

Supporting Information

Easy conjugations between molecules via copper-catalyzed reactions of *ortho*-aromatic diamines with ketones

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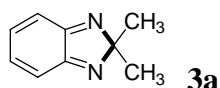
A: General experimental procedures

Proton and carbon magnetic resonance spectra (^1H NMR and ^{13}C NMR) were recorded using tetramethylsilane (TMS). Chemical shifts (δ) are given in ppm relative to TMS. The residual solvent signals were used as references and the chemical shifts converted to the TMS scale (CDCl_3 : $\delta_{\text{H}} = 7.26$ ppm, $\delta_{\text{C}} = 77.16$ ppm; $\text{DMSO}-d_6$: $\delta_{\text{H}} = 2.50$ ppm, $\delta_{\text{C}} = 39.52$ ppm; CD_3OD : $\delta_{\text{H}} = 3.31$ ppm, $\delta_{\text{C}} = 49.00$ ppm).

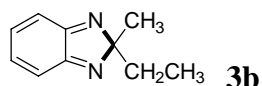
B: General Procedure for Copper-Catalyzed Conjugations of *ortho*-Aromatic

Diamines with Ketones. A 25 mL flask was charged with a magnetic stirrer and ethanol (2.0 mL) or water/ethanol (v/v = 10:1) (3.3 mL) (for **3g'** and **3h'**), *o*-aromatic diamine (**1**) (1.0 mmol), ketone (**2**) (1.2 mmol) and $\text{Cu}(\text{OAc})_2$ (0.05 mmol, 9.1 mg) were added to the flask. The mixture was stirred at room temperature (~ 25 °C) under air. After the conjugation completed (TLC determination), the resulting solution was concentrated by a rotary evaporator, and the residue was purified by column chromatography on silica gel using an eluent (petroleum ether/ethyl acetate, ethyl acetate/methanol, ethyl acetate/ethanol or diethyl ether) to provide the desired target product (**3a-h'**).

C: Characterization data of compounds **3a-h'**

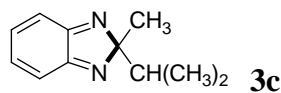


2,2-Dimethyl-2H-benzo[d]imidazole (3a).¹ Eluent: diethyl ether. Yield: 133 mg (91%) as a yellow oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.19 (dd, 2H, $J = 7.3, 2.7$ Hz), 7.00 (dd, 2H, $J = 7.3, 2.7$ Hz), 1.54 (s, 6H). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 159.5, 134.5, 126.0, 104.4, 21.6. ESI-MS $[\text{M}+\text{H}]^+$ m/z 147.3.

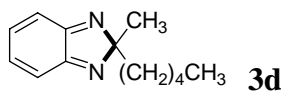


2-Ethyl-2-methyl-2H-benzo[d]imidazole (3b).² Eluent: diethyl ether. Yield: 152 mg (95%) as a yellow oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.20 (dd, 2H, $J = 7.3, 3.2$ Hz), 7.01 (dd, 2H, $J = 7.3, 3.2$ Hz), 2.07 (q, 2H, $J = 7.3$ Hz), 1.51 (s, 3H), 0.74 (t, 3H,

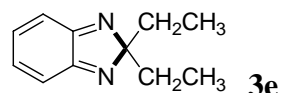
$J = 7.3$ Hz). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 159.8, 134.4, 125.8, 107.1, 29.3, 19.9, 8.9. ESI-MS $[\text{M}+\text{H}]^+$ m/z 161.5.



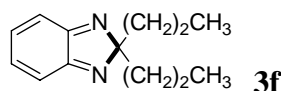
2-isoPropyl-2-methyl-2H-benzo[d]imidazole (3c). Eluent: diethyl ether. Yield: 136 mg (78%) as a yellow oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.20 (dd, 2H, $J = 7.3$, 2.7 Hz), 7.00 (dd, 2H, $J = 7.3$, 2.7 Hz), 2.30 (m, 1H, $J = 6.8$ Hz), 1.47 (s, 3H), 0.95 (d, 6H, $J = 6.8$ Hz). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 159.8, 134.4, 125.7, 109.8, 35.0, 18.6, 18.3. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{11}\text{H}_{15}\text{N}_2$ 175.1235, found 175.1231.



2-Methyl-2-pentyl-2H-benzo[d]imidazole (3d). Eluent: diethyl ether. Yield: 188 mg (93%) as a yellow oil. ^1H NMR (300 MHz, CDCl_3 , ppm) δ 7.20 (dd, 2H, $J = 7.2$, 2.7 Hz), 7.00 (dd, 2H, $J = 7.2$, 2.7 Hz), 2.00-1.97 (m, 2H), 1.51 (s, 3H), 1.26-1.11 (m, 6H), 0.83 (t, 3H, $J = 6.8$ Hz). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 159.7, 134.4, 125.8, 107.1, 36.2, 32.0, 24.1, 22.4, 20.4, 14.0. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{13}\text{H}_{19}\text{N}_2$ 203.1548, found 203.1543.

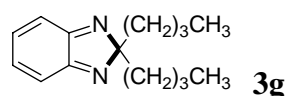


2,2-Diethyl-2H-benzo[d]imidazole (3e).² Eluent: diethyl ether. Yield: 151 mg (87%) as a brown oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.20 (dd, 2H, $J = 7.8$, 2.7 Hz), 7.01 (dd, 2H, $J = 7.8$, 2.7 Hz), 2.12 (q, 4H, $J = 7.3$ Hz), 0.67 (t, 6H, $J = 7.3$ Hz). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 160.3, 134.4, 125.6, 109.9, 27.8, 8.4. ESI-MS $[\text{M}+\text{H}]^+$ m/z 175.6.

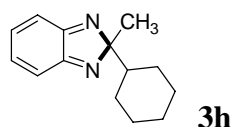


2,2-Dipropyl-2H-benzo[d]imidazole (3f). Eluent: ethyl acetate/petroleum ether = 1:30. Yield: 172 mg (85%) as a brown oil. ^1H NMR (300 MHz, CDCl_3 , ppm) δ 7.19 (dd, 2H, $J = 7.5$, 3.1 Hz), 7.00 (dd, 2H, $J = 7.5$, 3.1 Hz), 2.06-2.01 (m, 4H), 1.07-0.99 (m, 4H), 0.82 (t, 6H, $J = 7.2$ Hz). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 160.1, 134.3,

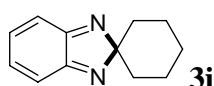
125.6, 109.7, 37.3, 17.2, 14.3. HR-MS $[M+H]^+$ m/z calcd for $C_{13}H_{19}N_2$ 203.1548, found 203.1546.



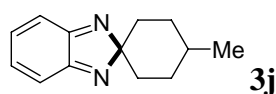
2,2-Dibutyl-2H-benzo[d]imidazole (3g). Eluent: ethyl acetate/petroleum ether = 1:20. Yield: 140 mg (61%) as a yellow oil. 1H NMR (400 MHz, $CDCl_3$, ppm) δ 7.20 (dd, 2H, $J = 7.3, 2.7$ Hz), 7.00 (dd, 2H, $J = 7.3, 2.7$ Hz), 2.07-2.02 (m, 4H), 1.26-1.20 (m, 4H), 1.02-0.98 (m, 4H), 0.82 (t, 6H, $J = 7.3$ Hz). ^{13}C NMR (100 MHz, $CDCl_3$, ppm) δ 160.0, 134.2, 125.5, 109.4, 34.7, 25.9, 22.8, 13.7. HR-MS $[M+H]^+$ m/z calcd for $C_{15}H_{23}N_2$ 231.1861, found 231.1859.



2-Cyclohexyl-2-methyl-2H-benzo[d]imidazole (3h). Eluent: ethyl acetate/petroleum ether = 1:20. Yield: 160 mg (75%) as a yellow oil. 1H NMR (300 MHz, $CDCl_3$, ppm) δ 7.19 (dd, 2H, $J = 7.5, 3.1$ Hz), 6.99 (dd, 2H, $J = 7.5, 3.1$ Hz), 1.99 (tt, 1H, $J = 11.3, 2.7$ Hz), 1.78-1.60 (m, 5H), 1.45 (s, 3H), 1.25-1.01 (m, 5H). ^{13}C NMR (75 MHz, $CDCl_3$, ppm) δ 159.7, 134.3, 125.8, 109.6, 44.8, 28.6, 26.7, 26.2, 18.6. HR-MS $[M+H]^+$ m/z calcd for $C_{14}H_{19}N_2$ 215.1548, found 215.1542.

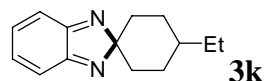


Compound **3i**.³ Eluent: ethyl acetate/petroleum ether = 1:30. Yield: 165 mg (89%) as a brown oil. 1H NMR (300 MHz, $CDCl_3$, ppm) δ 7.22 (dd, 2H, $J = 7.2, 3.1$ Hz), 7.00 (dd, 2H, $J = 7.2, 3.1$ Hz), 2.20-1.92 (m, 4H), 1.79-1.72 (m, 2H), 1.65-1.64 (m, 4H). ^{13}C NMR (75 MHz, $CDCl_3$, ppm) δ 159.4, 134.2, 126.0, 107.2, 32.6, 25.6, 24.7. ESI-MS $[M+H]^+$ m/z 187.3.



Compound **3j**.⁴ Eluent: ethyl acetate/petroleum ether = 1:30. Yield: 180 mg (90%) as a brown oil. 1H NMR (300 MHz, $CDCl_3$, ppm) δ 7.26-7.18 (m, 2H), 7.01-6.98 (m,

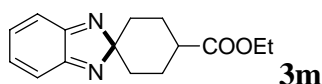
2H), 2.40 (t, 2H, $J = 12.3$ Hz), 1.92-1.89 (m, 2H), 1.74-1.66 (m, 3H), 1.09 (d, 3H, $J = 5.5$ Hz), 0.96 (d, 2H, $J = 12.3$ Hz). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 159.8, 159.1, 134.2, 134.1, 126.0, 125.9, 117.0, 33.1, 32.3, 31.9, 21.9. ESI-MS $[\text{M}+\text{H}]^+$ m/z 201.2.



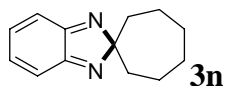
Compound **3k**. Eluent: ethyl acetate/petroleum ether = 1:30. Yield: 193 mg (90%) as a brown oil. ^1H NMR (300 MHz, CDCl_3 , ppm) δ 7.26-7.18 (m, 2H), 7.01-6.98 (m, 2H), 2.38 (td, 2H, $J = 13.0, 3.4$ Hz), 2.00-1.95 (m, 2H), 1.74-1.60 (m, 2H), 1.52-1.40 (m, 3H), 1.00-0.95 (m, 5H). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 159.8, 159.0, 134.2, 134.1, 126.0, 125.9, 107.4, 38.7, 32.3, 30.8, 30.5, 29.2, 11.7. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{14}\text{H}_{19}\text{N}_2$ 215.1548, found 215.1542.



Compound **3l**. Eluent: ethyl acetate/petroleum ether = 1:30. Yield: 225 mg (93%) as a white solid. mp 141-143 °C. ^1H NMR (300 MHz, CDCl_3 , ppm) δ 7.27-7.18 (m, 2H), 6.99 (dd, 2H, $J = 7.5, 3.1$ Hz), 2.47 (td, 2H, $J = 13.4, 3.1$ Hz), 1.99-1.95 (m, 2H), 1.76 (qd, 2H, $J = 12.7, 2.7$ Hz), 1.39-1.26 (m, 2H), 0.97 (s, 9H), 0.92-0.87 (m, 1H). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 159.8, 159.0, 134.1, 126.1, 125.9, 107.1, 47.9, 33.1, 32.5, 27.8, 25.8. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{16}\text{H}_{23}\text{N}_2$ 243.1861, found 243.1863.

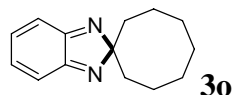


Compound **3m**. Eluent: ethyl acetate/petroleum ether = 1:30. Yield: 235 mg (91%) as a brown oil. ^1H NMR (300 MHz, CDCl_3 , ppm) δ 7.26-7.18 (m, 2H), 7.03 (dd, 2H, $J = 7.5, 2.7$ Hz), 4.19 (q, 2H, $J = 7.2$ Hz), 2.70-2.63 (m, 1H), 2.27-2.18 (m, 6H), 1.29 (t, 3H, $J = 7.2$ Hz), 1.26-1.22 (m, 2H). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 175.0, 159.9, 159.4, 134.5, 134.4, 125.9, 125.8, 106.1, 60.3, 42.0, 31.3, 26.9, 14.2. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{15}\text{H}_{19}\text{N}_2\text{O}_2$ 259.1447, found 259.1441.

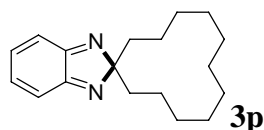


Compound **3n**. Eluent: ethyl acetate/petroleum ether = 1:20. Yield: 176 mg (88%) as a

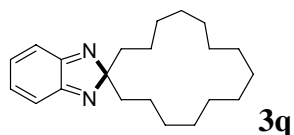
yellow solid. mp 92-93 °C. ¹H NMR (300 MHz, CDCl₃, ppm) δ 7.18 (dd, 2H, *J* = 7.5, 3.1 Hz), 6.97 (dd, 2H, *J* = 7.5, 3.1 Hz), 1.98-1.96 (m, 4H), 1.84-1.80 (m, 4H), 1.72-1.69 (m, 4H). ¹³C NMR (75 MHz, CDCl₃, ppm) δ 158.9, 134.2, 126.0, 110.9, 34.0, 29.9, 25.1. HR-MS [M+H]⁺ *m/z* calcd for C₁₃H₁₇N₂ 201.1392, found 201.1389.



Compound **3o**. Eluent: ethyl acetate/petroleum ether = 1:20. Yield: 156 mg (73%) as a yellow solid. mp 103-105 °C. ¹H NMR (300 MHz, CDCl₃, ppm) δ 7.20 (dd, 2H, *J* = 7.5, 3.1 Hz), 6.98 (dd, 2H, *J* = 7.5, 3.1 Hz), 1.99-1.98 (m, 4H), 1.84-1.73 (m, 6H), 1.68-1.64 (m, 4H). ¹³C NMR (75 MHz, CDCl₃, ppm) δ 159.2, 134.3, 126.2, 110.8, 30.0, 28.6, 25.1, 25.0. HR-MS [M+H]⁺ *m/z* calcd for C₁₄H₁₉N₂ 215.1548, found 215.1543.

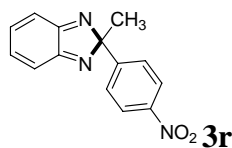


Compound **3p**. Eluent: ethyl acetate/petroleum ether = 1:20. Yield: 189 mg (70%) as a white solid. mp 111-112 °C. ¹H NMR (300 MHz, CDCl₃, ppm) δ 7.73-7.70 (m, 1H), 7.29-7.24 (m, 1H), 7.20 (dd, 2H, *J* = 6.1, 3.1 Hz), 4.09 (t, 2H, *J* = 7.5 Hz), 2.89 (t, 2H, *J* = 7.5 Hz), 2.00-1.85 (m, 4H), 1.50-1.31 (m, 12H), 1.23-1.20 (m, 2H). ¹³C NMR (75 MHz, CDCl₃, ppm) δ 155.1, 142.8, 135.4, 121.8, 121.6, 119.2, 109.2, 42.5, 26.9, 25.9, 25.8, 25.6, 25.5, 25.2, 25.1, 24.6, 24.5, 23.8. HR-MS [M+H]⁺ *m/z* calcd for C₁₈H₂₇N₂ 271.2174, found 271.2171.

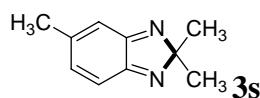


Compound **3q**. Eluent: ethyl acetate/petroleum ether = 1:30. Yield: 178 mg (57%) as a yellow solid. mp 56-58 °C. ¹H NMR (400 MHz, CDCl₃, ppm) δ 7.20 (dd, 2H, *J* = 7.3, 2.7 Hz), 6.99 (dd, 2H, *J* = 7.3, 2.7 Hz), 1.76-1.73 (m, 4H), 1.59-1.55 (m, 4H), 1.41-1.40 (m, 20H). ¹³C NMR (100 MHz, CDCl₃, ppm) δ 159.4, 134.3, 126.1, 110.3, 32.6, 27.8, 27.1, 26.7, 26.6, 26.4, 24.7. HR-MS [M+H]⁺ *m/z* calcd for C₂₁H₃₃N₂

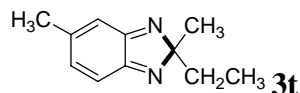
313.2644, found 313.2643.



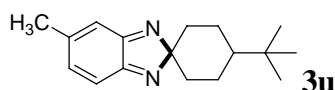
2-Methyl-2-(4-nitrophenyl)-2H-benzo[d]imidazole (3r). Eluent: ethyl acetate/petroleum ether = 1:20. Yield: 147 mg (58%) as a yellow solid. mp 168-169 °C. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 8.18 (d, 2H, $J = 8.7$ Hz), 7.96 (d, 2H, $J = 9.1$ Hz), 7.25 (dd, 2H, $J = 7.3, 3.2$ Hz), 7.06 (dd, 2H, $J = 7.3, 3.2$ Hz), 1.80 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 160.4, 147.4, 146.0, 135.5, 128.7, 125.8, 123.5, 107.4, 25.6. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{14}\text{H}_{12}\text{N}_3\text{O}_2$ 254.0930, found 254.0925.



2,2,5-Trimethyl-2H-benzo[d]imidazole (3s). Eluent: diethyl ether. Yield: 149 mg (93%) as a brown oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.12 (d, 1H, $J = 9.6$ Hz), 6.92 (s, 1H), 6.85 (d, 1H, $J = 9.1$ Hz), 2.23 (s, 3H), 1.52 (s, 6H). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 159.6, 158.7, 144.9, 138.7, 124.9, 122.2, 104.4, 22.7, 21.9. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{10}\text{H}_{13}\text{N}_2$ 161.1079, found 161.1072.

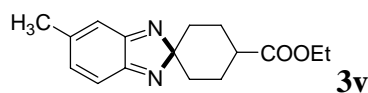


2-Ethyl-2,5-dimethyl-2H-benzo[d]imidazole (3t). Eluent: diethyl ether. Yield: 165 mg (95%) as a brown oil. ^1H NMR (300 MHz, CDCl_3 , ppm) δ 7.12 (d, 1H, $J = 9.6$ Hz), 6.94 - 6.92 (m, 1H), 6.85 (dd, 1H, $J = 9.6, 1.3$ Hz), 2.24 (d, 3H, $J = 1.3$ Hz), 2.05 (q, 2H, $J = 7.5$ Hz), 1.50 (s, 3H), 0.71 (t, 3H, $J = 7.5$ Hz). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 160.1, 159.2, 144.9, 138.7, 124.8, 122.1, 107.1, 29.6, 22.7, 20.4, 8.8. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{11}\text{H}_{15}\text{N}_2$ 175.1235, found 175.1228.

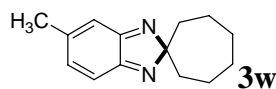


Compound **3u**. Eluent: diethyl ether. Yield: 233 mg (91%) as a brown solid. mp 77-78 °C. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.15 (dd, 1H, $J = 25.1, 9.6$ Hz), 6.96 (dd, 2H, $J = 28.8, 1.3$ Hz), 6.84 (dt, 1H, $J = 9.6, 1.8$ Hz), 2.43 (td, 2H, $J = 13.2, 3.2$ Hz), 2.22

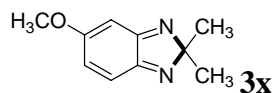
(s, 3H), 1.82 (dd, 2H, $J = 12.8, 1.8$ Hz), 1.61 (qd, 2H, $J = 13.2, 1.3$ Hz), 1.20 (tt, 1H, $J = 12.3, 2.7$ Hz), 0.83 (s, 9H), 0.81-0.78 (m, 2H). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 160.0, 159.2, 159.1, 158.3, 144.5, 138.3, 125.1, 124.9, 122.5, 122.2, 107.1, 47.9, 41.3, 33.4, 32.5, 27.8, 27.6, 25.8, 22.7, 22.6. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{17}\text{H}_{25}\text{N}_2$ 257.2018, found 257.2016.



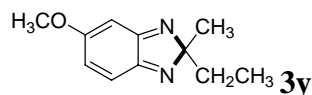
Compound **3v**. Eluent: diethyl ether. Yield: 245 mg (90%) as a brown oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.18-7.12 (m, 1H), 6.95 (d, 1H, $J = 14.2$ Hz), 6.88 (d, 1H, $J = 9.6$ Hz), 4.19 (q, 2H, $J = 6.8$ Hz), 2.68-2.65 (m, 1H), 2.25 (s, 3H), 2.22-2.17 (m, 6H), 1.29 (t, 3H, $J = 7.3$ Hz), 1.26-1.22 (m, 2H). ^{13}C NMR (75 MHz, CDCl_3 , ppm) δ 175.0, 160.0, 159.6, 159.2, 158.7, 145.0, 144.9, 138.6, 125.0, 124.8, 122.3, 122.1, 106.0, 60.2, 42.0, 41.9, 31.6, 31.5, 27.0, 26.9, 25.2, 23.1, 22.7, 22.6, 14.2. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{16}\text{H}_{21}\text{N}_2\text{O}_2$ 273.1603, found 273.1596.



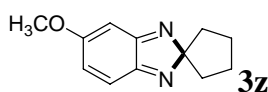
Compound **3w**. Eluent: diethyl ether. Yield: 190 mg (89%) as a yellow solid. mp 96-98 °C. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.11 (d, 1H, $J = 9.1$ Hz), 6.91 (s, 1H), 6.82 (d, 1H, $J = 9.1$ Hz), 2.22 (s, 3H), 1.96-1.95 (m, 4H), 1.82-1.81 (m, 4H), 1.71-1.70 (m, 4H). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 159.2, 158.3, 144.7, 138.5, 125.1, 122.3, 110.9, 34.3, 30.0, 25.1, 22.7. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{14}\text{H}_{19}\text{N}_2$ 215.1548, found 215.1546.



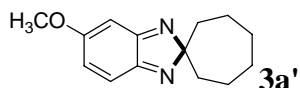
5-Methoxy-2,2-dimethyl-2H-benzimidazole (3x). Eluent: diethyl ether. Yield: 167 mg (95%) as a yellow solid. mp 83-85 °C. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.14 (d, 1H, $J = 10.0$ Hz), 6.78 (dd, 1H, $J = 10.0, 2.2$ Hz), 6.26 (d, 1H, $J = 1.8$ Hz), 3.83 (s, 3H), 1.52 (s, 6H). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 163.5, 159.6, 158.1, 134.3, 126.1, 104.7, 96.3, 55.8, 22.3. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{10}\text{H}_{13}\text{N}_2\text{O}$ 177.1028, found 177.1021.



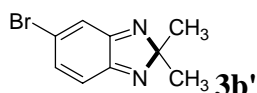
2-Ethyl-5-methoxy-2-methyl-2H-benzo[d]imidazole (3y). Eluent: diethyl ether. Yield: 182 mg (96%) as a yellow solid. mp 93-94 °C. ¹H NMR (400 MHz, CDCl₃, ppm) δ 7.02 (d, 1H, *J* = 9.6 Hz), 6.66 (dd, 1H, *J* = 9.6, 1.3 Hz), 6.15 (s, 1H), 3.71 (s, 3H), 1.91 (q, 2H, *J* = 7.3 Hz), 1.37 (s, 3H), 0.61 (t, 3H, *J* = 7.3 Hz). ¹³C NMR (100 MHz, CDCl₃, ppm) δ 163.5, 160.0, 158.5, 134.2, 125.9, 107.4, 96.3, 55.7, 29.8, 20.7, 8.8. HR-MS [M+H]⁺ *m/z* calcd for C₁₁H₁₅N₂O 191.1184, found 191.1179.



Compound **3z**. Eluent: diethyl ether. Yield: 145 mg (72%) as a yellow solid. mp 83-85 °C. ¹H NMR (300 MHz, CDCl₃, ppm) δ 7.16 (d, 1H, *J* = 9.6 Hz), 6.78 (dd, 1H, *J* = 10.0, 2.2 Hz), 6.30 (d, 1H, *J* = 2.2 Hz), 3.82 (s, 3H), 2.23-2.20 (m, 4H), 2.03-2.00 (m, 4H). ¹³C NMR (75 MHz, CDCl₃, ppm) δ 163.4, 159.6, 158.1, 133.9, 125.8, 114.7, 96.2, 55.7, 33.7, 26.1. HR-MS [M+H]⁺ *m/z* calcd for C₁₂H₁₅N₂O 203.1184, found 203.1178.

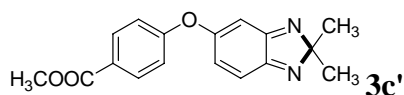


Compound **3a'**. Eluent: ethyl acetate/petroleum ether = 1:20. Yield: 212 mg (92%) as a yellow solid. mp 101-103 °C. ¹H NMR (400 MHz, CDCl₃, ppm) δ 7.13 (d, 1H, *J* = 9.9 Hz), 6.75 (dd, 1H, *J* = 9.6, 2.0 Hz), 6.27 (d, 1H, *J* = 2.0 Hz), 3.81 (s, 3H), 1.95-1.91 (m, 4H), 1.82-1.77 (m, 4H), 1.74-1.68 (m, 4H). ¹³C NMR (100 MHz, CDCl₃, ppm) δ 163.4, 159.2, 157.6, 134.1, 126.2, 111.2, 96.5, 55.7, 34.8, 29.9, 25.0. HR-MS [M+H]⁺ *m/z* calcd for C₁₄H₁₉N₂O 231.1497, found 231.1492.

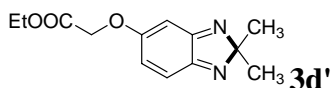


5-Bromo-2,2-dimethyl-2H-benzo[d]imidazole (3b'). Eluent: diethyl ether. Yield: 162 mg (72%) as a brown oil. ¹H NMR (400 MHz, CDCl₃, ppm) δ 7.51 (s, 1H), 7.14-7.05 (m, 2H), 1.54 (s, 6H). ¹³C NMR (100 MHz, CDCl₃, ppm) δ 158.9, 157.4, 138.9, 130.3, 127.5, 126.6, 105.6, 21.5. HR-MS [M+H]⁺ *m/z* calcd for C₉H₁₀BrN₂

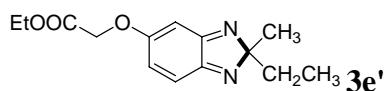
225.0027, found 225.0023.



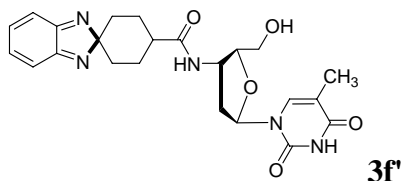
Methyl 4-(2,2-dimethyl-2H-benzo[d]imidazol-5-yloxy)benzoate (3c'). Eluent: diethyl ether. Yield: 266 mg (90%) as a brown oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 8.08 (d, 2H, $J = 8.7$ Hz), 7.25-7.23 (m, 1H), 7.15 (d, 2H, $J = 8.7$ Hz), 6.94 (dd, 1H, $J = 9.6, 2.2$ Hz), 6.25 (d, 1H, $J = 2.2$ Hz), 3.90 (s, 3H), 1.48 (s, 6H). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 166.1, 161.6, 159.1, 158.0, 157.5, 133.1, 131.9, 127.4, 127.3, 120.4, 105.5, 103.8, 52.3, 22.1. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{17}\text{H}_{17}\text{N}_2\text{O}_3$ 297.1239, found 297.1238.



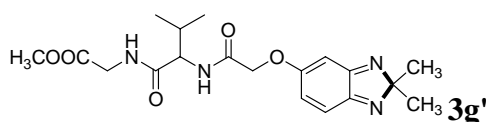
Ethyl 2-(2,2-dimethyl-2H-benzo[d]imidazol-5-yloxy)acetate (3d'). Eluent: diethyl ether. Yield: 223 mg (90%) as a brown oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.05 (d, 1H, $J = 9.6$ Hz), 6.77 (dd, 1H, $J = 10.0, 2.2$ Hz), 6.05 (d, 1H, $J = 1.8$ Hz), 4.49 (s, 2H), 4.16 (q, 2H, $J = 7.3$ Hz), 1.38 (s, 6H), 1.19 (t, 3H, $J = 7.3$ Hz). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 167.1, 161.6, 159.1, 157.9, 133.8, 126.5, 105.0, 97.7, 65.1, 61.7, 22.1, 14.1. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{13}\text{H}_{17}\text{N}_2\text{O}_3$ 249.1239, found 249.1233.



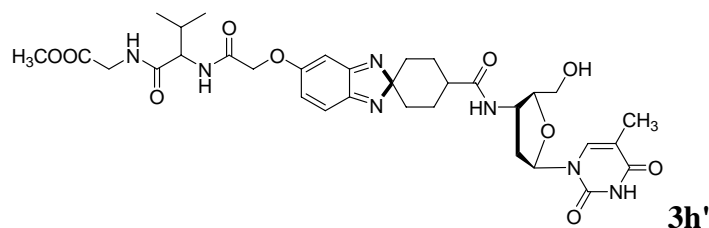
Ethyl 2-(2-ethyl-2-methyl-2H-benzo[d]imidazol-5-yloxy)acetate (3e'). Eluent: diethyl ether. Yield: 231 mg (88%) as a brown oil. ^1H NMR (400 MHz, CDCl_3 , ppm) δ 7.19 (d, 1H, $J = 9.6$ Hz), 6.90 (dd, 1H, $J = 9.6, 2.2$ Hz), 6.19 (d, 1H, $J = 1.8$ Hz), 4.62 (s, 2H), 4.29 (q, 2H, $J = 7.3$ Hz), 2.01 (q, 2H, $J = 7.3$ Hz), 1.48 (s, 3H), 1.32 (t, 3H, $J = 7.3$ Hz), 0.74 (t, 3H, $J = 7.3$ Hz). ^{13}C NMR (100 MHz, CDCl_3 , ppm) δ 167.1, 161.7, 159.6, 158.3, 133.7, 126.4, 107.8, 97.7, 65.1, 61.7, 29.7, 20.5, 14.1, 8.9. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{14}\text{H}_{19}\text{N}_2\text{O}_3$ 263.1396, found 263.1392.



Compound **3f'**. Eluent: ethyl acetate/ methanol = 15:1. Yield: 335 mg (74%) as a brown solid. mp 88-90 °C. ¹H NMR (400 MHz, CD₃OD, ppm) δ 7.88 (s, 1H), 7.20-7.12 (m, 4H), 6.23 (t, 1H, *J* = 5.9 Hz), 4.51-4.49 (m, 1H), 3.88-3.70 (m, 3H), 2.53-2.50 (m, 1H), 2.36-2.25 (m, 4H), 2.20-2.11 (m, 2H), 2.03-2.00 (m, 2H), 1.84 (s, 3H), 1.02 (d, 2H, *J* = 12.3 Hz). ¹³C NMR (100 MHz, CD₃OD, ppm) δ 177.0, 165.0, 160.3, 159.4, 151.0, 136.8, 135.9, 135.4, 125.0, 124.5, 110.1, 105.4, 85.4, 84.5, 61.2, 48.9, 43.5, 37.4, 31.5, 27.5, 27.3, 11.2. HR-MS [*M*+*H*]⁺ *m/z* calcd for C₂₃H₂₈N₅O₅ 454.2090, found 454.2080.



Methyl 2-(2-(2-(2,2-dimethyl-2H-benzo[d]imidazol-6-yloxy)acetamido)-3-methylbutanamido)acetate (3g'). Eluent: ethyl acetate/ ethanol = 30:1. Yield: 312 mg (80%) as a brown oil. ¹H NMR (400 MHz, DMSO-*d*₆, ppm) δ 8.49 (t, 1H, *J* = 5.5 Hz), 8.09 (d, 1H, *J* = 8.7 Hz), 7.19 (d, 1H, *J* = 9.6 Hz), 6.93 (d, 1H, *J* = 9.6 Hz), 6.26 (s, 1H), 4.67-4.53 (m, 2H), 4.24 (t, 1H, *J* = 7.3 Hz), 3.81 (qd, 2H, *J* = 17.4, 5.5 Hz), 3.58 (s, 3H), 2.00-1.97 (m, 1H), 1.31 (s, 6H), 0.86-0.81 (m, 6H). ¹³C NMR (100 MHz, DMSO-*d*₆, ppm) δ 171.7, 170.6, 166.8, 161.9, 159.3, 157.9, 134.6, 126.7, 105.1, 98.2, 67.3, 57.8, 52.1, 41.0, 31.1, 22.6, 19.5, 18.4. HR-MS [*M*+*H*]⁺ *m/z* calcd for C₁₉H₂₇N₄O₅ 391.1981, found 391.1977.



Compound **3h'**. Eluent: ethyl acetate/ ethanol = 10:1. Yield: 474 mg (68%) as a brown solid. mp 96-98 °C. ¹H NMR (400 MHz, DMSO-*d*₆, ppm) δ 11.20 (s, 1H), 8.45 (t, 1H, *J* = 4.5 Hz), 8.21 (d, 1H, *J* = 6.8 Hz), 8.06 (d, 1H, *J* = 8.7 Hz), 7.71 (s, 1H), 7.16 (d,

1H, $J = 9.6$ Hz), 6.91 (d, 1H, $J = 9.6$ Hz), 6.28 (s, 1H), 6.13 (t, 1H, $J = 5.9$ Hz), 5.00 (s, 1H), 4.63-4.49 (m, 2H), 4.28 (s, 1H), 4.19 (t, 1H, $J = 7.7$ Hz), 3.84-3.70 (m, 3H), 3.58-3.48 (m, 5H), 3.28 (s, 1H), 2.45-2.35 (m, 3H), 2.16-1.79 (m, 8H), 1.70 (s, 3H), 0.85-0.77 (m, 6H). ^{13}C NMR (100 MHz, DMSO- d_6 , ppm) δ 175.4, 171.7, 170.6, 166.8, 164.2, 161.9, 159.9, 157.8, 150.9, 136.7, 134.6, 126.6, 109.9, 106.8, 98.5, 85.8, 84.0, 67.3, 61.9, 57.8, 49.4, 43.3, 41.0, 37.5, 32.3, 31.1, 27.9, 27.8, 25.6, 19.5, 18.5, 12.7. HR-MS $[\text{M}+\text{H}]^+$ m/z calcd for $\text{C}_{33}\text{H}_{44}\text{N}_7\text{O}_{10}$ 698.3150, found 698.3143.

D: References

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E: The ^1H NMR and ^{13}C NMR spectra of compounds 3a-h'

