₕ₋ₓ = 3.8 Hz), 135.2 (d, Jₕ₋ₓ = 12.4 Hz), 161.2 (d, Jₕ₋ₓ = 246.1 Hz), 183.8. ¹⁹F NMR (369 MHz, CDCl₃) δ −115.4. IR (neat) 1695, 1484, 1363, 1161, 975, 526 cm⁻¹. MS (ESI) calcd for C₁₆H₂₀FClIN₂O₅S₂ [M+Cl]⁻ 564.9536, found 564.9538.

![Image of a chemical structure](image-url)

**N-((3,5-Diiodo-6-methoxy-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3k):** ¹H NMR (400 MHz, CDCl₃) δ 1.45 (s, 9H), 3.20 (s, 6H), 3.91 (s, 3H), 5.13 (s, 2H), 6.83 (s, 1H), 7.87 (s, 1H). ¹³C NMR (100 MHz, CDCl₃) δ 28.2 (3C), 43.7 (2C), 44.6, 45.7, 56.7, 68.8, 80.9, 95.5, 126.1, 131.6, 132.4, 136.3, 155.9, 183.9. IR (neat) 1702, 1360, 1151, 1041, 976, 529 cm⁻¹. MS (ESI) calcd for C₁₇H₂₂Cl₂I₂N₂O₆S₂ [M+Cl]⁻ 702.8703, found 702.8712.
\[
N-((3-Iodo-1-pivaloyl-6-(trifluoromethyl)-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3i): \quad ^1H \text{ NMR (400 MHz, CDCl}_3) \delta 1.48 (s, 9H), 3.25 (s, 6H), 5.18 (s, 2H), 7.51 (d, \ J = 8.4 \text{ Hz}, 1H), 7.60 (d, \ J = 8.4 \text{ Hz}, 1H), 7.68 (s, 1H). \quad ^13C \text{ NMR (100 MHz, CDCl}_3) \delta 28.2 \text{ (3C), 43.6 (2C), 44.4, 45.3, 69.2, 110.6 (q, } J_{C-F} = 3.8 \text{ Hz), 119.1 (q, } J_{C-F} = 3.8 \text{ Hz), 122.8, 124.3 (q, } J_{C-F} = 273.0 \text{ Hz), 127.1 (q, } J_{C-F} = 32.6 \text{ Hz), 132.5, 134.6, 135.4, 183.7. \quad ^19\text{F NMR (369 MHz, CDCl}_3) \delta \ -61.2. \quad \text{IR (neat) 1699, 1329, 1149, 1114, 974, 531 cm}^{-1}. \quad \text{MS (ESI) calcd for } C_{17}H_{20}ClF_3N_2O_5S_2 [M+Cl]^+ 614.9504, \text{ found 614.9511.}
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\text{Methyl 3-iodo-2-((N-(methylsulfonyl)methylsulfonyl)amino)methyl)-1-pivaloyl-1H-indole-6-carboxylate (3m): \quad ^1H \text{ NMR (400 MHz, CDCl}_3) \delta 1.50 (s, 9H), 3.26 (s, 6H), 3.96 (s, 3H), 5.18 (s, 2H), 7.73 (dd, \ J = 8.4, 0.4 \text{ Hz}, 1H), 7.94 (dd, \ J = 8.4, 1.4 \text{ Hz}, 1H), 8.16-8.21 (m, 1H). \quad ^13C \text{ NMR (100 MHz, CDCl}_3) \delta 28.3 \text{ (3C), 43.6 (2C), 44.3, 45.3, 52.4, 69.5, 115.3, 121.9, 123.3, 126.7, 133.6, 135.0, 135.8, 167.0, 184.0. \quad \text{IR (neat) 1719, 1343, 1236, 1155, 979, 528 cm}^{-1}. \quad \text{MS (ESI) calcd for } C_{18}H_{23}ClIN_2O_5S_2 [M+Cl]^+ 604.9685, \text{ found 604.9692.}
\]

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N-((3-Iodo-6-nitro-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3n): \quad ^1H \text{ NMR (400 MHz, CDCl}_3) \delta 1.53 (s, 9H), 3.22 (s, 6H), 5.11 (s, 2H), 7.58 (d, \ J = 8.9 \text{ Hz}, 1H), 8.08 (d, \ J = 1.8 \text{ Hz}, 1H), 8.14 (dd, \ J = 8.9, 1.8 \text{ Hz}, 1H). \quad ^13C \text{ NMR (100 MHz, CDCl}_3) \delta 27.2 \text{ (3C), 39.4, 43.8 (2C), 44.3, 62.4, 105.3, 117.3, 123.1, 131.1, 133.7, 136.8, 145.4, 176.3. \quad \text{IR (neat) 1793, 1514, 1335, 1159, 1011, 523 cm}^{-1}. \quad \text{MS (APPI) calcd for } C_{14}H_{14}IN_2O_3 [M–NMs}_2]^+ 385.0044, \text{ found 385.0045.}
\]

\[
N-((3-Iodo-5-methyl-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3o): \quad ^1H \text{ NMR (400 MHz, CDCl}_3) \delta 1.48 (s, 9H), 2.47 (s, 3H), 3.22 (s, 6H), 5.17 (s, 2H), 7.15
\]
(dd, J = 8.5, 1.4 Hz, 1H), 7.26 (m, 1H), 7.32 (d, J = 8.5 Hz, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 21.1, 28.2 (3C), 43.7 (2C), 43.9, 45.6, 70.6, 113.3, 121.8, 126.6, 130.4, 132.3, 132.7, 133.8, 184.2. IR (neat) 1728, 1362, 1157, 993, 521 cm$^{-1}$. MS (ESI) calcd for C$_{13}$H$_{22}$ClIN$_2$O$_5$S$_2$ [M+Cl]$^-$ 560.9787, found 560.9801.

\[ \text{Br} \quad \begin{array}{c} \text{N} \\ \text{Piv} \end{array} \text{NMs}_2 \]

$^N$-((5-Bromo-3-iodo-1-pivaloyl-1H-indol-2-yl)methyl)-$^N$-(methylsulfonyl)methanesulfonamide (3p): $^1$H NMR (400 MHz, CDCl$_3$) δ 1.45 (s, 9H), 3.24 (s, 6H), 5.15 (s, 2H), 7.27 (d, J = 8.9 Hz, 1H), 7.42 (dd, J = 8.9, 2.0 Hz, 1H), 7.64 (d, J = 2.0 Hz, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 28.2 (3C), 43.7 (2C), 44.3, 45.4, 68.7, 114.7, 115.9, 124.8, 127.9, 132.0, 133.9, 134.3, 183.9. IR (neat) 1729, 1362, 1159, 992, 525 cm$^{-1}$. MS (ESI) calcd for C$_{16}$H$_{20}$BrClIN$_2$O$_5$S$_2$ [M+Cl]$^-$ 624.8736, found 624.8746.

\[ \text{Cl} \quad \begin{array}{c} \text{N} \\ \text{Piv} \end{array} \text{NMs}_2 \]

$^N$-((5-Chloro-3-iodo-1-pivaloyl-1H-indol-2-yl)methyl)-$^N$-(methylsulfonyl)methanesulfonamide (3q): $^1$H NMR (400 MHz, CDCl$_3$) δ 1.46 (s, 9H), 3.24 (s, 6H), 5.15 (s, 2H), 7.28 (dd, J = 9.2, 2.0 Hz, 1H), 7.33 (dd, J = 9.2, 0.5 Hz, 1H), 7.48 (dd, J = 2.0, 0.5 Hz, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 28.2 (3C), 43.7 (2C), 44.3, 45.4, 68.9, 114.4, 121.7, 125.3, 128.5, 131.5, 134.0, 134.1, 183.9. IR (neat) 1730, 1362, 1159, 992, 522 cm$^{-1}$. MS (ESI) calcd for C$_{16}$H$_{20}$Cl$_2$IN$_2$O$_5$S$_2$ [M+Cl]$^-$ 580.9241, found 580.9254.

\[ \text{F} \quad \begin{array}{c} \text{N} \\ \text{Piv} \end{array} \text{NMs}_2 \]

$^N$-((5-Fluoro-3-iodo-1-pivaloyl-1H-indol-2-yl)methyl)-$^N$-(methylsulfonyl)methanesulfonamide (3r): $^1$H NMR (400 MHz, CDCl$_3$) δ 1.47 (s, 9H), 3.24 (s, 6H), 5.15 (s, 2H), 7.07 (d, J = 9.1, 2.5 Hz, 1H), 7.17 (dd, J = 8.7, 2.5 Hz, 1H), 7.35 (dd, J = 9.1, 4.1 Hz, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 28.2 (3C), 43.7 (2C), 44.2, 45.5, 69.4, 107.5 (d, J$_{C-F}$ = 24.9 Hz), 113.4 (d, J$_{C-F}$ = 25.9 Hz), 114.5 (d, J$_{C-F}$ = 8.6 Hz), 131.4 (d, J$_{C-F}$ = 10.5 Hz), 132.0, 134.4, 159.1 (d, J$_{C-F}$ = 241.4 Hz), 184.0. $^{19}$F NMR (369 MHz, CDCl$_3$) δ −120.1. IR (neat) 1698, 1366, 1160, 979, 510 cm$^{-1}$. MS (ESI) calcd for C$_{16}$H$_{20}$ClIFIN$_2$O$_5$S$_2$ [M+Cl]$^-$ 564.9536, found 564.9548.
**N-((3,6-Diiodo-5-methoxy-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3s):**  
$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 1.46 (s, 9H), 3.23 (s, 6H), 3.97 (s, 3H), 5.14 (s, 2H), 6.83 (s, 1H), 7.84 (s, 1H).  
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 28.3 (3C), 43.7 (2C), 44.1, 45.5, 56.7, 70.0, 83.8, 102.2, 124.2, 131.1, 131.4, 133.5, 154.1, 183.6.  
IR (neat) 1694, 1365, 1161, 978, 531 cm$^{-1}$.  
MS (ESI) calcd for C$_{17}$H$_{22}$ClN$_2$O$_6$S$_2$ [M+Cl]$^-$ 702.8703, found 702.8722.

**N-((5-Cyano-3-iodo-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3t):**  
$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 1.46 (s, 9H), 3.26 (s, 6H), 5.15 (s, 2H), 7.44 (dd, $J$ = 8.7, 0.7 Hz, 1H), 7.57 (dd, $J$ = 8.7, 1.6 Hz, 1H), 7.86 (dd, $J$ = 1.6, 0.7 Hz, 1H).  
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 28.1 (3C), 43.6 (2C), 44.7, 45.2, 68.9, 106.1, 114.0, 119.1, 127.56, 127.59, 130.3, 135.1, 137.3, 183.7.  
IR (neat) 2230, 1709, 1347, 1156, 1005, 538 cm$^{-1}$.  
MS (ESI) calcd for C$_{17}$H$_{20}$ClIN$_3$O$_5$S$_2$ [M+Cl]$^-$ 571.9583, found 571.9599.

**N-((3-Iodo-5-nitro-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3u):**  
$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 1.47 (s, 9H), 3.27 (s, 6H), 5.15 (s, 2H), 7.45 (d, $J$ = 9.4 Hz, 1H), 8.23 (dd, $J$ = 9.4, 2.2 Hz, 1H), 8.46 (d, $J$ = 2.2 Hz, 1H).  
$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 28.1 (3C), 43.6 (2C), 44.8, 45.2, 69.9, 113.3, 119.1, 120.0, 130.2, 136.0, 138.4, 143.5, 183.6.  
IR (neat) 1714, 1520, 1361, 1154, 974, 532 cm$^{-1}$.  
MS (ESI) calcd for C$_{16}$H$_{20}$ClIN$_3$O$_7$S$_2$ [M+Cl]$^-$ 591.9481, found 591.9485.

**Methyl 3-iodo-2-((N-(methylsulfonyl)methylsulfonamido)methyl)-1-pivaloyl-1H-indole-5-carboxylate (3v):**  
$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 1.51 (s, 9H), 3.19 (s, 6H), 3.94 (s, 3H), 5.10 (s, 2H), 7.49 (d, $J$ = 8.5 Hz, 1H), 7.87 (d, $J$ = 1.4 Hz, 1H), 7.92 (dd, $J$ = 8.5, 1.4 Hz, 1H).  
$^{13}$C NMR
(100 MHz, CDCl3) δ 27.2 (3C), 39.3, 43.9 (2C), 44.5, 52.3, 63.0, 110.8, 122.3, 123.1, 127.0, 130.2, 134.5, 134.8, 166.9, 176.5. IR (neat) 1781, 1716, 1351, 1248, 1159, 1072, 966, 521 cm⁻¹. MS (APCI) calcd for C18H23N2O3S2 [M⁺] 569.9986, found 569.9991.

N-((3-Iodo-4-methyl-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonfonyl)methanesulfonamide (3w): ¹H NMR (400 MHz, CDCl3) δ 1.40 (s, 9H), 2.92 (s, 3H), 3.23 (s, 6H), 5.18 (s, 2H), 6.93-6.99 (m, 1H), 7.11-7.18 (m, 1H), 7.22-7.28 (m, 1H). ¹³C NMR (100 MHz, CDCl3) δ 20.3, 28.3 (3C), 43.6 (2C), 44.9, 46.3, 66.8, 111.3, 124.0, 124.4, 125.8, 131.3, 132.0, 136.1, 184.7. IR (neat) 1732, 1366, 1158, 961, 526 cm⁻¹. MS (ESI) calcd for C17H23ClI2N2O5S2 [M+Cl⁻] 560.9787, found 560.9792.

N-((5,6-Dichloro-3-iodo-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonfonyl)methanesulfonamide (3x): ¹H NMR (400 MHz, CDCl3) δ 1.46 (s, 9H), 3.24 (s, 6H), 5.12 (s, 2H), 7.52 (s, 1H), 7.58 (s, 1H). ¹³C NMR (100 MHz, CDCl3) δ 28.2 (3C), 43.6 (2C), 44.3, 45.3, 68.3, 114.8, 123.1, 127.1, 129.2, 130.0, 134.0, 134.7, 183.4. IR (neat) 1712, 1353, 1156, 971, 530 cm⁻¹. MS (ESI) calcd for C16H19Cl3I2N2O5S2 [M+Cl⁻] 614.8851, found 614.8857.

N-((3,4-Diiodo-5,7-dimethyl-1-pivaloyl-1H-indol-2-yl)methyl)-N-(methylsulfonfonyl)methanesulfonamide (3y): ¹H NMR (400 MHz, CDCl3) δ 1.09 (s, 9H), 2.56 (s, 3H), 2.60 (s, 3H), 3.28 (s, 6H), 5.08 (s, 2H), 7.24 (s, 1H). ¹³C NMR (100 MHz, CDCl3) δ 26.0, 27.7 (3C), 30.1, 43.4 (2C), 45.6, 47.2, 71.6, 106.8, 119.8, 126.8, 130.6, 131.7, 135.1, 136.4, 186.6. IR (neat) 1712, 1372, 1157, 1030, 527 cm⁻¹. MS (ESI) calcd for C18H24Cl2I2N2O5S2 [M+Cl⁻] 700.8910, found 700.8916.
**N-((1-Iodo-3-pivaloyl-3H-benzo[e]indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3z–H):**

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 1.39 (s, 9H), 3.19 (s, 6H), 5.28 (s, 2H), 7.42 (d, \(J = 9.1\) Hz, 1H), 7.49-7.56 (m, 1H), 7.65-7.71 (m, 2H), 7.92 (d, \(J = 8.2\) Hz, 1H), 7.61 (d, \(J = 8.5\) Hz, 1H).

\(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 28.2 (3C), 43.8 (2C), 45.6, 46.3, 66.4, 95.7, 120.8, 121.7, 124.3, 126.3, 126.9, 127.9, 129.9, 130.2, 133.4, 133.7, 184.0.

IR (neat) 1731, 1361, 1154, 960, 529 cm\(^{-1}\).

MS (ESI) calcd for C\(_{20}\)H\(_{22}\)ClIN\(_2\)O\(_5\)S\(_2\) [M+Cl]\(^+\) 596.9787, found 596.9794.

**N-((1,5-Diiodo-3-pivaloyl-3H-benzo[e]indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3z–I):**

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 1.40 (s, 9H), 3.20 (s, 6H), 5.26 (s, 2H), 7.57-7.64 (m, 1H), 7.69-7.75 (m, 1H), 8.06 (s, 1H), 8.21-8.26 (m, 1H), 9.56-9.61 (m, 1H).

\(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 28.2 (3C), 43.7 (2C), 45.6, 46.3, 66.4, 95.7, 120.8, 121.7, 124.3, 126.3, 126.9, 127.9, 129.9, 130.2, 133.4, 133.7, 184.0.

IR (neat) 1729, 1367, 1153, 1002, 528 cm\(^{-1}\).

MS (ESI) calcd for C\(_{20}\)H\(_{22}\)ClI\(_2\)N\(_2\)O\(_5\)S\(_2\) [M+Cl]\(^+\) 722.8754, found 722.8764.

**N-((1-Benzoyl-3-iodo-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3aa):**

\(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 3.28 (s, 6H), 5.54 (s, 2H), 6.46 (d, \(J = 8.7\) Hz, 1H), 7.03-7.09 (m, 1H), 7.20-7.26 (m, 1H), 7.47 (d, \(J = 8.0\) Hz, 1H), 7.50-7.56 (m, 2H), 7.76-7.73 (m, 1H), 7.80-7.86 (m, 2H).

\(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 42.7 (2C), 44.8, 75.2, 114.1, 122.1, 123.3, 125.3, 129.0 (2C), 130.4 (2C), 130.5, 133.8, 134.1, 134.9, 136.7, 169.4.

IR (neat) 1685, 1375, 1158, 977, 745 cm\(^{-1}\).

MS (ESI) calcd for C\(_{18}\)H\(_{17}\)IN\(_2\)NaO\(_5\)S\(_2\) [M+Na]\(^+\) 554.9516, found 554.9519.

**N-((3-Iodo-1-tosyl-1H-indol-2-yl)methyl)-N-(methylsulfonyl)methanesulfonamide (3ab):**

\(^1\)H
NMR (400 MHz, CDCl₃) δ 2.34 (s, 3H), 3.49 (s, 6H), 5.46 (s, 2H), 7.16-7.23 (m, 2H), 7.28-7.35 (m, 1H), 7.35-7.43 (m, 2H), 7.61-7.68 (m, 2H), 8.03-8.09 (m, 1H).

¹³C NMR (100 MHz, CDCl₃) δ 21.6, 42.8 (2C), 45.5, 80.8, 115.3, 122.5, 124.7, 126.5 (2C), 126.9, 130.1 (2C), 131.5, 132.8, 134.8, 136.7, 145.5.

IR (neat) 1372, 1359, 1174, 1154, 996, 569 cm⁻¹.


6. Derivatization of 2-Aminomethyl-3-iodo indole Derivatives (3b) (Scheme 5).

To a solution of 3b (2.03 g, 3.50 mmol) in toluene (44 mL) was added Red-Al® (60 wt. % toluene solution; 2.85 mL, 8.75 mmol) dropwise at −20 °C, and the reaction mixture was stirred at 0 °C for 1 h under argon atmosphere. Saturated NH₄Cl aqueous solution (50 mL) was added to the mixture at 0 °C, and the product was extracted with AcOEt (50 mL × 3). The organic phase was washed with brine (50 mL), and dried over Na₂SO₄. The solvent was removed under reduced pressure. The crude mixture was purified by column chromatography (eluent: hexane/AcOEt=2/1) to give the desired product 5 (455.2 mg, 37% yield).

N-((3-Iodo-1H-indol-2-yl)methyl)methanesulfonamide (5): ¹H NMR (400 MHz, MeCN-d₃) δ 2.89 (s, 3H), 4.41 (s, 2H), 5.72 (brs, 1H), 7.11-7.17 (m, 1H), 7.18-7.25 (m, 1H), 7.29-7.35 (m, 1H), 7.38-7.43 (m, 1H), 9.78 (brs, 1H). ¹³C NMR (100 MHz, MeCN-d₃) δ 40.4, 41.5, 59.0, 112.7, 121.2, 121.5, 124.1, 131.1, 136.6, 137.4. IR (neat) 3381, 3303, 1310, 1148, 1068, 589 cm⁻¹. MS (ESI) calcd for C₁₀H₁₂N₂O₂ [M+H]^+ 350.9659, found 350.9651.

To a solution of 5 (70.0 mg, 0.20 mmol) in DMF (0.8 mL) and THF (0.8 mL) was added Boc₂O (183.0 µL, 0.80 mmol) and DMAP (2.4 mg, 0.020 mmol), and the mixture was stirred at room
temperature for 16 h. The solvent was removed under reduced pressure and the crude mixture was purified by column chromatography (eluent: hexane/AcOEt=5/1) to give the desired product 6 (109.0 mg, >99% yield).

**tert-Butyl 2-((N-(tert-butoxycarbonyl)methylsulfonamido)methyl)-3-iodo-1H-indole-1-carboxylate (6):** \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 1.51 (s, 9H), 1.70 (s, 9H), 3.04 (s, 3H), 5.45 (s, 2H), 7.27-7.33 (m, 1H), 7.33-7.39 (m, 1H), 7.41-7.45 (m, 1H), 7.93-7.98 (m, 1H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 27.9 (3C), 28.1 (3C), 42.3, 43.9, 74.0, 84.6, 85.3, 115.4, 121.8, 123.4, 125.7, 130.8, 135.7, 135.8, 149.4, 151.6. IR (neat) 1729, 1353, 1237, 1143, 543 cm\(^{-1}\). MS (ESI) calcd for C\(_{20}\)H\(_{28}\)IN\(_2\)O\(_6\)S \([M+H]^{+}\) 551.0707, found 551.0707.

To a solution of 6 (110.1 mg, 0.20 mmol) and Pd(PPh\(_3\))\(_4\) (11.6 mg, 0.010 mmol) in toluene (1 mL) was added tributylvinyltin (70.2 \(\mu\)L, 0.24 mmol), and the reaction mixture was stirred at 80 °C for 4 h under argon atmosphere. Water (10 mL) was added to the mixture and the organic phase was extracted with AcOEt (10 mL \(\times\) 3). The organic phase was dried over Na\(_2\)SO\(_4\) and concentrated under reduced pressure. The crude mixture was purified by column chromatography (10% w/w anhydrous K\(_2\)CO\(_3\)-silica gel, eluent: hexane/AcOEt=7/1) to give the desired product 7 (81.5 mg, 90% yield).

**tert-Butyl 2-((N-(tert-butoxycarbonyl)methylsulfonamido)methyl)-3-vinyl-1H-indole-1-carboxylate (7):** \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 1.51 (s, 9H), 1.70 (s, 9H), 2.95 (s, 3H), 5.43 (s, 2H), 5.51 (dd, \(J = 11.6, 1.4\) Hz, 1H), 5.77 (dd, \(J = 18.0, 1.4\) Hz, 1H), 6.92 (dd, \(J = 18.0, 11.6\) Hz, 1H), 7.23-7.29 (m, 1H), 7.29-7.35 (m, 1H), 7.80 (d, \(J = 7.6\) Hz, 1H), 8.02 (d, \(J = 8.4\) Hz, 1H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 27.8 (3C), 28.2 (3C), 41.3, 41.9, 84.5, 84.7, 115.3, 118.0, 120.1, 120.6, 123.0, 124.8, 127.2, 127.9, 132.2, 136.0, 150.2, 151.6. IR (neat) 1727, 1453, 1240, 1140 cm\(^{-1}\).
MS (ESI) calcd for C_{22}H_{31}N_{2}O_{6}S [M+H]^+ 451.1897, found 451.1894.

To a solution of 7 (45.1 mg, 0.10 mmol) in CH$_2$Cl$_2$ (2 mL) was added 4-phenyl-1,2,4-triazoline-3,5-dione (19.3 mg, 0.11 mmol) at −78 °C, the mixture was stirred at −78 °C for 1.5 h under argon atmosphere. The solvent was removed under reduced pressure and the crude mixture was purified by column chromatography (eluent: hexane/MeCN=1/1) to give the desired product 8 (61.9 mg, >99% yield).

** tert-Butyl 11a-((N-(tert-butoxycarbonyl)methylsulfonamido)methyl)-1,3-dioxo-2-phenyl-2,3,5, 11a-tetrahydro-1H,11H-[1,2,4]triazolo[1′,2′:1,2]pyridazino[3,4-b]indole-11-carboxylate (8): **

$^1$H NMR (400 MHz, MeCN-$d_3$ (60 °C)) δ 1.37 (s, 9H), 1.59 (s, 9H), 2.89 (brs, 3H), 4.57 (dd, $J = 17.2$, 2.8 Hz, 1H), 4.70 (dd, $J = 17.2$, 7.2 Hz, 1H), 4.80 (d, $J = 16.0$ Hz, 1H), 5.26 (d, $J = 16.0$ Hz, 1H), 6.42 (dd, $J = 6.8$, 2.8 Hz, 1H), 7.04-7.10 (m, 1H), 7.28-7.35 (m, 1H), 7.36-7.43 (m, 3H), 7.43-7.53 (m, 3H), 7.91 (dd, $J = 8.8$ Hz, 1H). $^{13}$C NMR (100 MHz, MeCN-$d_3$ (60 °C)) δ 28.1 (3C), 28.7 (3C), 43.3, 45.6, 46.5, 83.2, 84.2, 86.4, 115.4, 116.5, 121.7, 124.4, 125.6, 127.9 (2C), 129.5, 130.1 (2C), 131.9, 133.3, 139.6, 145.9, 149.4, 152.1, 152.9, 155.2. IR (neat) 1716, 1407, 1356, 1154, 753 cm$^{-1}$. MS (ESI) calcd for C$_{30}$H$_{35}$N$_3$O$_8$S [M+H]$^+$ 626.2279, found 626.2268.

**Crystal data for 8:** Formula C$_{30}$H$_{35}$N$_3$O$_8$S, colorless, crystal dimensions 0.20 × 0.20 × 0.10 mm$^3$, Monoclinic, space group P 1 21/c 1’, $a = 15.0230(15)$ Å, $b = 12.3995(12)$ Å, $c = 17.7457(17)$ Å, $\alpha = 90.00$ o, $\beta = 112.6609(12)$ o, $\gamma = 90.00$ o, $V = 3050.4(5)$ Å$^3$, $Z = 4$, $\rho_{calc} = 1.362$ g cm$^{-3}$, F(000) = 1320, $\mu$(MoK$\alpha$) = 0.165 mm$^{-1}$, $T = 173$ K. 17156 reflections collected, 6907 independent reflections with $I > 2\sigma(I)$ ($2\theta_{max} = 27.48$°), and 404 parameters were used for the solution of the structure. The non-hydrogen atoms were refined anisotropically. $R_1 = 0.0449$ and $wR_2 = 0.1090$. GOF = 0.993. Crystallographic data (excluding structure factors) for the structure reported in this paper have been deposited with the Cambridge Crystallographic Data Centre as supplementary publication no. CCDC-1589706. Copies of the data can be obtained free of charge on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK [Fax: int. code + 44(1223)336-033; E-mail: deposit@ccdc.cam.ac.uk].
A solution of 6 (79.5 mg, 0.144 mmol), Pd(PPh₃)₄ (16.6 mg, 0.0144 mmol), 2-(Methoxycarbonyl)phenylboronic Acid (64.8 mg, 0.360 mmol), K₃PO₄ (115.0 mg, 0.540 mmol) in DMF (1.2 mL) and MeOH (300 µL) was stirred at 60 ºC for 3 h under argon atmosphere. Saturated NH₄Cl aqueous solution (10 mL) was added to the mixture at 0 ºC, and the product was extracted with AcOEt (10 mL × 3). The organic phase was dried over Na₂SO₄ and concentrated under reduced pressure. The crude mixture was purified by column chromatography (eluent: hexane/CHCl₃/AcOEt=10/10/1) to give the desired product 9 (62.9 mg, 78% yield).
**tert-Butyl**

2-((N-(tert-butoxycarbonyl)methylsulfonamido)methyl)-3-(2-(methoxycarbonyl)phenyl)-1H-indole-1-carboxylate (9):  

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 1.40 (s, 9H), 1.73 (s, 9H), 2.83 (s, 3H), 3.59 (s, 3H), 5.20 (d, $J = 16.4$ Hz, 1H), 5.38 (d, $J = 16.4$ Hz, 1H), 7.05-7.11 (m, 1H), 7.11-7.18 (m, 1H), 7.26-7.32 (m, 1H), 7.41-7.46 (m, 1H), 7.46-7.52 (m, 1H), 7.58-7.65 (m, 1H), 7.98-8.08 (m, 2H).  

$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 27.7 (3C), 28.2 (3C), 41.7, 41.8, 51.9, 84.1, 84.4, 115.2, 119.3, 122.8, 123.8, 124.5, 127.9, 129.9, 130.5, 130.9, 131.4, 132.0, 132.7, 133.6, 135.1, 150.4, 151.5, 157.0.  

IR (neat) 1731, 1362, 1347, 1146, 1091, 751 cm$^{-1}$.  

MS (ESI) calcd for C$_{28}$H$_{35}$N$_2$O$_8$S [M+H]$^+$ 559.2109, found 559.2110.

A solution of 9 (158.7 mg, 0.284 mmol) and NaOMe (153.4 mg, 2.84 mmol) in MeOH (2.8 mL) was refluxed for 16 h under argon atmosphere. Saturated NH$_4$Cl aqueous solution (10 mL) was added to the mixture, and the product was extracted with AcOEt (10 mL $\times$ 3). The organic phase was dried over Na$_2$SO$_4$ and concentrated under reduced pressure. The crude mixture was purified by column chromatography (eluent: hexane/ AcOEt=2/1) to give the desired product 10 (66.2 mg, 69% yield).

**Methyl 2-(2-(methylsulfonamidomethyl)-1H-indol-3-yl)benzoate (10):**  

$^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 2.90 (s, 3H), 3.60 (s, 3H), 4.17 (dd, $J = 15.4$, 4.4 Hz, 1H), 4.31 (dd, $J = 15.4$, 8.2 Hz, 1H), 5.39 (dd, $J = 8.2$, 4.4 Hz, 1H), 7.01-7.08 (m, 1H), 7.14-7.21 (m, 1H), 7.21-7.27 (m, 1H), 7.34 (d, $J = 8.4$ Hz, 1H), 7.36-7.41 (m, 1H), 7.41-7.48 (m, 1H), 7.52-7.59 (m, 1H), 7.86-7.92 (m, 1H), 8.99 (s, 1H).  

$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 39.2, 40.6, 52.4, 111.2, 114.4, 119.0, 120.0, 122.6, 127.2,
128.0, 129.8, 131.0, 131.5, 132.0, 132.9, 134.1, 135.4, 168.9. IR (neat) 3387, 3285, 1707, 1430, 1325, 1152, 1093, 743 cm⁻¹. MS (ESI) calcd for C₁₈H₁₉N₂O₄S [M+H]⁺ 359.1060, found 359.1057.

To a solution of 10 (65.2 mg, 0.182 mmol) in THF (1.8 mL) was added LiAlH₄ (13.8 mg, 0.364 mmol) at 0 ºC, and the mixture was stirred at room temperature for 1 h under argon atmosphere. Saturated Na₂SO₄ aqueous solution (10 mL) was added to the mixture at 0 ºC, and Na₂SO₄ (5 g) was added to the solution. The resulting mixture was filtered with Celite, and the filtrate was extracted with AcOEt (10 mL × 3). The organic phase was dried over Na₂SO₄, and concentrated under reduced pressure. The crude mixture was purified by column chromatography (eluent: hexane/AcOEt=1/1 to 1/2) to give the desired product S1 (59.8 g, >99% yield).

N-((3-(2-(Hydroxymethyl)phenyl)-1H-indol-2-yl)methyl)methanesulfonamide (S1): ¹H NMR (400 MHz, CDCl₃) δ 2.00 (brs, 1H), 2.90 (s, 3H), 4.10 (dd, J = 15.4, 4.0 Hz, 1H), 4.30 (dd, J = 15.4, 8.4 Hz, 1H), 4.35 (d, J = 12.0 Hz, 1H), 4.48 (d, J = 12.0 Hz, 1H), 5.89 (dd, J = 8.4, 4.0 Hz, 1H), 7.03-7.11 (m, 1H), 7.16-7.27 (m, 2H), 7.29-7.35 (m, 1H), 7.37-7.48 (m, 3H), 7.49-7.55 (m 1H), 8.93 (s, 1H). ¹³C NMR (100 MHz, CDCl₃) δ 38.5, 40.5, 63.3, 111.3, 114.5, 119.4, 120.1, 122.8, 128.09, 128.15 (2C), 129.6, 131.6, 132.1, 133.4, 135.4, 139.9. IR (neat) 3383, 1455, 1306, 1142, 1057, 744 cm⁻¹. MS (ESI) calcd for C₁₇H₁₉N₂O₃S [M+H]⁺ 331.1111, found 331.1111.

To a solution of S1 (58.2 mg, 0.176 mmol) in CH₂Cl₂ (1.8 mL) was added PPh₃ (72.1 mg, 0.275
mmol) and CBr₄ (91.2 mg, 0.275 mmol) at 0 °C, and the mixture was stirred room temperature for 1 h under argon atmosphere. The crude mixture was purified by column chromatography (eluent: hexane/AcOEt=2/3) to give the desired product 11 (49.5 mg, 72% yield).

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N\text{-}(3\text{-}(2\text{-}(\text{Bromomethyl})\text{phenyl})\text{-}1H\text{-indol-2-yl})\text{methyl})\text{methanesulfonamide (11):}\]

\begin{align*}
^1{H}\text{ NMR (400 MHz, CDCl}_3) & \delta 2.97 (s, 3H), 4.27 (dd, J = 15.6, 5.2 Hz, 1H), 4.361 (d, J = 9.8 Hz, 1H), 4.362 (dd, J = 15.6, 7.8 Hz, 1H), 4.42 (d, J = 9.8 Hz, 1H), 4.94 (dd, J = 7.8, 5.2 Hz, 1H), 7.04-7.11 (m, 1H), 7.13-7.19 (m, 1H), 7.20-7.28 (m, 2H), 7.35-7.47 (m, 3H), 7.56-7.61 (m 1H), 9.03 (s, 1H). \\
^{13}{C}\text{ NMR (100 MHz, CDCl}_3) & \delta 33.3, 38.8, 40.9, 111.4, 113.8, 119.1, 120.3, 123.0, 127.9, 128.6, 128.9, 130.7, 131.3, 132.4, 133.6, 135.6, 137.9. \\
\text{IR (neat)} & 3377, 3316, 1405, 1306, 1156, 1054, 749 \text{ cm}^{-1}. \\
\text{MS (ESI)} & \text{calcd for C}_{17}H_{18}BrN_2O_2 S [M+H]^+ 393.0267, found 393.0264. \\
\end{align*}

To a solution of 11 (49.5 mg, 0.126 mmol) in DMF (1.3 mL) was added K₂CO₃ (87.0 mg, 0.630 mmol), and the mixture was stirred room temperature for 3 h under argon atmosphere. Saturated NH₄Cl aqueous solution (10 mL) was added to the mixture, and the product was extracted with AcOEt (10 mL × 3). The organic phase was dried over Na₂SO₄ and concentrated under reduced pressure. The crude mixture was purified by column chromatography (eluent: hexane/AcOEt=2/3) to give the desired product 12 (36.2 mg, 92% yield).

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6\text{-}(\text{Methylsulfonyl})\text{-}5,6,7,8\text{-tetrahydrobenzo[5,6]azepino[3,4-b]indole (12):}\]

\begin{align*}
^1{H}\text{ NMR (400 MHz, DMSO-}d_6) & \delta 2.59 (s, 3H), 4.33 (s, 2H), 4.76 (s, 2H), 7.07-7.14 (m, 1H), 7.15-7.21 (m, 1H), 7.21-7.27 (m, 1H), 7.38-7.45 (m, 2H), 7.45-7.52 (m 1H), 7.85 (d, J = 8.0 Hz, 1H), 7.87-7.92 (m, 1H), 11.59 (s, 1H). \\
^{13}{C}\text{ NMR (100 MHz, DMSO-}d_6) & \delta 36.9, 45.9, 50.6, 111.2, 111.6, 118.8, \\
\end{align*}

S21
120.0, 122.0, 125.1, 125.9, 127.2, 128.5, 130.0, 133.2, 134.3, 134.9, 136.1. IR (neat) 3375, 2920, 1728, 1456, 1320, 1139, 1071 752 cm\(^{-1}\). MS (ESI) calcd for C\(_{17}\)H\(_{17}\)N\(_2\)O\(_2\)S \([\text{M+H}]^+\) 313.1005, found 313.1007.