

Electronic Supporting Information for
Metal-Free Construction of Dihydropyrazino[2,3-*b*]indoles from 2-
Aminoacetophenones, Isocyanates and 1,2-Diamines

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1. General information.

All starting materials and reagents were purchased from commercial sources and used as received unless otherwise noted. Reactions were monitored using thin-layer chromatography (TLC) on commercial silica gel plates. Visualization of the developed plates was performed under UV light (254 nm). NMR spectra data were obtained on Avance (III) HD 400 MHz instruments. ¹H NMR and ¹³C NMR spectra were referenced to residual protic solvent peaks or TMS signal (0 ppm). Data for ¹H NMR are recorded as follows: chemical shift (δ , ppm), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet or unresolved, br = broad singlet, coupling constant (s) in Hz, integration). Data for ¹³C NMR are reported in terms of chemical shift (δ , ppm). HRMS Spectra were obtained with Waters Q-TOF Premier (ESI, positive mode) spectrometers.

2. Experimental section

2.1 General synthesis of dihydropyrazino[2,3-*b*]indoles 4

A solution of 2-aminoacetophenones **1** (1.0 mmol), isocyanates **2** (2.0 mmol) and TsOH (0.1 mmol) were dissolved in 2-MeTHF (5 mL) under an ambient atmosphere. The mixture was stirred at rt for 12 h. Then 1,2-diamines **3** (1.2 mmol), I₂ (1.1 mmol) and NaOH (1.2 mmol) was added into the mixture. The resulting mixture was further stirred at rt for 4 h. After the reaction was completed, Na₂S₂O₃ (2.0 mmol) was added and the mixture was vigorously stirred at rt for 10 min to quench the excess I₂. Then the reaction mixture was concentrated under reduced pressure. The residue was suspended in 20 mL petroleum ether/ethyl acetate (10/1 v/v) and was then filtered by a Buchner funnel, which contains a layer of silica gel (SiO₂). The filtrate was concentrated under reduced pressure to yield the crude product, which was purified by recrystallization from hexane/CH₂Cl₂.

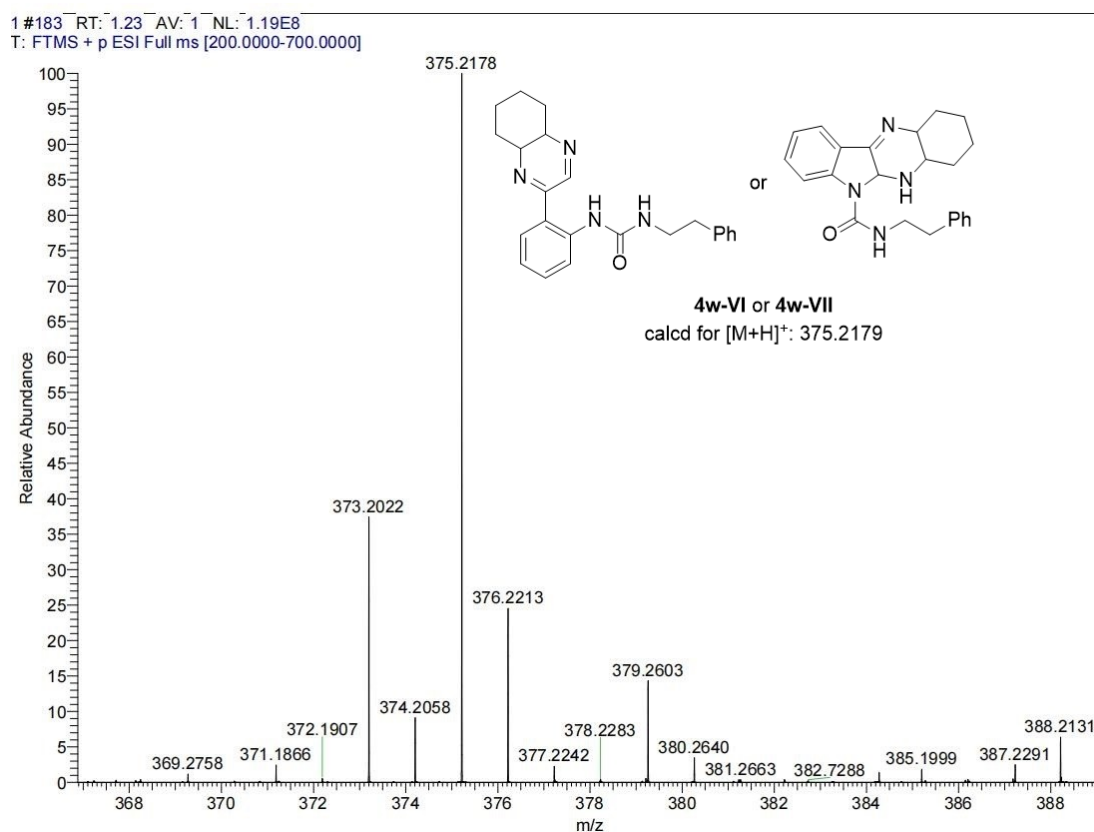
2.2 Gram-scale preparation of 4a

A solution of 2-aminoacetophenone **1a** (1.35 g, 10 mmol), *p*-tolyl isocyanate **2a** (2.66 g, 20 mmol) and TsOH (172 mg, 1.0 mmol) were dissolved in 2-MeTHF (50 mL) under an ambient atmosphere. The mixture was stirred at rt for 12 h. Then cyclohexane-1,2-diamine **3a** (1.37 g, 12 mmol), I₂ (2.79 g, 11 mmol) and NaOH (480 mg, 12 mmol) was added into the mixture. The resulting mixture was further stirred at rt for 4 h. After the reaction was completed, Na₂S₂O₃ (1.90 g, 20 mmol) was added and the mixture was vigorously stirred at rt for 10 min to quench the excess I₂. Then the reaction mixture was concentrated under reduced pressure. The residue was suspended in 200 mL petroleum ether/ethyl acetate (10/1) and was then filtered by a Buchner funnel, which contains a layer of silica gel (SiO₂). The filtrate was concentrated under reduced pressure to yield the crude product, which was purified by recrystallization from hexane/CH₂Cl₂ to give the pure product **4a** as a white solid (2.94 g, 82%).

2.3 Synthesis of pyrazino[2,3-*b*]indole **5w**

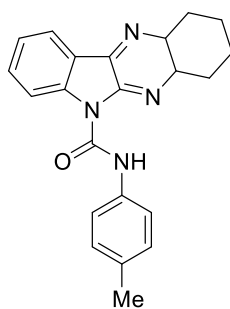
A solution of dihydropyrazino[2,3-*b*]indole **4w** (374 mg, 1.0 mmol) and $K_2S_2O_8$ (811 mg, 3.0 mmol) in 2-MeTHF (2 mL) was stirred 60 °C rt for 6 h. After the reaction was completed, the mixture was filtered by a Buchner funnel and the filtrate was concentrated under reduced pressure to yield the crude product, which was purified by recrystallization from hexane/ CH_2Cl_2 to give the pure product **5w** as a yellow solid (346 mg, 93%).

3. HRMS analysis



4. Characterization data of products

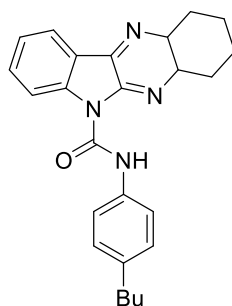
N-(*p*-Tolyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (**4a**)



4a

Yellow solid, 83% yield, 298.1 mg, m.p. 164.2-166.3 °C, IR (KBr thin film): $\nu = 3446, 1704, 1608, 1561 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.51 (s, 1H), 8.42 (d, $J = 8.0 \text{ Hz}$, 1H), 7.76 (d, $J = 7.2 \text{ Hz}$, 1H), 7.45 (dd, $J = 21.2, 7.6 \text{ Hz}$, 3H), 7.15 (dd, $J = 12.8, 7.6 \text{ Hz}$, 3H), 3.94 – 3.12 (m, 2H), 2.50 (d, $J = 12.8 \text{ Hz}$, 1H), 2.36 (s, 1H), 2.32 (d, $J = 3.2 \text{ Hz}$, 3H), 2.00 – 1.84 (m, 2H), 1.65 – 1.54 (m, 2H), 1.47 (t, $J = 8.4 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.9, 150.1, 149.0, 146.6, 135.3, 133.8, 133.5, 129.5, 124.1, 122.2, 121.2, 120.1, 117.2, 61.2, 58.6, 34.2, 33.5, 26.0, 25.6, 20.9. HRMS (ESI-TOF) m/z $[\text{M} + \text{H}]^+$ Calcd for $\text{C}_{22}\text{H}_{23}\text{N}_4\text{O}^+$ 359.1866, found: 359.1861.

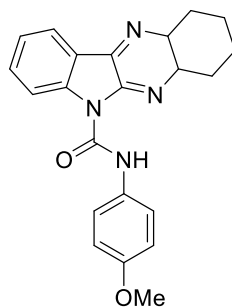
***N*-(4-Butylphenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4b)**



4b

Yellow solid, 80% yield, 320.8 mg, m.p. 143.4-144.7 °C, IR (KBr thin film): $\nu = 3435, 1703, 1608, 1561 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.50 (s, 1H), 8.43 (d, $J = 8.4 \text{ Hz}$, 1H), 7.77 (d, $J = 7.6 \text{ Hz}$, 1H), 7.50 – 7.40 (m, 3H), 7.15 (d, $J = 8.4 \text{ Hz}$, 3H), 3.31 – 3.16 (m, 2H), 2.59 (t, $J = 7.6 \text{ Hz}$, 2H), 2.50 (dd, $J = 12.8, 3.1 \text{ Hz}$, 1H), 2.35 (dt, $J = 13.2, 2.8 \text{ Hz}$, 1H), 1.97 – 1.87 (m, 2H), 1.60 (qt, $J = 7.2, 2.4 \text{ Hz}$, 4H), 1.51 – 1.41 (m, 2H), 1.35 (q, $J = 7.2 \text{ Hz}$, 2H), 0.93 (t, $J = 7.2 \text{ Hz}$, 3H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.9, 150.2, 149.0, 146.7, 138.7, 135.4, 133.8, 128.9, 124.2, 122.3, 121.2, 120.3, 117.2, 61.2, 58.7, 35.1, 34.2, 33.8, 33.5, 26.0, 25.6, 22.3, 14.0. HRMS (ESI) m/z : $[\text{M} + \text{H}]^+$ calcd for $\text{C}_{25}\text{H}_{29}\text{N}_4\text{O}^+$ 401.2336, found: 401.2328.

***N*-(4-Methoxyphenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4c)**

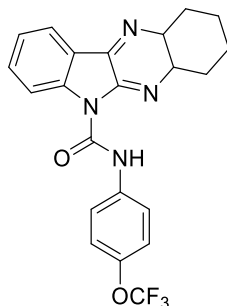


4c

Yellow solid, 84% yield, 315.1 mg, m.p. 189.2-191.6 °C, IR (KBr thin film): $\nu = 3446, 1705, 1605, 1559 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.42 (s, 1H), 8.41 (d, $J = 8.4 \text{ Hz}$, 1H), 7.76 (dd, $J = 7.2, 1.2 \text{ Hz}$, 1H), 7.45 (d, $J = 9.2 \text{ Hz}$, 3H), 7.15 (t, $J = 7.2 \text{ Hz}$, 1H), 6.88 (d, $J = 9.2 \text{ Hz}$, 2H), 3.80 (s, 3H), 3.20 (t, $J = 11.2 \text{ Hz}$, 2H), 2.49 (d, $J = 12.0 \text{ Hz}$, 1H), 2.33 (d, $J = 12.0 \text{ Hz}$, 1H), 1.94 (t, $J = 7.6 \text{ Hz}$, 2H), 1.66 – 1.53 (m, 2H), 1.45 (q, $J = 11.6, 10.4 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 156.2,

152.9, 150.3, 148.9, 146.7, 133.8, 131.0, 124.1, 122.2, 121.8, 121.2, 117.1, 114.2, 61.2, 58.6, 55.5, 34.2, 33.5, 26.0, 25.6. HRMS (ESI) m/z: [M+H]⁺ calcd for C₂₂H₂₃N₄O₂⁺ 375.1816, found: 375.1823.

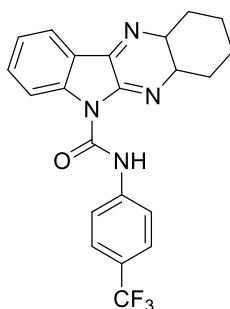
***N*-(4-(Trifluoromethoxy)phenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4d)**



4d

Yellow solid, 78% yield, 334.6 mg, m.p. 95.7-97.1 °C, IR (KBr thin film): $\nu = 3435, 1711, 1608, 1572 \text{ cm}^{-1}$; ¹H NMR (400 MHz, CDCl₃) δ 11.71 (s, 1H), 8.38 (d, $J = 8.4 \text{ Hz}$, 1H), 7.76 (d, $J = 7.6 \text{ Hz}$, 1H), 7.56 (d, $J = 9.2 \text{ Hz}$, 2H), 7.52 – 7.43 (m, 1H), 7.17 (dd, $J = 12.4, 8.1 \text{ Hz}$, 3H), 3.49 – 3.03 (m, 2H), 2.50 (d, $J = 13.2 \text{ Hz}$, 1H), 2.34 (d, $J = 13.2 \text{ Hz}$, 1H), 2.02 – 1.84 (m, 2H), 1.61 (d, $J = 7.2 \text{ Hz}$, 2H), 1.47 (t, $J = 9.6 \text{ Hz}$, 2H). ¹³C NMR (100 MHz, CDCl₃) δ 152.7, 150.0, 148.9, 146.3, 136.7, 133.8, 124.4, 122.3, 121.8, 121.2, 121.2 (d, $J = 187.2 \text{ Hz}$), 121.0, 117.1, 61.3, 58.6, 34.2, 33.5, 25.9, 25.5. HRMS (ESI) m/z: [M+H]⁺ calcd for C₂₂H₂₀F₃N₄O₂⁺ 429.1533, found: 429.1538.

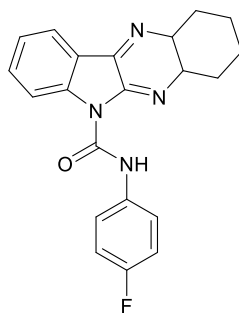
***N*-(4-(Trifluoromethyl)phenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4e)**



4e

Yellow solid, 81% yield, 334.6 mg, m.p. 173.7-174.8 °C, IR (KBr thin film): $\nu = 3446, 1717, 1610, 1567 \text{ cm}^{-1}$; ¹H NMR (400 MHz, CDCl₃) δ 11.89 (s, 1H), 8.38 (d, $J = 8.4 \text{ Hz}$, 1H), 7.76 (d, $J = 6.4 \text{ Hz}$, 1H), 7.65 (d, $J = 8.4 \text{ Hz}$, 2H), 7.57 (d, $J = 8.4 \text{ Hz}$, 2H), 7.47 (t, $J = 7.2 \text{ Hz}$, 1H), 7.18 (t, $J = 7.6 \text{ Hz}$, 1H), 3.36 – 3.04 (m, 2H), 2.51 (d, $J = 12.8 \text{ Hz}$, 1H), 2.35 (d, $J = 13.2 \text{ Hz}$, 1H), 2.05 – 1.87 (m, 2H), 1.62 (q, $J = 11.2, 10.6 \text{ Hz}$, 2H), 1.46 (q, $J = 9.2 \text{ Hz}$, 2H). ¹³C NMR (100 MHz, CDCl₃) δ 152.6, 149.8, 148.9, 146.2, 141.2, 133.9, 126.3 (q, $J = 3.8 \text{ Hz}$), 125.7, 125.4, 124.5, 124.2 (q, $J = 269.7 \text{ Hz}$), 122.3, 121.3, 119.4, 117.1, 61.3, 58.6, 34.2, 33.5, 25.9, 25.6. HRMS (ESI) m/z: [M+H]⁺ calcd for C₂₂H₂₀F₃N₄O⁺ 413.1584, found: 413.1588.

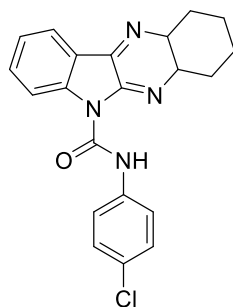
***N*-(4-Fluorophenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4f)**



4f

Yellow solid, 75% yield, 272.3 mg, m.p. 170.5-172.5 °C, IR (KBr thin film): $\nu = 3446, 1707, 1607, 1579 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.58 (s, 1H), 8.40 (d, $J = 8.0 \text{ Hz}$, 1H), 7.77 (d, $J = 9.2 \text{ Hz}$, 1H), 7.58 – 7.38 (m, 3H), 7.18 (t, $J = 7.2 \text{ Hz}$, 1H), 7.04 (t, $J = 8.8 \text{ Hz}$, 2H), 3.95 – 3.13 (m, 2H), 2.51 (d, $J = 12.4 \text{ Hz}$, 1H), 2.35 (d, $J = 13.2 \text{ Hz}$, 1H), 1.94 (t, $J = 13.6 \text{ Hz}$, 2H), 1.69 – 1.55 (m, 2H), 1.47 (t, $J = 8.8 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 159.2 (d, $J = 241.4 \text{ Hz}$), 152.8, 150.2, 148.9, 146.5, 133.9 (d, $J = 2.7 \text{ Hz}$), 133.9, 124.3, 122.3, 121.7, 121.7, 121.2, 117.1, 115.8, 115.6, 61.3, 58.6, 34.2, 33.5, 25.9, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{20}\text{FN}_4\text{O}^+$ 363.1616, found: 363.1611.

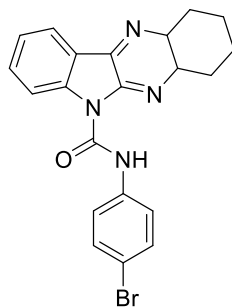
***N*-(4-Chlorophenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4g)**



4g

Yellow solid, 74% yield, 280.5 mg, m.p. 196.5-197.3 °C, IR (KBr thin film): $\nu = 3446, 1704, 1606, 1557 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.68 (s, 1H), 8.39 (d, $J = 8.4 \text{ Hz}$, 1H), 7.77 (d, $J = 6.4 \text{ Hz}$, 1H), 7.52 – 7.46 (m, 1H), 7.45 (d, $J = 9.6 \text{ Hz}$, 4H), 7.17 (t, $J = 7.6 \text{ Hz}$, 1H), 3.91 – 3.07 (m, 2H), 2.51 (d, $J = 12.4 \text{ Hz}$, 1H), 2.35 (d, $J = 12.8 \text{ Hz}$, 1H), 2.02 – 1.81 (m, 2H), 1.68 – 1.55 (m, 2H), 1.53 – 1.34 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.7, 149.9, 148.9, 146.3, 137.1, 133.9, 132.0, 124.4, 122.3, 121.5, 121.4, 121.2, 117.1, 116.4, 61.3, 58.6, 34.2, 33.5, 25.9, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{20}\text{ClN}_4\text{O}^+$ 379.1320, found: 379.1316.

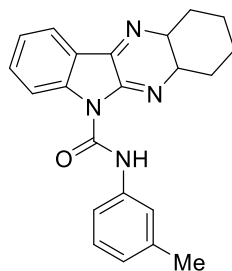
***N*-(4-Bromophenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4h)**



4h

Yellow solid, 79% yield, 334.2 mg, m.p. 274.1-275.2 °C, IR (KBr thin film): $\nu = 3420, 1716, 1606, 1553 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.67 (s, 1H), 8.38 (d, $J = 8.4 \text{ Hz}$, 1H), 7.76 (d, $J = 7.6 \text{ Hz}$, 1H), 7.47 (t, $J = 8.4 \text{ Hz}$, 1H), 7.43 (s, 4H), 7.17 (t, $J = 7.2 \text{ Hz}$, 1H), 3.96 – 3.11 (m, 2H), 2.50 (d, $J = 12.8 \text{ Hz}$, 1H), 2.34 (d, $J = 12.4 \text{ Hz}$, 1H), 2.08 – 1.81 (m, 2H), 1.61 (d, $J = 12.0 \text{ Hz}$, 2H), 1.47 (t, $J = 9.6 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100MHz, CDCl_3) δ 152.7, 149.9, 148.9, 146.3, 137.1, 133.8, 132.0, 124.4, 122.3, 121.4, 121.2, 117.1, 116.4, 61.3, 58.6, 34.2, 33.5, 25.9, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{20}\text{BrN}_4\text{O}^+$ 423.0815, found: 423.0818.

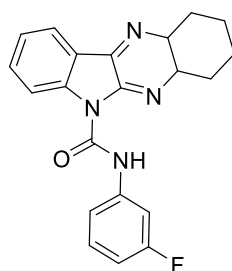
***N*-(*m*-Tolyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4i)**



4i

Yellow solid, 82% yield, 294.5 mg, m.p. 161.7-162.5 °C, IR (KBr thin film): $\nu = 3446, 1706, 1600, 1578 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.55 (s, 1H), 8.43 (d, $J = 8.4 \text{ Hz}$, 1H), 7.76 (d, $J = 7.6 \text{ Hz}$, 1H), 7.48 (t, $J = 8.0 \text{ Hz}$, 1H), 7.42 (s, 1H), 7.31 (d, $J = 8.0 \text{ Hz}$, 1H), 7.22 (t, $J = 7.6 \text{ Hz}$, 1H), 7.16 (t, $J = 7.6 \text{ Hz}$, 1H), 6.92 (d, $J = 7.6 \text{ Hz}$, 1H), 3.31 – 3.13 (m, 2H), 2.50 (d, $J = 14.0 \text{ Hz}$, 1H), 2.36 (s, 4H), 2.00 – 1.87 (m, 2H), 1.61 (q, $J = 12.4 \text{ Hz}$, 2H), 1.46 (q, $J = 8.8 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.9, 150.1, 149.0, 146.6, 139.0, 137.9, 133.8, 128.8, 124.8, 124.2, 122.2, 121.2, 120.7, 117.20, 117.18, 61.3, 58.6, 34.2, 33.5, 26.0, 25.6, 21.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{23}\text{N}_4\text{O}^+$ 359.1866, found: 359.1861.

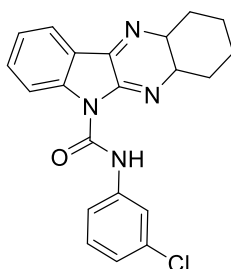
***N*-(3-Fluorophenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4j)**



4j

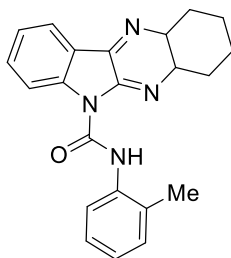
Yellow solid, 77% yield, 279.6 mg, m.p. 156.4-158.3 °C, IR (KBr thin film): $\nu = 3446, 1703, 1607, 1568 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.73 (s, 1H), 8.37 (d, $J = 8.4 \text{ Hz}$, 1H), 7.74 (d, $J = 6.4 \text{ Hz}$, 1H), 7.53 – 7.41 (m, 2H), 7.29 – 7.22 (m, 1H), 7.15 (t, $J = 7.4 \text{ Hz}$, 2H), 6.77 (td, $J = 8.0, 2.4 \text{ Hz}$, 1H), 3.39 – 3.00 (m, 2H), 2.49 (d, $J = 13.2 \text{ Hz}$, 1H), 2.33 (d, $J = 12.8 \text{ Hz}$, 1H), 1.98 – 1.86 (m, 2H), 1.60 (d, $J = 12.4 \text{ Hz}$, 2H), 1.52 – 1.36 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 163.1 (d, $J = 242.9 \text{ Hz}$), 152.6, 149.8, 148.8, 146.3, 139.6 (d, $J = 10.9 \text{ Hz}$), 133.8, 130.0 (d, $J = 9.4 \text{ Hz}$), 128.1 (d, $J = 8.8 \text{ Hz}$), 124.4, 122.3, 121.2, 117.1, 115.1 (d, $J = 2.8 \text{ Hz}$), 110.4 (d, $J = 21.2 \text{ Hz}$), 107.2 (d, $J = 26.2 \text{ Hz}$), 61.2, 58.6, 34.2, 33.5, 25.9, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{20}\text{FN}_4\text{O}^+$ 363.1616, found: 363.1611.

***N*-(3-Chlorophenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4k)**

**4k**

Yellow solid, 62% yield, 235.0 mg, m.p. 133.7-134.5 °C, IR (KBr thin film): $\nu = 3446, 1706, 1596, 1558 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.72 (s, 1H), 8.39 (d, $J = 8.0 \text{ Hz}$, 1H), 7.76 (d, $J = 7.6 \text{ Hz}$, 1H), 7.67 (t, $J = 2.0 \text{ Hz}$, 1H), 7.48 (t, $J = 8.0 \text{ Hz}$, 1H), 7.36 (d, $J = 8.4 \text{ Hz}$, 1H), 7.23 (t, $J = 8.0 \text{ Hz}$, 1H), 7.17 (t, $J = 7.6 \text{ Hz}$, 1H), 7.06 (d, $J = 6.0 \text{ Hz}$, 1H), 3.94 – 3.13 (m, 2H), 2.51 (d, $J = 13.6 \text{ Hz}$, 1H), 2.36 (d, $J = 12.8 \text{ Hz}$, 1H), 2.01 – 1.81 (m, 2H), 1.61 (q, $J = 12.0 \text{ Hz}$, 2H), 1.55 – 1.38 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.7, 149.8, 148.9, 146.3, 139.2, 134.7, 133.8, 130.0, 124.4, 123.9, 122.3, 121.2, 119.9, 117.9, 117.1, 61.3, 58.6, 34.2, 33.5, 25.9, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{20}\text{ClN}_4\text{O}^+$ 379.1320, found: 379.1316.

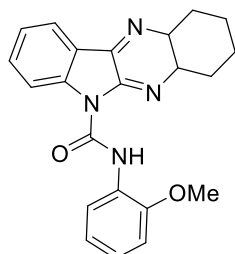
***N*-(*o*-Tolyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4l)**

**4l**

Yellow solid, 77% yield, 276.3 mg, m.p. 162.5-163.7 °C, IR (KBr thin film): $\nu = 3436, 1711, 1596, 1563 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.23 (s, 1H), 8.43 (d, $J = 8.4 \text{ Hz}$, 1H), 8.17 (d, $J = 8.0 \text{ Hz}$, 1H), 7.75 (d, $J = 8.0 \text{ Hz}$, 1H), 7.53 – 7.42 (m, 1H), 7.22 (d, $J = 8.4 \text{ Hz}$, 1H), 7.16 (q, $J = 8.4, 7.6 \text{ Hz}$, 2H), 7.03 (d, $J = 7.2 \text{ Hz}$, 1H), 3.44 – 2.77 (m, 2H), 2.49 (d, $J = 5.6 \text{ Hz}$, 1H), 2.35 (s, 1H), 2.32 (s, 3H), 1.96 – 1.84 (m, 2H), 1.56 (q, $J = 16.4, 14.4 \text{ Hz}$, 2H), 1.44 (d, $J = 10.8 \text{ Hz}$, 2H). ^{13}C

NMR (100 MHz, CDCl₃) δ 152.8, 150.2, 149.0, 146.7, 136.6, 133.8, 130.4, 127.8, 126.7, 124.2, 123.9, 122.2, 121.3, 121.1, 117.23, 61.1, 58.6, 34.0, 33.5, 25.9, 25.6, 19.0. HRMS (ESI) m/z : [M+H]⁺ calcd for C₂₂H₂₃N₄O⁺ 359.1866, found: 359.1861.

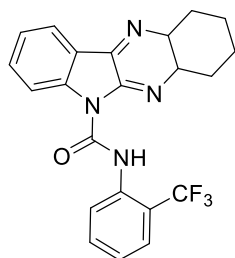
***N*-(2-Methoxyphenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4m)**



4m

Yellow solid, 75% yield, 281.4 mg, m.p. 153.5-155.3 °C, IR (KBr thin film): ν = 3412, 1713, 1605, 1548 cm⁻¹; ¹H NMR (400 MHz, CDCl₃) δ 11.76 (s, 1H), 8.46 (d, J = 8.4 Hz, 1H), 8.39 (d, J = 6.0 Hz, 1H), 7.76 (d, J = 8.8 Hz, 1H), 7.50 – 7.43 (m, 1H), 7.15 (t, J = 7.6 Hz, 1H), 7.05 – 6.95 (m, 2H), 6.88 (d, J = 7.6 Hz, 1H), 3.89 (s, 3H), 3.19 (q, J = 16.0, 15.2 Hz, 2H), 2.49 (d, J = 14.0 Hz, 1H), 2.36 (d, J = 13.2 Hz, 1H), 1.92 (d, J = 10.0 Hz, 2H), 1.67 – 1.55 (m, 2H), 1.47 (d, J = 11.2 Hz, 2H). ¹³C NMR (100 MHz, CDCl₃) δ 152.8, 149.9, 148.8, 148.7, 146.7, 133.7, 128.0, 124.1, 123.3, 122.2, 121.4, 121.0, 119.9, 117.2, 110.1, 61.1, 58.6, 55.6, 34.1, 33.5, 26.0, 25.7. HRMS (ESI) m/z : [M+H]⁺ calcd for C₂₂H₂₃N₄O₂⁺ 375.1816, found: 375.1823.

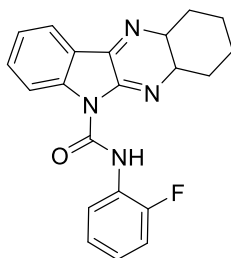
***N*-(2-(Trifluoromethyl)phenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4n)**



4n

Yellow solid, 71% yield, 293.3 mg, m.p. 140.5-142.1 °C, IR (KBr thin film): ν = 3421, 1717, 1599, 1564 cm⁻¹; ¹H NMR (400 MHz, CDCl₃) δ 11.75 (s, 1H), 8.42 (dd, J = 8.4, 4.4 Hz, 1H), 8.18 (d, J = 8.0 Hz, 1H), 7.80 (d, J = 7.6 Hz, 1H), 7.64 (d, J = 8.0 Hz, 1H), 7.58 (t, J = 7.2 Hz, 1H), 7.53 – 7.45 (m, 1H), 7.22 (dt, J = 14.8, 7.8 Hz, 2H), 3.95 – 3.15 (m, 2H), 2.50 (d, J = 12.4 Hz, 1H), 2.37 (d, J = 13.6 Hz, 1H), 1.99 – 1.84 (m, 2H), 1.58 (dd, J = 29.6, 10.8 Hz, 2H), 1.52 – 1.33 (m, 2H). ¹³C NMR (100 MHz, CDCl₃) δ 152.6, 150.5, 148.8, 146.4, 135.2, 133.8, 132.5, 126.1 (q, J = 5.3 Hz), 125.3, 124.5, 124.3, 123.8 (d, J = 271.6 Hz), 122.3, 121.4, 117.3, 61.3, 58.7, 33.5, 33.5, 25.9, 25.6. HRMS (ESI) m/z : [M+H]⁺ calcd for C₂₂H₂₀F₃N₄O⁺ 413.1584, found: 413.1588.

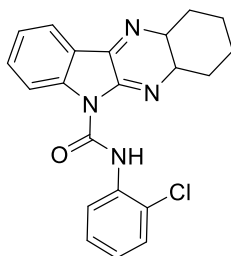
***N*-(2-Fluorophenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4o)**



4o

Yellow solid, 67% yield, 243.3 mg, m.p. 164.0-165.2 °C, IR (KBr thin film): $\nu = 3435, 1720, 1606, 1561 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.93 (s, 1H), 8.42 (d, $J = 8.4$ Hz, 1H), 8.34 (t, $J = 7.2$ Hz, 1H), 7.78 (d, $J = 6.4$ Hz, 1H), 7.53 – 7.43 (m, 1H), 7.21 – 7.16 (m, 1H), 7.13 (d, $J = 7.6$ Hz, 1H), 7.09 (d, $J = 10.8$ Hz, 1H), 7.04 (t, $J = 7.2$ Hz, 1H), 3.23 (dd, $J = 13.2, 11.6$ Hz, 2H), 2.50 (d, $J = 12.8$ Hz, 1H), 2.38 (d, $J = 13.6$ Hz, 1H), 1.99 – 1.86 (m, 2H), 1.67 – 1.55 (m, 2H), 1.51 – 1.35 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 153.0 (d, $J = 243.2$ Hz), 152.6, 149.9, 148.8, 146.4, 133.8, 126.6 (d, $J = 10.4$ Hz), 124.5 (d, $J = 3.1$ Hz), 124.4, 123.8, 123.7, 122.3, 121.4, 117.1, 114.9 (d, $J = 18.8$ Hz), 61.3, 58.6, 33.9, 33.5, 26.0, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{20}\text{FN}_4\text{O}^+$ 363.1616, found: 363.1611.

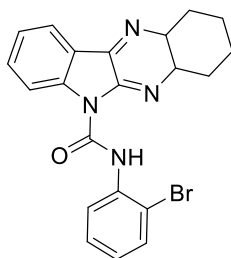
***N*-(2-Chlorophenyl)-1,2,3,4,4a,11a-hexahydro-6H-indolo[2,3-*b*]quinoxaline-6-carboxamide (4p)**



4p

Yellow solid, 75% yield, 284.3 mg, m.p. 165.4-166.5 °C, IR (KBr thin film): $\nu = 3435, 1713, 1598, 1552 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.84 (s, 1H), 8.42 (dd, $J = 8.4, 4.4$ Hz, 2H), 7.76 (dd, $J = 7.6, 1.2$ Hz, 1H), 7.47 (t, $J = 8.0$ Hz, 1H), 7.37 (d, $J = 8.0$ Hz, 1H), 7.26 (t, $J = 7.2$ Hz, 1H), 7.17 (t, $J = 7.6$ Hz, 1H), 7.01 (t, $J = 6.8$ Hz, 1H), 3.51 – 2.87 (m, 2H), 2.49 (d, $J = 12.4$ Hz, 1H), 2.36 (d, $J = 13.2$ Hz, 1H), 1.98 – 1.85 (m, 2H), 1.59 (p, $J = 11.6, 11.2$ Hz, 2H), 1.49 – 1.31 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.6, 150.0, 148.6, 146.4, 135.6, 133.8, 129.3, 127.4, 124.4, 124.1, 123.6, 122.3, 121.7, 121.5, 117.2, 61.2, 58.6, 33.9, 33.5, 26.0, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{20}\text{ClN}_4\text{O}^+$ 379.1320, found: 379.1316.

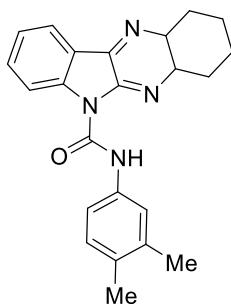
***N*-(2-Bromophenyl)-1,2,3,4,4a,11a-hexahydro-6H-indolo[2,3-*b*]quinoxaline-6-carboxamide (4q)**



4q

Yellow solid, 79% yield, 334.2 mg, m.p. 152.4-153.9 °C, IR (KBr thin film): $\nu = 3435, 1712, 1591, 1547 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.67 (s, 1H), 8.43 (d, $J = 8.0$ Hz, 1H), 8.34 (d, $J = 8.4$ Hz, 1H), 7.78 (d, $J = 8.8$ Hz, 1H), 7.56 (d, $J = 9.6$ Hz, 1H), 7.49 (t, $J = 7.2$ Hz, 1H), 7.31 (d, $J = 7.2$ Hz, 1H), 7.18 (t, $J = 7.2$ Hz, 1H), 6.97 (t, $J = 6.8$ Hz, 1H), 3.33 – 3.15 (m, 2H), 2.46 (dd, $J = 31.2, 13.2$ Hz, 2H), 1.96 – 1.87 (m, 2H), 1.60 (d, $J = 3.6$ Hz, 2H), 1.45 (q, $J = 12.4, 11.2$ Hz, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.6, 150.2, 148.6, 146.4, 136.7, 133.8, 132.7, 128.0, 124.90, 124.4, 122.7, 122.3, 121.5, 117.3, 114.1, 77.4, 77.1, 76.8, 61.2, 58.8, 34.0, 33.5, 25.9, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{20}\text{BrN}_4\text{O}^+$ 423.0815, found: 423.0818.

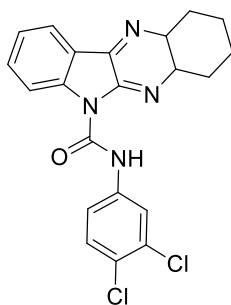
***N*-(3,4-Dimethylphenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4r)**



4r

Yellow solid, 76% yield, 283.6 mg, m.p. 144.3-146.1 °C, IR (KBr thin film): $\nu = 3436, 1703, 1603, 1556 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.44 (s, 1H), 8.42 (d, $J = 8.2$ Hz, 1H), 7.76 (d, $J = 7.6$ Hz, 1H), 7.47 (t, $J = 7.2$ Hz, 1H), 7.33 (s, 1H), 7.25 (d, $J = 8.4$ Hz, 1H), 7.15 (t, $J = 7.6$ Hz, 1H), 7.07 (d, $J = 8.0$ Hz, 1H), 3.20 (t, $J = 7.6$ Hz, 2H), 2.49 (d, $J = 12.8$ Hz, 1H), 2.35 (d, $J = 12.8$ Hz, 1H), 2.27 (d, $J = 4.4$ Hz, 3H), 2.22 (s, 3H), 1.91 (dd, $J = 24.4, 13.2$ Hz, 3H), 1.60 (q, $J = 12.0, 10.4$ Hz, 2H), 1.45 (d, $J = 10.0$ Hz, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.9, 150.1, 149.0, 146.7, 137.3, 135.6, 133.8, 132.3, 130.0, 124.1, 122.2, 121.4, 121.2, 117.6, 117.2, 61.2, 58.6, 34.2, 33.5, 26.0, 25.6, 20.0, 19.2. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{23}\text{H}_{25}\text{N}_4\text{O}^+$ 373.2023, found: 373.2021.

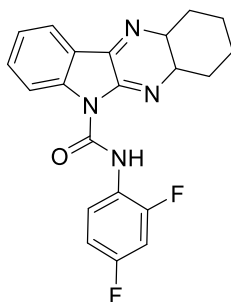
***N*-(3,4-Dichlorophenyl)-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4s)**



4s

Yellow solid, 82% yield, 358.5 mg, m.p. 188.2-189.1 °C, IR (KBr thin film): $\nu = 3446, 1701, 1597, 1547 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.75 (s, 1H), 8.35 (d, $J = 8.4 \text{ Hz}$, 1H), 7.97 – 7.59 (m, 2H), 7.47 (t, $J = 8.4 \text{ Hz}$, 1H), 7.34 (d, $J = 8.8 \text{ Hz}$, 1H), 7.30 (dd, $J = 8.8, 2.4 \text{ Hz}$, 1H), 7.18 (t, $J = 7.6 \text{ Hz}$, 1H), 3.98 – 3.06 (m, 2H), 2.51 (d, $J = 13.6 \text{ Hz}$, 1H), 2.35 (d, $J = 12.8 \text{ Hz}$, 1H), 1.95 (t, $J = 10.8 \text{ Hz}$, 2H), 1.61 (q, $J = 12.4 \text{ Hz}$, 2H), 1.47 (q, $J = 9.2 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.6, 149.7, 148.8, 146.1, 137.6, 133.8, 132.8, 130.4, 126.9, 124.5, 122.3, 121.3, 121.2, 119.0, 117.0, 61.3, 58.6, 34.2, 33.5, 25.9, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{19}\text{Cl}_2\text{N}_4\text{O}^+$ 413.0930, found: 413.0935.

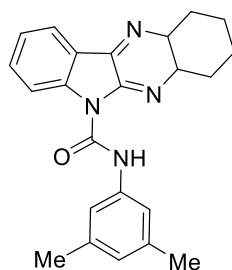
***N*-(2,4-Difluorophenyl)-1,2,3,4,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4t)**



4t

Yellow solid, 69% yield, 263.0 mg, m.p. 211.5-213.1 °C, IR (KBr thin film): $\nu = 3435, 1703, 1609, 1572 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.86 (s, 1H), 8.35 (dd, $J = 8.0, 7.4 \text{ Hz}$, 2H), 7.79 (d, $J = 7.6 \text{ Hz}$, 1H), 7.50 (t, $J = 8.0 \text{ Hz}$, 1H), 7.19 (t, $J = 7.6 \text{ Hz}$, 1H), 6.89 (t, $J = 7.2 \text{ Hz}$, 2H), 3.43 – 3.03 (m, 2H), 2.51 (d, $J = 12.8 \text{ Hz}$, 1H), 2.37 (d, $J = 12.8 \text{ Hz}$, 1H), 1.92 (d, $J = 12.8 \text{ Hz}$, 2H), 1.62 (dd, $J = 23.2, 12.0 \text{ Hz}$, 2H), 1.46 (q, $J = 11.6, 10.4 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.7, 150.1, 148.9, 146.3, 133.9, 124.5, 122.4, 122.3 (d, $J = 2.5 \text{ Hz}$), 121.4, 117.1, 111.2 (d, $J = 3.6 \text{ Hz}$), 111.0 (d, $J = 3.6 \text{ Hz}$), 103.9, 103.6 (d, $J = 3.3 \text{ Hz}$), 103.4, 77.4, 77.0, 76.7, 61.4, 58.6, 34.0, 33.5, 26.0, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{21}\text{H}_{19}\text{F}_2\text{N}_4\text{O}^+$ 381.1521, found: 381.1517.

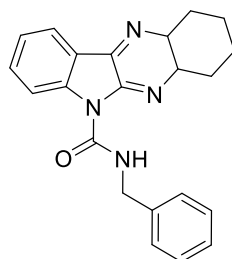
***N*-(3,5-Dimethylphenyl)-1,2,3,4,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4u)**



4u

Yellow solid, 74% yield, 276.2 mg, m.p. 176.1-178.3 °C, IR (KBr thin film): $\nu = 3435, 1708, 1606, 1585 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.49 (s, 1H), 8.43 (d, $J = 8.0 \text{ Hz}$, 1H), 7.76 (d, $J = 7.6 \text{ Hz}$, 1H), 7.47 (t, $J = 7.6 \text{ Hz}$, 1H), 7.18 (d, $J = 8.0 \text{ Hz}$, 3H), 6.75 (s, 1H), 3.70 – 2.79 (m, 2H), 2.50 (d, $J = 13.6 \text{ Hz}$, 1H), 2.32 (d, $J = 4.0 \text{ Hz}$, 7H), 1.93 (t, $J = 11.2 \text{ Hz}$, 2H), 1.66 – 1.55 (m, 2H), 1.46 (d, $J = 8.8 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.9, 150.1, 148.9, 146.6, 138.7, 137.8, 133.8, 125.8, 124.2, 122.2, 121.2, 118.0, 117.8, 117.2, 61.2, 58.6, 34.2, 33.5, 26.0, 25.6, 21.5. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{23}\text{H}_{25}\text{N}_4\text{O}^+$ 373.2023, found: 373.2021.

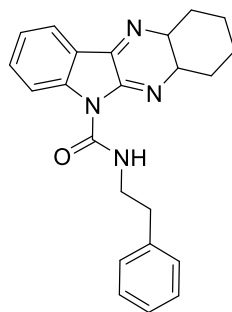
***N*-Benzyl-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4v)**



4v

Yellow solid, 85% yield, 305.3 mg, m.p. 150.9-151.6 °C, IR (KBr thin film): $\nu = 3436, 1706, 1608, 1586 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 9.77 (t, $J = 5.6 \text{ Hz}$, 1H), 8.40 (d, $J = 8.4 \text{ Hz}$, 1H), 7.75 (d, $J = 6.4 \text{ Hz}$, 1H), 7.46 (t, $J = 8.4 \text{ Hz}$, 1H), 7.37 (s, 2H), 7.35 (d, $J = 3.2 \text{ Hz}$, 2H), 7.30 – 7.25 (m, 1H), 7.14 (t, $J = 7.6 \text{ Hz}$, 1H), 4.60 (d, $J = 5.6 \text{ Hz}$, 2H), 3.54 – 2.69 (m, 2H), 2.47 (d, $J = 13.2 \text{ Hz}$, 1H), 2.22 (d, $J = 13.2 \text{ Hz}$, 1H), 1.96 – 1.81 (m, 2H), 1.50 (d, $J = 13.6 \text{ Hz}$, 2H), 1.41 (d, $J = 10.4 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 153.02, 153.00, 149.1, 146.8, 138.5, 133.8, 128.7, 127.32, 127.3, 124.0, 122.2, 121.1, 117.0, 61.2, 58.6, 43.7, 34.2, 33.5, 26.0, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{22}\text{H}_{23}\text{N}_4\text{O}^+$ 359.1866, found: 359.1861.

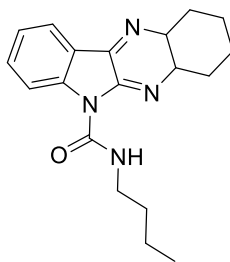
***N*-Phenethyl-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4w)**



4w

Yellow solid, 84% yield, 313.4 mg, m.p. 157.6-159.4 °C, IR (KBr thin film): $\nu = 3446, 1706, 1608, 1560 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 9.31 (t, $J = 5.6 \text{ Hz}$, 1H), 8.38 (d, $J = 8.4 \text{ Hz}$, 1H), 7.74 (d, $J = 6.4 \text{ Hz}$, 1H), 7.46 (t, $J = 8.0 \text{ Hz}$, 1H), 7.35 – 7.28 (m, 2H), 7.28 – 7.22 (m, 3H), 7.14 (t, $J = 7.6 \text{ Hz}$, 1H), 3.72 – 3.60 (m, 2H), 3.09 (d, $J = 5.6 \text{ Hz}$, 2H), 2.92 (t, $J = 7.2 \text{ Hz}$, 2H), 2.46 (d, $J = 13.6 \text{ Hz}$, 1H), 2.13 (d, $J = 8.8 \text{ Hz}$, 1H), 1.90 (q, $J = 10.4, 8.8 \text{ Hz}$, 2H), 1.58 (t, $J = 12.0 \text{ Hz}$, 1H), 1.49 – 1.34 (m, 3H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 153.0, 148.9, 146.9, 139.1, 133.7, 128.9, 128.6, 126.4, 123.9, 122.2, 121.1, 117.0, 61.1, 58.6, 41.3, 35.9, 34.1, 33.5, 26.0, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{23}\text{H}_{25}\text{N}_4\text{O}^+$ 373.2023, found: 373.2021.

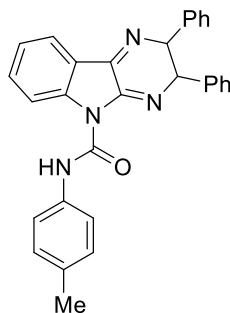
***N*-Butyl-1,2,3,4,4a,11a-hexahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (4x)**



4x

Yellow solid, 77% yield, 250.4 mg, m.p. 154.1-155.7 °C, IR (KBr thin film): $\nu = 3256, 1707, 1570, 1553 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 9.32 (t, $J = 5.6 \text{ Hz}$, 1H), 8.38 (d, $J = 8.4 \text{ Hz}$, 1H), 7.74 (d, $J = 6.4 \text{ Hz}$, 1H), 7.46 (t, $J = 7.2 \text{ Hz}$, 1H), 7.13 (t, $J = 7.2 \text{ Hz}$, 1H), 3.45 – 3.32 (m, 2H), 3.23 – 3.08 (m, 2H), 2.48 (d, $J = 13.2 \text{ Hz}$, 1H), 2.27 (d, $J = 12.8 \text{ Hz}$, 1H), 1.98 – 1.85 (m, 2H), 1.59 (dt, $J = 14.4, 7.2 \text{ Hz}$, 4H), 1.43 (dt, $J = 15.2, 8.0 \text{ Hz}$, 4H), 0.96 (t, $J = 7.2 \text{ Hz}$, 3H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 153.1, 153.0, 149.1, 147.0, 133.7, 123.8, 122.1, 121.1, 117.0, 61.1, 58.6, 39.5, 34.2, 33.5, 31.56, 26.0, 25.6, 20.2, 13.8. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{19}\text{H}_{25}\text{N}_4\text{O}^+$ 325.2023, found: 325.2028.

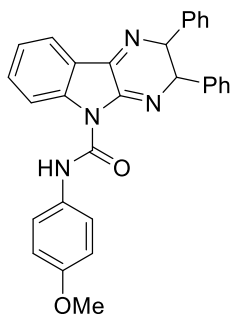
2,3-Diphenyl-*N*-(*p*-tolyl)-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4y)



4y

Orange solid, 79% yield, 361.1 mg, m.p. 156.6-158.2 °C, IR (KBr thin film): $\nu = 3446, 1715, 1608, 1559 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.47 (s, 1H), 8.49 (d, $J = 8.4 \text{ Hz}$, 1H), 7.83 (d, $J = 7.6 \text{ Hz}$, 1H), 7.52 (t, $J = 8.0 \text{ Hz}$, 1H), 7.30 (q, $J = 7.2, 6.4 \text{ Hz}$, 8H), 7.19 (t, $J = 7.6 \text{ Hz}$, 1H), 7.06 (dd, $J = 7.2, 5.2 \text{ Hz}$, 6H), 5.14 – 4.54 (m, 2H), 2.27 (s, 3H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.0, 150.1, 148.3, 147.0, 141.4, 141.0, 135.1, 134.3, 133.6, 129.5, 128.5, 128.5, 128.4, 127.9, 127.8, 127.7, 124.4, 122.7, 121.1, 120.2, 117.4, 67.1, 64.3, 20.9. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{30}\text{H}_{25}\text{N}_4\text{O}^+$ 457.2023, found: 457.2027.

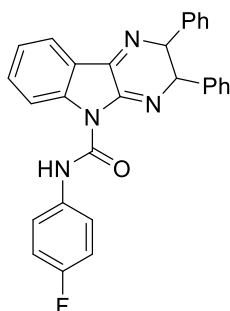
***N*-(4-Methoxyphenyl)-2,3-diphenyl-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4z)**



4z

Orange solid, 74% yield, 350.2 mg, m.p. 110.3-112.0 °C, IR (KBr thin film): $\nu = 3435, 1709, 1608, 1513 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.39 (s, 1H), 8.50 (d, $J = 8.4 \text{ Hz}$, 1H), 7.85 (d, $J = 7.6 \text{ Hz}$, 1H), 7.60 – 7.46 (m, 2H), 7.38 – 7.28 (m, 8H), 7.12 – 7.02 (m, 4H), 6.82 (d, $J = 9.2 \text{ Hz}$, 2H), 5.28 – 4.67 (m, 2H), 3.76 (s, 3H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 156.3, 151.9, 150.3, 148.3, 147.0, 141.5, 141.0, 134.3, 130.7, 128.6, 128.4, 127.9, 127.8, 127.7, 127.7, 124.4, 122.8, 121.9, 121.9, 121.1, 117.3, 114.21, 114.20, 67.1, 64.3, 55.5. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{30}\text{H}_{25}\text{N}_4\text{O}_2^+$ 473.1972, found: 473.1979.

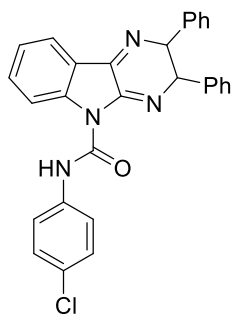
***N*-(4-Fluorophenyl)-2,3-diphenyl-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4a')**



4a'

Orange solid, 67% yield, 309.0 mg, m.p. 124.3-126.1 °C, IR (KBr thin film): $\nu = 3435, 1713, 1608, 1510$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.54 (s, 1H), 8.49 (d, $J = 8.4 \text{ Hz}$, 1H), 7.85 (d, $J = 7.6 \text{ Hz}$, 1H), 7.55 (t, $J = 7.6 \text{ Hz}$, 1H), 7.39 (dd, $J = 8.8, 4.8 \text{ Hz}$, 2H), 7.30 (d, $J = 3.2 \text{ Hz}$, 5H), 7.22 (t, $J = 7.6 \text{ Hz}$, 1H), 7.08 (dd, $J = 6.8, 3.2 \text{ Hz}$, 3H), 6.96 (t, $J = 8.4 \text{ Hz}$, 2H), 4.90 (q, $J = 12.8 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 159.3 (d, $J = 241.3 \text{ Hz}$), 151.9, 150.2, 148.3, 146.8, 141.4, 140.9, 134.4, 133.7 (d, $J = 2.4 \text{ Hz}$), 128.6, 128.5, 128.4, 127.9, 127.8, 124.6, 122.9, 121.9, 121.8, 121.1, 117.3, 115.8, 115.5, 67.1, 64.3. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{29}\text{H}_{22}\text{FN}_4\text{O}^+$ 461.1772, found: 461.1776.

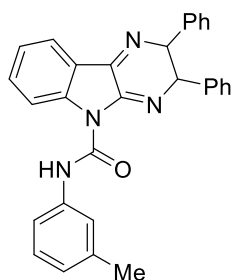
***N*-(4-Chlorophenyl)-2,3-diphenyl-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4b')**



4b'

Orange solid, 70% yield, 334.0 mg, m.p. 176.5-177.9 °C, IR (KBr thin film): $\nu = 3430, 1715, 1607, 1559 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.62 (s, 1H), 8.47 (d, $J = 8.4 \text{ Hz}$, 1H), 7.84 (d, $J = 7.6 \text{ Hz}$, 1H), 7.58 – 7.50 (m, 1H), 7.37 (d, $J = 8.8 \text{ Hz}$, 2H), 7.30 (d, $J = 2.0 \text{ Hz}$, 5H), 7.25 – 7.18 (m, 3H), 7.13 – 6.92 (m, 4H), 5.12 – 4.65 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 151.8, 149.9, 148.2, 146.7, 141.3, 140.9, 136.4, 134.3, 129.0, 128.9, 128.6, 128.4, 128.4, 127.9, 127.8, 127.8, 124.7, 122.9, 121.2, 121.1, 117.3, 67.1, 64.2. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{29}\text{H}_{22}\text{ClN}_4\text{O}^+$ 477.1477, found: 477.1472.

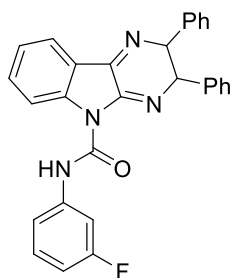
2,3-Diphenyl-*N*-(*m*-tolyl)-2,3-dihydro-5H-pyrazino[2,3-*b*]indole-5-carboxamide (4c')



4c'

Orange solid, 70% yield, 320.0 mg, m.p. 160.2-161.8 °C, IR (KBr thin film): $\nu = 3435, 1706, 1597, 1575 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.51 (s, 1H), 8.51 (d, $J = 8.4 \text{ Hz}$, 1H), 7.85 (d, $J = 7.6 \text{ Hz}$, 1H), 7.59 – 7.44 (m, 2H), 7.42 – 7.28 (m, 7H), 7.22 – 6.87 (m, 8H), 5.46 – 4.44 (m, 2H), 2.30 (s, 3H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 156.3, 152.0, 150.3, 148.3, 147.0, 141.5, 141.0, 134.3, 130.7, 128.6, 128.4, 127.9, 127.8, 127.7, 124.4, 122.8, 122.0, 121.1, 117.4, 114.2, 67.1, 64.3, 55.5. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{30}\text{H}_{25}\text{N}_4\text{O}^+$ 457.2023, found: 457.2027.

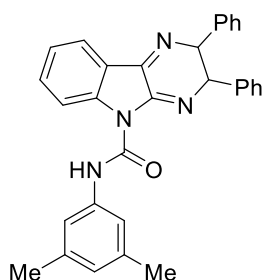
***N*-(3-Fluorophenyl)-2,3-diphenyl-2,3-dihydro-5H-pyrazino[2,3-*b*]indole-5-carboxamide (4d')**



4d'

Orange solid, 69% yield, 318.2 mg, m.p. 116.9-118.4 °C, IR (KBr thin film): $\nu = 3435, 1715, 1608, 1570 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.72 (s, 1H), 8.50 (d, $J = 8.4 \text{ Hz}$, 1H), 7.87 (d, $J = 7.6 \text{ Hz}$, 1H), 7.57 (t, $J = 8.8 \text{ Hz}$, 1H), 7.46 (dt, $J = 11.2, 2.4 \text{ Hz}$, 1H), 7.34 – 7.28 (m, 6H), 7.26 – 7.15 (m, 3H), 7.08 (td, $J = 7.6, 3.6 \text{ Hz}$, 4H), 7.01 (dd, $J = 8.0, 2.0 \text{ Hz}$, 1H), 5.06 – 4.69 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 164.3, 161.8, 151.8, 149.9, 148.3, 146.7, 141.3, 140.9, 139.4, 139.3, 134.4, 130.1, 130.0, 128.6, 128.5, 128.4, 128.3, 128.2, 128.1, 127.9, 127.82, 127.80, 127.7, 124.7, 122.9, 121.1, 117.4, 115.4, 115.3, 110.8, 110.6, 107.6, 107.3, 77.4, 77.1, 76.7, 67.0, 64.2. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{29}\text{H}_{22}\text{FN}_4\text{O}^+$ 461.1772, found: 461.1776.

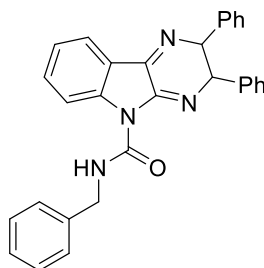
***N*-(3,5-Dimethylphenyl)-2,3-diphenyl-2,3-dihydro-5H-pyrazino[2,3-*b*]indole-5-carboxamide (4e')**



4e'

Orange solid, 84% yield, 395.8 mg, m.p. 180.6-182.4 °C, IR (KBr thin film): $\nu = 3446, 1711, 1610, 1583 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.45 (s, 1H), 8.50 (d, $J = 8.4 \text{ Hz}$, 1H), 7.84 (d, $J = 7.6 \text{ Hz}$, 1H), 7.53 (t, $J = 8.0 \text{ Hz}$, 1H), 7.30 (p, $J = 3.2 \text{ Hz}$, 6H), 7.20 (t, $J = 7.6 \text{ Hz}$, 1H), 7.16 – 6.81 (m, 6H), 6.71 (s, 1H), 5.49 – 4.76 (m, 2H), 2.24 (s, 6H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 151.9, 150.1, 148.3, 146.9, 141.4, 141.0, 138.7, 137.5, 134.3, 128.6, 128.4, 128.3, 127.9, 127.8, 127.7, 125.8, 124.4, 122.8, 121.1, 118.0, 117.4, 67.0, 64.1, 21.4. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{31}\text{H}_{27}\text{N}_4\text{O}^+$ 471.2179, found: 471.2184.

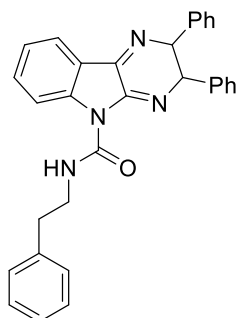
***N*-Benzyl-2,3-diphenyl-2,3-dihydro-5H-pyrazino[2,3-*b*]indole-5-carboxamide (4f')**



4f'

Orange solid, 73% yield, 333.8 mg, m.p. 83.4-85.6 °C, IR (KBr thin film): $\nu = 3435, 1693, 1606, 1542 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 9.76 (s, 1H), 8.45 (d, $J = 8.4 \text{ Hz}$, 1H), 7.82 (d, $J = 7.6 \text{ Hz}$, 1H), 7.50 (d, $J = 7.2 \text{ Hz}$, 1H), 7.34 – 7.15 (m, 11H), 7.02 (ddd, $J = 26.4, 7.6, 3.2 \text{ Hz}$, 4H), 4.83 (s, 2H), 4.63 (dd, $J = 15.2, 6.4 \text{ Hz}$, 1H), 4.46 (dd, $J = 15.2, 5.2 \text{ Hz}$, 1H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.9, 152.0, 148.3, 147.1, 141.6, 141.1, 138.3, 134.2, 128.6, 128.5, 128.4, 128.3, 128.0, 127.8, 127.5, 127.3, 127.2, 124.2, 122.7, 121.0, 117.2, 66.9, 64.3, 43.7. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{30}\text{H}_{25}\text{N}_4\text{O}^+$ 457.2023, found: 457.2027.

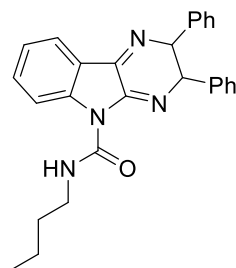
***N*-Phenethyl-2,3-diphenyl-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4g')**



4g'

Orange solid, 82% yield, 386.4 mg, m.p. 70.6-72.4 °C, IR (KBr thin film): $\nu = 3446, 1704, 1607, 1544 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 9.28 (t, $J = 5.4 \text{ Hz}$, 1H), 8.45 (d, $J = 8.4 \text{ Hz}$, 1H), 7.80 (d, $J = 7.6 \text{ Hz}$, 1H), 7.50 (t, $J = 8.4 \text{ Hz}$, 1H), 7.28 (p, $J = 2.4 \text{ Hz}$, 6H), 7.16 (t, $J = 7.6 \text{ Hz}$, 1H), 7.10 (t, $J = 3.6 \text{ Hz}$, 5H), 7.03 (dd, $J = 6.4, 2.8 \text{ Hz}$, 2H), 6.99 – 6.92 (m, 2H), 4.79 (d, $J = 2.8 \text{ Hz}$, 2H), 3.66 (dd, $J = 13.2, 6.4 \text{ Hz}$, 1H), 3.53 (dd, $J = 13.2, 5.6 \text{ Hz}$, 1H), 2.83 (p, $J = 7.2 \text{ Hz}$, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.9, 151.9, 148.3, 147.1, 141.7, 141.2, 138.9, 134.2, 128.8, 128.5, 128.5, 128.4, 128.3, 128.0, 127.8, 127.6, 126.3, 124.2, 122.7, 121.0, 117.2, 66.9, 64.3, 41.5, 35.7. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{31}\text{H}_{27}\text{N}_4\text{O}^+$ 471.2179, found: 471.2184.

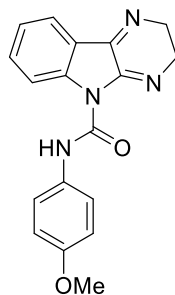
***N*-Butyl-2,3-diphenyl-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4h')**



4h'

Orange solid, 76% yield, 321.6 mg, m.p. 83.7-84.9 °C, IR (KBr thin film): $\nu = 3446, 1699, 1607, 1556 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 9.29 (s, 1H), 8.45 (d, $J = 8.4 \text{ Hz}$, 1H), 7.81 (d, $J = 6.4 \text{ Hz}$, 1H), 7.54 – 7.44 (m, 1H), 7.28 (td, $J = 6.0, 5.2, 2.4 \text{ Hz}$, 6H), 7.17 (t, $J = 7.6 \text{ Hz}$, 1H), 7.11 – 6.97 (m, 4H), 4.83 (d, $J = 2.8 \text{ Hz}$, 2H), 3.39 (dt, $J = 13.2, 6.4 \text{ Hz}$, 1H), 3.33 – 3.18 (m, 1H), 1.50 (td, $J = 7.2, 4.0 \text{ Hz}$, 2H), 1.33 – 1.26 (m, 2H), 0.85 (d, $J = 7.2 \text{ Hz}$, 3H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.9, 152.1, 148.3, 147.2, 141.8, 141.2, 134.2, 128.5, 128.4, 128.3, 128.0, 127.7, 127.5, 124.1, 122.7, 121.0, 117.2, 66.9, 64.3, 39.6, 31.5, 20.1, 13.7. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{27}\text{H}_{27}\text{N}_4\text{O}^+$ 423.2179, found: 423.2184.

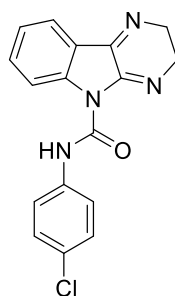
***N*-(4-Methoxyphenyl)-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4i')**



4i'

Yellow solid, 72% yield, 231.2 mg, m.p. 115.7-116.3 °C, IR (KBr thin film): $\nu = 3436, 1698, 1605, 1569 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.23 (s, 1H), 8.45 (d, $J = 8.0 \text{ Hz}$, 1H), 7.74 (d, $J = 8.0 \text{ Hz}$, 1H), 7.52 – 7.47 (m, 3H), 7.19 (t, $J = 7.2 \text{ Hz}$, 1H), 6.90 (d, $J = 8.4 \text{ Hz}$, 1H), 3.96 – 3.92 (m, 2H), 3.83 – 3.81 (m, 5H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 156.4, 152.7, 150.5, 148.6, 146.4, 133.9, 130.8, 124.2, 122.3, 122.1, 121.4, 117.2, 114.2, 55.5, 45.3, 42.5. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{18}\text{H}_{17}\text{N}_4\text{O}_2^+$ 321.1346, found: 321.1341.

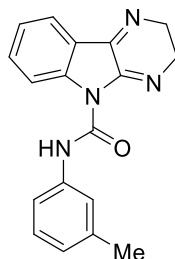
***N*-(4-Chlorophenyl)-2,3-dihydro-5H-pyrazino[2,3-*b*]indole-5-carboxamide (4j')**



4j'

Yellow solid, 61% yield, 198.3 mg, m.p. 157.8-159.1 °C, IR (KBr thin film): $\nu = 3446, 1699, 1604, 1561 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.43 (s, 1H), 8.37 (d, $J = 8.0 \text{ Hz}$, 1H), 7.70 (d, $J = 7.6 \text{ Hz}$, 1H), 7.49 (t, $J = 8.0 \text{ Hz}$, 3H), 7.28 (s, 2H), 7.16 (t, $J = 7.6 \text{ Hz}$, 1H), 3.92 (t, $J = 8.4 \text{ Hz}$, 2H), 3.85 – 3.68 (m, 2H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.4, 150.0, 148.4, 136.5, 133.9, 129.0, 128.9, 124.4, 122.1, 121.4, 121.3, 117.1, 45.2, 42.4. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{17}\text{H}_{14}\text{ClN}_4\text{O}^+$ 325.0851, found: 325.0855.

***N*-(*m*-Tolyl)-2,3-dihydro-5H-pyrazino[2,3-*b*]indole-5-carboxamide (4k')**

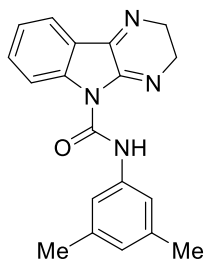


4k'

Yellow solid, 62% yield, 189.18 mg, m.p. 135.4-137.2 °C, IR (KBr thin film): $\nu = 3326, 1705, 1598, 1566 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 11.34 (s, 1H), 8.42 (d, $J = 8.4 \text{ Hz}$, 1H), 7.72 (dd, $J = 7.6,$

1.2 Hz, 1H), 7.48 (t, $J = 7.2$ Hz, 1H), 7.41 (s, 1H), 7.35 (d, $J = 8.8$ Hz, 1H), 7.22 (t, $J = 7.6$ Hz, 1H), 7.17 (t, $J = 7.2$ Hz, 1H), 6.92 (d, $J = 7.6$ Hz, 1H), 3.97 – 3.87 (m, 2H), 3.84 – 3.73 (m, 2H), 2.36 (s, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 152.6, 150.1, 148.5, 146.2, 138.9, 137.7, 133.9, 128.8, 124.9, 124.2, 122.1, 121.4, 120.9, 117.4, 117.2, 45.2, 42.4, 21.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{18}\text{H}_{17}\text{N}_4\text{O}^+$ 305.1397, found: 305.1394.

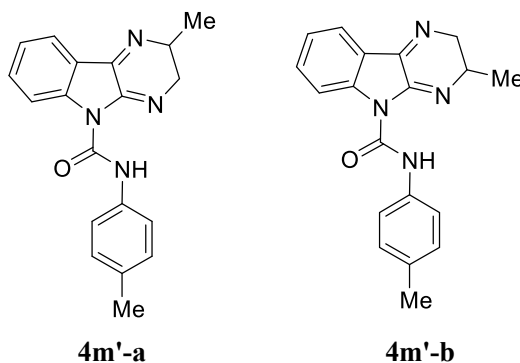
***N*-(3,5-Dimethylphenyl)-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (41')**



41'

Yellow solid, 73% yield, 233.0 mg, m.p. 109.5-111.3 °C, IR (KBr thin film): $\nu = 3435, 1690, 1601, 1573$ cm^{-1} ; ^1H NMR (400 MHz, CDCl_3) δ 11.29 (s, 1H), 8.43 (d, $J = 8.4$ Hz, 1H), 7.72 (d, $J = 7.6$ Hz, 1H), 7.48 (t, $J = 8.0$ Hz, 1H), 7.18 (d, $J = 13.2$ Hz, 3H), 6.75 (s, 1H), 3.92 (t, $J = 9.2$ Hz, 2H), 3.81 (t, $J = 8.0$ Hz, 2H), 2.32 (s, 6H). ^{13}C NMR (100 MHz, CDCl_3) δ 152.6, 150.1, 148.5, 146.3, 138.7, 137.6, 133.9, 125.8, 124.2, 122.0, 121.4, 118.0, 117.2, 45.3, 42.5, 21.4. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{19}\text{H}_{19}\text{N}_4\text{O}^+$ 319.1553, found: 319.1557.

2-Methyl-*N*-(*p*-tolyl)-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4m'-a) and 3-methyl-*N*-(*p*-tolyl)-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4m'-b)

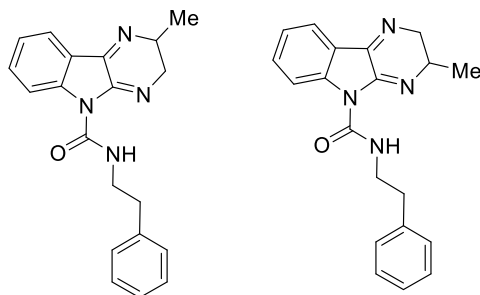


4m'-a

4m'-b

Yellow solid, 69% yield, 220.2 mg, **4m'-a:4m'-b** = 1:5.6 (the isomer ratio was determined by ^1H NMR); The isolated product was an inseparable mixture of isomers, m.p. 113.7-115.4 °C, IR (KBr thin film): $\nu = 3436, 1708, 1608, 1561$ cm^{-1} ; ^1H NMR (400 MHz, CDCl_3) δ 11.48 and 11.33 (s, 1H), 8.44 (d, $J = 8.4$ Hz, 1H), 7.73 (d, $J = 7.6$ Hz, 1H), 7.52 – 7.42 (m, 3H), 7.17 (dd, $J = 14.4, 7.6$ Hz, 3H), 4.09 (dd, $J = 17.6, 7.2$ Hz, 1H), 3.91 (dd, $J = 12.8, 6.4$ Hz, 1H), 3.56 (dd, $J = 17.6, 12.4$ Hz, 1H), 2.33 (s, 3H), 1.43 (dd, $J = 13.2, 6.8$ Hz, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 152.3, 150.2, 148.2, 146.4, 135.3, 133.9, 133.6, 129.6, 124.2, 122.1, 121.3, 120.4, 120.3, 120.3, 117.2, 52.1, 48.1, 20.9, 20.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{19}\text{H}_{19}\text{N}_4\text{O}^+$ 319.1553, found: 319.1557.

2-Methyl-*N*-phenethyl-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4n'-a) and 3-methyl-*N*-phenethyl-2,3-dihydro-5*H*-pyrazino[2,3-*b*]indole-5-carboxamide (4n'-b)

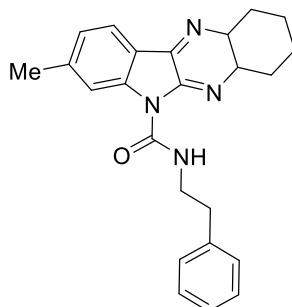


4n'-a

4n'-b

Orange solid, 72% yield, 240.0 mg, **4n'-a**:**4n'-b** = 2:1 (the isomer ratio was determined by ^1H NMR); The isolated product was an inseparable mixture of isomers, m.p. 135.5-137.7 °C, IR (KBr thin film): $\nu = 3400, 1691, 1588, 1554\text{ cm}^{-1}$; ^1H NMR (400 MHz, CDCl_3) δ 9.32 and 9.26 (s, 1H), 8.37 (d, $J = 8.4\text{ Hz}$, 1H), 7.71 (dd, $J = 13.2, 7.6\text{ Hz}$, 1H), 7.46 (t, $J = 8.0\text{ Hz}$, 1H), 7.34 – 7.29 (m, 2H), 7.28 – 7.23 (m, 3H), 7.14 (t, $J = 7.6\text{ Hz}$, 1H), 4.02 – 3.83 (m, 1H), 3.76 – 3.61 (m, 3H), 3.52 – 3.29 (m, 1H), 2.92 (t, $J = 7.2\text{ Hz}$, 2H), 1.40 and 1.22 (d, $J = 6.8\text{ Hz}$, 3H). ^{13}C NMR (100 MHz, CDCl_3) δ 153.0, 152.9, 152.3, 151.9, 148.3, 148.1, 146.7, 146.6, 139.1, 139.1, 133.8, 129.0, 128.9, 128.6, 128.5, 126.4, 123.9, 122.1, 122.0, 121.23, 121.20, 117.0, 116.9, 52.0, 50.2, 48.9, 47.9, 41.5, 41.2, 36.0, 35.9, 20.4, 19.8. HRMS (ESI) m/z: $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{20}\text{H}_{21}\text{N}_4\text{O}^+$ 333.1710, found: 333.1716.

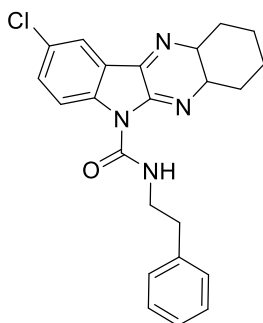
8-Methyl-N-phenethyl-1,2,3,4,4a,11a-hexahydro-6H-indolo[2,3-b]quinoxaline-6-carboxamide (4o')



4o'

Green solid, 83% yield, 321.4 mg, m.p. 84.9-86.6 °C, IR (KBr thin film): $\nu = 3218, 1693, 1609, 1535\text{ cm}^{-1}$; ^1H NMR (400 MHz, CDCl_3) δ 9.42 and 9.33 (t, $J = 5.6\text{ Hz}$, 1H), 8.24 (s, 1H), 7.62 (d, $J = 7.6\text{ Hz}$, 1H), 7.35 – 7.12 (m, 5H), 6.95 (d, $J = 7.6\text{ Hz}$, 1H), 3.87 – 3.73 and 3.14 – 3.00 (m, 2H), 3.73 – 3.42 (m, 2H), 2.91 (t, $J = 7.2\text{ Hz}$, 4H), 2.46 and 2.41 (s, 3H), 2.12 (d, $J = 9.2\text{ Hz}$, 1H), 1.97 – 1.76 (m, 2H), 1.63 – 1.33 (m, 4H). ^{13}C NMR (100 MHz, CDCl_3) δ 153.1, 149.4, 147.0, 145.0, 139.2, 128.8, 128.6, 126.4, 124.8, 121.9, 118.6, 117.6, 60.9, 58.7, 41.3, 35.9, 34.1, 33.6, 26.0, 25.6, 22.6. HRMS (ESI) m/z: $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{24}\text{H}_{27}\text{N}_4\text{O}^+$ 387.2179, found: 387.2185.

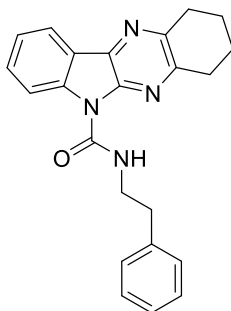
9-Chloro-N-phenethyl-1,2,3,4,4a,11a-hexahydro-6H-indolo[2,3-b]quinoxaline-6-carboxamide (4p')



4p'

Green solid, 70% yield, 321.4 mg, m.p. 83.2-84.7 °C, IR (KBr thin film): $\nu = 3218, 1693, 1609, 1535 \text{ cm}^{-1}$; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 9.29 and 9.19 (t, $J = 5.6 \text{ Hz}$, 1H), 8.31 (d, $J = 8.8 \text{ Hz}$, 1H), 7.69 (d, $J = 2.4 \text{ Hz}$, 1H), 7.39 (dd, $J = 8.8, 2.4 \text{ Hz}$, 1H), 7.35 – 7.26 (m, 2H), 7.28 – 7.19 (m, 3H), 3.89 – 3.79 and 3.19 – 3.02 (m, 2H), 3.74 – 3.54 (m, 2H), 2.90 (t, $J = 6.8 \text{ Hz}$, 2H), 2.50 – 2.40 and 2.21 – 2.06 and 2.00 – 1.79 (m, 3H), 1.63 – 1.34 (m, 5H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 152.6, 152.0, 148.5, 145.2, 139.0, 133.2, 129.5, 128.8, 128.6, 128.6, 126.5, 122.6, 122.0, 118.1, 77.4, 77.1, 76.8, 61.2, 58.6, 41.3, 35.8, 34.5, 33.4, 25.9, 25.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{23}\text{H}_{24}\text{ClN}_4\text{O}^+$ 407.1633, found: 407.1638.

***N*-Phenethyl-1,2,3,4-tetrahydro-6*H*-indolo[2,3-*b*]quinoxaline-6-carboxamide (5w)**



5w

Yellow solid, 93% yield, 345.2 mg, m.p. 121.2-122.4 °C; $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 9.53 (t, $J = 5.6 \text{ Hz}$, 1H), 8.74 (d, $J = 8.4 \text{ Hz}$, 1H), 8.19 (d, $J = 7.6 \text{ Hz}$, 1H), 7.58 (t, $J = 8.0 \text{ Hz}$, 1H), 7.39 (t, $J = 7.6 \text{ Hz}$, 1H), 7.31 (d, $J = 5.6 \text{ Hz}$, 4H), 7.27 – 7.23 (m, 1H), 3.84 (q, $J = 6.4 \text{ Hz}$, 2H), 3.11 (t, $J = 6.0 \text{ Hz}$, 2H), 3.01 (t, $J = 6.8 \text{ Hz}$, 2H), 2.85 (t, $J = 6.0 \text{ Hz}$, 2H), 1.96 (d, $J = 6.0 \text{ Hz}$, 4H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 153.0, 147.5, 146.8, 142.3, 139.8, 139.1, 136.1, 129.9, 128.9, 128.6, 126.5, 123.4, 121.1, 120.4, 116.9, 41.4, 35.9, 32.3, 32.0, 22.9, 22.6. HRMS (ESI) m/z : $[\text{M}+\text{H}]^+$ calcd for $\text{C}_{23}\text{H}_{23}\text{N}_4\text{O}^+$ 371.1866, found: 371.1861.

5. ^1H NMR and ^{13}C NMR spectra of products

