Application of Isatin-derived Saturated Esters in the Synthesis of 3,3’-Spirooxindole γ-Butyrolactams

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General Methods and Materials---------------------------------------------------------------S2
Attempts on asymmetric synthesis of 3a using chiral organocatalysts------------------------S2
General procedure for the synthesis of 1b and 1d-f ----------------------------------------S3
Procedure for the synthesis of 1g and 1h-----------------------------------------------S6
General procedure for the synthesis of 3 and 4 ------------------------------------------S8
General procedure for the synthesis of 6 and 7---------------------------------------------S18
Procedure for the synthesis of 3a with chiral-phase-transfer catalysis-------------------S23
Procedure for the synthesis of 6a with chiral-phase-transfer catalysis-------------------S23
Procedure for the deprotection of the products 3a and 5a-----------------------------S24
Copies of NMR spectra for substrates 1 ------------------------------------------------------S26
Copies of NMR spectra for products 3 and 4-----------------------------------------------S34
Copies of NMR spectra for products 6 and 7-----------------------------------------------S59
Copies of NMR spectra for products 8 and 9-----------------------------------------------S68
Copies of HPLC spectra for product 3a---------------------------------------------------S70
Copies of the x-ray structures of 3a and 6b---------------------------------------------S71
**General Methods and Materials.** All reactions were carried out in dry glassware, and were monitored by analytical thin-layer chromatography (TLC), which was visualized by ultraviolet light (254 nm). All solvents were obtained from commercial sources and were purified according to standard procedures. Purification of the products was accomplished by flash chromatography using silica gel (200-300 mesh). Substrates 2\(^1\) and 5\(^2\) were prepared according to known procedures. All NMR spectra were recorded on Bruker spectrometers, running at 300 MHz or 400 MHz for \(^1\)H and 75 MHz or 100 MHz for \(^13\)C respectively. Chemical shifts (\(\delta\)) and coupling constants (\(J\)) are reported in ppm and Hz respectively. The solvent signals were used as references (residual CHCl\(_3\) in CDCl\(_3\): \(\delta\)\(H\) = 7.26 ppm, \(\delta\)\(C\) = 77.0 ppm). The following abbreviations are used to indicate the multiplicity in NMR spectra: s (singlet); d (doublet); t (triplet); q (quartet); m (multiplet). High resolution mass spectrometry (HRMS) was recorded on TOF perimer for ESI\(^+\).

**Attempts on asymmetric synthesis of 3a using chiral organocatalysts**
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**General procedure for the synthesis of 1b and 1d-f.**

(tert-Butoxycarbonylmethylene)triphenylphosphorane (4.9 g, 13.2 mmol) was added to a stirred suspension of N-substituted isatin (13.9 mmol) in toluene (80 mL). The mixture was heated to reflux and stirred for 1.5 h before being allowed to cool to room temperature. The reaction was filtered through a pad of celite and concentrated in vacuo. Then the residue was dissolved in methanol (50 mL) and the resulting solution was cooled to 0 °C, followed by the addition of NaBH$_4$ (26 mmol) in batches. The mixture
was stirred at 0 °C until the completion of the reaction as monitored by TLC. Then, the reaction mixture was quenched with 150 mL of water and was further extracted with CH₂Cl₂ (50 mL×3). The combined organic phase was washed with brine (100 mL) and was dried over anhydrous Na₂SO₄. The mixture was then filtered and the resulting filtrate was concentrated under reduced pressure. Then the residue was dissolved in toluene (50 mL) heat to 50 °C. Trifluoroacetic acid (20 mL) was then added and the reaction was stirred for an additional 2 h. The reaction was basified by the cautious addition of saturated aqueous sodium bicarbonate solution; the organic layer was isolated and discarded. The aqueous layer was acidified with aqueous hydrochloric acid (1 M) and extracted thoroughly with ethyl acetate. Then, the combined organic extracts were concentrated in vacuum, and the residue was purified by flash chromatography (hexane: EtOAc = 4:1, v/v) to give the acid.

R’OH (17.2 mmol), DMAP (1 mmol), DCC (17.2 mmol) were added to a stirred solution of the acid (10.6 mmol) in EtOAc (30 mL). The mixture was stirred at room temperature until the completion of the reaction as monitored by TLC. The mixture was filtered and concentrated under reduced pressure and the residue was purified by flash chromatography (hexane: EtOAc = 15:1, v/v) on silica gel to afford compounds 1a-f.

4-Nitrophenyl 2-(1-benzyl-2-oxoindolin-3-yl)acetate (1a). Yellowish solid, mp: 140-142°C. ¹H NMR (400 MHz, Chloroform-d) δ 8.20 (d, \( J = 9.1 \) Hz, 2H), 7.37-7.27 (m, 3H), 7.27-7.19 (m, 4H), 7.13-7.00 (m, 3H), 6.78 (d, \( J = 7.8 \) Hz, 1H), 4.97 (d, \( J = 15.6 \) Hz, 1H), 4.91 (d, \( J = 15.6 \) Hz, 1H), 3.99 (t, \( J = 6.1 \) Hz, 1H), 3.39-3.25 (m, 2H). ¹³C NMR (101 MHz, Chloroform-d) δ 176.2, 168.6, 154.96, 145.4, 143.5, 135.5, 128.7, 128.6, 127.6, 127.3, 127.1, 125.1, 123.7, 122.7, 122.3, 109.3, 43.96, 41.7, 34.9. HRMS (ESI) calcd for C₂₃H₁₈N₂O₅ (M+Na)⁺: 425.1113, found 425.1112.
1,1,1,3,3,3-Hexafluoropropan-2-yl 2-(1-benzyl-2-oxoindolin-3-yl)acetate (1b).

White solid, mp: 120-122 °C. $^1$H NMR (300 MHz, CDCl$_3$) $\delta$ 7.40-7.28 (m, 5H), 7.23 (t, $J = 8.2$ Hz, 2H), 7.04 (t, $J = 7.5$ Hz, 1H), 6.78 (d, $J = 7.8$ Hz, 1H), 5.79 (hept, $J = 6.1$ Hz, 1H), 5.02 (d, $J = 15.7$ Hz, 1H), 4.90 (d, $J = 15.7$ Hz, 1H), 3.96 (dd, $J = 7.8$, 4.5 Hz, 1H), 3.39 (dd, $J = 17.4$, 4.5 Hz, 1H), 3.12 (dd, $J = 17.4$, 7.9 Hz, 1H).

$^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 175.8, 168.3, 143.5, 135.6, 128.8, 128.7, 127.7, 127.3, 126.9, 123.7, 122.8, 120.2 (d, $J = 277.4$ Hz), 109.4, 66.8 (m), 44.0, 41.4, 34.1. HRMS (ESI) calcd for C$_{20}$H$_{15}$F$_6$NO$_3$ (M+H)$^+$: 432.1034, found 432.1027.

1,3-Dioxoisooindolin-2-yl 2-(1-benzyl-2-oxoindolin-3-yl)acetate (1c). White solid, mp: 160-162°C. $^1$H NMR (500 MHz, Chloroform-$d$) $\delta$ 7.90 (dd, $J = 5.4$, 3.1 Hz, 2H), 7.80 (dd, $J = 5.5$, 3.1 Hz, 2H), 7.45 (d, $J = 7.4$ Hz, 1H), 7.32-7.29 (m, 4H), 7.24-7.19 (m, 2H), 7.08 (d, $J = 7.3$ Hz, 1H), 6.76 (d, $J = 7.8$ Hz, 1H), 5.04-4.88 (m, 2H), 4.05 (dd, $J = 9.7$, 3.6 Hz, 1H), 3.58 (dd, $J = 16.9$, 3.7 Hz, 1H), 3.05 (dd, $J = 16.9$, 9.7 Hz, 1H). $^{13}$C NMR (101 MHz, Chloroform-$d$) $\delta$ 175.5, 167.9, 161.6, 143.2, 135.5, 134.8, 128.75, 128.73, 128.65, 127.6, 127.3, 126.9, 124.5, 123.98, 122.98, 109.3, 43.96, 41.5, 32.4. HRMS (ESI) calcd for C$_{25}$H$_{18}$N$_2$O$_5$ (M+H)$^+$: 427.1294, found 427.1292.

1,1,1,3,3,3-Hexafluoropropan-2-yl 2-(1-benzyl-5-chloro-2-oxoindolin-3-yl)acetate (1d). White solid, mp: 85-87 °C. $^1$H NMR (300 MHz, CDCl$_3$) $\delta$ 7.40-7.26 (m, 5H), 7.24 (s, 1H), 7.19 (d, $J = 8.3$ Hz, 1H), 6.68 (d, $J = 8.3$ Hz, 1H), 5.87-5.70 (m, 1H), 4.99 (d, $J = 15.7$ Hz, 1H), 4.90 (d, $J = 15.7$ Hz, 1H), 3.94 (dd, $J = 7.5$, 4.4 Hz, 1H), 3.38 (dd, $J = 17.6$, 4.5 Hz, 1H), 3.14 (dd, $J = 17.6$, 7.7 Hz, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 175.2, 168.0, 142.0, 135.1, 128.9, 128.6, 128.5, 128.3, 127.9, 127.2, 124.2, 120.1 (d, $J = 279.3$ Hz), 110.3, 66.8 (m), 44.1, 41.3, 33.8. HRMS (ESI) calcd for C$_{20}$H$_{14}$ClF$_6$NO$_3$Na (M+Na)$^+$: 488.0464, found 488.0465.
1,1,1,3,3,3-Hexafluoropropan-2-yl 2-(1-benzyl-5-methyl-2-oxoindolin-3-yl)acetate

(1e). White solid, mp: 108-110 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.41-7.23 (m, 5H), 7.11-6.96 (m, 2H), 6.66 (d, $J = 7.9$ Hz, 1H), 5.82 (hept, $J = 6.1$ Hz, 1H), 4.99 (d, $J = 15.6$ Hz, 1H), 4.89 (d, $J = 15.7$ Hz, 1H), 3.94 (dd, $J = 7.9$, 4.4 Hz, 1H), 3.38 (dd, $J = 17.3$, 4.5 Hz, 1H), 3.09 (dd, $J = 17.3$, 8.0 Hz, 1H), 2.31 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 175.6, 168.3, 141.0, 135.6, 132.5, 128.9, 128.7, 127.6, 127.2, 126.9, 124.5, 120.2 (d, $J = 283$ Hz), 109.1, 66.7 (m), 44.0, 41.4, 34.2, 20.9. HRMS (ESI) calcd for C$_{21}$H$_{17}$F$_6$NO$_3$ (M+H$^+$): 446.1191, found 446.1186.

1,1,1,3,3,3-Hexafluoropropan-2-yl 2-(1-methyl-2-oxoindolin-3-yl)acetate (1f).

White solid, mp: 79-81 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.31 (t, $J = 7.7$ Hz, 1H), 7.21 (d, $J = 7.4$ Hz, 1H), 7.05 (t, $J = 7.4$ Hz, 1H), 6.86 (d, $J = 7.8$ Hz, 1H), 5.82-5.66 (m, 1H), 3.82 (dd, $J = 7.6$, 4.6 Hz, 1H), 3.28 (dd, $J = 17.3$, 4.6 Hz, 1H), 3.22 (s, 3H), 3.03 (dd, $J = 17.3$, 7.7 Hz, 1H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 175.6, 168.2, 144.3, 128.8, 126.8, 123.5, 122.7, 120.1 (q, $J = 281.1$ Hz), 108.3, 66.6 (m), 41.3, 34.0, 26.3. HRMS (ESI) calcd for C$_{14}$H$_{12}$F$_6$NO$_3$ (M+H$^+$): 356.0721, found: 356.0715.

Procedure for the synthesis of 1g and 1h.

To an 50 mL two-necked flask was charged with tert-butyl 2,3-dioxoindoline-1-carboxylate (494 mg, 2 mmol), (benzyloxycarbonylmethylene)triphenylphosphine (874 mg, 2.2 mmol). Then 20 mL CHCl$_3$ was added and the mixture was stirred at room temperature. Upon completion of the reaction as monitored by TLC, the mixture was concentrated under reduced pressure and the residue was purified by column chromatography to give the witting product. Then, to a 50 mL round bottom flask was added witting product (2 mmol), Pd/C (50% mol) and 20 mL of methanol under H$_2$. 

56
The resulting mixture was stirred at room temperature. Upon completion of the reaction as monitored by TLC, the mixture was filtered to separate Pd/C and the filtrate was concentrated under reduced pressure to get the acid directly used for next step.

The acid intermediate (2 mmol) was dissolved in ethyl acetate, followed by the addition of 1,1,1,3,3,3-hexafluoro-2-propanol (2.4 mmol), DCC (2.4 mmol) and DMAP (0.2 mmol). The mixture was stirred at room temperature until the completion of the reaction as monitored by TLC. The mixture was filtered and the filtrate was concentrated under reduced pressure, the residue was purified by column chromatography (hexane: EtOAc = 15:1, v/v) to afford compound 1g as white solid.

To a 25ml flask was charged with 1g (65 mg, 0.15 mmol) and 5 mL CH₂Cl₂, then TFA (1 mL) was added. The mixture was stirred at room temperature. Upon completion of the reaction as monitored by TLC. The reaction was basified by the cautious addition of saturated aqueous sodium bicarbonate solution and the mixture was extracted by EtOAc (3×10 mL). The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure to afford product 1h as a yellow oil (Yield = 70%, 36 mg).

**tert-Butyl 3-(2-((1,1,1,3,3,3-hexafluoropropan-2-yl)oxy)-2-oxoethyl)-2-oxoindoline-1-carboxylate (1g).** White solid, mp: 80-82 °C. ¹H NMR (300 MHz, CDCl₃) δ 7.85 (d, \(J = 8.2\) Hz, 1H), 7.33 (t, \(J = 7.7\) Hz, 1H), 7.24-7.09 (m, 2H), 5.70 (hept, \(J = 6.0\) Hz, 1H), 3.94 (t, \(J = 5.7\) Hz, 1H), 3.30 (dd, \(J = 17.4, 6.7\) Hz, 1H), 3.17 (dd, \(J = 17.4, 4.7\) Hz, 1H), 1.64 (s, 9H). ¹³C NMR (75 MHz, CDCl₃) δ 174.1, 167.7, 148.9, 140.2, 129.0, 125.5, 124.6, 123.1, 120.1 (q, \(J = 280.8\) Hz), 115.3, 84.6, 66.7 (m), 41.9, 34.3, 28.0. HRMS (ESI) calcd for C₁₈H₁₇F₆NO₅ (M+Na)+: 464.0909, found 464.0901.

**1,1,1,3,3,3-Hexafluoropropan-2-yl 2-(2-hydroxy-1H-indol-3-yl)acetate (1h).** ¹H NMR (300 MHz, Chloroform-\(d\)) δ 8.06 (brs, 1H), 7.54 (d, \(J = 7.7\) Hz, 1H), 7.30 (d, \(J = 7.8\) Hz, 1H), 7.25-7.18 (m, 1H), 7.17-7.12 (m, 1H), 7.09 (d, \(J = 2.4\) Hz, 1H), 5.85-5.73 (m, 1H), 3.95
(s, 2H). $^{13}$C NMR (100 MHz, Chloroform-$d$) δ 168.8, 136.0, 126.7, 123.4, 122.5, 120.4 (q, $J = 279.8$ Hz), 119.9, 119.0, 118.4, 106.1, 66.7 (m), 30.1.

**General procedure for the synthesis of 3 and 4.**

![Diagram](image)

To an oven-dried 10 mL flask was charged with 1 (0.2 mmol), 2 (0.24 mmol), 163 mg of Cs$_2$CO$_3$ (0.5 mmol) and 100 mg of 4 Å molecular sieves. Then, 2 mL of dry EtOAc was added and the resulting mixture was stirred at a certain temperature. Upon completion of the reaction as monitored by TLC, the mixture was filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using hexane/ethyl acetate/triethylamine (v/v/v = 4/1/0.005) as the eluent to afford products 3 and 4.

(2'S,3R)- and (2'R,3S)-*tert*-Butyl 1-benzyl-2,5'-dioxo-2'-phenylspiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3a). 78 mg (83%, >95:5 dr), white solid, mp: 190-192 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.48 (d, $J = 7.0$ Hz, 1H), 7.37-7.29 (m, 1H), 7.27-6.79 (m, 9H), 6.54 (t, $J = 7.0$ Hz, 3H), 5.29 (s, 1H), 5.00 (d, $J = 15.8$ Hz, 1H), 4.22 (d, $J = 15.8$ Hz, 1H), 3.13 (d, $J = 17.2$ Hz, 1H), 2.98 (d, $J = 17.3$ Hz, 1H), 1.19 (s, 9H). $^{13}$C NMR (125 MHz, CDCl$_3$) δ 175.2, 171.6, 148.8, 142.9, 135.9, 134.9, 129.3, 128.6, 128.26, 128.22, 127.3, 126.8, 126.3, 123.1, 122.5, 109.5, 83.4, 69.7, 51.5, 43.7, 41.2, 27.5. HRMS (ESI) calcd for C$_{29}$H$_{28}$N$_2$NaO$_4$: 491.1947, found 491.1945. IR (KBr): ν 3040, 3019, 3009, 2982, 2967, 2850, 2828, 2822, 2770, 1600, 1500, 1450, 1410, 1362, 1257, 1000, 750 cm$^{-1}$.

(2'S,3R)- and (2'R,3S)-*tert*-Butyl 1-benzyl-2'- (4-methoxyphenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3b). 89 mg (89%, 83:17 dr), white solid, mp: 198-200 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.53-7.43 (m, 1H), 7.27-6.79 (m, 9H), 6.54 (t, $J = 7.0$ Hz, 3H), 5.27 (s, 1H), 3.56 (s, 3H), 3.25 (s, 3H), 2.80 (s, 3H), 2.65 (s, 3H), 1.19 (s, 9H). $^{13}$C NMR (125 MHz, CDCl$_3$) δ 175.2, 171.6, 148.8, 142.9, 135.9, 134.9, 129.3, 128.6, 128.26, 128.22, 127.3, 126.8, 126.3, 123.1, 122.5, 109.5, 83.4, 69.7, 51.5, 43.7, 41.2, 27.5. HRMS (ESI) calcd for C$_{29}$H$_{28}$N$_2$NaO$_4$: 491.1947, found 491.1945. IR (KBr): ν 3040, 3019, 3009, 2982, 2967, 1801, 1770, 1769, 1710, 1694, 1610, 1520, 1494, 1480, 1425, 1365, 1253, 1000, 750 cm$^{-1}$. 

(2'S,3R)- and (2'R,3S)-*tert*-Butyl 1-benzyl-2'- (4-methoxyphenyl)-2,5'-dioxospiro-[indoline-3,3'-pyrrolidine]-1'-carboxylate (3b). 89 mg (89%, 83:17 dr), white solid, mp: 198-200 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.53-7.43 (m, 1H), 7.27-6.84 (m, 7H), 6.77 (d, $J = 8.3$ Hz, 2H), 6.60-6.54 (m, 3H), 5.27 (s,
1H), 5.06 (d, J = 15.8 Hz, 1H), 4.23 (d, J = 15.8 Hz, 1H), 3.79 (s, 3H), 3.12 (d, J = 17.2 Hz, 1H), 2.98 (d, J = 17.2 Hz, 1H), 1.24 (s, 9H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 175.4, 171.6, 159.5, 148.9, 143.0, 134.9, 129.3, 129.1, 128.4, 127.8, 127.5, 127.4, 126.7, 123.1, 122.5, 113.5, 109.4, 83.3, 69.4, 55.1, 51.7, 43.6, 41.1, 27.5. HRMS (ESI) calcd for C$_{30}$H$_{30}$N$_2$O$_5$Na(M+Na)$^+$: 521.2052, found 521.2051. IR (KBr): 3063, 3006, 3000, 2989, 2982, 2792, 1807, 1801, 1788, 1769, 1711, 1694, 1614, 1513, 1494, 1488, 1467, 1425, 1365, 1326, 1253, 1003, 762 cm$^{-1}$.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2,5'-dioxo-2'-(p-tolyl)spiro[indoline-3,3'-pyrrolidin]-1'-carboxylate (3c). 90 mg (83%, 83:17 dr), white solid, mp: 196-198 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.45 (dd, J = 7.2, 0.9 Hz, 1H), 7.23-7.10 (m, 5H), 7.05-6.75 (m, 4H), 6.53 (d, J = 6.8 Hz, 2H), 5.25 (s, 1H), 5.02 (d, J = 15.8 Hz, 1H), 4.23 (d, J = 15.8 Hz, 1H), 3.12 (d, J = 17.2 Hz, 1H), 2.94 (d, J = 17.2 Hz, 1H), 2.34 (s, 3H), 1.21 (s, 9H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 175.3, 171.7, 148.9, 142.8, 137.9, 134.9, 132.8, 129.4, 129.2, 128.9, 128.4, 127.3, 126.8, 126.2, 123.1, 122.4, 109.5, 83.3, 69.6, 51.6, 43.6, 41.1, 27.5, 21.3. HRMS (ESI) calcd for C$_{30}$H$_{30}$N$_2$O$_5$Na(M+Na)$^+$: 505.2108, found 505.2098. IR (KBr): 3009, 2975, 1800, 1740, 1622, 1499, 1467, 1429, 1375, 1326, 1253, 1025, 755 cm$^{-1}$.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2'-(4-fluorophenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidin]-1'-carboxylate (3d). 86 mg (89%, 82:18 dr), white solid, mp: 186-188 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.47 (d, J = 7.1 Hz, 1H), 7.25-7.12 (m, 5H), 7.05-6.87 (m, 4H), 6.61-6.56 (m, 3H), 5.27 (s, 1H), 4.98 (d, J = 15.7 Hz, 1H), 4.23 (d, J = 15.7 Hz, 1H), 3.09 (d, J = 17.2 Hz, 1H), 2.98 (d, J = 17.3 Hz, 1H), 1.22 (s, 9H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 175.3, 171.4, 162.6 (d, J = 245.4 Hz), 148.8, 142.9, 134.8, 131.6 (d, J = 3.2 Hz), 129.5, 128.7, 128.5, 127.9 (d, J = 8.0 Hz), 127.5, 126.7, 123.2, 122.6, 115.2 (d, J = 21.7 Hz), 109.5, 83.6, 69.0, 51.5, 43.6, 41.1, 27.5. HRMS (ESI) calcd for C$_{29}$H$_{27}$FN$_2$O$_4$Na(M+Na)$^+$: 509.1853, found 509.1857. IR (KBr): 3001, 2990, 2822, 1815, 1780, 1624, 1474, 1425, 1326, 1003, 752
(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2'-(4-chlorophenyl)-2,5'-dioxospiro-
[indoline-3,3'-pyrrolidine]-1'-carboxylate (3e). 83 mg (82%, 80:20 dr), white solid, mp: 193-195 °C. \(^1\)H NMR (300 MHz, CDCl\(_3\)) \(\delta\) 7.46 (dd, \(J = 7.2, 1.0 \) Hz, 1H), 7.25-6.69 (m, 9H), 6.60-6.55 (m, 3H), 5.26 (s, 1H), 5.02 (d, \(J = 15.7 \) Hz, 1H), 4.21 (d, \(J = 15.7 \) Hz, 1H), 3.08 (d, \(J = 17.2 \) Hz, 1H), 2.99 (d, \(J = 17.2 \) Hz, 1H), 1.24 (s, 9H). \(^1\)C NMR (75 MHz, CDCl\(_3\)) \(\delta\) 175.2, 171.3, 148.8, 143.0, 134.7, 134.4, 134.1, 129.5, 128.6, 128.50, 127.6, 127.5, 126.7, 123.3, 122.6, 109.6, 83.7, 68.9, 51.5, 43.7, 41.2, 27.6. HRMS (ESI) calcd for C\(_{29}\)H\(_{27}\)ClN\(_2\)O\(_4\)Na (M\(^+\)Na\(^+\)): 525.1557, found 525.1560. IR (KBr): 3122, 3001, 2990, 1815, 1780, 1615, 1500, 1425, 1326, 1003, 750 cm\(^{-1}\).

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2'-(4-bromophenyl)-2,5'-dioxospiro-
[indoline-3,3'-pyrrolidine]-1'-carboxylate (3f). 99 mg (91%, 84:16 dr), white solid, mp: 194-196 °C. \(^1\)H NMR (300 MHz, CDCl\(_3\)) \(\delta\) 7.46 (d, \(J = 7.0 \) Hz, 1H), 7.35 (d, \(J = 7.9 \) Hz, 2H), 7.26-6.70 (m, 7H), 6.61-6.53 (m, 3H), 5.25 (s, 1H), 5.02 (d, \(J = 15.7 \) Hz, 1H), 4.21 (d, \(J = 15.7 \) Hz, 1H), 3.16-2.93 (m, 2H), 1.24 (s, 9H). \(^1\)C NMR (75 MHz, CDCl\(_3\)) \(\delta\) 175.2, 171.2, 148.7, 143.0, 134.9, 134.7, 131.4, 129.5, 128.7, 128.4, 127.9, 127.5, 126.7, 123.3, 122.6, 122.2, 109.6, 83.7, 68.9, 51.4, 43.7, 41.2, 27.6. HRMS (ESI) calcd for C\(_{29}\)H\(_{27}\)BrN\(_2\)O\(_4\)Na (M\(^+\)Na\(^+\)): 569.1052, found 569.1048. IR (KBr): 3001, 2990, 1815, 1780, 1624, 1474, 1425, 1326, 1125, 1003, 750 cm\(^{-1}\).

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2,5'-dioxo-2'-(4-(trifluoromethyl)phenyl)
spiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3g). 87 mg (81%, 80:20 dr, -20 °C), white solid, mp: 197-199 °C. \(^1\)H NMR (300 MHz, CDCl\(_3\)) \(\delta\) 7.49 (d, \(J = 7.5 \) Hz, 3H), 7.26-7.06 (m, 7H), 6.61-6.56 (t, \(J = 7.0 \) Hz, 3H), 5.35 (s, 1H), 4.95 (d, \(J = 15.7 \) Hz, 1H), 4.24 (d, \(J = 15.7 \) Hz, 1H), 3.10 (d, \(J = 17.2 \) Hz, 1H), 3.01 (d, \(J =
17.3 Hz, 1H), 1.22 (s, 9H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 175.1, 171.1, 148.7, 142.9, 140.0, 134.7, 130.4 (d, $J = 32.4$ Hz), 129.6, 128.6, 128.5, 127.6, 126.70, 126.65, 125.1 (d, $J = 3.5$ Hz), 123.8 (q, $J = 270.5$ Hz), 123.4, 122.6, 109.7, 83.9, 68.9, 51.3, 43.8, 41.3, 27.5. HRMS (ESI) calcd for C$_{30}$H$_{27}$F$_3$N$_2$O$_4$Na (M+Na)$^+$: 559.1821, found 559.1821. IR (KBr): 3001, 2988, 1818, 1730, 1624, 1474, 1425, 1320, 1000, 752 cm$^{-1}$.

(2'S,3R) and (2'R,3S)-**tert-**Butyl 1-benzyl-2'-((3-fluorophenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3h). 83 mg (86%, 90:10 dr, -20 °C), white solid, mp: 195-197 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.46 (d, $J = 6.7$ Hz, 1H), 7.25-7.10 (m, 6H), 6.98 (td, $J = 8.3$, 2.2 Hz, 1H), 6.93-6.64 (m, 4H), 6.61 (d, $J = 7.6$ Hz, 1H), 5.26 (s, 1H), 4.97 (d, $J = 15.7$ Hz, 1H), 4.27 (d, $J = 15.7$ Hz, 1H), 3.12 (d, $J = 17.3$ Hz, 1H), 2.95 (d, $J = 17.3$ Hz, 1H), 1.24 (s, 9H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 174.9, 171.3, 162.5 (d, $J = 245.5$ Hz), 148.7, 142.8, 138.5 (d, $J = 7.1$ Hz), 134.9, 129.8 (d, $J = 8.0$ Hz), 129.5, 129.1, 128.6, 127.5, 126.8, 123.3, 122.4, 121.8 (d, $J = 2.5$ Hz), 115.2 (d, $J = 20.9$ Hz), 113.4 (d, $J = 22.6$ Hz), 109.6, 83.7, 69.1, 51.2, 43.7, 41.1, 27.5. HRMS (ESI) calcd for C$_{29}$H$_{27}$F$_3$N$_2$O$_4$Na (M+Na)$^+$: 509.1853, found 509.1851. IR (KBr): 3080, 2997, 2980, 1798, 1720, 1645, 1474, 1425, 1326, 750 cm$^{-1}$.

(2'S,3R) and (2'R,3S)-**tert-**Butyl 1-benzyl-2'-((3-chlorophenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3i). 85 mg (85%, >95:5 dr, -20 °C), white solid, mp: 197-199 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.45 (dd, $J = 7.3$, 0.9 Hz, 1H), 7.29-7.23 (m, 2H), 7.23-6.79 (m, 7H), 6.72-6.68 (m, 2H), 6.65-6.58 (m, 1H), 5.23 (s, 1H), 5.00 (d, $J = 15.6$ Hz, 1H), 4.25 (d, $J = 15.6$ Hz, 1H), 3.13 (d, $J = 17.3$ Hz, 1H), 2.95 (d, $J = 17.3$ Hz, 1H), 1.23 (s, 9H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 174.9, 171.3, 148.7, 142.8, 138.0, 134.9, 134.2, 129.55, 129.52, 129.1, 128.7, 128.5, 127.5, 126.8, 126.4, 124.3, 123.3, 122.4, 109.6, 83.7, 69.0, 51.2, 43.7, 41.0, 27.5. HRMS (ESI) calcd for C$_{29}$H$_{27}$ClN$_2$O$_4$Na (M+Na)$^+$: 525.1557, found 525.1546. IR (KBr): 3070, 2997, 2970, 1790, 1728, 1645, 1474, 1425, 1326, 1124, 750 cm$^{-1}$.
(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2,5'-dioxo-2'-2'-m-tolyl]spiro[indoline-3,3'-pyrrolidin]-1'-carboxylate (3j). 83 mg (86%, >95:5 dr, -20 °C), white solid, mp: 212-214 °C. 1H NMR (300 MHz, CDCl3) δ 7.53-7.42 (m, 1H), 7.25-6.64 (m, 9H), 6.61-6.53 (m, 3H), 5.24 (s, 1H), 5.03 (d, J = 15.7 Hz, 1H), 4.21 (d, J = 15.8 Hz, 1H), 3.13 (d, J = 17.2 Hz, 1H), 2.95 (d, J = 17.2 Hz, 1H), 2.21 (s, 3H), 1.19 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 175.2, 171.7, 148.9, 142.9, 135.7, 135.0, 129.5, 129.3, 129.0, 128.5, 128.10, 128.05, 127.3, 126.7, 123.1, 122.4, 109.4, 83.3, 69.8, 51.5, 43.7, 41.1, 27.4, 21.3. HRMS (ESI) calcd for C30H30N2O4Na (M+Na)+: 505.2108, found 505.2100. IR (KBr): 3065, 3006, 2976, 1790, 1735, 1645, 1474, 1425, 1326, 750 cm⁻¹.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2'(3-methoxyphenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidin]-1'-carboxylate (3k). 87 mg (87%, >95:5 dr, 0 °C), white solid, mp: 204-206 °C. 1H NMR (300 MHz, CDCl3) δ 7.46 (dd, J = 7.2, 1.2 Hz, 1H), 7.23-7.07 (m, 6H), 6.84 (dd, J = 8.0, 2.2 Hz, 1H), 6.79-6.22 (m, 5H), 5.25 (s, 1H), 5.01 (d, J = 15.7 Hz, 1H), 4.23 (d, J = 15.8 Hz, 1H), 3.61 (s, 3H), 3.11 (d, J = 17.2 Hz, 1H), 2.97 (d, J = 17.2 Hz, 1H), 1.22 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 175.3, 171.6, 159.5, 148.8, 143.0, 137.2, 134.9, 129.30, 129.23, 129.18, 128.6, 127.3, 126.7, 123.1, 122.5, 118.5, 114.6, 109.5, 83.4, 69.7, 55.2, 51.5, 43.7, 41.1, 27.5. HRMS (ESI) calcd for C30H30N2O5Na (M+Na)+: 521.2052, found 521.2052. IR (KBr): 3070, 3000, 2890, 1780, 1720, 1645, 1474, 1425, 1320, 750 cm⁻¹.

(2'R,3R) and (2'S,3S)-tert-Butyl 1-benzyl-2'(2-methoxyphenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidin]-1'-carboxylate (4l). 85 mg (85%, <5:95 dr, 0 °C), white solid, mp: 206-208 °C. 1H NMR (300 MHz, CDCl3) δ 7.44 (d, J = 7.1 Hz, 1H), 7.32-7.27 (m, 2H), 7.25-7.18 (m, 4H), 7.10 (t, J = 7.2 Hz, 1H), 7.04-6.91 (m, 3H), 6.76 (d, J = 8.3 Hz, 1H), 6.68 (d, J = 7.7 Hz, 1H), 5.78 (s, 1H), 4.93 (d, J = 15.7 Hz, 1H), 4.54 (d, J = 15.7 Hz, 1H), 3.37 (s, 3H), 3.22 (d, J = 17.2 Hz,
1H), 2.72 (d, J = 17.2 Hz, 1H), 1.24 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 174.4, 172.3, 156.5, 148.8, 142.0, 135.4, 132.0, 129.1, 128.8, 128.6, 127.4, 127.1, 126.0, 124.5, 122.9, 122.2, 120.6, 110.1, 109.1, 83.2, 62.8, 54.9, 50.2, 43.9, 41.4, 27.5. HRMS (ESI) calec for C30H30N2O5Na (M+Na)+: 521.2052, found 521.2043. IR (KBr): 3120, 3020, 2934, 1756, 1726, 1645, 1474, 1425, 1326, 1056, 750 cm⁻¹.

(2'R,3R) and (2'S,3S)-tert-Butyl 1-benzyl-2,5'-dioxo-2'-(o-tolyl)spiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (4m). 85 mg (88%, <5:95 dr, -20 °C), white solid, mp: 208-210 °C. 1H NMR (300 MHz, CDCl3) δ 7.55-7.38 (m, 2H), 7.25-7.08 (m, 7H), 7.08-6.97 (m, 1H), 6.80-6.67 (m, 2H), 6.63 (d, J = 7.7 Hz, 1H), 5.58 (s, 1H), 4.97 (d, J = 15.6 Hz, 1H), 4.33 (d, J = 15.6 Hz, 1H), 3.25 (d, J = 17.4 Hz, 1H), 2.90 (d, J = 17.4 Hz, 1H), 1.15 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 175.0, 171.9, 148.6, 142.4, 135.2, 135.0, 134.6, 130.8, 130.2, 129.3, 128.6, 128.0, 127.4, 127.1, 126.3, 126.2, 123.2, 122.5, 109.5, 83.3, 65.4, 50.7, 43.9, 41.3, 27.4, 19.1. HRMS (ESI) calec for C30H30N2O4Na (M+Na)+: 505.2108, found 505.2095. IR (KBr): 3060, 2990, 2890, 1765, 1734, 1645, 1474, 1425, 1320, 750 cm⁻¹.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2'-(2-chlorophenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3n). 88 mg (combined yield: 87%, 51:49 dr), white solid, mp: 194-196 °C. 1H NMR (300 MHz, CDCl3) δ 7.44-7.35 (m, 2H), 7.35-7.27 (m, 5H), 7.24 (dd, J = 7.0, 1.9 Hz, 1H), 7.14 (d, J = 7.8 Hz, 1H), 7.07 (td, J = 7.8, 0.8 Hz, 1H), 6.75-6.56 (m, 2H), 5.90-5.88 (m, 2H), 5.08 (d, J = 15.6 Hz, 1H), 4.82 (d, J = 15.6 Hz, 1H), 2.98 (d, J = 17.7 Hz, 1H), 2.88 (d, J = 17.7 Hz, 1H), 1.27 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 178.1, 171.5, 148.5, 143.3, 143.3, 135.6, 135.3, 133.9, 129.7, 129.5, 128.9, 128.8, 127.8, 127.3, 127.0, 126.1, 125.7, 124.1, 122.2, 109.1, 83.5, 63.0, 48.9, 43.9, 40.4, 27.5. HRMS (ESI) calec for C29H27ClN2O4Na (M+Na)+: 525.1557, found 525.1546. IR (KBr): 3120, 3010, 2975, 1770, 1735, 1640, 1476, 1430, 750 cm⁻¹.
(2'R,3R) and (2'S,3S)-tert-Butyl 1-benzyl-2'-((2-chlorophenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (4n). 88 mg (combined yield: 87%, 51:49 dr), white solid, mp: 167-169 °C. 1H NMR (300 MHz, CDCl3) δ 7.44 (dd, J = 6.9, 4.9 Hz, 2H), 7.37-7.20 (m, 7H), 7.12 (t, J = 7.2 Hz, 1H), 7.05-7.02 (m, 2H), 6.73 (d, J = 7.8 Hz, 1H), 5.81 (s, 1H), 4.85 (d, J = 15.6 Hz, 1H), 4.63 (d, J = 15.6 Hz, 1H), 3.29 (d, J = 17.3 Hz, 1H), 2.75 (d, J = 17.3 Hz, 1H), 1.23 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 174.0, 171.8, 148.4, 142.0, 135.1, 134.2, 132.9, 131.6, 129.4, 129.3, 129.2, 128.6, 127.6, 127.3, 127.1, 127.0, 123.3, 122.3, 109.5, 83.7, 65.3, 50.0, 44.2, 41.3, 27.5. HRMS (ESI) calcd for C29H27ClN2O4Na (M+Na)+: 525.1557, found 525.1556. IR (KBr): 30500, 2990, 2943, 1767, 1735, 1647, 1474, 1425, 1300, 754 cm⁻¹.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2'-((2-bromophenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3o). 95 mg (combined yield: 87%, 54:46 dr), white solid, mp: 195-197 °C. 1H NMR (300 MHz, CDCl3) δ 7.46-7.27 (m, 8H), 7.22-7.14 (m, 1H), 7.09 (td, J = 7.8, 1.0 Hz, 1H), 6.70 (d, J = 7.8 Hz, 1H), 6.61 (td, J = 7.6, 0.6 Hz, 1H), 5.85 (s, 1H), 5.83 (d, J = 8.5 Hz, 1H), 5.07 (d, J = 15.5 Hz, 1H), 4.82 (d, J = 15.5 Hz, 1H), 2.98 (d, J = 17.7 Hz, 1H), 2.85 (d, J = 17.7 Hz, 1H), 1.27 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 178.1, 171.5, 148.5, 143.5, 137.0, 135.3, 132.9, 129.8, 128.9, 128.7, 127.8, 127.6, 127.5, 126.0, 125.9, 124.6, 124.1, 122.2, 109.1, 83.5, 65.2, 48.8, 43.9, 40.4, 27.6. HRMS (ESI) calcd for C29H27BrN2O4Na (M+Na)+: 569.1052, found 569.1047. IR (KBr): 3076, 2993, 2978, 1765, 1736, 1645, 1474, 1425, 1130, 750 cm⁻¹.

(2'R,3R) and (2'S,3S)-tert-Butyl 1-benzyl-2'-(2-bromophenyl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (4o). 95 mg (combined yield: 87%, 54:46 dr), white solid, mp: 166-168 °C. 1H NMR (400 MHz, CDCl3) δ 7.50 (d, J = 7.9 Hz, 1H), 7.45 (d, J = 7.3 Hz, 1H), 7.42-7.36 (m, 2H), 7.28-7.21 (m, 4H), 7.13
$J = 7.5$ Hz, 1H), 7.09-7.05 (m, 2H), 6.75 (d, $J = 7.8$ Hz, 1H), 5.78 (s, 1H), 4.78 (d, $J = 15.6$ Hz, 1H), 4.71 (d, $J = 15.6$ Hz, 1H), 3.32 (d, $J = 17.4$ Hz, 1H), 2.74 (d, $J = 17.4$ Hz, 1H), 1.23 (s, 9H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 173.9, 171.9, 148.4, 142.0, 135.9, 135.2, 132.6, 131.9, 129.8, 129.2, 128.7, 127.6, 127.4, 127.3, 123.4, 123.2, 122.3, 109.5, 83.8, 67.7, 44.3, 41.3, 27.5. HRMS (ESI) calcd for C$_{29}$H$_{27}$BrN$_2$O$_4$Na (M+Na)$^+$: 569.1052, found 569.1047. IR (KBr): 3070, 2999, 2968, 1760, 1736, 1645, 1474, 1425, 1125, 750 cm$^{-1}$.

(2'R,3R) and (2'S,3S)-tert-Butyl 1-benzyl-2'-{(naphthalen-1-yl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (4p). 95 mg (92%, <5:95 dr), white solid, mp: 212-214 °C. $^1$H NMR (300 MHz, CDCl$_3$) δ 7.86 (t, $J = 8.3$ Hz, 2H), 7.68-7.57 (m, 2H), 7.52 (t, $J = 7.7$ Hz, 1H), 7.44-7.35 (m, 1H), 7.26-7.10 (m, 5H), 7.05 (t, $J = 7.3$ Hz, 2H), 6.62-6.57 (m, 3H), 6.19 (s, 1H), 4.73 (d, $J = 15.7$ Hz, 1H), 4.19 (d, $J = 15.7$ Hz, 1H), 3.40 (d, $J = 17.5$ Hz, 1H), 2.89 (d, $J = 17.5$ Hz, 1H), 1.03 (s, 9H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 174.4, 172.0, 148.7, 142.2, 134.8, 133.4, 132.3, 131.9, 130.7, 129.3, 129.0, 128.8, 128.5, 127.3, 126.9, 126.1, 125.5, 125.2, 123.5, 123.4, 122.2, 121.4, 109.6, 83.5, 65.0, 50.4, 44.0, 41.6, 27.3. HRMS (ESI) calcd for C$_{33}$H$_{30}$N$_2$O$_4$Na (M+Na)$^+$: 541.2103, found 541.2097. IR (KBr): 3032, 2978, 1758, 1738, 1645, 1454, 1325, 1129, 750 cm$^{-1}$.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2'-(naphthalen-2-yl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3q). 86 mg (83%, >95:5 dr), white solid, mp: 206-208 °C.

$^1$H NMR (300 MHz, CDCl$_3$) δ 7.82 (d, $J = 7.9$ Hz, 1H), 7.79-7.40 (m, 6H), 7.30-7.05 (m, 3H), 6.95 (t, $J = 7.4$ Hz, 1H), 6.65-6.45 (m, 3H), 6.27 (d, $J = 7.1$ Hz, 2H), 5.48 (s, 1H), 4.98 (d, $J = 15.7$ Hz, 1H), 4.10 (d, $J = 15.8$ Hz, 1H), 3.17 (d, $J = 17.2$ Hz, 1H), 3.05 (d, $J = 17.2$ Hz, 1H), 1.13 (s, 9H). $^{13}$C NMR (75 MHz, CDCl$_3$) δ 175.3, 171.6, 148.9, 143.0, 134.5, 133.4, 133.2, 132.9, 129.4, 129.0, 128.2, 128.0, 127.7, 127.1, 126.4, 126.3, 126.2, 125.2, 124.1, 123.2, 122.6, 109.5, 83.4, 69.8, 51.6, 43.6, 41.3, 27.4. HRMS (ESI) calcd for
C_{33}H_{30}N_{2}O_{4}Na (M+Na)^+: 541.2103, found 541.2103. IR (KBr): 3092, 3000, 2978, 1760, 1745, 1625, 1454, 1325, 1130, 1000, 750 cm⁻¹.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2'-((furan-2-yl)-2,5'-dioxospiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (4r). 46 mg (50%, 18: 82 dr), white solid, mp: 199-201 °C. ¹H NMR (300 MHz, CDCl₃) δ 7.40 (d, J = 1.0 Hz, 1H), 7.38-7.27 (m, 4H), 7.25-7.16 (m, 3H), 7.08 (t, J = 7.5 Hz, 1H), 6.76 (d, J = 7.8 Hz, 1H), 6.38 (dd, J = 3.2, 1.8 Hz, 1H), 6.24 (d, J = 3.2 Hz, 1H), 5.22 (s, 1H), 5.03 (d, J = 15.6 Hz, 1H), 4.59 (d, J = 15.6 Hz, 1H), 3.49 (d, J = 17.1 Hz, 1H), 2.67 (d, J = 17.1 Hz, 1H), 1.36 (s, 9H). ¹³C NMR (75 MHz, CDCl₃) δ 173.7, 171.4, 149.4, 148.7, 142.5, 141.7, 135.3, 131.8, 129.3, 128.8, 127.7, 127.3, 123.4, 121.8, 110.5, 109.5, 108.1, 83.8, 63.4, 50.3, 44.0, 40.4, 27.7. HRMS (ESI) calcd for C_{27}H_{26}N_{2}O_{5}Na (M+Na)^+: 481.1739, found 481.1736. IR (KBr): 3012, 2988, 1788, 1708, 1612, 1494, 1392, 1120, 750 cm⁻¹.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-2,5'-dioxo-2'-(thiophen-2-yl)spiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (4s). 47 mg (49%, <5:95 dr, 0 °C), white solid, mp: 198-200 °C. ¹H NMR (300 MHz, CDCl₃) δ 7.44-7.36 (m, 1H), 7.25-7.17 (m, 5H), 7.15-7.09 (m, 1H), 6.95 (dd, J = 4.9, 3.7 Hz, 1H), 6.92-6.81 (m, 3H), 6.64 (d, J = 7.7 Hz, 1H), 5.48 (s, 1H), 5.04 (d, J = 15.7 Hz, 1H), 4.39 (d, J = 15.7 Hz, 1H), 3.25 (d, J = 17.2 Hz, 1H), 2.86 (d, J = 17.2 Hz, 1H), 1.29 (s, 9H). ¹³C NMR (75 MHz, CDCl₃) δ 174.6, 171.4, 148.6, 142.6, 138.7, 135.0, 129.8, 129.4, 128.6, 127.5, 127.0, 126.8, 125.5, 124.7, 123.2, 122.2, 109.5, 83.7, 65.5, 51.5, 43.8, 40.5, 27.6. HRMS (ESI) calcd for C_{27}H_{26}N_{2}O_{5}Na (M+Na)^+: 497.1511, found 497.1504. IR (KBr): 3325, 3062, 2966, 2914, 1795, 1701, 1575, 1490, 1367, 1141, 744 cm⁻¹.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-5-chloro-2,5'-dioxo-2'-phenylspiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3t). 77 mg (77%, 67:33 dr), white solid, mp: 192-194 °C. ¹H NMR (300 MHz, CDCl₃) δ 7.46 (d, J = 2.0 Hz, 1H), 7.37-7.30 (m, 1H), 7.28-7.21 (m, 2H), 7.20-6.84 (m, 6H), 6.50 (d, J = 6.7 Hz, 2H), 5.42 (d, J = 3.2 Hz, 1H), 3.49 (d, J = 17.1 Hz, 1H), 2.86 (d, J = 17.1 Hz, 1H), 1.36 (s, 9H). ¹³C NMR (75 MHz, CDCl₃) δ 174.6, 171.4, 148.6, 142.6, 138.7, 135.0, 129.8, 129.4, 128.6, 127.5, 127.0, 126.8, 125.5, 124.7, 123.2, 122.2, 109.5, 83.7, 65.5, 51.5, 43.8, 40.5, 27.6. HRMS (ESI) calcd for C_{27}H_{26}N_{2}O_{5}Na (M+Na)^+: 497.1511, found 497.1504. IR (KBr): 3325, 3062, 2966, 2914, 1795, 1701, 1575, 1490, 1367, 1141, 744 cm⁻¹.
6.43 (d, J = 8.4 Hz, 1H), 5.26 (s, 1H), 4.98 (d, J = 15.8 Hz, 1H), 4.18 (d, J = 15.8 Hz, 1H), 3.10 (d, J = 17.2 Hz, 1H), 2.97 (d, J = 17.2 Hz, 1H), 1.18 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 174.8, 171.2, 148.6, 141.4, 135.5, 134.4, 130.7, 129.3, 128.6, 128.5, 128.4, 128.3, 127.5, 126.6, 126.2, 123.1, 110.5, 83.6, 69.5, 51.7, 43.7, 41.0, 27.4. HRMS (ESI) calcd for C29H27ClN2O4Na (M+Na)+: 525.1557, found 525.1563. IR (KBr): 3018, 2978, 1778, 1728, 1622, 1454, 1372, 1129, 738 cm⁻¹.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-benzyl-5-methyl-2,5'-dioxo-2'-phenylspiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3u).

45 mg (47%, >95:5 dr), white solid, mp: 184-186 °C. 1H NMR (300 MHz, CDCl3) δ 7.35-7.20 (m, 5H), 7.17-7.09 (m, 3H), 6.99 (d, J = 7.9 Hz, 2H), 6.62-6.50 (m, 2H), 6.42 (d, J = 8.0 Hz, 1H), 5.27 (s, 1H), 4.97 (d, J = 15.7 Hz, 1H), 4.20 (d, J = 15.8 Hz, 1H), 3.13 (d, J = 17.2 Hz, 1H), 2.95 (d, J = 17.2 Hz, 1H), 2.37 (s, 3H), 1.19 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 175.2, 171.8, 148.8, 140.4, 136.0, 135.0, 132.8, 129.6, 129.4, 128.5, 128.2, 127.3, 126.7, 126.3, 123.2, 109.3, 83.4, 69.8, 51.5, 43.6, 41.2, 27.4, 21.2. HRMS (ESI) calcd for C30H30N2O4Na (M+Na)+: 505.2108, found 505.2108. IR (KBr): 3002, 2985, 1776, 1738, 1612, 1494, 1382, 1130, 744 cm⁻¹.

(2'S,3R) and (2'R,3S)-tert-Butyl 1-methyl-2,5'-dioxo-2'-phenylspiro[indoline-3,3'-pyrrolidine]-1'-carboxylate (3v).

71 mg (90%, >95:5 dr), white solid, mp: 197-199 °C. 1H NMR (300 MHz, CDCl3) δ 7.43 (d, J = 7.3 Hz, 1H), 7.35 (t, J = 7.6 Hz, 1H), 7.22-7.14 (m, 4H), 7.04-6.84 (m, 2H), 6.73 (d, J = 7.8 Hz, 1H), 5.16 (s, 1H), 3.13 (d, J = 17.3 Hz, 1H), 2.85 (d, J = 17.3 Hz, 1H), 2.85 (s, 3H), 1.19 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 174.7, 171.8, 148.8, 143.4, 135.8, 130.2, 129.4, 128.2, 127.9, 125.7, 123.1, 122.2, 108.3, 83.3, 70.0, 51.4, 40.2, 27.5, 26.0. HRMS (ESI) calcd for C23H24N2O4Na (M+Na)+: 415.1634, found 415.1629. IR (KBr): 3032, 2989, 1776, 1728, 1646, 1464, 1378, 1138, 755 cm⁻¹.

517
(2'S,3R) and (2'R,3S)-di-tert-Butyl 2,5'-dioxo-2'-phenylspiro[indoline-3,3'-pyrrolidine]-1,1'-dicarboxylate (3w). 73 mg (76%, >95:5 dr), white solid, mp: 198-200 °C. 1H NMR (300 MHz, CDCl3) δ 7.73 (d, J = 8.0 Hz, 1H), 7.44 (d, J = 7.3 Hz, 1H), 7.37 (t, J = 7.3 Hz, 1H), 7.29 (d, J = 7.4 Hz, 1H), 7.20 (d, J = 5.9 Hz, 3H), 6.89 (brs, 2H), 5.12 (s, 1H), 3.12 (d, J = 17.4 Hz, 1H), 2.95 (d, J = 17.4 Hz, 1H), 1.83 (s, 9H), 1.18 (s, 9H). 13C NMR (75 MHz, CDCl3) δ 173.7, 171.3, 148.7, 148.3, 139.7, 135.0, 129.6, 128.4, 128.1, 128.0, 125.6, 125.1, 122.2, 115.1, 84.1, 83.5, 71.0, 52.2, 40.2, 27.8, 27.4. HRMS (ESI) calcd for C27H30N2O6Na (M+Na)+: 501.2002, found 501.2002. IR (KBr): 3033, 2990, 1778, 1756, 1737, 1643, 1454, 1367, 1129, 758 cm⁻¹.

General procedure for the synthesis of 6 and 7.

To an oven-dried 10 mL flask was charged with 1,1,1,3,3,3-hexafluoropropan-2-yl 2-(1-benzyl-2-oxoindolin-3-yl)acetate 1 (0.2 mmol), 5 (0.24 mmol), 163 mg of Cs2CO3 (0.5 mmol) and 100 mg of 4 Å molecular sieves. Then, 2 mL of dry EtOAc was added and the resulting mixture was stirred at a certain temperature. Upon completion of the reaction as monitored by TLC, the mixture was filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using hexane/ethyl acetate/triethylamine (v/v/v = 4/1/0.005) as the eluent to afford products 6 and 7.

(2'S,3S) and (2'R,3R)-tert-butyl 1,1''-dibenzyl-2,2'',5' -trioxodispiro[indoline-3,2'-pyrrolidine-3',3''-indoline]-1'-carboxylate (6a). 96 mg (80%, 85:15 dr), white solid, mp: 187-190 °C. 1H NMR (300 MHz, CDCl3) δ 7.46 (d, J = 7.4 Hz, 1H), 7.26-7.22 (m, 2H), 7.20-7.05 (m, 7H), 6.97 (t, J = 7.4 Hz, 2H), 6.65-6.57 (m, 2H), 6.48 (t, J = 7.5 Hz, 3H), 6.40 (d, J = 7.5 Hz, 1H), 5.24 (d, J = 16.1 Hz, 1H), 5.16 (d, J = 15.6 Hz, 1H), 4.54 (d, J = 15.6 Hz, 1H), 4.30 (d, J = 16.1 Hz, 1H),
3.99 (d, J = 16.3 Hz, 1H), 2.76 (d, J = 16.3 Hz, 1H), 1.04 (s, 9H). 13C NMR (75 MHz, CDCl₃) δ 173.0, 172.5, 172.4, 147.7, 143.8, 142.4, 134.8, 134.3, 129.9, 128.55, 128.49, 128.3, 127.6, 127.5, 127.1, 126.0, 124.3, 123.83, 123.80, 122.8, 121.8, 109.70, 109.69, 84.0, 71.3, 54.2, 44.6, 43.6, 38.9, 27.3. HRMS (ESI) calecf for C₃₇H₃₃N₃O₅NH₄⁺: 617.2764, found 617.2754. IR (KBr): 3043, 2998, 2889, 1768, 1738, 1619, 1494, 1392, 1110, 750 cm⁻¹.

(2'S,3S) and (2'R,3R)-tert-butyl 1''-benzyl-1-methyl-2,2'',5'''-trioxodispiro[indoline-3,2'-pyrrolidine-3',3''-indoline]-1''-carboxylate (6b). 90 mg (86%, 84:16 dr), white solid, mp: 194-197 °C. ¹H NMR (300 MHz, CDCl₃) δ 7.56 (d, J = 7.2 Hz, 1H), 7.28 (t, J = 7.8 Hz, 1H), 7.24-7.03 (m, 5H), 6.73 (d, J = 7.8 Hz, 1H), 6.63 (t, J = 7.6 Hz, 1H), 6.45 (t, J = 7.2 Hz, 3H), 6.31 (d, J = 7.5 Hz, 1H), 5.17 (d, J = 16.1 Hz, 1H), 4.25 (d, J = 16.1 Hz, 1H), 4.02 (d, J = 16.2 Hz, 1H), 3.16 (s, 3H), 2.66 (d, J = 16.2 Hz, 1H), 1.06 (s, 9H). ¹³C NMR (75 MHz, CDCl₃) δ 173.0, 172.6, 172.0, 147.6, 144.5, 142.0, 134.5, 130.0, 129.8, 128.8, 128.6, 127.2, 126.0, 124.4, 123.7, 123.5, 122.8, 121.7, 109.7, 108.3, 83.9, 71.2, 54.3, 43.5, 38.7, 27.3, 26.4. HRMS (ESI) calecf for C₃₁H₂₉N₃O₅NH₄⁺: 541.2451, found 541.2443. IR (KBr): 3001, 2976, 1765, 1746, 1612, 1500, 1392, 1133, 750 cm⁻¹.

(2'S,3S) and (2'R,3R)-tert-butyl 1''''-dibenzy-5-methyl-2,2'',5'''-trioxodispiro[indoline-3,2'-pyrrolidine-3',3''-indoline]-1''''-carboxylate (6c). 91 mg (74%, 87:13 dr), white solid, mp: 178-182 °C. ¹H NMR (300 MHz, CDCl₃) δ 7.43 (d, J = 7.2 Hz, 1H), 7.24-6.89 (m, 11H), 6.50-6.43 (m, 4H), 6.18 (s, 1H), 5.23 (d, J = 16.2 Hz, 1H), 5.13 (d, J = 15.6 Hz, 1H), 4.52 (d, J = 15.6 Hz, 1H), 4.30 (d, J = 16.1 Hz, 1H), 3.97 (dd, J = 16.3, 3.1 Hz, 1H), 2.78 (dd, J = 16.2, 3.1 Hz, 1H), 1.92 (s, 3H), 1.04 (s, 9H). ¹³C NMR (75 MHz, CDCl₃) δ 172.9, 172.48, 172.47, 147.8, 142.5, 141.3, 135.0, 134.4, 131.4, 130.0, 129.7, 128.5, 128.4, 128.2, 127.6, 127.4, 127.1, 126.1, 125.1, 123.9, 122.6, 109.7, 109.4, 83.9, 71.4, 54.2, 44.6, 43.6, 38.8, 27.3, 20.6. HRMS (ESI) calecf for C₃₈H₃₅N₃O₅NH₄⁺: 631.2920, found 631.2908. IR (KBr): 3022, 2990,
1776, 1740, 1484, 1376, 1143, 755 cm⁻¹.

(2'S,3S) and (2'R,3R)-tert-butyl 1,1''-dibenzyl-5-methoxy-2,2'',5'-trioxodispiro[indoline-3,2'-pyrrolidine-3',3''-indoline]-1'-carboxylate (6d). 59 mg (47%, 80:20 dr), white solid, mp: 204-207 °C. ¹H NMR (400 MHz, CDCl₃) δ 7.55 (d, J = 7.3 Hz, 1H), 7.40-7.29 (m, 2H), 7.20-7.07 (m, 5H), 7.02 (t, J = 7.5 Hz, 2H), 6.72 (dd, J = 8.6, 2.5 Hz, 1H), 6.50 (d, J = 7.3 Hz, 4H), 5.98 (d, J = 2.4 Hz, 1H), 5.29 (d, J = 16.2 Hz, 1H), 5.17 (d, J = 15.6 Hz, 1H), 4.55 (d, J = 15.6 Hz, 1H), 4.32 (d, J = 16.2 Hz, 1H), 4.08 (d, J = 16.3 Hz, 1H), 3.30 (s, 3H), 2.78 (d, J = 16.3 Hz, 1H), 1.09 (s, 9H). ¹³C NMR (100 MHz, CDCl₃) δ 172.8, 172.5, 172.2, 155.1, 147.8, 142.5, 137.2, 135.0, 134.3, 129.9, 128.6, 128.5, 127.7, 127.5, 127.2, 126.0, 124.6, 123.8, 122.7, 116.0, 110.6, 110.3, 109.9, 84.1, 71.4, 55.8, 54.2, 44.8, 43.6, 38.7, 27.4. HRMS (ESI) calcd for C₃₈H₃₅N₃O₆Na (M+Na)⁺: 652.2424, found 652.2421. IR (KBr): 3065, 3000, 1776, 1743, 1642, 1484, 1395, 1123, 747 cm⁻¹.

(2'S,3S) and (2'R,3R)-tert-butyl 1,1''-dibenzyl-5-fluoro-2,2'',5'-trioxodispiro[indoline-3,2'-pyrrolidine-3',3''-indoline]-1'-carboxylate (6e). 70 mg (57%, 42:58 dr), white solid, mp: 176-180 °C. Minor product: ¹H NMR (400 MHz, CDCl₃) δ 7.51 (d, J = 7.1 Hz, 1H), 7.34-7.24 (m, 3H), 7.18-7.10 (m, 5H), 7.03 (t, J = 7.4 Hz, 2H), 6.88-6.82 (m, 1H), 6.65-6.43 (m, 4H), 6.13 (dd, J = 8.1, 2.2 Hz, 1H), 5.23 (d, J = 16.0 Hz, 1H), 5.16 (d, J = 15.6 Hz, 1H), 4.59 (d, J = 15.6 Hz, 1H), 4.35 (d, J = 16.0 Hz, 1H), 4.04 (d, J = 16.3 Hz, 1H), 2.78 (d, J = 16.3 Hz, 1H), 1.14 (s, 9H). ¹³C NMR (100 MHz, CDCl₃) δ 172.9, 172.1, 158.1 (d, J = 240.6 Hz), 147.8, 142.3, 139.85, 139.84, 134.6, 134.4, 130.2, 128.63, 128.60, 128.0, 127.72, 127.67, 127.4, 126.2, 125.4 (d, J = 8.3 Hz), 123.7, 123.0, 116.0 (d, J = 23.2 Hz), 112.5 (d, J = 26.2 Hz), 110.1 (d, J = 7.7 Hz), 109.9, 84.4, 71.2, 54.0, 44.9, 43.7, 38.8, 27.5. HRMS (ESI) calcd for C₃₇H₃₂FN₃NaO₅ (M+Na)⁺: 640.2224, found 640.2210. IR (KBr): 3065, 3000, 2998, 2897, 1767, 1736, 1615, 1494, 1392, 1120, 746 cm⁻¹.
(2'R,3S) and (2'S,3R)-tert-butyl 1,1''-dibenzyl-5-fluoro-2,2'',5''-trioxodispiro[indoline-3,2''-pyrrolidine-3',3''-indoline]-1''-carboxylate (7e). 70 mg (57%, 42:58 dr), red oil. Major product: \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.46 (d, \(J = 7.3\) Hz, 1H), 7.31-7.10 (m, 8H), 6.90-8.83 (m, 6H), 6.55 (d, \(J = 7.7\) Hz, 1H), 6.39 (dd, \(J = 8.4, 3.9\) Hz, 1H), 5.03 (d, \(J = 15.9\) Hz, 1H), 4.96 (d, \(J = 16.0\) Hz, 1H), 4.58 (d, \(J = 15.9\) Hz, 1H), 4.56 (d, \(J = 15.8\) Hz, 1H), 3.64 (d, \(J = 16.7\) Hz, 1H), 2.85 (d, \(J = 16.7\) Hz, 1H), 1.17 (s, 9H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 175.5, 174.3, 171.2, 159.2 (d, \(J = 241.3\) Hz), 147.8, 143.7, 139.38, 139.37, 134.6, 134.2, 129.9, 128.7, 127.64, 127.61, 127.1, 126.7, 126.5 (d, \(J = 8.3\) Hz), 125.4, 123.4, 123.1, 116.2 (d, \(J = 23.2\) Hz), 113.5 (d, \(J = 25.9\) Hz), 109.7. 84.0, 70.7, 52.4, 44.3, 43.7, 38.9, 27.5. HRMS (ESI) calcd for C\(_{37}\)H\(_{32}\)FN\(_3\)O\(_5\)Na (M+Na\(^+\)): 640.2224, found 640.2210. IR (KBr): 3038, 2997, 2890, 1760, 1740, 1625, 1490, 1389, 1116, 750 cm\(^{-1}\).

(2'R,3S) and (2'S,3R)-tert-butyl 1,1''-dibenzyl-4-chloro-2,2'',5''-trioxodispiro[indoline-3,2''-pyrrolidine-3',3''-indoline]-1''-carboxylate (7f). 88 mg (69%, <5:95 dr), white solid, mp: 182-185 \(^\circ\)C. \(^1\)H NMR (400 MHz, CDCl\(_3\)) \(\delta\) 7.49 (d, \(J = 7.5\) Hz, 1H), 7.21-7.09 (m, 8H), 7.01 (t, \(J = 7.6\) Hz, 1H), 6.96 (d, \(J = 8.2\) Hz, 1H), 6.86 (d, \(J = 7.0\) Hz, 4H), 6.60 (d, \(J = 7.8\) Hz, 1H), 6.49 (d, \(J = 7.8\) Hz, 1H), 4.73 (d, \(J = 15.6\) Hz, 1H), 4.66 (d, \(J = 15.5\) Hz, 1H), 4.40 (d, \(J = 15.6\) Hz, 1H), 4.31 (d, \(J = 15.5\) Hz, 1H), 3.49 (d, \(J = 17.1\) Hz, 1H), 3.12 (d, \(J = 17.2\) Hz, 1H), 1.19 (s, 9H). \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) \(\delta\) 174.3, 172.9, 171.4, 147.8, 143.8, 142.4, 135.0, 134.7, 132.4, 130.4, 129.7, 128.64, 128.60, 127.7, 127.5, 127.3, 127.1, 126.7, 126.2, 124.3, 123.6, 122.6, 109.0, 107.5, 84.0, 73.2, 52.4, 44.4, 44.1, 41.4, 27.4. HRMS (ESI) calcd for C\(_{37}\)H\(_{32}\)ClN\(_3\)O\(_5\)Na (M+Na\(^+\)): 656.1928, found 656.1922. IR (KBr): 3033, 2996, 2890, 1777, 1730, 1615, 1494, 1390, 1115, 748 cm\(^{-1}\).
6g. 119 mg (94%, 87:13). White solid, mp: 181-182 °C. $^1$H NMR (400 MHz, Chloroform-$d$) δ 7.38 (d, $J = 1.1$ Hz, 1H), 7.25-7.14 (m, 4H), 7.12-7.06 (m, 4H), 6.98 (t, $J = 7.5$ Hz, 2H), 6.71 (t, $J = 7.6$ Hz, 1H), 6.61 (d, $J = 7.9$ Hz, 1H), 6.48 (d, $J = 7.4$ Hz, 3H), 6.38 (d, $J = 8.4$ Hz, 1H), 5.22 (d, $J = 16.1$ Hz, 1H), 5.15 (d, $J = 15.6$ Hz, 1H), 4.53 (d, $J = 15.6$ Hz, 1H), 4.28 (d, $J = 16.1$ Hz, 1H), 3.94 (d, $J = 16.4$ Hz, 1H), 2.76 (d, $J = 16.4$ Hz, 1H), 1.05 (s, 9H). $^{13}$C NMR (101 MHz, Chloroform-$d$) δ 172.7, 171.99, 171.87, 147.5, 143.7, 140.9, 134.7, 133.8, 130.1, 129.8, 129.7, 128.6, 128.5, 128.3, 127.6, 127.5, 127.3, 125.98, 124.11, 124.10, 123.6, 122.0, 110.7, 109.9, 84.3, 71.1, 54.2, 44.7, 43.7, 38.7, 27.3. HRMS (ESI) calcd for C$_{37}$H$_{32}$ClN$_3$O$_5$NH$_4$ (M+NH$_4$)$^+$: 651.2374, found 651.2373. IR (KBr): 3048, 2998, 2890, 1798, 1748, 1610, 1499, 1392, 1130, 751 cm$^{-1}$.

6h. 112 mg (94%, 79:21). White solid, mp: 185-187°C. $^1$H NMR (400 MHz, Chloroform-$d$) δ 7.28-7.24 (m, 3H), 7.17-7.05 (m, 5H), 7.00-6.94 (m, 3H), 6.64 (t, $J = 7.6$ Hz, 1H), 6.58 (d, $J = 7.8$ Hz, 1H), 6.47 (d, $J = 7.5$ Hz, 2H), 6.40 (d, $J = 7.5$ Hz, 1H), 6.34 (d, $J = 8.0$ Hz, 1H), 5.19 (t, $J = 16.6$ Hz, 2H), 4.52 (d, $J = 15.6$ Hz, 1H), 4.27 (d, $J = 16.1$ Hz, 1H), 3.98 (d, $J = 16.3$ Hz, 1H), 2.74 (d, $J = 16.3$ Hz, 1H), 2.33 (s, 3H), 1.03 (s, 9H). $^{13}$C NMR (100 MHz, Chloroform-$d$) δ 173.1, 172.7, 172.3, 147.7, 143.9, 139.9, 134.9, 134.4, 132.5, 130.2, 129.8, 128.50, 128.46, 128.3, 127.7, 127.5, 127.1, 125.98, 124.4, 124.3, 123.9, 121.8, 109.7, 109.5, 84.0, 71.3, 54.2, 44.7, 43.6, 38.9, 27.3, 21.1. HRMS (ESI) calcd for C$_{38}$H$_{35}$N$_3$O$_5$NH$_4$ (M+NH$_4$)$^+$: 631.2920, found 631.2920. IR (KBr): 3022, 2990, 2892, 1770, 1741, 1619, 1489, 1392, 1120, 746 cm$^{-1}$. 
Procedure for the synthesis of 3a with chiral-phase-transfer catalysis.

\[
\begin{align*}
\text{OCH(CF}_3\text{)}_2 \\
\text{N} \\
\text{O} \\
\text{Bn} \\
\end{align*}
\]

\[
\begin{align*}
\text{OCH(CF}_3\text{)}_2 \\
\text{N} \\
\text{O} \\
\text{Bn} \\
\end{align*}
\]

To a 25mL flask was charged with an 1,1,1,3,3,3-hexafluoropropan-2-yl 2-(1-benzyl-2-oxoindolin-3-yl)acetate 1a (43 mg, 0.1 mmol), tert-butyl-benzylidene carbamate 2a’ (25 mg, 0.12 mmol), LiOH (6 mg, 0.5 mmol) and PTC-A4 (9 mg, 15 mol%). Then, 6 mL toluene and 2 ml H2O was added and the resulting mixture was stirred at room temperature. Upon completion of the reaction as monitored by TLC, the mixture was poured to 10 mL water and extracted by EtOAc (3 × 10 mL). The combined organic layers were washed with brine, dried over Na2SO4 and concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using hexane/ethyl acetate/triethylamine (v/v/v = 4/1/0.005) as the eluent to afford product 3a (54 mg, 93% yield, 90.5:9.5 er). HPLC DAICEL CHIRALCEL IF, n-hexane/2-propanol = 70/30, flow rate = 1.2 mL/min, λ = 254 nm, retention time: 17.53 min (minor), 20.96 min (major).

Procedure for the synthesis of 6a with chiral-phase-transfer catalysis.

To a 25 mL flask was charged with 1,1,1,3,3,3-hexafluoropropan-2-yl 2-(1-benzyl-2-oxoindolin-3-yl)acetate 3a (43 mg, 0.1 mmol), tert-butyl-(1-benzyl-2-oxoindolin-3-ylidene) carbamate 5a (40 mg, 0.12 mmol), LiOH (6 mg, 0.5 mmol) and PTC-A4 (9 mg, 15 mol%). Then, 6 mL toluene and 2 ml H2O was added and the resulting mixture was stirred at room temperature. Upon completion of the reaction as monitored by TLC, the mixture was poured to 10 mL water and extracted by EtOAc (3 × 10 mL). The combined organic layers were washed with brine, dried over Na2SO4 and concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using hexane/ethyl acetate/triethylamine (v/v/v = 4/1/0.005) as the eluent to afford product 6a (44 mg, 74% yield, 50:50 er).
Procedure for the deprotection of the products 3a and 6a.

To a 25ml flask was charged with 3a (93.6 mg, 0.2 mmol) and 10 mL CH₂Cl₂, then TFA (1 mL) was added. The mixture was stirred at room temperature. Upon completion of the reaction as monitored by TLC. The reaction was basified by the cautious addition of saturated aqueous sodium bicarbonate solution and the mixture was extracted by EtOAc (3×10 mL). The combined organic layers were washed with brine, dried over Na₂SO₄ and concentrated under reduced pressure to afford NMR pure product 8.

This procedure is also applicable to the synthesis of 9.

(2'S,3R) and (2'R,3S)-1-benzyl-2'-phenylspiro[indoline-3,3'-pyrrolidine]-2,5'-dione (8). 74 mg (99% yield), white solid, mp: 220-223 °C. ¹H NMR (300 MHz, CDCl₃) δ 7.57-7.44 (m, 1H), 7.32 (t, J = 7.3 Hz, 1H), 7.24-7.11 (m, 5H), 7.10-6.86 (m, 4H), 6.51-6.44 (m, 3H), 5.19 (s, 1H), 4.98 (d, J = 15.8 Hz, 1H), 4.16 (d, J = 15.8 Hz, 1H), 2.98 (d, J = 16.8 Hz, 1H), 2.90 (d, J = 16.9 Hz, 1H). ¹³C NMR (75 MHz, CDCl₃) δ 175.9, 175.2, 143.1, 135.0, 134.9, 129.1, 128.8, 128.6, 128.5, 127.2, 126.6, 126.5, 122.9, 122.8, 109.3, 66.5, 55.5, 43.5, 40.6. HRMS (ESI) calcd for C₂₄H₂₁N₂O₂(M+H)+: 369.1603, found 369.1595. IR (KBr): 3112, 3001, 2920, 1760, 1743, 1601, 1500, 1312, 1119, 750 cm⁻¹.

(2'S,3S) and (2'R,3R)-1,1''-dibenzyldispiro[indoline-3,2'-pyrrolidine-3',3''-indoline]-2,2'',5'-trione (9). 99 mg (99% yield), white solid, mp: 212-215 °C. ¹H NMR (300 MHz, DMSO) δ 8.77 (brs, 1H), 7.52 (d, J = 7.3 Hz, 1H), 7.33-7.04 (m, 9H), 7.00 (t, J = 7.3 Hz, 2H), 6.72 (d, J = 7.8 Hz, 1H), 6.62 (t, J = 7.1 Hz, 2H), 6.53 (d, J = 7.4 Hz, 2H), 6.41 (d, J = 7.4 Hz, 1H), 5.06 (d, J = 16.4 Hz, 1H), 4.94 (d, J = 16.0 Hz, 1H), 4.73 (d, J = 16.0 Hz, 1H), 4.49 (d, J = 16.4 Hz, 1H), 3.55 (d, J = 15.8 Hz, 1H),
2.51 (d, J = 15.6 Hz, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 176.8, 175.1, 172.7, 143.6, 142.1, 135.6, 135.2, 130.4, 129.6, 129.5, 128.5, 128.4, 127.33, 127.26, 126.9, 126.0, 125.3, 123.8, 123.0, 122.6, 121.7, 109.7, 109.6, 68.6, 57.3, 43.3, 42.6, 38.4. HRMS (ESI) calcd for C$_{32}$H$_{26}$N$_3$O$_3$(M+H)$^+$: 500.1974, found 500.1969. IR (KBr): 3030, 2999, 2898, 1769, 1740, 1615, 1494, 1401, 1129, 752 cm$^{-1}$.

References:


1d
3n
4n

\[
\text{O} \quad \text{Boc} \\
\text{N} \quad \text{Bn} \\
\]

\[
\text{O} \\
\text{Boc} \\
\text{N} \quad \text{Bn} \\
\]

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6c
7f
### HPLC spectra of 3a

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X-ray structure of 3a
X-ray structure of 6b