

Supporting Information for

Synthesis of Isoquinolines via Rh-Catalyzed C-H Activation/C-N Cyclization with Diazodiester or Diazoketoesters as C₂ Source

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1. General Information

Materials:

All reactions were carried out without any particular precautions to extrude moisture or oxygen. All reactions beyond room temperature (rt) were run in oil baths with the temperatures calibrated with a thermometer. Prior to an experiment, the oil bath was allowed to equilibrate to the desired temperature for 15 min. Dry solvents (<50 ppm H₂O) were purchased from Sigma-Aldrich or TCI and stored over molecular sieves under argon atmosphere and were transferred under nitrogen. [RhCp*Cl₂]₂ and AgSbF₆ were purchased from Meryer or Sigma-Aldrich, stored and weighed in a nitrogen-filled glove box. All other chemicals were obtained from local suppliers or synthesized according to the literature procedures.

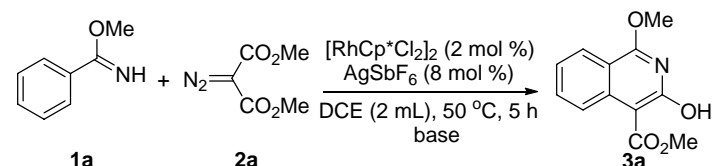
Methods:

Analytical thin layer chromatography (TLC) was performed on silica gel 60 F₂₅₄ aluminum plates. TLC plates were visualized by exposure to short wave ultraviolet light (254 nm, 365 nm) and/or iodine. Flash chromatography was performed on Merck silica gel (40-63 mesh) by standard techniques. ¹H and ¹³C NMR spectra were recorded on a Bruker AV 300, Bruker AV 400 in solvents as indicated. Chemical shifts (δ) for ¹H and ¹³C NMR spectra are given in ppm relative to TMS. The residual solvent signals were used as references for ¹H and ¹³C NMR spectra and the chemical shifts converted to the TMS scale. The following notations were used: br – broad, s – singlet, d – doublet, t – triplet, q – quartet, m – multiplet, dd – doublet of doublet, dt – doublet of triplet, td – triplet of doublet, ddd – doublet of doublet. Mass spectroscopy data of the products were collected on an HRMS-TOF instrument using ESI ionization.

2. Synthesis of Substrates

The benzimidates^{S1, S2} and α -diazo compounds^{S3, S4, S5, S6} were prepared according to the methods given in the cited references without any optimization of the reaction conditions.

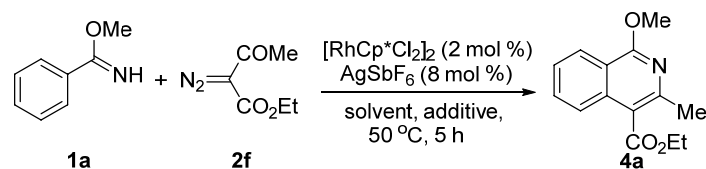
3. Table 1. Screening of Base Quantities^{a,b}



entry	base (mol %)	yield (%)
1	5	45
2	10	82
3	20	95
4	50	94
5	100	90
6	150	84
7	200	70

^aReaction conditions: **1a** (0.4 mmol), **2** (0.6 mmol). ^bIsolated yields.

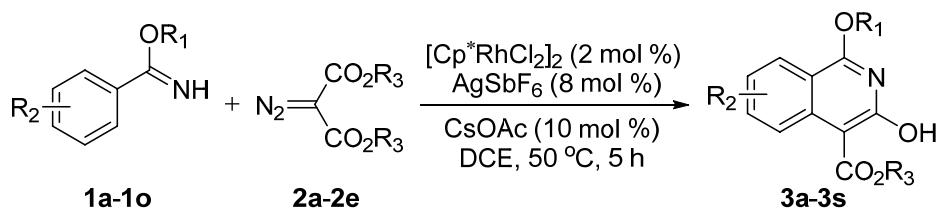
4. Table 2. Screening of Solvent^{a,b}



entry	solvent	additive	yield (%)
1	DCE	KOAc	0
2	DCE	-	0
3	CH ₃ OH	-	90
4	CH ₃ CN	-	72
5	CF ₃ CH ₂ OH	-	85
6	THF	-	0
7	Toluene	-	0
8	Acetone	-	54
9	CH ₃ OH	KOAc	82
10	CH ₃ OH	HOAc	62

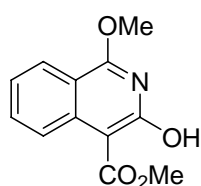
^aReaction conditions: **1a** (0.4 mmol), **2f** (0.6 mmol), solvent (2 mL), additive (10 mol %). ^bIsolated yields.

5. Synthesis and Characterization of Isoquinoline-3-oles

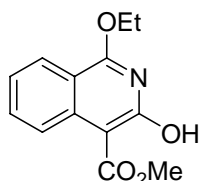


To a 13 × 150 mm test tube equipped with magnetic stir bar were added [RhCp*Cl₂]₂ (2 mol %), AgSbF₆ (8 mol %)

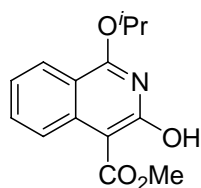
and KOAc (20 mol %) in the glovebox. The test tube was sealed with a rubber septum and removed from the glovebox. The solution of benzimidates (e.g. **1a**, 0.4mmol), α -diazo- β -ester compounds (e.g. **2a**, 0.6 mmol) in DCE (2 mL) was injected into the test tube via syringe. The reaction mixture was placed in a pre-heated oil bath (50 °C), stirred for 12 h, during which time a constant checking by TLC was performed. Once the reaction proceeded to a desired degree, the reaction mixture was cooled to rt and filtered over celite. The solvent was then removed under reduce pressure and the residue was purified by flash column chromatography on silica gel with hexanes/EtOAc as the eluent to give the corresponding isoquinoline-3- hydroxy (e.g. **3a**).



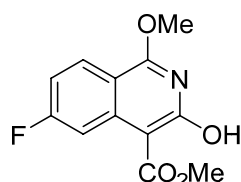
Methyl 3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3a): The title compound was obtained as a white solid in 94% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.31 (s, 1H), 8.63 (d, $J = 8.7$ Hz, 1H), 8.25 (d, $J = 7.4$ Hz, 1H), 7.68 (ddd, $J = 8.6, 7.0, 1.5$ Hz, 1H), 7.36 (t, $J = 7.1$ Hz, 1H), 4.66 (q, $J = 7.1$ Hz, 2H), 4.09 (s, 3H), 1.51 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101MHz, CDCl_3) δ 172.85, 167.34, 165.28, 137.34, 132.62, 125.05, 124.55, 123.91, 116.02, 91.93, 54.84, 52.46. **HRMS (ESI)** Calcd. For $\text{C}_{12}\text{H}_{12}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 234.0761. Found: m/z , 234.0760.



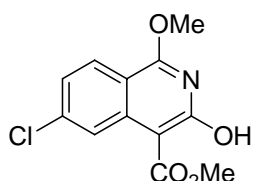
Methyl 1-ethoxy-3-hydroxyisoquinoline-4-carboxylate (3b): The title compound was obtained as a white solid in 93% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.31 (s, 1H), 8.63 (d, $J = 8.7$ Hz, 1H), 8.25 (dd, $J = 8.3, 0.9$ Hz, 1H), 7.68 (ddd, $J = 8.6, 7.0, 1.5$ Hz, 1H), 7.36 (ddd, $J = 8.1, 7.0, 0.9$ Hz, 1H), 4.66 (q, $J = 7.1$ Hz, 2H), 4.09 (s, 3H), 1.51 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.85, 167.42, 164.91, 137.29, 132.53, 125.07, 124.48, 123.77, 116.05, 91.67, 63.55, 52.42, 14.36. **HRMS (ESI)** Calcd. for $\text{C}_{13}\text{H}_{14}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 248.0917. Found: m/z , 248.0916.



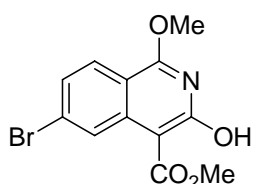
Methyl 3-hydroxy-1-isopropoxyisoquinoline-4-carboxylate (3c): The title compound was obtained as a white solid in 94% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.32 (s, 1H), 8.63 (d, $J = 8.7$ Hz, 1H), 8.24 (d, $J = 7.5$ Hz, 1H), 7.67 (t, $J = 7.2$ Hz, 1H), 7.35 (t, $J = 7.4$ Hz, 1H), 5.77 – 5.66 (m, 1H), 4.08 (s, 3H), 1.47 (d, $J = 6.2$ Hz, 6H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 166.34, 160.12, 152.02, 138.46, 133.35, 130.45, 128.53 (2C), 128.46 (2C), 127.96, 126.20, 123.66, 115.72, 70.02, 21.98 (3C). **HRMS (ESI)** Calcd. for $\text{C}_{14}\text{H}_{16}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 262.1074. Found: m/z , 262.1072.



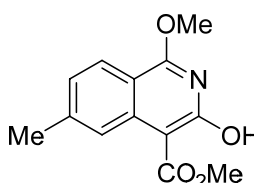
Methyl 6-fluoro-3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3d): The title compound was obtained as a white solid in 96% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.39 (s, 1H), 8.30 (dd, $J = 12.7, 2.4$ Hz, 1H), 8.23 (dd, $J = 9.1, 6.3$ Hz, 1H), 7.10 (ddd, $J = 9.1, 7.8, 2.5$ Hz, 1H), 4.19 (s, 3H), 4.10 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.42, 168.15, 165.45 (d, $J = 251.69$), 164.91, 139.39 (d, $J = 12.22$), 127.96 (d, $J = 10.61$), 113.21 (d, $J = 24.75$), 112.72, 109.70 (d, $J = 25.96$), 91.85 (d, $J = 3.64$), 54.91, 52.59. **HRMS (ESI)** Calcd. for $\text{C}_{12}\text{H}_{11}\text{FNO}_4$: $[\text{M}+\text{H}]^+$, 252.0667. Found: m/z , 252.0665.



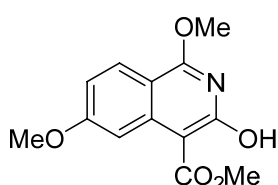
Methyl 6-chloro-3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3e): The title compound was obtained as a white solid in 87% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.41 (s, 1H), 8.62 (d, $J = 1.8$ Hz, 1H), 8.13 (d, $J = 8.8$ Hz, 1H), 7.31 (dd, $J = 8.8, 2.0$ Hz, 1H), 4.19 (s, 3H), 4.11 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.32, 167.97, 164.99, 139.42, 138.16, 126.52, 124.55, 123.88, 114.11, 91.31, 54.98, 52.69. **HRMS (ESI)** Calcd. for $\text{C}_{12}\text{H}_{11}\text{ClNO}_4$: $[\text{M}+\text{H}]^+$, 268.0371. Found: m/z , 268.0370.



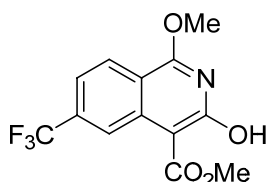
Methyl 6-bromo-3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3f): The title compound was obtained as a white solid in 84% yield. $^1\text{H NMR}$ (300 MHz, CDCl_3) $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.39 (s, 1H), 8.81 (d, $J = 1.8$ Hz, 1H), 8.06 (d, $J = 8.8$ Hz, 1H), 7.46 (dd, $J = 8.8, 1.8$ Hz, 1H), 4.19 (s, 3H), 4.11 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.30, 167.87, 165.13, 138.37, 128.43, 127.27, 127.05, 126.49, 114.40, 91.17, 55.02, 52.74. **HRMS (ESI)** Calcd. for $\text{C}_{12}\text{H}_{11}\text{BrNO}$: $[\text{M}+\text{H}]^+$, 311.9866. Found: m/z , 311.9866.



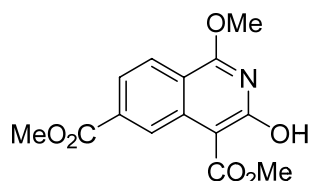
Methyl 3-hydroxy-1-methoxy-6-methylisoquinoline-4-carboxylate (3g): The title compound was obtained as a white solid in 92% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.32 (s, 1H), 8.42 (s, 1H), 8.10 (d, $J = 8.4$ Hz, 1H), 7.19 (dd, $J = 8.4, 1.2$ Hz, 1H), 4.18 (s, 3H), 4.09 (s, 3H), 2.53 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.88, 167.45, 165.10, 143.16, 137.51, 125.70, 124.79, 124.00, 113.97, 91.57, 54.66, 52.34, 22.66. **HRMS (ESI)** Calcd. for $\text{C}_{13}\text{H}_{14}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 248.0917. Found: m/z , 248.0916.



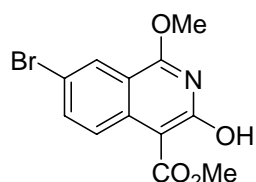
Methyl 3-hydroxy-1,6-dimethoxyisoquinoline-4-carboxylate (3h): The title compound was obtained as a white solid in 96% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.32 (s, 1H), 8.12 (d, $J = 9.1$ Hz, 1H), 8.05 (d, $J = 2.4$ Hz, 1H), 6.97 (dd, $J = 9.1, 2.5$ Hz, 1H), 4.17 (s, 3H), 4.08 (s, 3H), 3.94 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.82, 168.06, 165.01, 163.07, 139.63, 126.92, 114.39, 110.56, 105.44, 91.68, 55.21, 54.68, 52.45. **HRMS (ESI)** Calcd. for $\text{C}_{13}\text{H}_{14}\text{NO}_5$: $[\text{M}+\text{H}]^+$, 264.0866. Found: m/z , 264.0865.



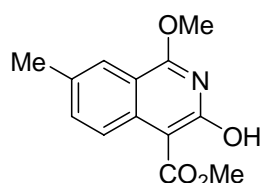
Methyl 3-hydroxy-1-methoxy-6-(trifluoromethyl)isoquinoline-4-carboxylate (3i): The title compound was obtained as a white solid in 95% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.41 (s, 1H), 8.96 (s, 1H), 8.33 (d, $J = 8.6$ Hz, 1H), 7.55 (dd, $J = 8.6, 1.5$ Hz, 1H), 4.23 (s, 3H), 4.13 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.21, 167.97, 164.91, 136.81, 133.84 (q, $J = 32.12$), 126.10, 123.90 (q, $J = 274.11$), 122.00 (q, $J = 4.55$), 119.73 (q, $J = 3.23$), 117.32, 92.10, 55.19, 52.78. **HRMS (ESI)** Calcd. for $\text{C}_{13}\text{H}_{11}\text{F}_3\text{NO}_4$: $[\text{M}+\text{H}]^+$, 302.0635. Found: m/z , 302.0635.



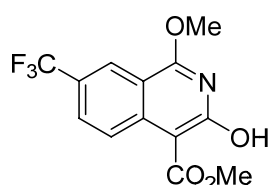
Dimethyl 3-hydroxy-1-methoxyisoquinoline-4,6-dicarboxylate (3j): The title compound was obtained as a white solid in 78% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.38 (s, 1H), 9.36 (d, $J = 1.0$ Hz, 1H), 8.28 – 8.25 (m, 1H), 7.94 (dd, $J = 8.6, 1.5$ Hz, 1H), 4.22 (s, 3H), 4.13 (s, 3H), 4.00 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.43, 167.63, 166.78, 164.95, 136.76, 133.29, 126.82, 125.22, 123.59, 117.99, 92.27, 55.08, 52.75, 52.56. **HRMS (ESI)** Calcd. for $\text{C}_{14}\text{H}_{14}\text{NO}_6$: $[\text{M}+\text{H}]^+$, 292.0816. Found: m/z , 292.0815.



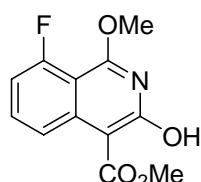
Methyl 7-bromo-3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3k): The title compound was obtained as a white solid in 93% yield. $^1\text{H NMR}$ (300 MHz, CDCl_3) δ 13.31 (s, 1H), 8.51 (d, $J = 9.3$ Hz, 1H), 8.35 (d, $J = 2.2$ Hz, 1H), 7.72 (dd, $J = 9.3, 2.3$ Hz, 1H), 4.20 (s, 3H), 4.09 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.45, 167.35, 164.25, 135.99, 135.68, 127.41, 126.49, 117.51, 117.29, 91.94, 55.09, 52.68. **HRMS (ESI)** Calcd. for $\text{C}_{12}\text{H}_{11}\text{BrNO}_4$: $[\text{M}+\text{H}]^+$, 311.9866. Found: m/z , 311.9864.



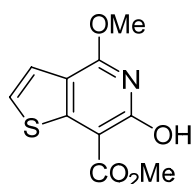
Methyl 3-hydroxy-1-methoxy-7-methylisoquinoline-4-carboxylate (3l): The title compound was obtained as a white solid in 90% yield. $^1\text{H NMR}$ (300 MHz, CDCl_3) δ 13.23 (s, 1H), 8.52 (d, $J = 8.8$ Hz, 1H), 8.00 (s, 1H), 7.50 (dd, $J = 8.9, 2.0$ Hz, 1H), 4.19 (s, 3H), 4.08 (s, 3H), 2.46 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.84, 166.74, 164.85, 135.24, 134.49, 133.60, 124.44, 124.13, 116.10, 91.88, 54.73, 52.38, 21.07. **HRMS (ESI)** Calcd. for $\text{C}_{13}\text{H}_{14}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 248.1917. Found: m/z , 248.1916.



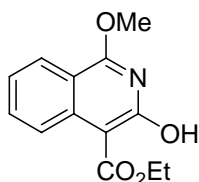
Methyl 3-hydroxy-1-methoxy-7-(trifluoromethyl)isoquinoline-4-carboxylate (3m): The title compound was obtained as a white solid in 78% yield. $^1\text{H NMR}$ (300 MHz, CDCl_3) δ 13.48 (s, 1H), 8.74 (d, $J = 9.1$ Hz, 1H), 8.50 (s, 1H), 7.83 (dd, $J = 9.1, 1.7$ Hz, 1H), 4.23 (s, 3H), 4.11 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.38, 168.54, 165.38, 139.28, 128.17 (q, $J = 3.1$), 125.79 (q, $J = 33.4$), 125.49, 123.93 (q, $J = 272.8$), 122.84 (q, $J = 4.3$), 115.10, 92.02, 55.20, 52.77. **HRMS (ESI)** Calcd. for $\text{C}_{13}\text{H}_{11}\text{F}_3\text{NO}_4$: $[\text{M}+\text{H}]^+$, 302.0635. Found: m/z , 302.0633.



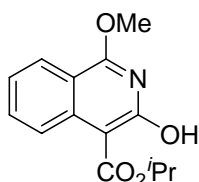
Methyl 8-fluoro-3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3n): The title compound was obtained as a white solid in 74% yield. $^1\text{H NMR}$ (300 MHz, CDCl_3) δ 13.36 (s, 1H), 8.42 (d, $J = 8.8$ Hz, 1H), 7.57 (td, $J = 8.3, 5.6$ Hz, 1H), 7.00 (dd, $J = 11.5, 7.9$ Hz, 1H), 4.19 (s, 3H), 4.07 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.57, 167.32, 164.47 (d, $J = 5.6$), 160.38 (d, $J = 262.1$), 140.08, 133.03 (d, $J = 10.0$), 120.34 (d, $J = 4.5$), 110.25 (d, $J = 21.9$), 106.42 (d, $J = 11.4$), 91.61 (d, $J = 2.7$), 55.14, 52.71. **HRMS (ESI)** Calcd. for $\text{C}_{12}\text{H}_{11}\text{FNO}_4$: $[\text{M}+\text{H}]^+$, 252.0667. Found: m/z , 252.0665.



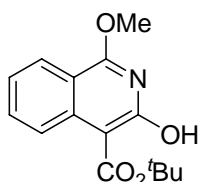
Methyl 6-hydroxy-4-methoxythieno[3,2-c]pyridine-7-carboxylate (3o): The title compound was obtained as a white solid in 70% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 12.49 (s, 1H), 7.76 (d, $J = 5.4$ Hz, 1H), 7.69 (d, $J = 5.4$ Hz, 1H), 4.15 (s, 3H), 4.03 (s, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 171.17, 166.56, 161.26, 147.40, 134.03, 125.01, 116.70, 94.40, 54.73, 52.47. **HRMS (ESI)** Calcd. for $\text{C}_{10}\text{H}_{10}\text{NO}_4\text{S}$: $[\text{M}+\text{H}]^+$, 240.0325. Found: m/z , 240.0324.



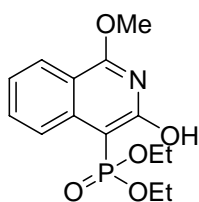
Ethyl 3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3p): The title compound was obtained as a white solid in 70% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.44 (s, 1H), 8.69 (d, $J = 8.8$ Hz, 1H), 8.21 (dd, $J = 8.3, 0.9$ Hz, 1H), 7.68 (ddd, $J = 8.6, 6.9, 1.5$ Hz, 1H), 7.36 (ddd, $J = 8.1, 7.0, 1.0$ Hz, 1H), 4.56 (q, $J = 7.1$ Hz, 2H), 4.20 (s, 3H), 1.53 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.46, 167.37, 165.15, 137.44, 132.55, 125.01, 124.47, 123.80, 115.97, 91.92, 61.98, 54.80, 14.36. **HRMS (ESI)** Calcd. for $\text{C}_{13}\text{H}_{14}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 248.0917. Found: m/z , 248.0917.



Isopropyl 3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3q): The title compound was obtained as a white solid in 70% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.53 (s, 1H), 8.71 (d, $J = 8.7$ Hz, 1H), 8.22 (dd, $J = 8.3, 0.9$ Hz, 1H), 7.68 (ddd, $J = 8.6, 6.9, 1.5$ Hz, 1H), 7.36 (ddd, $J = 8.1, 7.0, 1.0$ Hz, 1H), 5.45 (hept, $J = 6.3$ Hz, 1H), 4.20 (s, 3H), 1.51 (d, $J = 6.3$ Hz, 6H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.04, 167.38, 165.11, 137.62, 132.54, 125.04, 124.50, 123.77, 116.03, 92.19, 70.16, 54.80, 22.13. **HRMS (ESI)** Calcd. for $\text{C}_{14}\text{H}_{16}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 261.1074. Found: m/z , 262.1072.

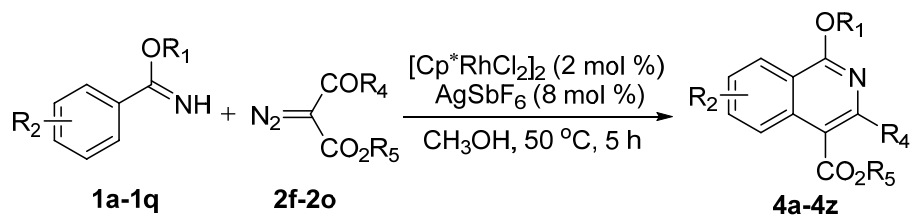


Tert-butyl 3-hydroxy-1-methoxyisoquinoline-4-carboxylate (3r): The title compound was obtained as a white solid in 70% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 13.63 (s, 1H), 8.70 (d, $J = 8.8$ Hz, 1H), 8.21 (dd, $J = 8.3, 1.0$ Hz, 1H), 7.66 (ddd, $J = 8.6, 6.9, 1.5$ Hz, 1H), 7.34 (ddd, $J = 8.1, 7.0, 1.0$ Hz, 1H), 4.19 (s, 3H), 1.72 (s, 9H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 171.95, 167.30, 164.85, 137.70, 132.36, 125.01, 124.49, 123.63, 116.01, 92.97, 84.08, 54.75, 28.57. **HRMS (ESI)** Calcd. for $\text{C}_{15}\text{H}_{18}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 276.1230. Found: m/z , 276.1229.

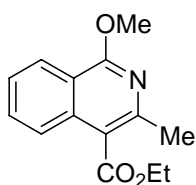


Diethyl (3-hydroxy-1-methoxyisoquinolin-4-yl)phosphonate (3s): The title compound was obtained as a white solid in 70% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 12.30 (s, 1H), 8.19 (d, $J = 8.3$ Hz, 1H), 7.92 (d, $J = 8.5$ Hz, 1H), 7.64 (ddd, $J = 8.4, 7.0, 1.4$ Hz, 1H), 7.39 – 7.32 (m, 1H), 4.22 – 4.15 (m, 5H), 3.99 (dd, $J = 17.2, 8.5$ Hz, 2H), 1.29 (t, $J = 7.1$ Hz, 6H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 166.42 (d, $J = 12.8$), 165.50 (d, $J = 1.7$), 139.32 (d, $J = 8.8$), 132.19, 125.04, 123.96, 123.62 (d, $J = 4.0$), 115.84 (d, $J = 10.1$), 84.14 (d, $J = 187.6$), 62.58 (d, $J = 4.2$), 54.70, 16.14 (d, $J = 6.9$). **HRMS (ESI)** Calcd. for $\text{C}_{16}\text{H}_{19}\text{NO}_5\text{P}$: $[\text{M}+\text{H}]^+$, 312.0923. Found: m/z , 312.0921.

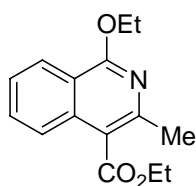
6. Synthesis and Characterization of Isoquinolines



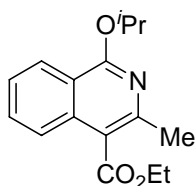
To a 13 × 150 mm test tube equipped with magnetic stir bar were added $[\text{RhCp}^*\text{Cl}_2]_2$ (2 mol %) and AgSbF_6 (8 mol %) in the glovebox. The test tube was sealed with a rubber septum and removed from the glovebox. The solution of benzimidates (e.g. **1a**, 0.4mmol), α -diazo- β -keto compounds (e.g. **2f**, 0.6 mmol) in CH_3OH (2 mL) was injected into the test tube via syringe. The reaction mixture was placed in a pre-heated oil bath (50 °C), stirred for 5h, during which time a constant checking by TLC was performed. Once the reaction proceeded to a desired degree, the reaction mixture was cooled to rt and filtered over celite. The solvent was then removed under reduce pressure and the residue was purified by flash column chromatography on silica gel with hexanes/ EtOAc as the eluent to give the corresponding isoquinoline derivatives (e.g. **4a**).



Ethyl 1-methoxy-3-methylisoquinoline-4-carboxylate (4a): The title compound was obtained as a white solid in 90% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.22 (d, $J = 8.2$ Hz, 1H), 7.88 (d, $J = 8.5$ Hz, 1H), 7.66 (ddd, $J = 8.4, 7.0, 1.3$ Hz, 1H), 7.52 – 7.45 (m, 1H), 4.50 (q, $J = 7.1$ Hz, 2H), 4.14 (s, 3H), 2.62 (s, 3H), 1.45 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 168.88, 160.54, 148.83, 135.74, 131.08, 125.94, 124.11, 123.63, 117.45, 117.25, 61.14, 53.76, 23.27, 14.33. **HRMS (ESI)** Calcd. For $\text{C}_{14}\text{H}_{16}\text{NO}_3$: $[\text{M}+\text{H}]^+$, 246.1125. Found: m/z , 246.1123.

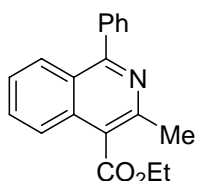


Ethyl 1-ethoxy-3-methylisoquinoline-4-carboxylate (4b) ^{S7}: The title compound was obtained as a white solid in 87% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.24 (d, $J = 8.3$ Hz, 1H), 7.88 (d, $J = 8.5$ Hz, 1H), 7.65 (ddd, $J = 8.4, 7.0, 1.3$ Hz, 1H), 7.50 – 7.44 (m, 1H), 4.59 (q, $J = 7.1$ Hz, 2H), 4.49 (q, $J = 7.1$ Hz, 2H), 2.60 (s, 3H), 1.49 (t, $J = 7.1$ Hz, 3H), 1.45 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 169.05, 160.34, 148.92, 135.77, 131.07, 125.87, 124.24, 123.60, 117.57, 116.99, 62.25, 61.18, 23.32, 14.52, 14.37.

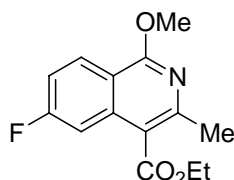


Ethyl 1-isopropoxy-3-methylisoquinoline-4-carboxylate (4c): The title compound was obtained as a white solid in 83% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.23 (d, $J = 8.2$ Hz, 1H), 7.87 (d, $J = 8.5$ Hz, 1H), 7.68 – 7.60 (m, 1H), 7.46 (dd, $J = 11.2, 3.9$ Hz, 1H), 5.70 – 5.58 (m, 1H), 4.49 (q, $J = 7.1$ Hz, 2H), 2.60 (s, 3H), 1.45 (t, $J = 6.6$ Hz, 9H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 169.10, 159.93, 149.00, 135.86, 131.03, 125.76, 124.36, 123.57, 117.90, 116.62, 68.83, 61.15, 23.40, 21.99, 14.37.

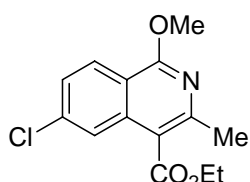
HRMS (ESI) Calcd. for $\text{C}_{16}\text{H}_{20}\text{NO}_3$: $[\text{M}+\text{H}]^+$, 274.1438. Found: m/z , 274.1436



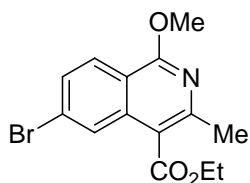
Ethyl 3-methyl-1-phenylisoquinoline-4-carboxylate (4d)^{S7}: The title compound was obtained as a white solid in 70% yield. ¹H NMR (400 MHz, CDCl₃) δ 8.04 (d, *J* = 8.4 Hz, 1H), 7.92 (d, *J* = 8.5 Hz, 1H), 7.72 – 7.63 (m, 3H), 7.55 – 7.46 (m, 4H), 4.57 (q, *J* = 7.1 Hz, 2H), 2.79 (s, 3H), 1.49 (t, *J* = 7.1 Hz, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 168.83, 161.71, 148.36, 139.04, 134.25, 131.03, 129.92, 128.91, 128.45, 127.94, 126.64, 124.63, 123.92, 122.61, 61.73, 23.09, 14.37.



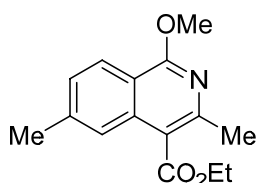
Ethyl 6-fluoro-1-methoxy-3-methylisoquinoline-4-carboxylate (4e): The title compound was obtained as a white solid in 85% yield. ¹H NMR (400 MHz, CDCl₃) δ 8.23 (dd, *J* = 9.1, 5.9 Hz, 1H), 8.23 (dd, *J* = 9.1, 5.9 Hz, 1H), 7.59 (dd, *J* = 10.9, 2.4 Hz, 1H), 7.59 (dd, *J* = 10.9, 2.4 Hz, 1H), 4.49 (q, *J* = 7.1 Hz, 2H), 4.13 (s, 3H), 2.63 (s, 3H), 1.45 (t, *J* = 7.1 Hz, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 168.43, 164.25 (d, *J* = 251.8 Hz), 160.46, 151.09, 137.81 (d, *J* = 10.8 Hz), 127.24 (d, *J* = 10.0 Hz), 116.70 (d, *J* = 4.5 Hz), 115.73 (d, *J* = 24.9 Hz), 114.44, 108.33 (d, *J* = 23.4 Hz), 61.31, 53.95, 23.58, 14.32. HRMS (ESI) Calcd. for C₁₄H₁₅FNO₃: [M+H]⁺, 264.1030. Found: *m/z*, 264.1029.



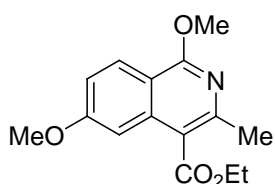
Ethyl 6-chloro-1-methoxy-3-methylisoquinoline-4-carboxylate (4f): The title compound was obtained as a white solid in 82% yield. ¹H NMR (400 MHz, CDCl₃) δ 8.15 (d, *J* = 8.8 Hz, 1H), 7.93 (d, *J* = 1.9 Hz, 1H), 7.42 (dt, *J* = 8.6, 2.8 Hz, 1H), 4.50 (q, *J* = 7.1 Hz, 2H), 4.13 (s, 3H), 2.63 (s, 3H), 1.46 (t, *J* = 7.1 Hz, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 168.31, 160.47, 150.87, 137.71, 136.78, 126.80, 125.88, 123.06, 116.24, 115.69, 61.36, 53.96, 23.55, 14.34. HRMS (ESI) Calcd. for C₁₄H₁₅ClNO₃: [M+H]⁺, 280.0735. Found: *m/z*, 280.0733.



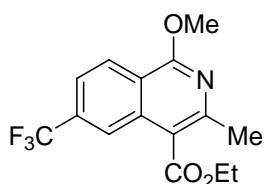
Ethyl 6-bromo-1-methoxy-3-methylisoquinoline-4-carboxylate (4g): The title compound was obtained as a white solid in 86% yield. ¹H NMR (400 MHz, CDCl₃) δ 8.15 (d, *J* = 8.8 Hz, 1H), 7.93 (d, *J* = 1.9 Hz, 1H), 7.42 (dt, *J* = 8.6, 2.8 Hz, 1H), 4.50 (q, *J* = 7.1 Hz, 2H), 4.13 (s, 3H), 2.63 (s, 3H), 1.46 (t, *J* = 7.1 Hz, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 168.31, 160.47, 150.87, 137.71, 136.78, 126.80, 125.88, 123.06, 116.24, 115.69, 61.36, 53.96, 23.55, 14.34. HRMS (ESI) Calcd. for C₁₄H₁₅BrNO₃: [M+H]⁺, 324.0230. Found: *m/z*, 324.0228.



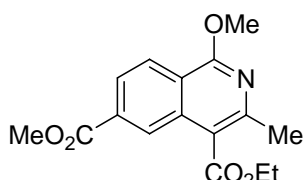
Ethyl 1-methoxy-3,6-dimethylisoquinoline-4-carboxylate (4h): The title compound was obtained as a white solid in 87% yield. ¹H NMR (400 MHz, CDCl₃) δ 8.10 (d, *J* = 8.4 Hz, 1H), 7.63 (s, 1H), 7.31 (dd, *J* = 8.4, 1.3 Hz, 1H), 4.50 (q, *J* = 7.1 Hz, 2H), 4.13 (s, 3H), 2.60 (s, 3H), 2.50 (s, 3H), 1.45 (t, *J* = 7.1 Hz, 3H). ¹³C NMR (101 MHz, CDCl₃) δ 169.17, 160.57, 148.67, 141.53, 136.01, 128.03, 124.00, 122.83, 116.98, 115.64, 61.15, 53.73, 23.23, 22.24, 14.36. HRMS (ESI) Calcd. for C₁₅H₁₈NO₃: [M+H]⁺, 260.1281. Found: *m/z*, 260.1279.



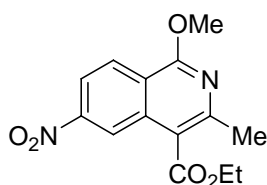
Ethyl 1,6-dimethoxy-3-methylisoquinoline-4-carboxylate (4i): The title compound was obtained as a white solid in 82% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.11 (d, $J = 9.1$ Hz, 1H), 7.26 (d, $J = 1.8$ Hz, 1H), 7.08 (dd, $J = 9.1, 2.4$ Hz, 1H), 4.49 (q, $J = 7.1$ Hz, 2H), 4.11 (s, 3H), 3.90 (s, 3H), 2.61 (s, 3H), 1.45 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 169.09, 161.72, 160.52, 150.23, 137.95, 125.93, 117.67, 116.49, 112.34, 102.87, 61.02, 55.26, 53.68, 23.59, 14.37. **HRMS (ESI)** Calcd. for $\text{C}_{15}\text{H}_{18}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 276.1230. Found: m/z , 276.1228.



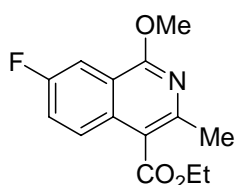
Ethyl 1-methoxy-3-methyl-6-(trifluoromethyl)isoquinoline-4-carboxylate (4j): The title compound was obtained as a white solid in 72% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.33 (d, $J = 8.6$ Hz, 1H), 8.26 (s, 1H), 7.66 (dd, $J = 8.6, 1.4$ Hz, 1H), 4.52 (q, $J = 7.1$ Hz, 2H), 4.16 (s, 3H), 2.67 (s, 3H), 1.47 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 168.09, 160.36, 151.29, 135.26, 133.65 (q, $J = 32.4$ Hz), 125.43, 123.87 (q, $J = 274.0$ Hz), 121.75 (q, $J = 3.1$ Hz), 121.57 (q, $J = 4.5$ Hz), 118.73, 117.17, 61.48, 54.12, 23.53, 14.25. **HRMS (ESI)** Calcd. for $\text{C}_{15}\text{H}_{15}\text{F}_3\text{NO}_3$: $[\text{M}+\text{H}]^+$, 314.0999. Found: m/z , 314.0998.



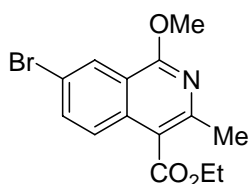
4-Ethyl 6-methyl 1-methoxy-3-methylisoquinoline-4,6-dicarboxylate (4k): The title compound was obtained as a white solid in 72% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.66 – 8.63 (m, 1H), 8.28 (d, $J = 8.6$ Hz, 1H), 8.08 (dd, $J = 8.6, 1.3$ Hz, 1H), 4.54 (q, $J = 7.1$ Hz, 2H), 4.17 (s, 3H), 3.98 (s, 3H), 2.66 (s, 3H), 1.48 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 168.38, 166.60, 160.43, 150.19, 135.26, 132.17, 126.30, 125.67, 124.54, 119.41, 117.62, 61.47, 54.09, 52.52, 23.34, 14.35. **HRMS (ESI)** Calcd. for $\text{C}_{16}\text{H}_{18}\text{NO}_5$: $[\text{M}+\text{H}]^+$, 304.1179. Found: m/z , 304.1178.



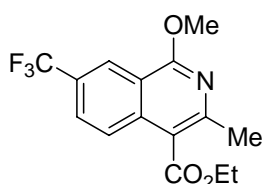
Ethyl 1-methoxy-3-methyl-6-nitroisoquinoline-4-carboxylate (4l): The title compound was obtained as a white solid in 69% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.92 (d, $J = 2.1$ Hz, 1H), 8.37 (d, $J = 9.0$ Hz, 1H), 8.22 (dd, $J = 9.0, 2.2$ Hz, 1H), 4.55 (q, $J = 7.1$ Hz, 2H), 4.17 (s, 3H), 2.69 (s, 3H), 1.49 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 167.52, 160.25, 152.63, 149.11, 135.57, 126.21, 120.27, 119.61, 119.33, 117.41, 61.73, 54.38, 23.69, 14.33. **HRMS (ESI)** Calcd. for $\text{C}_{14}\text{H}_{15}\text{N}_2\text{O}_5$: $[\text{M}+\text{H}]^+$, 291.0975. Found: m/z , 291.0975.



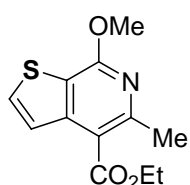
Ethyl 7-fluoro-1-methoxy-3-methylisoquinoline-4-carboxylate (4m): The title compound was obtained as a white solid in 81% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.02 (dd, $J = 8.2, 1.0$ Hz, 1H), 7.41 (td, $J = 8.0, 5.1$ Hz, 1H), 7.32 (ddd, $J = 11.6, 7.8, 1.1$ Hz, 1H), 4.46 (q, $J = 7.2$ Hz, 2H), 4.12 (s, 3H), 2.54 (s, 3H), 1.41 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 169.71, 159.85 (d, $J = 4.0$ Hz), 156.60 (d, $J = 252.5$ Hz), 147.33, 126.14 (d, $J = 8.1$ Hz), 125.38 (d, $J = 14.9$ Hz), 120.28 (d, $J = 4.2$ Hz), 119.11 (d, $J = 4.9$ Hz), 115.75 (d, $J = 20.7$ Hz), 113.87, 61.69, 54.01, 21.98, 14.08. **HRMS (ESI)** Calcd. for $\text{C}_{14}\text{H}_{15}\text{FNO}_3$: $[\text{M}+\text{H}]^+$, 264.1030. Found: m/z , 264.1028.



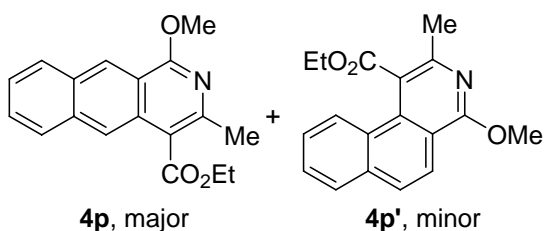
Ethyl 7-bromo-1-methoxy-3-methylisoquinoline-4-carboxylate (4n): The title compound was obtained as a white solid in 83% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.37 (d, $J = 2.0$ Hz, 1H), 7.80 (d, $J = 9.0$ Hz, 1H), 7.72 (dd, $J = 9.0, 2.1$ Hz, 1H), 4.49 (q, $J = 7.1$ Hz, 2H), 4.14 (s, 3H), 2.61 (s, 3H), 1.44 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 168.48, 159.59, 149.76, 134.44, 134.39, 126.67, 125.65, 119.72, 118.63, 116.91, 61.39, 54.05, 23.44, 14.34. **HRMS (ESI)** Calcd. for $\text{C}_{14}\text{H}_{15}\text{BrNO}_3$: $[\text{M}+\text{H}]^+$, 324.0230. Found: m/z , 324.0228.



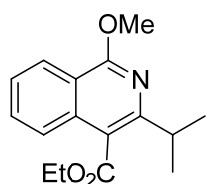
Ethyl 1-methoxy-3-methyl-7-(trifluoromethyl)isoquinoline-4-carboxylate (4o): The title compound was obtained as a white solid in 78% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.53 (s, 1H), 8.03 (d, $J = 8.9$ Hz, 1H), 7.82 (dd, $J = 8.9, 1.7$ Hz, 1H), 4.51 (q, $J = 7.1$ Hz, 2H), 4.16 (s, 3H), 2.65 (s, 3H), 1.46 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 168.25, 160.82, 151.92, 137.44, 127.81 (q, $J = 33.0$ Hz), 126.80 (q, $J = 3.1$ Hz), 124.93, 123.94 (q, $J = 273.1$ Hz), 122.20 (q, $J = 4.4$ Hz), 116.97, 116.58, 61.45, 54.13, 23.55, 14.29. **HRMS (ESI)** Calcd. for $\text{C}_{15}\text{H}_{15}\text{F}_3\text{NO}_3$: $[\text{M}+\text{H}]^+$, 314.0999. Found: m/z , 314.0996.



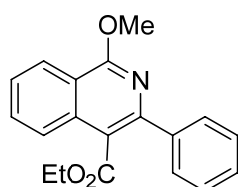
Ethyl 7-methoxy-5-methylthieno[2,3-c]pyridine-4-carboxylate (4p): The title compound was obtained as a white solid in 83% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.76 (d, $J = 5.4$ Hz, 1H), 7.66 (d, $J = 5.4$ Hz, 1H), 4.45 (q, $J = 7.1$ Hz, 2H), 4.15 (s, 3H), 2.78 (s, 3H), 1.45 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 167.55, 158.50, 154.00, 147.25, 131.94, 124.66, 120.90, 115.03, 60.90, 53.85, 24.20, 14.42. **HRMS (ESI)** Calcd. for $\text{C}_{12}\text{H}_{14}\text{NO}_3\text{S}$: $[\text{M}+\text{H}]^+$, 252.0689. Found: m/z , 252.0687.



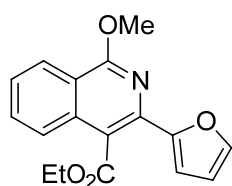
Ethyl 1-methoxy-3-methylbenzo[g]isoquinoline-4-carboxylate (4q) and ethyl 4-methoxy-2-methylbenzo[f]isoquinoline-1-carboxylate (4q'): The title compound was obtained as a yellow solid in 85% yield ($4\text{q}:4\text{q}' = 75\%:7.5\%$). ^1H and ^{13}C NMR characterization of **4q** (major): $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.85 (s, 1H), 8.41 (s, 1H), 8.02 (d, $J = 8.3$ Hz, 1H, major), 7.97 (d, $J = 8.3$ Hz, 1H), 7.56 (t, $J = 6.9$ Hz, 1H), 7.49 (t, $J = 6.9$ Hz, 1H), 4.57 (q, $J = 7.1$ Hz, 2H), 4.23 (s, 3H), 2.66 (s, 3H), 1.50 (t, $J = 7.1$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 169.23, 161.14, 147.51, 134.68, 131.75, 131.25, 128.96, 128.28, 127.58, 125.81, 124.53, 122.14, 116.86, 116.45, 61.26, 54.01, 23.44, 14.45. ^1H and ^{13}C NMR characterization of **4q'** (minor): $^1\text{H NMR}$ (400 MHz, CDCl_3) 8.31 (d, $J = 8.1$ Hz, 0.1H), 8.16 (d, $J = 8.9$ Hz, 0.1H), 7.91 (d, $J = 7.9$ Hz, 0.1H), 7.78 (d, $J = 8.9$ Hz, 0.1H), 7.65 (t, $J = 6.9$ Hz, 0.1H), 7.56 (t, $J = 6.9$ Hz, 0.1H), 4.52 (q, $J = 7.2$ Hz, 0.2H), 4.16 (s, 0.3H), 2.65 (s, 0.3H), 1.40 (t, $J = 7.2$ Hz, 0.3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 172.18, 160.51, 149.03, 134.80, 133.92, 128.99, 128.28, 128.05, 127.62, 127.48, 126.30, 125.57, 120.89, 117.96, 115.30, 61.85, 22.68, 14.02. **HRMS (ESI)** Calcd. for $\text{C}_{18}\text{H}_{18}\text{NO}_3$: $[\text{M}+\text{H}]^+$, 296.1281. Found: m/z , 296.1280.



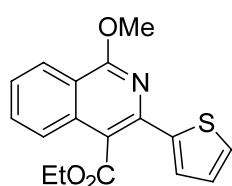
Ethyl 3-isopropyl-1-methoxyisoquinoline-4-carboxylate (4r): The title compound was obtained as a white solid in 79% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.22 (d, $J = 8.2$ Hz, 1H), 7.79 (d, $J = 8.4$ Hz, 1H), 7.65 (ddd, $J = 8.4, 7.0, 1.3$ Hz, 1H), 7.51 – 7.46 (m, 1H), 4.50 (q, $J = 7.1$ Hz, 2H), 4.15 (s, 3H), 3.23 (hept, $J = 6.6$ Hz, 1H), 1.45 (t, $J = 7.1$ Hz, 3H), 1.35 (d, $J = 6.7$ Hz, 6H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 169.33, 160.88, 156.01, 135.54, 130.99, 126.06, 124.11, 123.67, 117.63, 116.33, 61.31, 53.64, 33.55, 22.27, 14.35. **HRMS (ESI)** Calcd. For $\text{C}_{16}\text{H}_{20}\text{NO}_3$: $[\text{M}+\text{H}]^+$, 274.1438. Found: m/z , 274.1436.



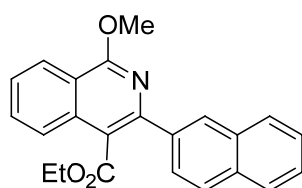
Ethyl 1-methoxy-3-phenylisoquinoline-4-carboxylate (4s): The title compound was obtained as a white solid in 85% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.31 (dd, $J = 8.3, 0.5$ Hz, 1H), 8.03 (d, $J = 8.4$ Hz, 1H), 7.74 (ddd, $J = 8.7, 6.8, 1.5$ Hz, 3H), 7.57 (ddd, $J = 8.1, 7.0, 1.0$ Hz, 1H), 7.49 – 7.40 (m, 3H), 4.21 (s, 3H), 4.21 (q, $J = 7.2$ Hz, 2H), 1.03 (t, $J = 7.2$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 169.32, 160.75, 149.36, 140.55, 135.84, 131.51, 128.81, 128.49, 128.23, 126.91, 124.29, 124.04, 117.97, 117.71, 61.46, 54.07, 13.71. **HRMS (ESI)** Calcd. For $\text{C}_{19}\text{H}_{18}\text{NO}_3$: $[\text{M}+\text{H}]^+$, 308.1281. Found: m/z , 308.1279.



Ethyl 3-(furan-2-yl)-1-methoxyisoquinoline-4-carboxylate (4t): The title compound was obtained as a white solid in 81% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.25 – 8.22 (m, 1H), 7.79 (d, $J = 8.4$ Hz, 1H), 7.69 (ddd, $J = 8.3, 7.0, 1.3$ Hz, 1H), 7.52 (ddt, $J = 4.0, 3.1, 1.7$ Hz, 2H), 7.15 (dd, $J = 3.3, 0.6$ Hz, 1H), 6.54 (dd, $J = 3.4, 1.8$ Hz, 1H), 4.52 (q, $J = 7.2$ Hz, 2H), 4.19 (s, 3H), 1.39 (t, $J = 7.2$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 168.95, 160.45, 153.43, 143.54, 137.07, 135.60, 131.53, 126.84, 124.32, 123.84, 118.30, 114.96, 111.87, 110.97, 61.66, 53.90, 14.33. **HRMS (ESI)** Calcd. For $\text{C}_{17}\text{H}_{16}\text{NO}_4$: $[\text{M}+\text{H}]^+$, 298.1074. Found: m/z , 289.1073.

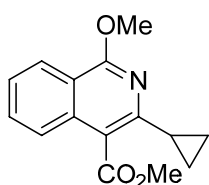


Ethyl 1-methoxy-3-(thiophen-2-yl)isoquinoline-4-carboxylate (4u): The title compound was obtained as a white solid in 88% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.25 (d, $J = 8.3$ Hz, 1H), 7.77 (d, $J = 8.4$ Hz, 1H), 7.73 – 7.68 (m, 1H), 7.56 – 7.51 (m, 1H), 7.43 (dd, $J = 8.3, 4.4$ Hz, 2H), 7.10 (dd, $J = 5.0, 3.8$ Hz, 1H), 4.46 (q, $J = 7.2$ Hz, 2H), 4.21 (s, 3H), 1.33 (t, $J = 7.2$ Hz, 3H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 169.40, 160.16, 143.88, 140.74, 135.78, 131.62, 128.00, 127.85, 126.83, 126.10, 124.38, 123.81, 118.01, 115.72, 61.98, 54.16, 14.02. **HRMS (ESI)** Calcd. For $\text{C}_{17}\text{H}_{16}\text{NO}_3\text{S}$: $[\text{M}+\text{H}]^+$, 314.0845. Found: m/z , 314.0844.

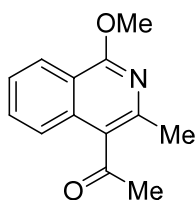


Ethyl 1-methoxy-3-(naphthalen-2-yl)isoquinoline-4-carboxylate (4v): The title compound was obtained as a white solid in 74% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.33 (d, $J = 8.3$ Hz, 1H), 8.20 (s, 1H), 8.06 (d, $J = 8.4$ Hz, 1H), 7.95 – 7.88 (m, 4H), 7.76 (ddd, $J = 8.4, 7.0, 1.3$ Hz, 1H), 7.60 (ddd, $J = 8.1, 7.0, 1.0$ Hz, 1H), 7.55 – 7.50 (m, 2H),

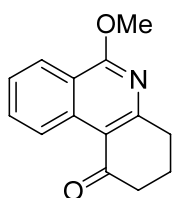
4.25 (s, 3H), 4.19 (q, $J = 7.1$ Hz, 2H), 0.93 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, CDCl_3) δ 169.44, 160.82, 149.21, 137.97, 135.95, 133.33, 133.25, 131.61, 128.54, 128.21, 127.93, 127.75, 127.04, 126.76, 126.55, 126.35, 124.38, 124.12, 118.14, 118.05, 61.54, 54.16, 13.80. HRMS (ESI) Calcd. For $\text{C}_{23}\text{H}_{20}\text{NO}_3$: $[\text{M}+\text{H}]^+$, 358.1438. Found: m/z , 358.1436.



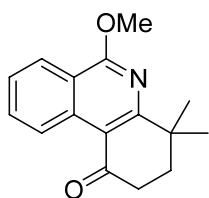
Methyl 3-cyclopropyl-1-methoxyisoquinoline-4-carboxylate (4w): The title compound was obtained as a white solid in 83% yield. ^1H NMR (400 MHz, CDCl_3) δ 8.16 (dd, $J = 8.3, 0.5$ Hz, 1H), 7.81 (d, $J = 8.5$ Hz, 1H), 7.63 (ddd, $J = 8.4, 7.0, 1.3$ Hz, 1H), 7.43 (ddd, $J = 8.1, 7.0, 1.0$ Hz, 1H), 4.04 (s, 6H), 2.33 – 2.24 (m, 1H), 1.27 – 1.22 (m, 2H), 1.00 – 0.94 (m, 2H). ^{13}C NMR (101 MHz, CDCl_3) δ 169.70, 161.08, 152.76, 135.78, 131.18, 125.65, 124.09, 123.39, 117.25, 116.24, 53.53, 52.28, 14.85, 9.53. HRMS (ESI) Calcd. For $\text{C}_{15}\text{H}_{16}\text{NO}_3$: $[\text{M}+\text{H}]^+$, 258.1125. Found: m/z , 258.1124.



1-(1-Methoxy-3-methylisoquinolin-4-yl)ethan-1-one (4x): The title compound was obtained as a white solid in 87% yield. ^1H NMR (400 MHz, CDCl_3) δ 8.23 (d, $J = 8.3$ Hz, 1H), 7.64 (ddd, $J = 8.2, 6.9, 1.2$ Hz, 1H), 7.56 (d, $J = 8.3$ Hz, 1H), 7.51 – 7.46 (m, 1H), 4.13 (s, 3H), 2.62 (s, 3H), 2.52 (s, 3H). ^{13}C NMR (101 MHz, CDCl_3) δ 206.31, 160.23, 144.55, 134.71, 131.16, 126.10, 125.99, 124.45, 122.91, 117.58, 53.83, 32.97, 22.53. HRMS (ESI) Calcd. For $\text{C}_{13}\text{H}_{14}\text{NO}_2$: $[\text{M}+\text{H}]^+$, 216.1019. Found: m/z , 216.1018.



6-Methoxy-3,4-dihydrophenanthridin-1(2H)-one (4y): The title compound was obtained as a white solid in 80% yield. ^1H NMR (400 MHz, CDCl_3) δ 9.38 (d, $J = 8.7$ Hz, 1H), 8.24 (d, $J = 8.2$ Hz, 1H), 7.76 (ddd, $J = 8.5, 7.0, 1.4$ Hz, 1H), 7.54 – 7.49 (m, 1H), 4.18 (s, 3H), 3.15 (t, $J = 6.2$ Hz, 2H), 2.75 – 2.71 (m, 2H), 2.21 – 2.14 (m, 2H). ^{13}C NMR (101 MHz, CDCl_3) δ 199.64, 162.64, 161.86, 136.10, 132.50, 126.33, 125.95, 124.05, 118.61, 116.72, 54.19, 40.39, 34.01, 21.86. HRMS (ESI) Calcd. For $\text{C}_{14}\text{H}_{14}\text{NO}_2$: $[\text{M}+\text{H}]^+$, 228.1019. Found: m/z , 228.1017.



6-Methoxy-4,4-dimethyl-3,4-dihydrophenanthridin-1(2H)-one (4z): The title compound was obtained as a white solid in 75% yield. ^1H NMR (400 MHz, CDCl_3) δ 9.39 (d, $J = 8.6$ Hz, 1H), 8.24 (d, $J = 8.2$ Hz, 1H), 7.80 – 7.73 (m, 1H), 7.51 (t, $J = 7.5$ Hz, 1H), 4.18 (s, 3H), 3.05 (s, 2H), 2.59 (s, 2H), 1.15 (s, 6H). ^{13}C NMR (101 MHz, CDCl_3) δ 199.83, 163.08, 160.22, 135.90, 132.57, 126.37, 125.81, 124.10, 118.59, 115.75, 54.20, 54.06, 47.90, 32.63, 28.21. HRMS (ESI) Calcd. For $\text{C}_{16}\text{H}_{18}\text{NO}_2$: $[\text{M}+\text{H}]^+$, 256.1332. Found: m/z , 256.1330.

7. References

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