Investigating Chelating Sulfonamides and their use in Metalloproteinase Inhibitors

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SUPPORTING INFORMATION

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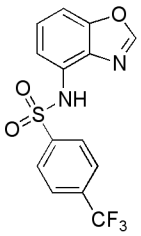
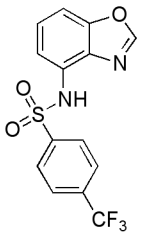
1. Synthetic Chemistry and Characterization

ZBG1 Library



ZBG1a



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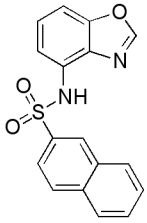

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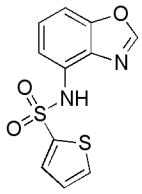
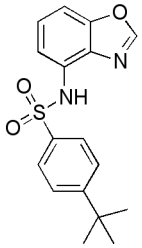


ZBG1g



ZBG1i

ZBG1a. 7-Aminobenzoxazole (495 mg, 3.69 mmol) and p-toluene sulfonyl chloride (915 mg, 4.8 mmol) were combined in 12 mL of pyridine. The solution was heated in a microwave reactor for 3 min at 130 °C and then poured into 50 mL of water. The solution was then extracted with chloroform and isolated by flash chromatography as a white powder. Yield: 515 mg (48%). ^{1}H NMR (DMSO, 400 MHz) δ 10.65 (s, 1H), 8.66 (s, 1H), 7.73 (d, J = 7.0 Hz, 2H), 7.62 (dt, J_1 = 6.4 Hz, J_2 = 0.8 Hz, 1H), 7.33-7.29 (m, 3H), 7.22 (dt, J_1 = 8.0 Hz, J_2 = 0.8 Hz, 1H), 2.30 (s, 3H). ^{13}C NMR (DMSO, 400 MHz) 153.89, 150.49, 143.65, 137.81, 132.96, 130.00, 129.90, 127.19, 126.37, 116.64, 107.62, 21.38. ESI-MS *m/z* 289.19 $(M+H)^+$.

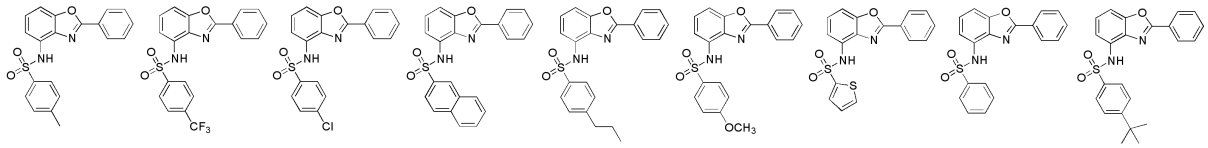
ZBG1-1. RSO_2Cl: 137 mg. Yield: 72.6 mg (57%). Purified by column chromatography (CH_2Cl_2). ^{1}H NMR (CD_3OD, 400 MHz) δ 8.25 (s, 1H), 8.00 (d, J = 8.0 Hz, 2H), 7.74 (d, J = 8.4 Hz, 2H), 7.43 (dd, J_1 = 7.2 Hz, J_2 = 1.2 Hz, 1H), 7.39 (dd, J_1 = 8.0 Hz, J_2 = 1.2 Hz, 1H), 7.33 (t, J = 8.0 Hz, 1H). ESI-MS *m/z* 343.17 $(M+H)^+$, 365.11 $(M+Na)^+$.

ZBG1-3. RSO_2Cl: 127 mg. Yield: 33 mg (27%). Recrystallized from methanol. ^{1}H NMR (DMSO-d_6, 400 MHz) δ 8.61 (s, 1H), 8.48 (s, 1H, NH), 8.08 (d, J = 8.0 Hz, 1H), 8.03 (d, J = 8.8 Hz, 1H), 7.85 (dd, J_1 = 8.4 Hz, J_2 = 2.0 Hz, 1H), 7.64 (m, 3H), 7.44 (dd, J_1 = 8.0 Hz, J_2 = 1.2 Hz, 1H, Hb), 7.26 (m, 2H, Hc + Hd), 6.96 (d, J = 8.4 Hz, 1H, Har), 6.80 (d, J = 8.4, 1H, Har). ESI-MS *m/z* 325.13 $(M+H)^+$, 347.10 $(M+Na)^+$.

ZBG1-6. RSO_2Cl: 130 mg. Yield: 23 mg (19%). Purified by automated column chromatography (10/0- 9/1 DCM/MeOH). ^{1}H NMR (CD_3OD 400 MHz) δ 8.28 (s, 1H, Ha), 7.77 (d, J = 8.8 Hz, 2H, Har), 7.47 (d, J = 8.8 Hz, 2H, Har), 7.42 (dd, J_1 = 6.8 Hz, J_2 = 1.2 Hz, 1H, Hb), 7.29-7.36 (m, 2H, Hc + Hd), 1.27 (s, 9H, ^{t}Bu). ESI-MS *m/z* 331.20 $(M+H)^+$.

ZBG1-8. RSO_2Cl: 102 mg. Yield: 12 mg (9%) purified by automated column chromatography (10/0- 9/1 DCM/MeOH). ^1H NMR (CD_3OD 400 MHz) δ 8.29 (s, 1H, Ha), 7.66 (dd, J_1 = 4.2 Hz, J_2 = 1.6 Hz, 1H, Har), 7.56 (dd, J_1 = 4.0 Hz, J_2 = 1.2 Hz, 1H, Har), 7.47 (dd, J_1 = 7.6 Hz, J_2 = 1.2 Hz, 1H, Hb), 7.39 (dd, J_1 = 8.0 Hz, J_2 = 1.6 Hz, 1H, Hc), 7.36 (d, J = 7.6 Hz, 1H, Hd), 7.00 (dd, J_1 = 4.0 Hz, J_2 = 1.2 Hz, 1H, Har). ESI-MS *m/z* 282.43 $(M+H)^+$.

ZBG-2 library



ZBG2a ZBG2b ZBG2c ZBG2d ZBG2e ZBG2f ZBG2g ZBG2h ZBG2i

ZBG2a. 2-Phenyl-7-aminobenzoxazole (414 mg, 2.0 mmol) and p-toluene sulfonyl chloride (751 mg, 4.0 mmol) were combined in 8 mL pyridine and heated in a microwave reactor at 130 °C for 3 min. The solution was poured into 30 mL of water, giving a white precipitate. The product was further purified by recrystallization from hot ethanol. Yield: 463 mg (64%). ^{1}H NMR (DMSO, 400 MHz) δ 10.61 (s, 1H), 8.12-8.08 (m, 2H), 7.74 (dt, J_1 = 11.2 Hz, J_2 = 2.4 Hz, 2H), 7.64-7.58 (m, 3H), 7.49 (d, J = 10.4 Hz, 1H), 7.33-7.26 (m, 3H), 7.16 (dd, J_1 = 10.4 Hz, J_2 = 1.2 Hz, 1H), 2.27 (s, 3H). *m/z* (ESI) 365.26 $(M+H)^+$.

ZBG2b. RSO_2Cl: 116 mg. Yield: 73 mg (73%). ^{1}H NMR (DMSO, 500 MHz) δ 8.00-8.05 (m, 4H), 7.93 (d, J = 8.0, 2H), 7.57-7.65 (m, 4H), 7.37 (t, J = 8.0 Hz, 1H), 7.22 (d, J = 8.0 Hz, 1H). ESI-MS *m/z* 419.32 $(M+H)^+$.

ZBG2c. RSO_2Cl: 134 mg. Yield: 15.4 mg (11%). ^{1}H NMR (DMSO, 400 MHz) δ 8.22 (m, 2H), 7.65 (m, 3H), 7.57 (d, J = 8.4 Hz, 1H), 7.49 (d, J = 8.0 Hz, 2H), 7.42 (d, J = 8.8 Hz, 2H), 7.34 (td, J_1 = 8.0 Hz, J_2 = 0.8 Hz, 1H), 7.14 (d, J =8.0 Hz, 1H). ESI-MS *m/z* 398.96 $(M+H)^+$.

ZBG2d. RSO_2Cl: 81 mg. Yield: 54 mg (57%). ^{1}H NMR (DMSO, 400 MHz) δ 8.53 (s, 1H), 8.11 (d, J = 7.6 Hz, 1H), 8.05 (d, J = 8.4 Hz, 1H), 7.95 (d, J = 8.0, 2H), 7.89 (d, J = 8.4, 1H), 7.47-7.66 (m, 7H), 7.28 (t, J = 6.8, 1H), 7.21 (d, J = 8.0, 1H). ESI-MS *m/z* 401.31 $(M+H)^+$.

ZBG2e. RSO_2Cl: 312 mg. Yield: 44 mg (47%). ^{1}H NMR (DMSO, 400 MHz) δ 8.10 (dt, J_1 = 5.2, J_2 = 1.2, 2H), 7.75 (d, J = 6.8, 2H), 7.59-7.64 (m, 3H), 7.51 (d, J = 6.4, 1H), 7.30-7.33 (m, 3H), 7.20 (dd, J_1 = 6.4, J_2 = 0.4, 1H), 1.44-1.50 (m, 2H), 2.50-2.53 (m, 2H), 0.74 (t, J = 6.0, 3H). ESI-MS *m/z* 393.10 $(M+H)^+$, 415.07 $(M+Na)^+$.

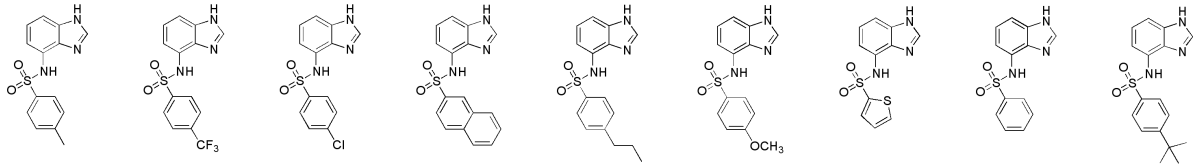
ZBG2f. RSO_2Cl: 98 mg. Yield: 70 mg (77%). ^{1}H NMR (DMSO, 400 MHz) δ 8.11 (d, J = 7.2, 2H), 7.78 (d, J = 8.8, H), 7.58-7.63 (m, 3H), 7.44 (m, 1H), 7.27 (t, J = 7.6, 1H), 7.15 (d, J = 7.6, 1H), 7.02 (d, J = 8.8, 2H), 3.73 (s, 3H, CH_3). ESI-MS *m/z* 381.16 $(M+H)^+$.

ZBG2g. RSO_2Cl: 65 mg. Yield: 48 mg (57%). ^1H NMR (DMSO, 400 MHz) δ 8.13 (dd, J_1 = 7.8, J_2 = 1.8, 2H), 7.85 (dd, J_1 = 4.8, J_2 = 1.2, 1H), 7.57-7.64 (m, 5H), 7.36 (t, J = 8, 1H), 7.26 (dd, J_1 = 8.0, J_2 = 0.8, 1H), 7.08 (dd, J_1 = 5.0, J_2 = 4.0, 1H). ESI-MS *m/z* 357.16 $(M+H)^+$.

ZBG2h. RSO_2Cl: 84 mg. Yield: 62 mg (74%). ^1H NMR (DMSO, 500 MHz) δ 8.12 (dd, J_1 = 7.8, J_2 = 1.5, 2H), 7.89 (d, J = 7.0, 2H), 7.51-7.65 (m, 7H), 7.32 (t, J = 8.5, 1H), 8.19 (d, J = 8.0, 1H). ESI-MS *m/z* 351.14 $(M+H)^+$, 373.08 $(M+Na)^+$.

ZBG2i. RSO_2Cl: 111 mg. Yield: 82 mg (85%). ^1H NMR (DMSO, 500 MHz) δ 8.21 (dt, J_1 = 6.0, J_2 = 1.5, 2H), 7.62-7.66 (m, 3H), 7.59 (dd, J_1 = 8.0, J_2 = 1.0, 1H), 7.39 (t, J = 8.0, 1H), 7.27 (dd, J_1 = 8.0, J_2 = 1.0, 1H). ESI-MS *m/z* 289.34 $(M+H)^+$.

ZBG-3 library



ZBG3a ZBG3b ZBG3c ZBG3d ZBG3e ZBG3f ZBG3g ZBG3h ZBG3i

ZBG3a. 7-Aminobenzimidazole (798 mg, 6.0 mmol) and p-toluene sulfonyl chloride (1.14 g, 6.0 mmol) were combined in 20 mL of pyridine and heated in a microwave reactor for 3.5 h at 100 °C. The solvent was removed and the residue taken up in 75 mL of water, yielding a white solid. The product was further purified by recrystallization from hot ethanol. Yield: 854 mg (50%). ^{1}H NMR (DMSO, 400 MHz) δ 12.08 (s, 1H), 10.01 (br s, 1H), 8.14 (s, 1H), 7.76 (br s, 1H), 7.60 (br s, 1H), 7.42-7.18 (m, 3H), 7.08-6.72 (m, 2H), 2.30 (s, 3H). ^{13}C NMR (DMSO, 400 MHz) 153.89, 150.49, 143.65, 137.81, 132.96, 130.00, 129.90, 127.19, 126.37, 116.64, 107.62, 21.38. *m/z* (ESI) 288.25 $(M+H)^{+}$.

ZBG3b. RSO_2Cl: 92 mg. Yield: 27 mg (21%). ^{1}H NMR (CD_3OD, 400 MHz) δ 8.09 (m, 2H), 7.91 (d, *J* = 5.6 Hz, 2H), 7.66 (d, *J* = 8.0 Hz, 2H), 7.40 (brs, 1H), 7.11 (t, *J* = 7.2 Hz, 1H). ESI-MS *m/z* 342.0 $(M+H)^{+}$.

ZBG3c. RSO_2Cl: 85 mg. Yield: 14 mg (12%). ^{1}H NMR (CD_3OD, 400 MHz) δ 8.30 (s, 1H), 7.37-7.39 (m, 5H), 7.15 (t, *J* = 7.6 Hz, 1H), 7.04 (d, *J* = 8.4 Hz, 1H), 4.81 (s, 2H). ESI-MS *m/z* 321.9 $(M+H)^{+}$.

ZBG3d. RSO_2Cl: 85 mg. Yield: 43 mg (35%). ^{1}H NMR (CD_3OD, 400 MHz) δ 8.29 (brs, 1H), 8.10 (s, 1H), 7.89-7.92 (m, 3H), 7.75-7.77 (d, *J* = 4.0 Hz, 1H), 7.54-7.63 (m, 2H), 7.34 (brs, 1H), 7.04 (brs,1H), 4.62 (brs, NH). ESI-MS *m/z* 323.99 $(M+H)^{+}$.

ZBG3e. RSO_2Cl: 82 mg. Yield: 9 mg (7%). ^{1}H NMR (CD_3OD, 500 MHz) δ 8.12 (s, 1H), 7.77 (brs, 1H), 7.63 (brs, 1H), 7.20-7.34 (m, 3H), 6.97–7.04 (m, 2H), 6.77 (s, NH), 2.55 (t, *J* = 7.0 Hz, 2H), 1.54 (sext, *J* = 7.5 Hz, 2H), 0.83 (t, *J* = 7.0 Hz, 3H). ESI-MS *m/z* 316.51 $(M+H)^{+}$.

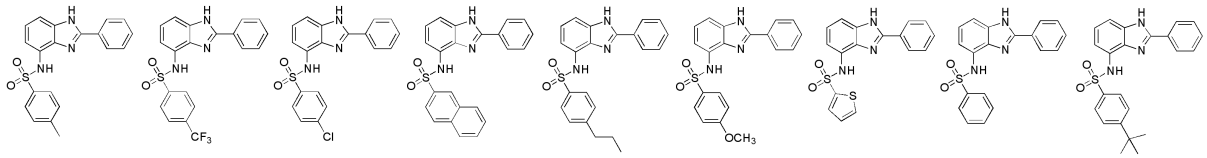
ZBG3f. RSO_2Cl: 78 mg. Yield: 40 mg (35%). ^{1}H NMR (DMSO, d_6, 500 MHz) δ 8.12 (s, 1H), 7.80 (d, *J* = 7.6 Hz, 1H), 7.63 (d, *J* = 8.0 Hz, 1H). ESI-MS *m/z* 304.02 $(M+H)^{+}$.

ZBG3g. RSO_2Cl: 68 mg. Yield: 51mg (49%). ^1H NMR (CD_3OD, 400 MHz) δ 8.01 (s, 1H), 7.67 (d, J = 5.2 Hz, 1H), 7.41-7.46 (m, 3H), 7.13 (t, J = 8.0 Hz, 1H), 7.01 (t, J = 4.8 Hz, 1H). ESI-MS *m/z* 279.92 $(M+H)^+$.

ZBG3h. RSO_2Cl: 66 mg. Yield: 11 mg (11%). ^1H NMR (CD_3OD, 400 MHz) δ 8.09 (brs, 1H), 7.75 (brs, 2H), 7.52 (t, J = 7.2 Hz, 1H), 7.36-7.44 (m, 3H), 7.08 (t, J = 5.6 Hz, 1H). ESI-MS *m/z* 274.32 $(M+H)^+$.

ZBG3i. RSO_2Cl: 87 mg. Yield: 45 mg (36%). ^1H NMR (CD_3OD, 400 MHz) δ 8.10 (brs, 1H), 7.68 (brs, 2H), 7.46-7.50 (m, 3H), 7.37 (brs, 1H), 7.10 (t, J = 5.6, 1H), 1.29 (s, 9H). ESI-MS *m/z* 330.0 $(M+H)^+$.

ZBG-4 library



ZBG4a ZBG4b ZBG4c ZBG4d ZBG4e ZBG4f ZBG4g ZBG4h ZBG4i

ZBG4a. 2-Phenyl-7-aminobenzoxazole (600 mg, 2.9 mmol) and p-toluene sulfonyl chloride (1.09 g, 5.7 mmol) were combined in 8 mL of pyridine and heated at 130 °C for 3 min. The solution was poured into 30 mL of water and extracted with chloroform. Solvent removal led to a white solid, and the product was further purified by recrystallization from hot ethanol. Yield: 702 mg (70%) ^{1}H NMR (DMSO, 400 MHz) δ 10.67 (s, 1H), 8.32-8.26 (m, 2H), 7.75 (d, J = 8.0 Hz, 2H), 7.73-7.68 (m, 3H), 7.48 (d, J = 8.0 Hz, 1H), 7.37-7.29 (m, 3H), 7.22 (d, J = 8.0 Hz, 1H), 2.28 (s, 3H). *m/z* (ESI) 364.21 $(M+H)^+$.

ZBG4b. RSO_2Cl: 117 mg. Yield: 27 mg (27%). ^{1}H NMR (DMSO, d_6, 500 MHz) δ 8.19 (m, 2H), 8.05 (d, J = 8.5 Hz, 2H), 7.93 (d, J = 8.5 Hz, 2H), 7.66 (dd, J_1 = 5.3 Hz, J_2 = 1.8 Hz, 1H), 7.52 (d, J = 8.0 Hz, 1H), 7.32 (t, J = 8.0 Hz, 1H), 7.11 (d, J = 7.5 Hz, 1H). ESI-MS *m/z* 418.05 $(M+H)^+$.

ZBG4c. RSO_2Cl : 107 mg. Yield: 80 mg (84%). ^{1}H NMR (DMSO, d_6, 400 MHz) δ 8.16 (dd, J_1 = 8.6 Hz, J_2=0.4 Hz, 2H), 7.73-7.84 (m, 3H), 7.68 (dd, J_1 = 8.4 Hz, J_2 = 0.8 Hz, 1H), 7.59 (t, J = 8.4 Hz, 1H), 7.48 (dd, J = 8.0 Hz, 1H), 7.34 (d, J = 8.4 Hz, 2H), 7.26 (d, J = 8.4 Hz, 2H), 3.34 (s, 2H). ESI-MS *m/z* 397.9 $(M+H)^+$.

ZBG4d. RSO_2Cl: 81 mg. Yield: 65 mg (68%). ^{1}H NMR (DMSO d_6, 400 MHz) δ 8.52 (brs, 1H), 8.08 (d, J = 7.6 Hz, 1H), 8.01 (m, 3H), 7.93 (m, 2H), 7.61 (m, 2H), 7.48 (d, J = 6.8 Hz, 3H), 7.26 (m, 1H), 7.03 (t, J = 6.8 Hz, 2H). ESI-MS *m/z* 400.06 $(M+H)^+$.

ZBG4e. RSO_2Cl: 105 mg. Yield: 62 mg (67%). ^{1}H NMR (DMSO d_6, 500 MHz) δ 8.10 (dd, J_1 = 8.3 Hz, J_2 = 1.3 Hz, 2H), 7.75 (brs, 2H), 7.55 (t, J = 8.0 Hz, 2H), 7.50 (t, J = 7.0 Hz, 1H), 7.30 (d, J = 8.0 Hz, 3H), 7.07 (t, J = 8.0 Hz, 1H), 6.99 (brs, 1H), 0.77 (t, J = 7.0 Hz, 3H), 1.48 (sex, J = 7.5 Hz, 2H), 2.32 (t, J = 7.5 Hz, 2H). ESI-MS *m/z* 392.06 $(M+H)^+$.

ZBG4f. RSO_2Cl: 99 mg. Yield: 64 mg (70%). ^{1}H NMR (DMSO d_6, 400 MHz) δ 8.10 (d, J = 7.2 Hz, 2H), 7.83 (d, J = 8.0 Hz, 1H), 7.70 (d, J = 6.4 Hz, 1H), 7.54 (m, 3H), 7.38 (m, 1H),

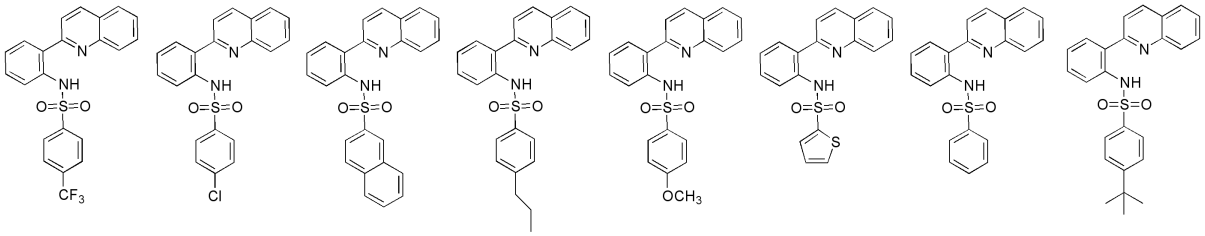
7.21 (d, J = 7.6 Hz, 1H), 7.01 (m, 3H), 8.56 (brs, NH), 6.90 (brs, NH), 3.72 (s, CH_3). ESI-MS m/z 380.04 $(M+H)^+$.

ZBG4g. RSO_2Cl: 65 mg. Yield: 58 mg (68%). ^1H NMR (DMSO d_6, 400 MHz) δ 8.10 (d, J = 5.6 Hz, 2H), 7.815 (d, J = 21 Hz, 1H), 7.28-7.62 (m, 5H), 7.04-7.09 (m, 2H), 6.91 (brs, 1H). m/z (ESI) 356.02 $(M+H)^+$.

ZBG4h. RSO_2Cl: 169 mg. Yield: 8 mg (5%). ^1H NMR (DMSO d_6, 500 MHz) δ 8.20 (d, J = 7.5 Hz, 2H), 7.72-7.83 (m, 5H), 7.63-7.67 (m, 2H), 7.52 (t, J = 7.5 Hz, 2H), 7.39 (t, J = 8.0 Hz, 1H), 6.84 (d, J = 8.0 Hz, 1H). ESI-MS m/z 350.07 $(M+H)^+$.

ZBG4i. RSO_2Cl: 111 mg. Yield: 83 mg (85%). ^1H NMR (DMSO d_6, 400 MHz) δ 8.07 (dd, J_1 = 8.4 Hz, J_2 = 0.6 Hz, 1H), 7.75 (m, 2H), 7.48 (m, 6H), 7.27 (m, 1H), 7.06 (t, J = 8.0 Hz, 1H), 7.00 (d, J = 8 Hz, 1H). ESI-MS m/z 406.11 $(M+H)^+$.

ZBG-5 library



ZBG5b **ZBG5c** **ZBG5d** **ZBG5e** **ZBG5f** **ZBG5g** **ZBG5h** **ZBG5i**

ZBG5b. RSO_2Cl: 111 mg. Yield: 103 mg (53%). ^1H NMR ($CDCl_3$, 400 MHz) δ 8.13 (dd, J1= 1.05, J2=3.6, 2H), 7.83 (m, 2H), 7.78 (d, J=8.4, 1H), 7.73 (d, J=7.6, 1H), 7.62 (t, J=6.8, 1H), 7.507 (d, J=8.8, 1H), 7.45 (m, 3H), 7.27 (m, 2H), 7.22 (d, J=8.4, 2H). ESI-MS *m/z* 429.08 $(M+H)^+$.

ZBG5c. RSO_2Cl: 102 mg. Yield: 52 mg (58%). ^1H NMR (CD_2Cl_2, 400 MHz) δ 8.71 (d, J = 8.4, 1H), 8.34 (d, J = 8.8, 1H), 8.08 (d, J = 8.8, 1H), 7.99 (d, J = 8.8, 2H), 7.87 (d, J = 8.0, 1H), 7.80 (td, J1 = 7.6, J2 = 1.2, 1H), 7.62 (td, J1 = 7.6, J2 = 0.8, 1H), 7.52 (td, J1 = 7.2, J2 = 1.2, 1H), 7.34 (td, J1 = 7.2, J2 = 0.8, 1H), 7.26 (s, 1H).

ZBG5d. RSO_2Cl: 103 mg. Yield: 22 mg (24%). ^1H NMR (CD_2Cl_2, 400 MHz) δ 8.19 (d, J = 8.4 Hz, 1H), 7.98 (s, 1H), 7.93 (d, J = 8.8 Hz, 1H), 7.86 (t, J = 6.8 Hz, 1H), 7.78 (dd, J_1= 8.4 Hz, J_2 = 4.0 Hz, 2H), 7.71 (t, J = 6.4 Hz, 2H), 7.63 (t, J = 7.2 Hz, 1H), 7.54 (t, J = 8.0 Hz, 1H), 7.46-7.48 (m, 3H), 7.43 (d, J = 8.8 Hz, 1H), 7.38 (d, J = 8.8 Hz, 1H), 7.31 (dd, J_1 = 7.2 Hz, J_2 = 0.8 Hz, 1H), 7.21 (t, J = 8.0 Hz, 1H). ESI-MS *m/z* 411.09 $(M+H)^+$.

ZBG5e. RSO_2Cl: 81 µL. Yield: 25 mg (27%). ^1H NMR (CD_2Cl_2, 400 MHz) δ 8.22 (t, J = 6.0 Hz, 1H), 8.17 (t, J = 6.8 Hz, 1H), 7.80-7.91 (m, 3H), 7.76 (t, J = 6.8 Hz, 1H), 7.65-7.68 (m, 2H). ESI-MS *m/z* 403.14 $(M+H)^+$

ZBG5f. RSO_2Cl: 94 mg. Yield: 58 mg (35%). ^1H NMR (CD_2Cl_2, 400 MHz) δ 8.22 (d, J = 8.8 Hz, 1H), 8.15 (d, J = 8.4 Hz, 1H), 7.86 (t, J = 8.4 Hz, 1H), 7.81 (t, J = 8.0 Hz, 1H), 7.72 (d, J = 8.0 Hz, 1H), 7.63 (t, J = 6.8 Hz, 1H), 7.34-7.42 (m, 3H), 7.22 (t, J = 7.2 Hz, 1H), 6.53 (d, J = 8.8 Hz, 2H), 3.69 (s, 3H). ESI-MS *m/z* 391.08 $(M+H)^+$.

ZBG5g. RSO_2Cl: 83 mg. Yield: 118 mg (71%). ^1H NMR ($CDCl_3$, 400 MHz) δ ^1H NMR (MeOH, 400 MHz) δ 8.207 (d, J=8.8, 1H), 8.16 (d, J=8.4, 1H), 7.83 (m, 4H), 7.71 (d, J=8.8, 1H), 7.60 (t, J=8.0, 1H), 7.43 (t, J=8.0, 1H), 7.23 (m, 3H), 6.71 (t, J=3.6, 1H). ESI-MS *m/z* 367.03 $(M+H)^+$.

ZBG5h. RSO_2Cl: 58 μL. Yield: 14 mg (16%). ^1H NMR (CD_2Cl_2, 400 MHz) δ 8.23 (d, J = 6.4 Hz, 1H), 8.17 (d, J = 8.4 Hz, 1H), 7.89 (d, J = 9.2 Hz, 1H), 7.86 (td, J_1 = 6.8 Hz, J_2 = 1.2 Hz, 1H), 7.82 (dd, J_1 = 8.0 Hz, J_2 = 1.6 Hz, 1H), 7.75 (dd, J_1 = 8.0 Hz, J_2 = 1.2 Hz, 1H), 7.63-7.68 (m, 2H), 7.40-7.48 (m, 3H), 7.33 (tt, J_1 = 7.6 Hz, J_2 = 1.2 Hz, 1H), 7.24 (td, J_1 = 8.0 Hz, J_2 = 1.2 Hz, 1H), 7.11 (td, J_1 = 7.6 Hz, J_2 =0.8 Hz, 2H). ESI-MS *m/z* 361.11 $(M+H)^+$.

ZBG5i. RSO_2Cl: 106 mg. Yield: 63 mg (66%). ^1H NMR (CD_2Cl_2, 400 MHz) δ 8.12-8.17 (m, 2H), 7.81-7.86 (m, 2H), 7.73-7.86 (m, 2H), 7.63 (t, J = 6.8 Hz, 1H), 7.58 (dd, J_1 = 8.8 Hz, J_2 = 3.2 Hz, 1H), 7.42 (t, J = 9.6 Hz, 1H), 7.29 (d, J = 5.2 Hz, 2H), 7.24 (t, J = 7.2 Hz, 1H), 7.04 (d, J = 5.2 Hz, 2H), 1.17 (s, 9H). ESI-MS *m/z* 417.16 $(M+H)^+$.

2. Coordination Compound Synthesis and Crystallization

Single-Crystal X-ray Diffraction - General. Single crystals were mounted on a nylon loop with Paratone oil and placed under a nitrogen cold stream (100 K). Data was collected on a Bruker Apex Platform diffractometer using Mo Kα radiation (λ = 0.71073 Å) controlled using the APEX 2.0 software package. A semiempirical method utilizing equivalents was employed to correct for absorption. All data collections were solved and refined using the SHELXTL suite. All non-hydrogen atoms were refined anisotropically. Hydrogen atoms bound to carbon atoms were placed in calculated positions and refined isotropically with a riding model. Hydrogen atoms bound to nitrogen and oxygen atoms were found via Fourier difference maps and refined isotropically.

THBI: A solution of 20 mg (0.069 mmol) **ZBG1a** and 10.3 mg (0.035 mmol) $Zn(NO_3)_2 \cdot 6H_2O$ in 3 mL each of methanol and chloroform was allowed to stir for approximately one week. The solvent was removed and the residue recrystallized from hot ethanol. ^{1}H NMR (DMSO-d_6, 400 MHz) δ 10.28 (br s, 1H), 8.65 (s, 1H), 7.99 (d, 2H, J = 8.0 Hz), 7.43 (d, 2H, J = 8.0 Hz), 7.24 (d, 1H, J = 8.0 Hz), 7.17 (t, 1H, J = 8.0 Hz), 6.71 (d, 1H, J = 8.0 Hz), 2.33 (s, 3H).

Zn_4(THBI)$_6Cl_2$: A solution of 20 mg (0.069 mmol) **ZBG1a** in 3 mL of chloroform was added dropwise with stirring to 4.7 mg (0.035 mmol) of $ZnCl_2$ dissolved in 2 mL of methanol. Triethylamine (9.5 μL, 0.069 mmol) was added and the solution was allowed to stir overnight. The solvent was removed and the residue taken up in a minimum amount of dichloromethane. The product was crystallized by vapor diffusion using diethyl ether as the precipitant.

Co(acac)$_2$(ZBG1a)$_2$: A solution of 20 mg (0.069mmol) **ZBG1a** in 2 mL of dichloromethane was added dropwise with stirring to 8.9 mg (0.035 mmol) of $Co(acac)_2$ dissolved in 3 mL of chloroform. The solution was allowed to stir overnight, then the solvent was removed and the residue taken up in a minimum amount of chloroform. The product was crystallized by vapor diffusion using diethyl ether as the precipitant.

Ni(acac)$_2$(ZBG1a)$_2$: A solution of 20 mg (0.069mmol) **ZBG1a** in 2 mL of dichloromethane was added dropwise with stirring to 8.9 mg (0.035 mmol) of $Ni(acac)_2$ dissolved in 3 mL of chloroform. The solution was allowed to stir overnight, then the solvent was removed and the residue taken up in a minimum amount of chloroform. The product was crystallized by vapor diffusion using diethyl ether as the precipitant.

Cu(OAc)$_2$(ZBG1a)$_2$: A solution of 20 mg (0.069mmol) **ZBG1a** in 2 mL of dichloromethane was added dropwise with stirring to 6.9 mg (0.035 mmol) of $Cu(OAc)_2 \cdot H_2O$ dissolved in 2 mL of dichloromethane and 1 mL of methanol. Triethylamine (9.5 μL, 0.069 mmol) was added and the

solution was allowed to stir overnight. The solvent was then removed and the residue taken up in a minimum amount of chloroform. The product was crystallized by vapor diffusion using diethyl ether as the precipitant.

Zn(ZBG2a)Cl_2·Et_3NH: A solution of 20 mg (0.055mmol) **ZBG2a** in 3 mL of methanol was added dropwise with stirring to 3.7 mg (0.028 mmol) of $ZnCl_2$ dissolved in 2 mL of methanol. Triethylamine (7.6 μL, 0.055 mmol) was added and the solution was allowed to stir overnight. The solvent was removed and the residue taken up in a minimum amount of methanol. The product was crystallized by vapor diffusion using diethyl ether as the precipitant. λ_{max} = 258 nm (DMSO, 0.1% triethylamine).

Zn(ZBG3a)$_3$·Et_2O: A solution of 20 mg (0.070 mmol) **ZBG3a** in 2 mL of dichloromethane was added dropwise with stirring to 10.4 mg (0.035 mmol) of $Zn(NO_3)_2·6H_2O$ dissolved in 3 mL of methanol. The solution was allowed to stir 2 hr after the addition of 35 μL of 1M NaOH. The solvent was removed and the residue taken up in a minimum amount of 50:50 methanol:chloroform. The product was crystallized by vapor diffusion using diethyl ether as the precipitant. λ = 256, 288 nm (DMSO, 0.1% triethylamine).

Co(ZBG3a)$_3$·Et_2O: A solution of 20 mg (0.070 mmol) **ZBG3a** in 1 mL dichloromethane and 2 mL of methanol was added dropwise with stirring to 8.9 mg (0.035 mmol) of $Co(acac)_2$ dissolved in 2 mL of methanol. The solution was allowed to stir overnight. The solvent was removed and the residue taken up in a minimum amount of 50:50 methanol:chloroform. The product was crystallized by vapor diffusion using diethyl ether as the precipitant. λ_{max} = 584, 605 nm (DMSO, 0.1% triethylamine).

Cu(ZBG3a)$_3$: A solution of 20 mg (0.070 mmol) **ZBG3a** in 3 mL of dichloromethane was added dropwise with stirring to 9.1 mg (0.035 mmol) of $Cu(acac)_2$ dissolved in 2 mL of acetonitrile. Triethylamine (9.7 μL, 0.070 mmol) was added and the solution was allowed to stir overnight. The solvent was removed and the residue taken up in a minimum amount of 50:50 methanol:acetone. The product was crystallized by vapor diffusion using diethyl ether as the precipitant. λ_{max} = 535 nm (DMSO, 0.1% triethylamine).

Ni(ZBG3a)$_2$(H_2O)$_2$·(CH_3)$_2$CO: A solution of 20 mg (0.070 mmol) **ZBG3a** in 2 mL of dichloromethane was added dropwise with stirring to 3.7 mg (0.035 mmol) of $NiCl_2$ dissolved in 3 mL of methanol. Triethylamine (9.7 μL, 0.070 mmol) was added and the solution was allowed to stir overnight. The solvent was removed and the residue taken up in a minimum amount of 50:50 methanol:acetone. The product was crystallized by vapor diffusion using diethyl ether as the precipitant. λ_{max} = 690 nm (DMSO, 0.1% triethylamine).

ZBG4a·HNO_3: A solution of 20 mg (0.055 mmol) **ZBG4a** in 2 mL of methanol was added dropwise with stirring to 8.0 mg (0.028 mmol) of $Zn(NO_3)_2·6H_2O$ dissolved in 2 mL of methanol and allowed to

stir overnight. The solvent was removed and the residue taken up in a minimum amount of chloroform. The product was crystallized by vapor diffusion using diethyl ether as the precipitant.

Table S1. Crystallographic and structure refinement data (CCDC 840783 - 840794).

Compound	**ZBG1a·0.5H$_2$O**	**THBI**	**Zn$_4$(THBI)$_6$Cl$_2$**	**Co(acac)$_2$(ZBG1a)$_2$**
Empirical Formula	$C_{28}H_{26}N_4O_7S_2$	$C_{14}H_{12}N_2O_3S$	$C_{46}H_{43}N_6O_{10}S_3Zn_2Cl$	$C_{38}H_{38}N_4O_{10}S_2Co$
Formula Weight	594.65	288.32	1102.23	833.78
Collection *T* (K)	100(2)	100(2)	100(2)	100(2)
λ (Å)	0.71073	0.71073	0.71073	0.71073
Crystal system	Monoclinic	Triclinic	Triclinic	Monoclinic
Space group	$P2_1/c$	P-1	P-1	$P2_1/n$
a (Å)	13.266(3)	4.930(3)	13.770(1)	10.764(2)
b (Å)	14.149(3)	11.347(6)	13.850(1)	11.592(2)
c (Å)	14.279(3)	11.935(6)	14.323(1)	15.174(2)
α (deg)	90	75.224(7)	74.033(3)	90
β (deg)	98.181(3)	80.593(7)	71.268(3)	103.642(2)
γ (deg)	90	80.207(7)	75.693(3)	90
V (Å^3)	42653.0(9)	631.2(6)	2448.9(4)	1839.8(6)
Z	4	2	2	2
D_{calcd} (g cm^{-3})	1.489	1.517	1.495	1.505
μ (mm^{-1})	0.258	0.265	1.224	0.646
min/max *T*	0.9153/0.9267	0.9588/0.9843	0.7102/0.7494	0.6179/0.7456
hkl ranges	-17<*h*<16	-6<*h*<6	-16<*h*<16	-14<*h*<13
	-17<*k*<18	-14<*k*<14	-16<*k*<16	-14<*k*<14
	-18<*l*<18	-15<*l*<15	-17<*l*<16	-19<*l*<19
total reflections	21291	8245	24336	23543
unique reflections	6181	2852	8556	4218
R (int)	0.0481	0.0430	0.0391	0.0432
parameters/restraints	384/4	185/0	613/0	256/0
R_1 (all data)	0.0876	0.0693	0.0641	0.0435
R_1 [$I > 2\sigma(I)$]	0.0707	0.0483	0.0422	0.0358
wR_2 (all data)	0.2002	0.1122	0.1337	0.0946
wR_2 [$I > 2\sigma(I)$]	0.1843	0.1002	0.1136	0.0902
max/min residual (e$^-$/Å^3)	1.179/-0.414	0.319/-0.443	0.876/-0.485	1.170/-0.424
G.O.F.	1.031	1.034	1.082	1.044

Table S1. Crystallographic and structure refinement data (CCDC 840783 - 840794).

Compound	**$Ni(acac)_2(ZBG1a)_2$**	**$Cu(OAc)_2(ZBG1a)_2$**	**$Zn(ZBG2a)Cl_2{\cdot}Et_3NH$**	**$Zn(ZBG3a)_3{\cdot}Et_2O$**
Empirical Formula	$C_{38}H_{38}N_4O_{10}S_2Ni$	$C_{36}H_{36}N_4O_{14}S_2Cu$	$C_{53}H_{66}N_6O_7S_2Cl_4Zn_2$	$C_{46}H_{47}N_9O_7S_3Zn$
Formula Weight	833.55	939.88	1235.78	999.48
Collection T (K)	100(2)	100(2)	100(2)	100(2)
λ (Å)	0.71073	0.71073	0.71073	0.71073
Crystal system	Monoclinic	Triclinic	Orthorhombic	Monoclinic
Space group	$P2_1/n$	P-1	$Pca2_1$	$P2_1/n$
a (Å)	10.6601(7)	8.1836(4)	15.578(1)	14.016(3)
b (Å)	11.6640(7)	14.1253(8)	11.6168(7)	21.426(5)
c (Å)	15.1089(9)	17.2139(9)	30.984(2)	15.589(4)
α (deg)	90	81.685(1)	90	90
β (deg)	103.468(1)	78.719(1)	90	100.610(4)
γ (deg)	90	80.159(1)	90	90
V (Å^3)	1839.8(6)	1909.9(2)	5607.1(6)	4601.6(19)
Z	2	2	4	4
D_{calcd} (g cm^{-3})	1.515	1.634	1.464	1.443
μ (mm^{-1})	0.711	1.298	1.176	0.732
min/max T	0.8096/0.9070	0.7374/0.9499	0.5852/0.6021	0.8615/0.9574
hkl ranges	-13<h<13	-9<h<9	-13<h<19	-16<h<17
	-15<k<15	-16<k<15	-14<k<8	-26<k<27
	-19<l<19	-19<l<19	-35<l<39	-19<l<19
total reflections	14427	22099	24454	33817
unique reflections	4073	6061	11534	9507
R (int)	0.0395	0.0291	0.0471	0.1116
parameters/restraints	256/0	535/0	674/1	612/0
R_1 (all data)	0.0421	0.0389	0.0470	0.0928
R_1 [$I > 2\sigma(I)$]	0.0338	0.0305	0.0429	0.0532
wR_2 (all data)	0.0826	0.0970	0.1105	0.1360
wR_2 [$I > 2\sigma(I)$]	0.0763	0.803	0.1078	0.1173
max/min residual (e$^-$/Å^3)	0.329/-0.403	0.443/-0.577	0.816/-0.711	0.495/-0.590
G.O.F.	1.043	1.150	1.029	0.982

Table S1. Crystallographic and structure refinement data (CCDC 840783 - 840794).

Compound	**Co(ZBG3a)$_3$·Et$_2$O**	**Cu(ZBG3a)$_3$**	**Ni(ZBG3a)$_2$(H$_2$O)$_2$·(CH$_3$)$_2$CO**	**ZBG4a·HNO$_3$**
Empirical Formula	$C_{46}H_{47}N_9O_7S_3Co$	$C_{42}H_{37}N_9O_6S_3Cu$	$C_{31}H_{34}N_6O_7S_2Ni$	$C_{20}H_{18}N_4O_5S$
Formula Weight	993.04	923.53	725.47	426.45
Collection *T* (K)	100(2)	100(2)	100(2)	100(2)
λ (Å)	0.71073	0.71073	0.71073	0.71073
Crystal system	Monoclinic	Triclinic	Monoclinic	Triclinic
Space group	$P2_1/n$	P-1	$P2_1/c$	P-1
a (Å)	14.082(1)	10.307(1)	12.938(2)	7.8042(9)
b (Å)	21.421(2)	14.164(2)	9.678(1)	9.653(1)
c (Å)	15.638(1)	16.076(2)	26.487(3)	13.521(2)
α (deg)	90	106.076(2)	90	93.722(2)
β (deg)	100.980(2)	104.444(2)	94.538(2)	95.255(2)
γ (deg)	90	104.477(2)	90	109.926(2)
V (Å^3)	4631.1(7)	2037.8(5)	3306.1(7)	948.6(2)
Z	4	2	4	2
D_{calcd} (g cm^{-3})	1.424	1.505	1.457	1.493
μ (mm^{-1})	0.567	0.751	0.769	0.214
min/max *T*	0.9197/0.9832	0.8957/0.9778	0.8251/0.9626	0.9505/0.9957
hkl ranges	-17<*h*<17	-13<*h*<13	-14<*h*<14	-9<*h*<9
	-26<*k*<26	-18<*k*<18	-10<*k*<9	-11<*k*<11
	-19<*l*<18	-20<*l*<17	-29<*l*<29	-16<*l*<16
total reflections	35930	23801	23225	12272
unique reflections	9787	9239	4828	3443
R (int)	0.1073	0.0800	0.0822	0.0503
parameters/restraints	612/0	565/4	441/8	281/3
R_1 (all data)	0.1359	0.1206	0.0768	0.1068
R_1 [$I > 2\sigma(I)$]	0.0590	0.0674	0.0485	0.0940
wR_2 (all data)	0.1286	0.1573	0.1305	0.2475
wR_2 [$I > 2\sigma(I)$]	0.1062	0.1268	0.1136	0.2421
max/min residual (e$^-$/Å^3)	0.489/-0.450	0.606/-1.483	0.823/-0.518	0.866/-0.509
G.O.F.	1.015	1.023	1.043	1.193

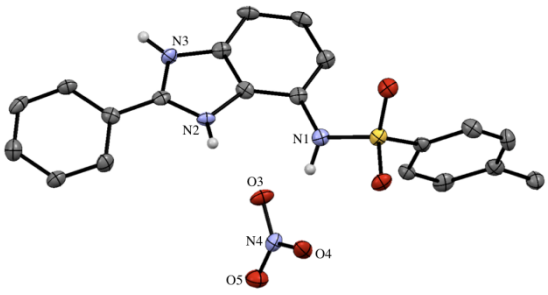


Figure S1. Structure of **ZBG4a**·HNO$_3$. Thermal ellipsoids are shown at 50% probability and most hydrogen atoms have been omitted for clarity.