Electronic Supplementary Information

Catalyst-free [3 + 2] Cyclization of Dihydroisoquinoline Imines and Isatin-derived Morita–Baylis–Hillman Carbonates via 1,5-Electrocyclization: Synthesis of Tetrahydroisoquinoline-fused Spirooxindoles

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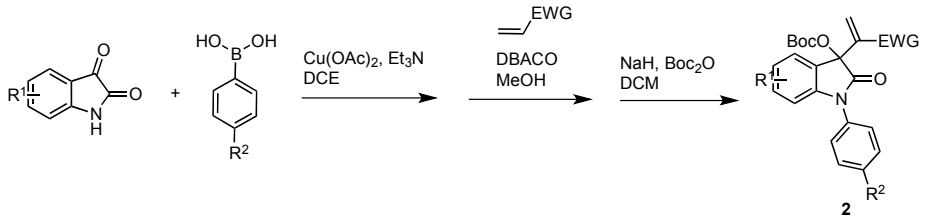
1. **General methods:**

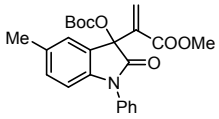
^{1}H NMR and ^{13}C NMR spectra were recorded at Bruker Avance 400. Chemical shifts are reported in ppm downfield from $CDCl_3$ (δ = 7.26 ppm) for ^{1}H NMR and relative to the central $CDCl_3$ resonance (δ = 77.0 ppm) for ^{13}C NMR spectroscopy. Coupling constants are given in Hz. ESI-MS analysis was performed using a Finnigan LCQ^{DECA} ion trap mass spectrometer.

All reagents and solvents were obtained from commercial sources and used without further purification. 3,4-Dihydroisoquinoline imines **1**[1], dihydro-β-carboline **4**[2] and isatin-derived Morita-Baylis-Hillman (MBH) carbonates **2**[3-5] were prepared according to reported procedure.

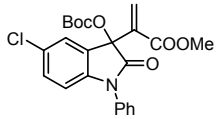
2. General procedure for the synthesis of compounds 2:



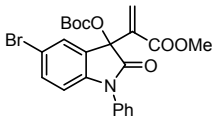
Isatin-derived MBH carbonates **2** were prepared according to reported literatures[3-5]. The yields of compound **2** shown as below are the overall yields for three steps.



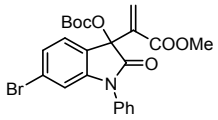
Compound 2b: White solid, 18% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55-7.50 (m, 4H), 7.41-7.38 (m, 1H), 7.06-7.03 (m, 2H), 6,69 (d, *J* = 8.0 Hz, 1H), 6.61 (s, 1H), 6.60 (s, 1H), 3.62 (s, 3H), 2.29 (s, 3H), 1.39 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 164.1, 150.0, 143.8, 136.8, 134.9, 132.3, 130.7, 129.5, 128.5, 127.9, 126.6, 126.2, 124.3, 109.1, 83.4, 79.9, 52.1, 27.7, 21.0; ESI-HRMS: calcd. for $C_{24}H_{25}NNaO_6^+$ $(M+Na)^+$ 446.1574, found 446.1578.



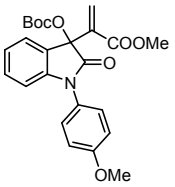
Compound 2c: White solid, 21% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55-7.50 (m, 4H), 7.44-7.40 (m, 1H), 7.23-7.19 (m, 2H), 6.70 (d, *J* = 8.4Hz, 1H), 6.65 (s, 1H), 6.62 (s, 1H), 3.65 (s, 3H), 1.41 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.6, 163.9, 150.0, 144.9, 136.2, 134.4, 130.3, 129.7, 129.1, 128.4, 127.9, 126.7, 123.9, 110.4, 83.8, 79.3, 52.2, 27.7; ESI-HRMS: calcd. for $C_{23}H_{22}ClNNaO_6^+$$(M+Na)^+$ 466.1033, found 466.1031.



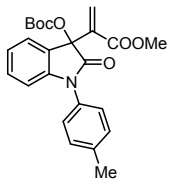
Compound 2d: White solid, 25% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56-7.50 (m, 4H), 7.44-7.40 (m, 1H), 7.37 (dd, *J* = 8.4, 2.0 Hz, 1H), 7.32 (d, *J* = 2.0 Hz, 1H), 6.70-6.64 (m, 2H), 6.63 (s, 1H), 3.65 (s, 3H), 1.41 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.5, 163.9, 150.0, 145.4, 136.2, 134.4, 133.2, 129.7, 129.2, 128.4, 128.2, 126.7, 126.6, 115.1, 110.9, 83.8, 79.2, 52.2, 27.7; ESI-HRMS: calcd. for $C_{23}H_{22}BrNNaO_6^+$ $(M+Na)^+$ 510.0523, found 510.0529.



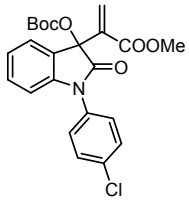
Compound 2e: White solid, 4% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57-7.50 (m, 4H), 7.46-7.40 (m, 1H), 7.16 (dd, J = 8.0, 1.6 Hz, 1H), 7.07 (d, *J* = 8.0 Hz, 1H), 6.89 (d, *J* = 1.6 Hz, 1H), 6.62 (s 1H), 6.61 (s 1H), 3.64 (s, 3H), 1.40 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.8, 164.0, 150.1, 147.5, 136.3, 134.2, 129.8, 128.9, 128.5, 126.8, 125.6, 125.3, 124.7, 124.3, 112.9, 83.7, 79.2, 52.2, 27.7; ESI-HRMS: calcd. for $C_{23}H_{22}BrNNaO_6^+$ $(M+Na)^+$ 510.0523, found 510.0529.



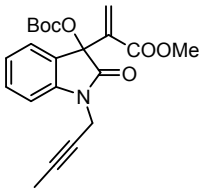
Compound 2f: White solid, 17% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47-7.45 (m, 2H), 7.27-7.20 (m, 2H), 7.06-6.99 (m, 3H), 6.72 (d, *J* = 7.6 Hz, 1H), 6.61 (s, 1H), 6.61 (s, 1H), 3.86 (s, 3H), 3.62 (s, 3H), 1.39 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.2, 164.1, 159.3, 150.1, 146.7, 136.7, 130.4, 128.5, 128.2, 127.4, 126.2, 123.4, 122.6, 114.9, 109.3, 83.4, 79.8, 55.5, 52.1, 27.7; ESI-HRMS: calcd. for $C_{24}H_{25}NNaO_7^+$$(M+Na)^+$ 462.1523, found 462.1526.



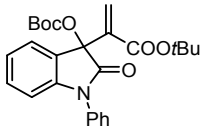
Compound 2g: White solid, 26% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (d, *J* = 8.4 Hz, 2H), 7.32 (d, *J* = 8.0 Hz, 2H), 7.24-7.20 (m, 2H), 7.01 (t, *J* = 7.6 Hz, 1H), 6.75 (d, *J* = 8.0 Hz, 1H), 6.61 (s, 1H), 6.60 (s, 1H), 3.61 (s, 3H), 2.42 (s, 3H), 1.38 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 164.1, 150.0, 146.4, 138.0, 136.7, 132.1, 130.3, 130.2, 128.5, 126.6, 126.3, 123.5, 122.6, 109.4, 83.4, 79.8, 52.0, 27.6, 21.3; ESI-HRMS: calcd. for $C_{24}H_{25}NNaO_6^+$$(M+Na)^+$ 446.1574, found 446.1579.



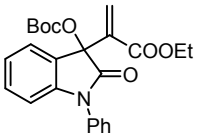
Compound 2h: White solid, 14% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51-7.48 (m, 4H), 7.29-7.25 (m, 1H), 7.21 (d, *J* = 6.8 Hz, 1H), 7.03 (t, *J* = 7.6 Hz, 1H), 6.76 (d, *J* = 8.0 Hz, 1H), 6.62 (s, 1H), 6.62 (s, 1H), 3.61 (s, 3H), 1.38 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 164.0, 150.1, 145.8, 136.6, 133.8, 133.3, 130.4, 129.8, 128.7, 128.2, 126.2, 123.6, 123.0, 109.2, 83.6, 79.6, 52.1, 27.6; ESI-HRMS: calcd. for $C_{23}H_{22}ClNNaO_6^+$(M+Na)$^+$ 466.1028, found 466.1030.



Compound 2l: Pale orange solid, 49% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (td, *J* = 7.6, 1.2 Hz, 1H), 7.21 (d, *J* = 7.2 Hz, 1H), 7.08 (d, *J* = 7.6 Hz, 1H), 7.02 (t, *J* = 7.6 Hz, 1H), 6.57 (s, 1H), 6.49 (s, 1H), 4.74-4.68 (m, 1H), 4.33 (dd, *J* = 17.6, 2.4 Hz, 1H), 3.56 (s, 3H), 1.82 (t, *J* = 2.4 Hz, 3H), 1.34 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.6, 164.1, 149.9, 144.4, 136.5, 130.4, 128.7, 126.5, 123.5, 122.7, 109.3, 83.4, 80.0, 79.9, 72.2, 51.9, 30.3, 27.6, 3.6; ESI-HRMS: calcd. for $C_{21}H_{23}NNaO_6^+$(M+Na)$^+$ 408.1418, found 408.1421.

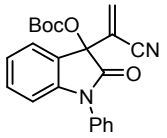


Compound 2n: Yellow solid, 14% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56-7.50 (m, 4H), 7.39 (t, *J* = 6.8 Hz, 1H), 7.27-7.24 (m, 2H), 7.03 (t, *J* = 7.6 Hz, 1H), 6.81 (d, *J* = 8 Hz, 1H), 6.46 (s, 1H), 6.44 (s, 1H), 1.38 (s, 9H), 1.26 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 163.3, 150.2, 146.2, 138.3, 134.9, 130.1, 129.4, 127.9, 127.2, 126.8, 126.6, 123.7, 122.7, 109.5, 83.2, 81.9, 79.9, 27.9, 27.7; ESI-HRMS: calcd. for $C_{26}H_{30}NO_6^+$(M+H)$^+$ 452.2068, found 452.2073.



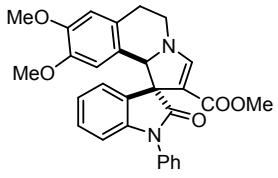
Compound 2o: White solid, 18% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56-7.50 (m, 4H), 7.43-7.38 (m, 1H), 7.27-7.25 (m, 1H), 7.23 (d, *J* = 6.8 Hz, 1H), 7.02 (t, *J* = 7.2 Hz, 1H), 6.79 (d, *J* = 7.6 Hz, 1H), 6.62 (s, 1H), 6.59 (s, 1H), 4.15-3.96 (m, 2H), 1.39 (s, 9H), 1.11 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 163.7, 150.1,

146.2, 136.9, 134.8, 130.3, 129.6, 128.4, 128.1, 126.7, 126.4, 123.6, 122.8, 109.4, 83.4, 79.8, 61.0, 27.7, 13.9; ESI-HRMS: calcd. for $C_{24}H_{25}NNaO_6^+(M+Na)^+$ 446.1580, found 446.1578.



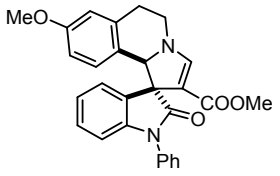
Compound 2p: Brown solid, 26% yield; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56-7.52 (m, 2H), 7.48-7.43 (m, 4H), 7.34 (t, *J* = 7.6 Hz, 1H), 7.17 (t, *J* = 7.6 Hz, 1H), 6.82 (d, *J* = 7.6 Hz, 1H), 6.39 (s, 1H), 6.25 (s, 1H), 1.42 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.2, 150.2, 144.6, 133.9, 133.3, 131.2, 129.8, 128.7, 126.8, 124.4, 124.0, 123.9, 120.2, 115.0, 110.3, 84.5, 79.3, 27.6; ESI-HRMS: calcd. for $C_{22}H_{20}N_2NaO_4^+(M+Na)^+$ 399.1315, found 399.1319.

3. The synthesis of compounds 3:



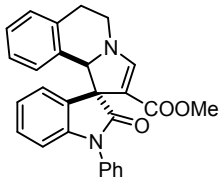
3a

Compound 3a: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2a** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3a** as a white solid (69.0 mg, 72% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (9:1 dr); Single crystal was obtained from MeOH/DCM/PE for X-ray analysis and ^{1}H NMR; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58-7.56 (m, 1H), 7.54-7.53 (m, 2H), 7.52 (s, 1H), 7.45-7.41 (m, 1H), 7.01 (td, *J* = 7.6, 1.2 Hz, 1H), 6.74-6.71 (m, 2H), 6.64-6.62 (m, 1H), 6.53 (s, 1H), 5.99 (s, 1H), 5.62 (s, 1H), 3.85-3.80 (m, 1H), 3.79 (s, 3H), 3.53-3.46 (m, 4H), 3.51 (s, 3H), 3.10-3.01 (m, 1H), 2.74 (dd, *J* = 15.2, 2.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.1, 164.5, 149.8, 147.7, 147.5, 142.8, 135.1, 129.7, 129.5, 128.1, 128.0, 126.4, 126.2, 124.6, 124.1, 122.9, 111.2, 108.6, 108.3, 104.0, 69.5, 61.6, 55.7, 55.5, 50.5, 44.6, 29.7; **(Minor diastereomer)** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58-7.51 (m, 2H), 7.45-7.35 (m, 2H), 7.31-7.27 (m, 1H), 7.23 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.18 (td, *J* = 7.6, 1.2 Hz, 1H), 7.05-7.03 (m, 2H), 6.78 -6.76 (m, 1H), 6.60 (s, 1H), 5.90 (s, 1H), 5.46 (s, 1H), 3.83 (s, 3H), 3.77-3.73 (m, 1H), 3.51 (s, 3H), 3.42-3.45 (m, 4H), 3.20-3.12 (m, 1H), 2.64-2.60 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.8, 164.8, 152.5, 148.0, 147.5, 144.6, 134.5, 133.2, 129.6, 128.3, 127.8, 127.7, 126.6, 123.6, 123.4, 111.8, 108.8, 106.9, 102.6, 70.7, 62.9, 55.7, 55.4, 50.5, 44.9, 29.6; ESI-HRMS: calcd. for $C_{29}H_{26}N_2NaO_5^+(M+Na)^+$ 505.1734, found 505.1740.



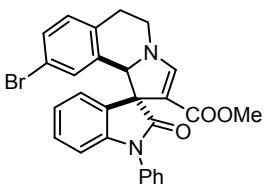
3b

Compound 3b: A mixture of 3,4-dihydroisoquinoline imine **1b** (0.3 mmol, 3 equiv), MBH carbonate **2a** (0.1 mmol, 1 equiv) and MeOH (2 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc = 3:1 to PE/EtOAc/DCM = 6:3:1) giving the product **3b** as a white solid (31.8 mg, 70% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (10:1 dr); ^1H NMR (400 MHz, $CDCl_3$) δ 7.59-7.56 (m, 4H), 7.51 (s, 1H), 7.45-7.41 (m, 1H), 7.00 (t, *J* = 7.6 Hz, 1H), 6.73-6.70 (m, 2H), 6.64 (d, *J* = 7.6Hz, 1H), 6.58 (s, 1H), 6.49-6.43 (m, 2H), 5.62 (s, 1H), 3.82 (dd, *J* = 12.8, 5.2 Hz, 1H), 3.69 (s, 3H), 3.51 (s, 3H), 3.46 (dd, *J* = 12.8, 3.2 Hz, 1H), 3.13-3.05 (m, 1H), 2.79 (dd, *J* = 16.0, 1.6 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.0, 164.6, 158.1, 149.8, 142.9, 135.4, 135.2, 129.6, 129.4, 128.0, 128.0, 126.8, 126.7, 124.4, 124.4, 122.8, 113.6, 112.8, 108.9, 104.4, 69.7, 61.8, 55.1, 50.6, 44.5, 30.7; ESI-HRMS: calcd. for $C_{28}H_{24}N_2NaO_4^+$(M+Na)$^+$ 475.1628, found 475.1630.



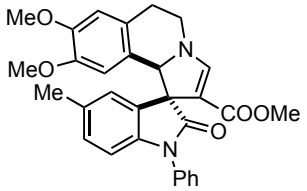
3c

Compound 3c: A mixture of 3,4-dihydroisoquinoline imine **1c** (0.3 mmol, 3 equiv), MBH carbonate **2a** (0.1 mmol, 1 equiv) and MeOH (2 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc = 3:1 to PE/EtOAc/DCM = 6:3:1) giving the product **3c** as a white solid (31.8 mg, 60% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (6.6:1 dr); ^1H NMR (400 MHz, $CDCl_3$) δ 7.60-7.53 (m, 5H), 7.46-7.43 (m, 1H), 7.07 (d, *J* = 7.6 Hz, 1H), 7.03-6.97 (m, 2H), 6.88 (t, *J* = 7.6 Hz, 1H), 6.72-6.73 (m, 2H), 6.63 (d, *J* = 7.2 Hz, 1H), 6.55 (d, *J* = 7.6 Hz, 1H), 5.68 (s, 1H), 3.85(dd, *J* = 12.8, 5.2 Hz, 1H), 3.54-3.47 (m, 1H), 3.52 (s, 3H), 3.16-3.07 (m, 1H), 2.84 (dd, *J* = 15.6, 2.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.9, 164.6, 149.9, 142.9, 135.1, 134.1, 132.2, 129.7, 129.3, 129.0, 128.1, 128.1, 126.9, 126.7, 126.5, 125.7, 124.2, 122.7, 108.9, 104.3, 69.9, 61.7, 50.6, 44.6, 30.4; ESI-HRMS: calcd. for $C_{27}H_{22}N_2NaO_3^+$(M+Na)$^+$ 445.1523, found 445.1529.



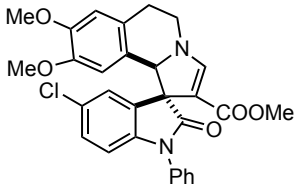
3d

Compound 3d: A mixture of 3,4-dihydroisoquinoline imine **1d** (0.3 mmol, 3 equiv), MBH carbonate **2a** (0.1 mmol, 1 equiv) and MeOH (2 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc = 5:1 to PE/EtOAc/DCM = 6:2:1) giving the product **3d** as a white solid (33.0 mg, 66% yield). Then the dr was determined by dissolving the solid in $CDCl_3$. (6.3:1 dr); **(Major diastereomer)** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59-7.58 (m, 4H), 7.52 (s, 1H), 7.47-7.44 (m, 1H), 7.13-7.11 (m, 1H), 7.03 (t, *J* = 7.6 Hz, 1H), 6.93 (d, *J* = 8.0 Hz, 1H), 6.77 (s, 1H), 6.74-6.71 (m, 2H), 6.65 (d, *J* = 7.2 Hz, 1H), 5.56 (s, 1H), 3.84 (dd, *J* = 12.8, 5.2 Hz, 1H), 3,53 (s, 3H), 3.46 (td, *J* = 12.8, 3.2 Hz, 1H), 3.06-2.98 (m, 1H), 2.82-2.78 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.6, 164.4, 149.6, 142.9, 135.0, 134.2, 132.9, 130.5, 130.0, 129.8, 128.7, 128.6, 128.6, 128.2, 126.8, 123.8, 122.9, 120.0, 109.1, 104.6, 69.6, 61.7, 50.7, 44.2, 29.8; **(Minor diastereomer)** ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.46 (s, 1H), 3.77 (dd, *J* = 13.2, 4.4 Hz, 1H), 3.15-3.11 (m, 1H), 2.69-2.66 (m, 1H); ESI-HRMS: calcd. for $C_{27}H_{21}BrN_2NaO_3^+$(M+Na)$^+$ 523.0628, found 523.0630.



3f

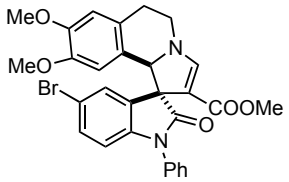
Compound 3f: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2b** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3f** as a white solid (63.5 mg, 64% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (10:1 dr); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56-7.51 (m, 5H), 7.43-7.39 (m, 1H), 6.80 (d, *J* = 8.0 Hz, 1H), 6.62 (d, *J* = 8.0 Hz, 1H), 6.53 (s, 1H), 6.43 (s, 1H), 6.00 (s, 1H), 5.59 (s, 1H), 3.84-3.81 (m, 1H), 3.79 (s, 3H), 3.51 (s, 3H), 3.50 (s, 3H), 3.48-3.43 (m, 1H), 3.10-3.02 (m, 1H), 2.75 (dd, *J* = 15.6, 2.8 Hz, 1H), 2.04 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.1, 164.6, 149.8, 147.7, 147.6, 140.5, 135.3, 132.3, 129.7, 129.5, 128.6, 127.9, 126.4, 126.3, 125.4, 124.2, 111.2, 108.4, 108.3, 104.2, 69.6, 61.6, 55.8, 55.6, 50.6, 44.7, 29.8, 20.9; ESI-HRMS: calcd. for $C_{30}H_{28}N_2NaO_5^+$(M+Na)$^+$ 519.1896, found 519.1898.



3g

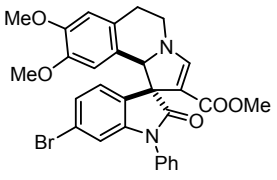
Compound 3g: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2c** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room

temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3g** as a white solid (69.0 mg, 67% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (8.4:1 dr); ^1H NMR (400 MHz, $CDCl_3$) δ 7.58-7.54 (m, 2H), 7.50-7.48 (m, 3H), 7.46-7.42 (m, 1H), 6.99 (dd, *J* = 8.4, 2.4 Hz, 1H), 6.65 (d, *J* = 8.4 Hz, 1H), 6.61 (d, *J* = 2.0 Hz, 1H), 6.57 (s, 1H), 6.02 (s, 1H), 5.61 (s, 1H), 3.85-3.81 (m, 1H), 3.81 (s, 3H), 3.53 (s, 6H), 3.52-3.48 (m, 1H), 3.11-3.02 (m, 1H), 2.76 (dd, *J* = 15.6, 2.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.6, 164.4, 149.9, 148.1, 147.8, 141.5, 134.8, 131.2, 129.9, 128.3, 128.2, 126.5, 126.4, 124.9, 123.6, 111.5, 109.6, 108.0, 103.8, 69.6, 61.8, 55.8, 55.7, 50.7, 44.6, 29.8; ESI-HRMS: calcd. for $C_{29}H_{25}N_2NaO_5^+(M+Na)^+$ 539.1344, found 539.1353.



3h

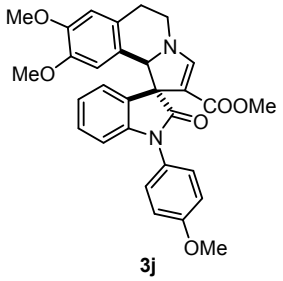
Compound 3h: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2d** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3h** as a white solid (55.5 mg, 49% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (>20:1 dr); ^1H NMR (400 MHz, $CDCl_3$) δ 7.56 (t, *J* = 7.6 Hz, 2H), 7.50-7.47 (m, 3H), 7.43 (t, *J* = 7.6 Hz, 1H), 7.13 (dd, *J* = 8.0, 1.6 Hz, 1H), 6.74 (d, *J* = 1.6 Hz, 1H), 6.60 (d, *J* = 8.4 Hz, 1H), 6.58 (s, 1H), 6.01 (s, 1H), 5.61 (s, 1H), 3.84-3.80 (m, 4H), 3.53 (s, 3H), 3.53 (s, 3H), 3.47 (td, *J* = 12.4, 3.6 Hz, 1H), 3.10-3.02 (m, 1H), 2.76 (dd, *J* = 15.2, 2.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.5, 164.4, 148.1, 147.8, 142.0, 134.8, 131.6, 131.1, 129.9, 128.3, 127.7, 126.5, 126.4, 123.6, 115.5, 111.6, 110.1, 108.1, 103.8, 69.6, 61.8, 55.8, 55.7, 50.6, 44.6, 29.8; ESI-HRMS: calcd. for $C_{29}H_{25}BrN_2NaO_5^+(M+Na)^+$ 583.0839, found 583.0844.



3i

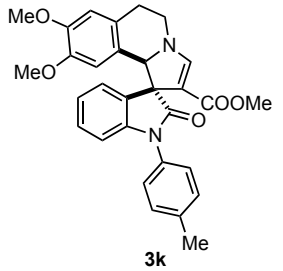
Compound 3i: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.3 mmol, 3 equiv), MBH carbonate **2e** (0.1 mmol, 1 equiv) and MeOH (2 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3i** as a white solid (51.6 mg, 92% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (4.6:1 dr); **(Major diastereomer)** ^1H NMR (400 MHz, $CDCl_3$) δ 7.6-7.54 (m, 2H), 7.50-7.44 (m, 4H), 6.87-6.84 (m, 2H), 6.54 (s, 1H), 6.49

(d, J = 8.4 Hz, 1H), 5.98 (s, 1H), 5.60 (s, 1H), 3.84-3.81 (m, 4H), 3.54 (s, 3H), 3.53 (s, 3H), 3.46-3.35 (m, 1H), 3.08-2.99 (m, 1H), 2.75 (dd, J = 15.6, 2.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 178.9, 164.5, 149.8, 148.0, 147.8, 144.2, 134.6, 130.0, 128.5, 128.5, 126.5, 126.4, 125.9, 125.8, 123.7, 121.9, 112.0, 111.4, 108.3, 103.7, 69.5, 61.4, 55.8, 55.7, 50.7, 44.6, 29.8; **(Minor diastereomer)** ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.92 (s, 1H), 5.43 (s, 1H), 2.65-2.61 (m, 1H); ESI-HRMS: calcd. for $C_{29}H_{25}BrN_2NaO_5^+$(M+Na)$^+$ 583.0839, found 583.0839.



3j

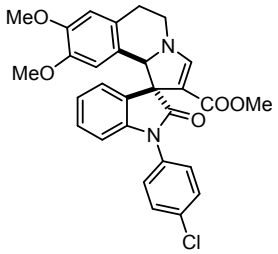
Compound 3j: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2f** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. The white precipitate was collected by filtration to give pure major diastereomer **3j** (42.0 mg). The filtrate was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3j** (mixture of major diastereomer and minor diastereomer) as a white solid (24.5 mg). The yield was caculated by combination of both (66.5 mg, 65%). Then the dr was determined by dissolving the solid in $CDCl_3$ (10:1, dr); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (s, 1H), 7.42 (d, J = 7.2 Hz, 2H), 7.07-7.00 (m, 3H), 6.67 (t, J = 7.4, Hz, 2H), 6.61 (d, J = 6 Hz, 1H), 6.52 (s, 1H), 5.97 (s, 1H), 5.60 (s, 1H), 3.87-3.78 (m, 4H), 3.78 (s, 3H), 3.51-3.48 (m, 1H), 3.51 (s, 3H), 3.48 (s, 3H), 3.07-3.02 (m, 1H), 2.75-2.72 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.4, 164.6, 159.2, 149.8, 147.7, 147.6, 143.4, 129.5, 128.2, 127.9, 127.8, 126.3, 124.6, 124.2, 122.9, 115.1, 111.3, 108.6, 108.4, 104.0, 69.5, 61.5, 55.7, 55.6, 55.6, 50.6, 44.7, 29.8; ESI-HRMS: calcd. for $C_{30}H_{28}N_2NaO_6^+$(M+Na)$^+$ 535.1840, found 535.1846.



3k

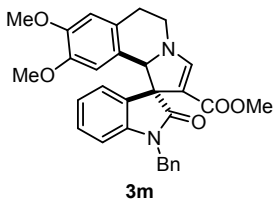
Compound 3k: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2g** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. The white precipitate was collected by filtration to give pure major diastereomer **3k** (50.0 mg). The filtrate was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3h** (mixture of major diastereomer and minor diastereomer) as a white solid

(30.0 mg). The yield was caculated by combination of both (80.0 mg, 81%). Then the dr was determined by dissolving the solid in $CDCl_3$ (10:1, dr); ^1H NMR (400 MHz, $CDCl_3$) δ 7.51 (s, 1H), 7.40 (d, *J* = 8.0 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.00 (t, *J* = 7.6 Hz, 1H), 6.73-6.70 (m, 2H), 6.62 (d, *J* = 7.6 Hz, 1H), 6.52 (s, 1H), 5.98 (s, 1H), 5.61 (s, 1H), 3.84-3.81 (m, 1H), 3.78 (s, 3H), 3.51 (s, 3H), 3.50-3.44 (m, 4H), 3.46 (d, *J* = 3.2 Hz, 1H), 3.09-3.01 (m, 1H), 2.74 (dd, *J* = 15.2, 1.2 Hz, 1H), 2.43 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.2, 164.6, 149.9, 147.7, 147.6, 143.1, 138.0, 132.4, 130.4, 129.6, 128.2, 126.3, 126.3, 124.6, 124.2, 122.9, 111.2, 108.6, 108.4, 104.0, 69.6, 61.6, 55.7, 55.6, 50.6, 44.6, 29.8, 21.3; ESI-HRMS: calcd. for $C_{30}H_{30}N_2NaO_5^+$(M+Na)$^+$ 519.1890, found 519.1896.



3l

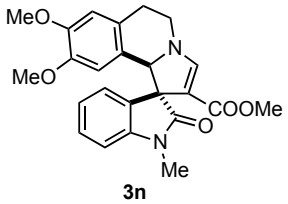
Compound 3l: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.3 mmol, 3 equiv), MBH carbonate **2h** (0.1 mmol, 1 equiv) and MeOH (2 mL) was stirred at room temperature for 24 h. The white precipitate was collected by filtration to give pure major diastereomer **3l** (11.0 mg). The filtrate was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3l** (mixture of major diastereomer and minor diastereomer) as a white solid (18.0 mg). The yield was caculated by combination of both (29.0 mg, 56%). Then the dr was determined by dissolving the solid in $CDCl_3$ (10:1, dr); ^1H NMR (400 MHz, $CDCl_3$) δ 7.54-7.47 (m, 5H), 7.03 (t, *J* = 7.2 Hz, 1H), 6.75-6.70 (m, 2H), 6.63 (d, *J* = 7.2 Hz, 1H), 6.53 (s, 1H), 5.94 (s, 1H), 5.60 (s, 1H), 3.84-3.80 (m, 1H), 3.78 (s, 3H), 3.53-3.48 (m, 1H), 3.51 (s, 3H), 3.46 (s, 3H), 3.09-3.01 (m, 1H), 2.74 (dd, *J* = 15.2, 2.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.1, 164.5, 149.7, 147.9, 147.6, 142.4, 133.7, 133.7, 130.0, 129.5, 128.3, 127.8, 126.4, 124.8, 124.0, 123.2, 111.4, 108.5, 104.1, 69.5, 61.7, 55.8, 55.6, 50.6, 44.7, 29.8; ESI-HRMS: calcd. for $C_{29}H_{25}ClN_2NaO_5^+$(M+Na)$^+$ 539.1344, found 539.1351.



3m

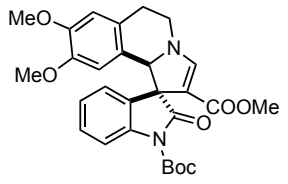
Compound 3m: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2i** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc= 3:1 to PE/EtOAc/DCM = 4:2:1) giving the product **3m** as a white solid (60.0 mg, 60% yield). Then the dr was

determined by dissolving the solid in $CDCl_3$ (3.3:1 dr); **(Major diastereomer)** ^1H NMR (400 MHz, $CDCl_3$) δ 7.55-7.51 (m, 3H), 7.36-7.32 (m, 2H), 7.29-7.27 (m, 1H), 7.00-6.96 (m, 1H), 6.71 (d, *J* = 8.0 Hz, 1H), 6.63 (t, *J* = 7.6 Hz, 1H), 6.49-6.46 (m, 2H), 5.56 (d, *J* = 10.0 Hz, 2H), 5.11 (d, *J* = 15.2 Hz, 1H), 4.96 (d, *J* = 15.2 Hz, 1H), 3.80 (dd, *J* = 13.2, 5.2 Hz, 1H), 3.75 (s, 3H), 3.49-3.44 (m, 1H), 3.44 (s, 3H), 3.03-2.97 (m, 1H), 2.97 (s, 3H), 2.71-2.67 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.9, 164.6, 150.4, 147.7, 147.5, 142.2, 136.5, 128.8, 128.6, 128.1, 128.1, 127.7, 126.2, 124.7, 124.2, 122.6, 111.2, 108.7, 108.2, 103.4, 69.7, 61.6, 55.7, 55.2, 50.4, 44.8, 44.6, 29.7; **(Minor diastereomer)** ^1H NMR (400 MHz, $CDCl_3$) δ 5.41 (s, 1H), 4.83 (d, *J* = 15.2 Hz, 1H), 4.47 (d, *J* = 15.2 Hz, 1H); ESI-HRMS: calcd. for $C_{30}H_{28}N_2NaO_5^+(M+Na)^+$ 519.1890, found 519.1896.



3n

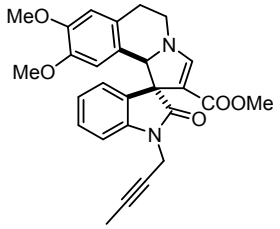
Compound 3n: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2j** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc= 3:1 to PE/EtOAc/DCM = 4:2:1) giving the product **3n** as a white solid (46.0 mg, 55% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (8:1 dr); ^1H NMR (400 MHz, $CDCl_3$) δ 7.48 (s, 1H), 7.09 (td, *J* = 7.6, 1.2 Hz, 1H), 6.76 (d, *J* = 7.6 Hz, 1H), 6.71-6.67 (m, 1H), 6.55-6.53 (m, 1H), 6.48 (s, 1H), 5.72 (s, 1H), 5.50 (s, 1H), 3.81-3.76 (m, 1H), 3.76 (s, 3H), 3.49-3.36 (m, 1H), 3.46 (s, 3H), 3.39 (s, 3H), 3.38 (s, 3H), 3.65-2.96 (m, 1H), 2.70 (dd, *J* = 15.6, 2.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.7, 164.5, 149.9, 147.7, 147.4, 142.9, 129.7, 128.4, 126.2, 124.4, 124.1, 122.6, 111.2, 108.3, 107.4, 103.4, 69.4, 61.6, 55.7, 55.3, 50.5, 44.6, 29.7, 26.9; ESI-HRMS: calcd. for $C_{24}H_{24}N_2NaO_5^+(M+Na)^+$ 443.1577, found 443.1582.



3o

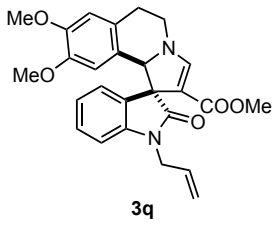
Compound 3o: mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2k** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:3:1) giving the product **3o** as a white solid (85.7 mg, 85% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (7.3:1 dr); ^1H NMR (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.0 Hz, 1H), 7.47 (s, 1H), 7.12-7.08 (m, 1H), 6.78 (t, *J* = 7.6 Hz, 1H), 6.57-6.54 (m,

1H), 6.47 (s, 1H), 5.77 (s, 1H), 5.53 (s, 1H), 3.81-3.76 (m, 1H), 3.76 (s, 3H), 3.48-3.44 (m, 1H), 3.46 (s, 3H), 3.42 (s, 3H), 3.03-2.95 (m, 1H), 2.70 (dd, *J* = 15.6, 2.4 Hz, 1H), 1.66 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.6, 164.4, 149.8, 149.3, 147.8, 147.5, 138.7, 128.5, 126.3, 124.3, 124.3, 123.5, 114.3, 111.2, 108.3, 104.4, 84.3, 70.7, 62.2, 55.7, 55.3, 50.6, 44.7, 29.7, 28.1; ESI-HRMS: calcd. for $C_{28}H_{30}N_2NaO_7^+$(M+Na)$^+$ 529.1945, found 529.1950.



3p

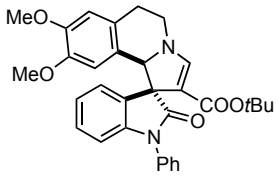
Compound 3p: mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2l** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:3:1) giving the product **3p** as a white solid (75.5 mg, 85% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (5:1 dr); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (s, 1H), 7.10 (t, *J* = 8.0 Hz, 1H), 6.99 (d, *J* = 7.6 Hz, 1H), 6.70 (t, *J* = 7.6 Hz, 1H), 6.53 (d, *J* = 7.2 Hz, 1H), 6.48 (s, 1H), 5.79 (s, 1H), 5.52 (s, 1H), 4.96 (dd, *J* = 17.2, 1.2 Hz, 1H), 4.28 (dd, *J* = 17.6, 2.0 Hz, 1H), 3.81-3.76 (m, 1H), 3.76 (s, 3H), 3.46-3.42 (m, 1H), 3.44 (s, 6H), 3.05-2.97 (m, 1H), 2.70 (dd, *J* = 15.2, 2.4 Hz, 1H), 1.78 (t, *J* = 2.0 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.6, 164.5, 149.9, 147.7, 147.6, 141.5, 129.8, 128.2, 126.1, 124.4, 124.1, 122.7, 111.2, 108.8, 108.6, 103.4, 79.6, 72.9, 69.3, 61.5, 55.7, 55.5, 50.4, 44.7, 30.3, 29.7, 3.4; ESI-HRMS: calcd. for $C_{27}H_{26}N_2NaO_5^+$(M+Na)$^+$ 481.1734, found 481.1738.



3q

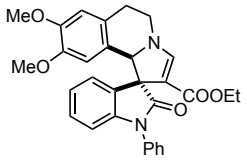
Compound 3q: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2m** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:3:1) giving the product **3q** as a white solid (52.6 mg, 59% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (10:1 dr); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 (s, 1H), 7.07-7.03 (m, 1H), 6.76 (d, *J* = 8.0 Hz, 1H), 6.67 (t, *J* = 7.6 Hz, 1H), 6.53 (d, *J* = 7.6 Hz, 1H), 6.48 (s, 1H), 5.99-5.89 (m, 1H), 5.71 (s, 1H), 5.52 (s, 1H), 5.49-5.45 (m, 1H), 5.29-5.26 (m, 1H), 4.55 (dd, *J* = 16.0, 5.6 Hz, 1H), 4.43 (dd, *J* = 16.0, 5.6 Hz, 1H),

3.81-3.76 (m, 1H), 3.76 (s, 3H), 3.48-3.41 (m, 1H), 3.45 (s, 3H), 3.38 (s, 3H), 3.04-2.96 (m, 1H), 2.70 (dd, J = 15.2, 2.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.4, 164.5, 150.2, 147.7, 147.4, 142.1, 131.7, 129.9, 128.2, 126.2, 124.5, 124.2, 122.5, 118.3, 111.2, 108.5, 108.3, 103.4, 69.5, 61.5, 55.7, 55.6, 50.4, 44.7, 43.1, 29.7; ESI-HRMS: calcd. for $C_{26}H_{26}N_2NaO_5^+$(M+Na)$^+$ 469.1734, found 469.1736.



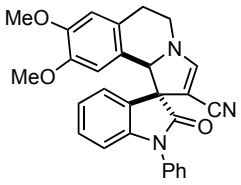
3r

Compound 3r: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2n** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 8:2:1) giving the product **3r** as a yellow solid (42.5 mg, 41% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (>20:1 dr); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58-7.51 (m, 5H), 7.41-7.38 (m, 1H), 7.02 (t, J = 8.0 Hz, 1H), 6.85 (d, J = 7.6 Hz, 1H), 6.74 (t, J = 7.2 Hz, 1H), 6.62 (d, J = 7.2 Hz, 1H), 6.51 (s, 1H), 5.94 (s, 1H), 5.59 (s, 1H), 3.82-3.78 (m, 1H), 3.78 (s, 3H), 3.48-3.41 (m, 1H), 3.46 (s, 3H), 3.06-2.97 (m, 1H), 2.69 (dd, J = 15.2, 1.2 Hz, 1H), 1.15 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.4, 164.2, 150.6, 147.7, 147.5, 142.4, 130.4, 129.5, 127.9, 127.6, 126.6, 125.8, 124.9, 124.4, 123.0, 111.3, 108.7, 108.6, 105.8, 78.9, 70.5, 62.3, 55.7, 55.7, 44.8, 29.8, 28.3; ESI-HRMS: calcd. for $C_{32}H_{32}N_2NaO_5^+$(M+Na)$^+$ 547.2203, found 547.2209.



3s

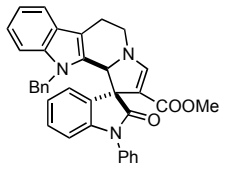
Compound 3s: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.6 mmol, 3 equiv), MBH carbonate **2o** (0.2 mmol, 1 equiv) and MeOH (4 mL) was stirred at room temperature for 24 h. Then the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 8:2:1) giving the product **3s** as a yellow solid (72.5 mg, 73% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (10:1 dr); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57-7.52 (m, 5H), 7.44-7.40 (m, 1H), 7.13-6.99 (m, 1H), 6.76-6.70 (m, 2H), 6.62 (t, J = 7.2 Hz, 1H), 6.52 (s, 1H), 5.98 (s, 1H), 5.62 (s, 1H), 4.02-3.87 (m, 2H), 3.84-3.78 (m, 1H), 3.78 (s, 3H), 3.51-3.42 (m, 1H), 3.48 (s, 3H), 3.08-3.00 (m, 1H), 2.73 (dd, J = 15.6, 2.4 Hz, 1H), 1.01-0.96 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.2, 164.3, 150.0, 147.7, 147.6, 142.8, 135.1, 129.8, 129.7, 128.1, 128.0, 126.4, 126.3, 124.8, 124.2, 123.0, 111.3, 108,6, 108.4, 104.3, 69.8, 61.8, 58.9, 55.7, 55.6, 44.7, 29.8, 14.4; ESI-HRMS: calcd. for $C_{30}H_{28}N_2NaO_5^+$(M+Na)$^+$ 519.1890, found 519.1895.



3t

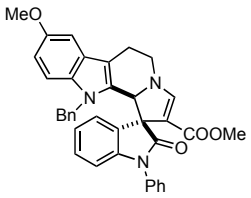
Compound 3t: A mixture of 3,4-dihydroisoquinoline imine **1a** (0.3 mmol, 3 equiv), MBH carbonate **2p** (0.1 mmol, 1 equiv) and MeOH (2 mL) was stirred at room temperature for 24 h. The white precipitate was collected by filtration to give pure major diastereomer **3t** (8.0 mg). The filtrate was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc/DCM = 6:2:1) giving the product **3t** (mixture of major diastereomer and minor diastereomer) as a white solid (20.0 mg). The yield was caculated by combination of both (28.0 mg, 62%). Then the dr was determined by dissolving the solid in $CDCl_3$ (7:1, dr); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (t, *J* = 7.6 Hz, 2H), 7.50-7.44 (m, 3H), 7.24 (s, 1H), 7.09 (t, *J* = 7.6 Hz, 1H), 6.80 (dd, *J* = 12.4, 7.6 Hz, 2H), 6.61 (d, *J* = 7.6 Hz, 1H), 6.55 (s, 1H), 5.86 (s, 1H), 5.61 (s, 1H), 3.84-3.80 (m, 1H), 3.80 (s, 3H), 3.52-3.45 (m, 1H), 3.43 (s, 3H), 3.09-3.01 (m, 1H), 2.73 (dd, *J* = 14.8, 1.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.3, 151.6, 148.1, 147.7, 142.4, 134.3, 129.9, 129.2, 128.5, 127.7, 126.5, 126.5, 125.7, 123.7, 123.2, 117.0, 111.4, 109.3, 108.8, 81.2, 68.9, 62.8, 55.8, 55.6, 44.9, 29.5; ESI-HRMS: calcd. for $C_{28}H_{23}N_3NaO_3^+$(M+Na)$^+$ 472.1632, found 472.1637.

4. The synthesis of compounds 5:



5a

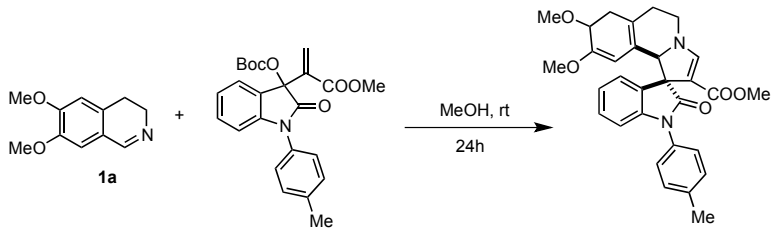
Compound 5a: A mixture of dihydro-β-carboline **4a** (0.2 mmol, 2 equiv), MBH carbonates **2a** (0.1 mmol, 1 equiv) and MeCN (2 mL) was stirred at 50 ^{o}C for 24 h. The reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc = 5:1) giving the product **5a** as a yellow solid (54.0 mg, 98% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (3.3:1 dr); **(Major diastereomer)** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55-5.53 (m, 2H), 7.41-7.35 (m, 3H), 7.32-7.28 (m, 1H), 7.19-7.13 (m, 4H), 7.12-7.01 (m, 4H), 6.91 (d, *J* = 7.6 Hz, 1H), 6.74-6.54 (m, 2H), 6,23 (d, *J* = 6.8 Hz, 2H), 5.43 (s, 1H), 5.07 (d, *J* = 17.2 Hz, 1H), 4.19 (d, *J* = 17.2 Hz, 1H), 3.83-3.77 (m, 1H), 3.49 (s, 3H), 3.26 (td, *J* = 12, 3.2 Hz, 1H), 3.10-3.06 (m, 1H), 2.94-2.90 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.9, 164.3, 152.8, 144.6, 138.0, 137.0, 134.7, 132.8, 129.6, 129.5, 128.7, 128.5, 127.7, 127.2, 126.5, 126.3, 125.7, 123.8, 123.4, 122.4, 119.7, 118.9, 113.5, 109.7, 109.1, 104.3, 68.2, 61.6, 50.5, 47.0, 46.3, 22.8; **(Minor diastereomer)** ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.79 (d, *J* = 17.2 Hz, 1H), 4.66 (d, *J* = 17.2 Hz, 1H), 3.98-3.91 (m, 1H), 3.68-3.65 (m, 1H), 3.49 (s, 3H), 3.12-3.11 (m, 1H), 3.10-3.06 (m, 1H); ESI-HRMS: calcd. for $C_{36}H_{30}N_3O_3^+$(M+H)$^+$ 552.2282, found 552.2288.



5b

Compound 5b: A mixture of dihydro-β-carboline **4b** (0.2 mmol, 2 equiv), MBH carbonates **2a** (0.1 mmol, 1 equiv) and MeCN (2 mL) was stirred at 50 °C for 40 h. the reaction mixture was concentrated and the residue was purified by a silica gel flash chromatography (PE/EtOAc = 5:1) giving the product **5b** as a yellow solid (56.8 mg, 98% yield). Then the dr was determined by dissolving the solid in $CDCl_3$ (2.5:1 dr); **(Major diastereomer)** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 (s, 1H), 7.46-7.41 (m, 1H), 7.38 (d, *J* = 7.6 Hz, 2H), 7.34-7.30 (m, 2H), 7.17-7.01 (m, 6H), 6.98 (s, 1H), 6.90 (d, *J* = 7.6 Hz, 1H), 6.79 (dd, *J* = 8.8, 2.4 Hz, 1H), 6.63-6.58 (m, 1H), 6.23 (d, *J* = 6.8 Hz, 2H), 5.42 (s, 1H), 4.97 (d, *J* = 16.8 Hz, 1H), 4.13 (d, *J* = 16.0 Hz, 1H), 3.94-3.85 (m, 1H), 3.85 (s, 3H), 3.49 (s, 3H), 3.26 (td, *J* = 12.4, 3.2 Hz, 1H), 3.10-3.02 (m, 1H), 2.89-2.84 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.9, 154.2, 152.8, 144.7, 137.1, 134.7, 133.2, 132.8, 130.3, 129.5, 128.7, 128.5, 127.7, 127.1, 127.1, 126.5, 126.4, 126.2, 125.6, 123.8, 123.4, 113.1, 112.5, 110.5, 109.1, 100.9, 68.2, 61.8, 55.9, 50.5, 47.2, 46.3, 22.9; **(Minor diastereomer)** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.01 (s, 1H), 6.97 (s, 1H), 6.73 (t, *J* = 7.6 Hz, 1H), 6.66 (d, *J* = 7.6 Hz, 1H), 6.53 (d, *J* = 7.2 Hz, 2H), 5.85 (d, *J* = 6.4 Hz, 1H), 4.74 (d, *J* = 16.8 Hz, 1H), 4.63 (d, *J* = 16.8 Hz, 1H), 3.83 (s, 3H), 3.79 (d, *J* = 4.0 Hz, 1H), 3.49 (s, 3H), 3.49-3.36 (m, 1H), 3.10-3.02 (m, 2H); ESI-HRMS: calcd. for $C_{37}H_{32}N_3O_4^+$(M+H)$^+$ 582.2387, found 582.2395.

5. Gram-scale reaction:

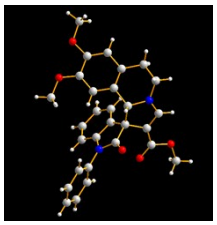


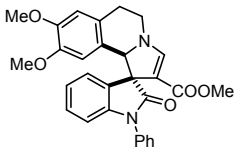
A mixture of 3,4-dihydroisoquinoline imine **1a** (1.35 g, 7.1 mmol, 3 equiv), MBH carbonate **2g** (1.00 g, 2.4 mmol, 1 equiv) and MeOH (47 mL) was stirred at room temperature for 24 h. Then the mixture was concentrated and the residue was recrystallized from 40 mL of ethanol to afford compound **3k** as white solid (715 mg, 61%, >20:1 dr).

Reference:

(1) T. O. Ronson, C. Kitsiou, W. P. Unsworth and R. J. K. Taylor, *Tetrahedron.,* **2016,** *72,* 6099.
(2) M. Bertrand, G. Poissonnet, M.e-H. Théret-Bettiol, C. Gaspard, G. H. Werner, B. Pfeiffer, P. Renard, S. Léonce and R. H. Dodd, *Bioorg. Med. Chem.*, **2001**, *9,* 2155.
(3) S. J. Gardena, J. M. S. Skakleb, *Tetrahedron Lett*., **2002**, *43,* 1969.
(4) D. Rambabu, S. K. Kumar, B. Y. Sreenivas, S. Sandra, A. Kandale, P. Misra,M. V. B. Rao, M. Pal, *Tetrahedron Lett.*, **2013**, *54,* 495.
(5) X. Fan, H. Yang, M. Shi, *Adv. Synth. Catal.*, **2017**, *359,* 49.

6. Crystal data of compound 3a





Bond precision: C-C = 0.0092 A Wavelength=0.71073

Cell: a=9.050(4) b=10.200(4) c=27.541(11)
alpha=89.877(6) beta=93.866(6) gamma=111.112(5)
Temperature: 296 K

	Calculated	Reported
Volume	2365.6(17)	2365.6(17)
Space group	P -1	P -1
Hall group	-P 1	-P 1
Moiety formula	C29 H26 N2 O5	C29 H26 N2 O5
Sum formula	C29 H26 N2 O5	C29 H26 N2 O5
Mr	482.52	482.52
Dx,g cm-3	1.355	1.355
Z	4	4
Mu (mm-1)	0.093	0.093
F000	1016.0	1016.0
F000'	1016.49	
h,k,lmax	11,12,33	11,12,33
Nref	8974	8865
Tmin,Tmax		0.563,0.746
Tmin'		

Correction method= # Reported T Limits: Tmin=0.563 Tmax=0.746
AbsCorr = MULTI-SCAN

Data completeness= 0.988 Theta(max)= 25.682

R(reflections)= 0.1072(5811) wR2(reflections)= 0.2967(8865)

S = 1.060 Npar= 657