Supporting Information

AQUEOUS SYNTHESIS OF (R*, R*)-BIS (SPIROPYRAZOLONE)-CYCLOPROPANES THROUGH IODINE-PROMOTED CYCLIZATION OF ALDEHYDES AND PYRAZOLIN-5-ONES

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1. General Information

All reagents were obtained from commercial sources and used without further purification. NMR spectra were recorded on a 500 MHz NMR spectrometer (500 MHz for $^1$H NMR and 125 MHz for $^{13}$C NMR). $^1$H NMR chemical shifts were determined relative to internal TMS at δ 0.0 ppm. $^{13}$C NMR chemical shifts were determined relative to CDCl$_3$ at δ 77.16 ppm. Data for $^1$H NMR and $^{13}$C NMR are reported as follows: chemical shift (δ, ppm) and multiplicity (s = singlet, d = doublet, t = triplet and m = multiplet). All melting points were determined on a XT-4 binocular microscope melting point apparatus. High-resolution mass spectra (HRMS) were measured with ESI-TOF in the positive mode.

2. Procedure for the Synthesis of 3

In a 25 mL of glass tube, a mixture containing pyrazolone 1 (1.0 mmol), benzaldehyde 2 (0.5 mmol), I$_2$ (152.3 mg, 0.6 mmol), K$_2$CO$_3$ (69.0 mg, 0.5 mmol), TBAI (73.8 mg, 0.2 mmol), and deionized water (8 mL) was vigorously stirred under air atmosphere at room temperature for 5 hours. After completion of the reaction (monitored by TLC), the reaction mixture was washed with aqueous Na$_2$S$_2$O$_3$ (5 wt%). The resulted solid was filtered, washed with water followed by an ice-cold ethanol/water solution (v/v 1:2), and dried to afford the corresponding product bispyrazolone cyclopropane 3, which can be directly used for NMR analysis. Samples for melting point determination were obtained by recrystallization from ethanol.

3. Characterization Data for 3

(5R*,6R*)-4,10-Dimethyl-2,8,11-triphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3a). White solid, 94% yield, mp 166–168 °C (Lit. [1] 166–168 °C); $^1$H NMR (500 MHz, CDCl$_3$) δ 7.93 (d, $J = 8.0$ Hz, 2H), 7.88 (d, $J = 8.0$ Hz, 2H), 7.44 (t, $J = 7.9$ Hz, 2H), 7.42–7.35 (m, 5H), 7.25–7.17 (m, 4H), 4.45 (s, 1H), 2.53 (s, 3H), 2.08 (s, 3H); $^{13}$C NMR (125 MHz, CDCl$_3$) δ 167.8, 165.6, 156.1, 155.4, 138.0,
137.9, 130.0 (2C), 129.1 (2C), 129.0 (2C), 128.9, 128.7 (2C), 128.1, 125.7, 125.6, 119.1 (4C), 51.4, 50.4, 43.2, 20.4, 18.5.

(5R*,6R*)-4,10-Dimethyl-2,8-diphenyl-11-(p-tolyl)-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3b). Light yellow solid, 90% yield, mp 145–146 °C (Lit. [2] 146–147 °C); $^1$H NMR (500 MHz, CDCl$_3$) $\delta$ 7.93 (d, $J$ = 8.6 Hz, 2H), 7.89 (d, $J$ = 8.6 Hz, 2H), 7.43 (t, $J$ = 8.0 Hz, 2H), 7.39 (t, $J$ = 8.0 Hz, 2H), 7.25–7.19 (m, 2H), 7.17 (d, $J$ = 7.7 Hz, 2H), 7.07 (d, $J$ = 7.9 Hz, 2H), 4.41 (s, 1H), 2.52 (s, 3H), 2.36 (s, 3H), 2.09 (s, 3H);

$^{13}$C NMR (125 MHz, CDCl$_3$) $\delta$ 167.8, 165.7, 156.1, 155.5, 138.7, 138.0, 137.9, 129.9 (2C), 129.4 (2C), 129.1 (2C), 129.0 (2C), 125.6, 125.5, 124.9, 119.1 (2C), 119.0 (2C), 51.5, 50.4, 43.2, 21.4, 20.4, 18.5.

(5R*,6R*)-11-(4-Methoxyphenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3c). Yellow solid, 87% yield, mp 164–166 °C (Lit. [2] 164–166 °C); $^1$H NMR (500 MHz, CDCl$_3$) $\delta$ 7.92 (d, $J$ = 7.8 Hz, 2H), 7.89 (d, $J$ = 7.8 Hz, 2H), 7.43 (t, $J$ = 7.8 Hz, 2H), 7.40 (t, $J$ = 8.4 Hz, 2H), 7.24–7.17 (m, 2H), 7.11 (d, $J$ = 8.4 Hz, 2H), 6.89 (d, $J$ = 8.7 Hz, 2H), 4.39 (s, 1H), 3.80 (s, 3H), 2.52 (s, 3H), 2.09 (s, 3H); $^{13}$C NMR (125 MHz, CDCl$_3$) $\delta$ 167.8, 165.7, 159.8, 156.2, 155.4, 138.0, 137.9, 131.2 (2C), 129.1 (2C), 129.0 (2C), 125.6, 125.5, 119.8, 119.1 (4C), 114.1 (2C), 55.4, 51.6, 50.5, 42.8, 20.4, 18.5.

(5R*,6R*)-11-(4-Chlorophenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3d). Light yellow solid, 96% yield, mp 143–144 °C; $^1$H NMR (500 MHz, CDCl$_3$) $\delta$ 7.91 (d, $J$ = 8.2 Hz, 2H), 7.87 (d, $J$ = 8.2 Hz, 2H), 7.44 (t, $J$ = 7.9 Hz, 2H), 7.40 (t, $J$ = 8.2 Hz, 2H), 7.36 (d, $J$ = 8.2 Hz, 2H), 7.26–7.19 (m, 2H), 7.14 (d, $J$ = 8.1 Hz, 2H), 4.37 (s, 1H), 2.52 (s, 3H), 2.09 (s, 3H);
(5R*,6R*)-4,10-Dimethyl-2,8-diphenyl-11-(4-(trifluoromethyl)phenyl)-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3e). White solid, 95% yield, mp 154–156 °C (Lit. [3] 154–156 °C); 1H NMR (500 MHz, CDCl₃) δ 7.93 (d, J = 8.1 Hz, 2H), 7.86 (d, J = 8.1 Hz, 2H), 7.64 (d, J = 8.0 Hz, 2H), 7.44 (t, J = 8.0 Hz, 2H), 7.41 (t, J = 8.0 Hz, 2H), 7.33 (d, J = 8.0 Hz, 2H), 7.26–7.19 (m, 2H), 4.42 (s, 1H), 2.53 (s, 3H), 2.08 (s, 3H); 13C NMR (125 MHz, CDCl₃) δ 167.4, 165.4, 155.8, 154.7, 137.8, 137.7, 132.3, 131.1 (q, J = 32.6 Hz), 130.5 (2C), 129.2 (2C), 129.1 (2C), 125.9, 125.8, 125.7 (q, J = 3.7 Hz, 2C), 123.8 (q, J = 272.3 Hz), 119.1 (4C), 51.0, 49.9, 42.2, 20.4, 18.5.

(5R*,6R*)-4,10-Dimethyl-2,8-diphenyl-11-(m-tolyl)-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3f). Light yellow solid, 88% yield, mp 145–147 °C; 1H NMR (500 MHz, CDCl₃) δ 7.94 (d, J = 7.8 Hz, 2H), 7.89 (d, J = 7.9 Hz, 2H), 7.43 (t, J = 8.0 Hz, 2H), 7.39 (t, J = 8.0 Hz, 2H), 7.27–7.15 (m, 4H), 6.99 (s, 1H), 6.98 (d, J = 6.9 Hz, 1H), 4.41 (s, 1H), 2.52 (s, 3H), 2.33 (s, 3H), 2.11 (s, 3H); 13C NMR (125 MHz, CDCl₃) δ 167.8, 165.6, 156.0, 155.4, 138.4, 138.0, 137.9, 130.5, 129.6, 129.1 (2C), 129.0 (2C), 128.6, 128.0, 127.0, 125.6, 125.5, 119.02 (2C), 119.00 (2C), 51.3, 50.4, 43.3, 21.5, 20.4, 18.4; HRMS (ESI-TOF) calcd for C₂₈H₂₅N₄O₂ [M + H]⁺ 449.1978, found 449.2001.

(5R*,6R*)-11-(3-Methoxyphenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3g). Yellow solid, 86% yield, mp 125–127 °C (Lit. [4] 126–127 °C); 1H NMR (500 MHz, CDCl₃) δ 7.93 (d, J = 8.1 Hz, 2H), 7.88
(d, J = 8.1 Hz, 2H), 7.43 (t, J = 7.9 Hz, 2H), 7.39 (t, J = 7.9 Hz, 2H), 7.28 (t, J = 8.0 Hz, 1H), 7.25–7.17 (m, 2H), 6.90 (dd, J = 8.3, 2.5 Hz, 1H), 6.78 (d, J = 7.6 Hz, 1H), 6.72 (s, 1H), 4.41 (s, 1H), 3.77 (s, 3H), 2.52 (s, 3H), 2.13 (s, 3H); 13C NMR (125 MHz, CDCl3) δ 167.8, 165.5, 159.7, 156.0, 155.3, 138.0, 137.9, 129.8, 129.5, 129.1 (2C), 129.0 (2C), 125.7, 125.5, 122.2, 119.1 (4C), 115.8, 114.1, 55.5, 51.4, 50.4, 43.1, 20.4, 18.4.

(5R*,6R*)-11-(3-Chlorophenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3h). Light yellow solid, 92% yield, mp 157–158 °C (Lit. [4] 158–159 °C); 1H NMR (500 MHz, CDCl3) δ 7.92 (d, J = 8.1 Hz, 2H), 7.87 (d, J = 8.2 Hz, 2H), 7.43 (t, J = 7.9 Hz, 2H), 7.39 (t, J = 7.9 Hz, 2H), 7.35 (d, J = 8.0 Hz, 1H), 7.29 (t, J = 7.8 Hz, 1H), 7.24–7.17 (m, 3H), 7.07 (d, J = 7.6 Hz, 1H), 4.36 (s, 1H), 2.50 (s, 3H), 2.11 (s, 3H); 13C NMR (125 MHz, CDCl3) δ 167.4, 165.3, 155.7, 154.8, 137.8, 137.7, 134.5, 130.1, 130.0, 129.9, 129.1 (2C), 129.04, 129.01 (2C), 128.2, 125.7, 125.6, 119.0 (4C), 50.9, 50.0, 42.2, 20.4, 18.4.

(5R*,6R*)-11-(3-Bromophenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3i). Light yellow solid, 90% yield, mp 152–153 °C (Lit. [2] 154–155 °C); 1H NMR (500 MHz, CDCl3) δ 7.92 (d, J = 8.2 Hz, 2H), 7.87 (d, J = 8.2 Hz, 2H), 7.51 (d, J = 8.0 Hz, 1H), 7.44 (t, J = 8.0 Hz, 2H), 7.40 (t, J = 8.0 Hz, 2H), 7.35 (s, 1H), 7.26–7.19 (m, 3H), 7.13 (d, J = 7.7 Hz, 1H), 4.38 (s, 1H), 2.51 (s, 3H), 2.12 (s, 3H); 13C NMR (125 MHz, CDCl3) δ 167.5, 165.3, 155.8, 154.8, 137.8, 137.7, 132.9, 132.0, 130.4, 130.2, 129.1 (2C), 129.0 (2C), 128.7, 125.8, 125.7, 122.6, 119.1 (4C), 50.9, 50.0, 42.1, 20.4, 18.5.

(5R*,6R*)-4,10-Dimethyl-11-(3-nitrophenyl)-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3j). Yellow solid, 93% yield, mp 183–185 °C (Lit. [3] 183–185 °C); 1H NMR (500 MHz, CDCl3) δ 8.25–8.21 (m, 1H), 8.08 (s, 1H), 7.94–7.90 (m, 2H), 7.85–7.81 (m, 2H), 7.58–7.52 (m, 2H), 7.44 (t, J = 8.0 Hz, 2H),
7.39 (t, J = 8.0 Hz, 2H), 7.26–7.19 (m, 2H), 4.43 (s, 1H), 2.52 (s, 3H), 2.07 (s, 3H); ^1^C NMR (125 MHz, CDCl$_3$) δ 167.1, 165.2, 155.6, 154.1, 148.2, 137.6, 136.1, 130.5, 129.7, 129.1 (2C), 129.0 (2C), 125.9, 125.8, 125.1, 123.8, 119.1 (2C), 119.0 (2C), 50.7, 49.7, 41.6, 20.4, 18.4.

$(5^R,6^R)$-4,10-Dimethyl-2,8-diphenyl-11-(o-tolyl)-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3k). White solid, 87% yield, mp 176–178 °C (Lit. [1] 177–178 °C); ^1^H NMR (500 MHz, CDCl$_3$) δ 7.93 (d, J = 8.2 Hz, 2H), 7.87 (d, J = 8.2 Hz, 2H), 7.43 (t, J = 7.8 Hz, 2H), 7.39 (t, J = 7.8 Hz, 2H), 7.30 (t, J = 7.4 Hz, 1H), 7.25–7.17 (m, 4H), 7.12 (d, J = 7.6 Hz, 1H), 4.25 (s, 1H), 2.55 (s, 3H), 2.09 (s, 6H); ^1^C NMR (125 MHz, CDCl$_3$) δ 167.7, 165.7, 156.0, 155.7, 138.0, 137.9, 137.6, 130.7, 130.4, 129.10 (2C), 129.06, 129.0 (2C), 126.7, 125.9, 125.7, 125.6, 119.15 (2C), 119.13 (2C), 51.5, 50.7, 42.8, 20.2, 19.5, 18.4.

$(5^R,6^R)$-11-(2-Chlorophenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3l). Light yellow solid, 90% yield, mp 169–171 °C (Lit. [4] 168–170 °C); ^1^H NMR (500 MHz, CDCl$_3$) δ 7.93 (d, J = 8.0 Hz, 2H), 7.83 (d, J = 8.0 Hz, 2H), 7.47–7.42 (m, 3H), 7.39 (t, J = 7.9 Hz, 2H), 7.35 (t, J = 7.6 Hz, 1H), 7.30 (t, J = 7.4 Hz, 1H), 7.26–7.18 (m, 3H), 4.24 (s, 1H), 2.53 (s, 3H), 2.14 (s, 3H); ^1^C NMR (125 MHz, CDCl$_3$) δ 167.5, 165.7, 156.0, 155.7, 155.3, 137.8, 135.3, 131.8, 130.3, 129.9, 129.1 (2C), 129.0 (2C), 126.8, 126.6, 125.7, 125.6, 119.3 (2C), 119.1 (2C), 50.9, 50.5, 41.8, 20.3, 18.4.

$(5^R,6^R)$-11-(2-Bromophenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3m). Light yellow solid, 89% yield, mp 154–155 °C (Lit. [4] 154–155 °C); ^1^H NMR (500 MHz, CDCl$_3$) δ 7.95–7.92 (m, 2H), 7.85–7.82 (m, 2H), 7.62 (dd, J = 7.9, 1.0 Hz, 1H), 7.46–7.42 (m, 2H), 7.41–7.37 (m, 2H), 7.36–7.32 (m, 1H), 7.29–7.25 (m, 1H), 7.24–7.18 (m, 3H), 4.22 (s, 1H), 2.54 (s, 3H), 2.15 (s, 3H); ^1^C NMR (125 MHz, CDCl$_3$) δ 167.5, 165.3, 155.8, 154.8, 137.8,
(5R*,6R*)-11-(3,4-Dimethylphenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadi-
spiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3n). Light yellow solid, 86% yield, mp
176–178 °C; 1H NMR (500 MHz, CDCl3) δ 7.93 (d, J = 7.8 Hz, 2H), 7.89 (d, J = 7.8
Hz, 2H), 7.42 (t, J = 8.0 Hz, 2H), 7.39 (t, J = 8.0 Hz, 2H), 7.23–7.16 (m, 2H), 7.12 (d,
J = 7.7 Hz, 1H), 6.93 (s, 1H), 6.91 (d, J = 7.7 Hz, 1H), 4.39 (s, 1H), 2.51 (s, 3H), 2.26
(s, 3H), 2.24 (s, 3H), 2.12 (s, 3H); 13C NMR (125 MHz, CDCl3) δ 167.9, 165.6, 156.1,
155.5, 138.1, 137.9, 137.3, 137.0, 131.0, 129.9, 129.1 (2C), 129.0 (2C), 127.3, 125.6,
125.4, 125.3, 119.1 (2C), 119.0 (2C), 51.4, 50.5, 43.3, 20.4, 19.8, 19.7, 18.4; HRMS
(ESI-TOF) calcd for C29H27N4O2 [M + H]+ 463.2134, found 463.2128.

(5R*,6R*)-11-(3,4-Dichlorophenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadi-
spiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3o). Light yellow solid, 94% yield, mp
156–157 °C; 1H NMR (500 MHz, CDCl3) δ 7.93–7.90 (m, 2H), 7.88–7.84 (m, 2H),
7.46–7.38 (m, 5H), 7.31–7.29 (m, 1H), 7.25–7.19 (m, 2H), 7.05–7.02 (m, 1H), 4.31 (s,
1H), 2.49 (s, 3H), 2.12 (s, 3H); 13C NMR (125 MHz, CDCl3) δ 167.3, 165.2, 155.6,
154.4, 137.8, 137.7, 133.2, 132.9, 131.9, 130.7, 129.3, 129.12 (2C), 129.06 (2C),
128.5, 125.8, 125.7, 119.0 (4C), 50.8, 49.9, 41.5, 20.4, 18.4; HRMS (ESI-TOF) calcd
for C27H27N4Cl2O2 [M + H]+ 503.1042, found 503.1053.

(5R*,6R*)-11-(3,5-Dimethylphenyl)-4,10-dimethyl-2,8-diphenyl-2,3,8,9-tetraazadi-
spiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3p). White solid, 91% yield, mp 142–144
°C; 1H NMR (500 MHz, CDCl3) δ 7.94 (d, J = 8.2 Hz, 2H), 7.89 (d, J = 8.2 Hz, 2H),
7.43 (t, J = 7.9 Hz, 2H), 7.39 (t, J = 8.0 Hz, 2H), 7.24–7.17 (m, 2H), 6.99 (s, 1H),
6.79 (s, 2H), 4.38 (s, 1H), 2.51 (s, 3H), 2.29 (s, 6H), 2.13 (s, 3H); 13C NMR (125
MHz, CDCl$_3$) δ 167.9, 165.6, 156.1, 155.5, 138.3 (2C), 138.1, 137.9, 130.5, 129.1 (2C), 129.0 (2C), 127.9, 127.6 (2C), 125.6, 125.4, 119.05 (2C), 119.01 (2C), 51.4, 50.5, 43.4, 21.4 (2C), 20.4, 18.4; HRMS (ESI-TOF) calcd for C$_{29}$H$_{27}$N$_4$O$_2$ [M + H]$^+$ 463.2134, found 463.2158.

(5R*,6R*)-4,10-Dimethyl-11-(naphthalen-2-yl)-2,8-diphenyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3q). White solid, 76% yield, mp 160–162 °C; $^1$H NMR (500 MHz, CDCl$_3$) δ 7.96 (d, $J = 7.8$ Hz, 2H), 7.90 (d, $J = 7.8$ Hz, 2H), 7.83 (d, $J = 8.6$ Hz, 2H), 7.80–7.77 (m, 1H), 7.67 (s, 1H), 7.52–7.47 (m, 2H), 7.45 (t, $J = 8.0$ Hz, 2H), 7.39 (t, $J = 8.0$ Hz, 2H), 7.23 (t, $J = 7.0$ Hz, 2H), 7.19 (t, $J = 7.4$ Hz, 1H), 4.58 (s, 1H), 2.56 (s, 3H), 2.07 (s, 3H); $^{13}$C NMR (125 MHz, CDCl$_3$) δ 167.8, 165.6, 156.0, 155.3, 138.0, 137.9, 133.2, 133.0, 129.4, 129.1 (2C), 129.0 (2C), 128.6, 128.0, 127.9, 127.1, 126.8, 126.7, 125.7, 125.5, 125.4, 119.1 (2C), 119.0 (2C), 51.4, 50.4, 43.4, 20.4, 18.5; HRMS (ESI-TOF) calcd for C$_{31}$H$_{25}$N$_4$O$_2$ [M + H]$^+$ 485.1978, found 485.1979.

(5R*,6R*)-4,10-Dimethyl-11-phenyl-2,8-di-p-tolyl-2,3,8,9-tetraazadispiro[4.0.4.1]undeca-3,9-diene-1,7-dione (3r). White solid, 89% yield, mp 141–142 °C; $^1$H NMR (500 MHz, CDCl$_3$) δ 7.79 (d, $J = 8.5$ Hz, 2H), 7.75 (d, $J = 8.5$ Hz, 2H), 7.37–7.33 (m, 3H), 7.22 (d, $J = 8.3$ Hz, 2H), 7.20–7.16 (m, 4H), 4.41 (s, 1H), 2.51 (s, 3H), 2.35 (s, 3H), 2.33 (s, 3H), 2.06 (s, 3H); $^{13}$C NMR (125 MHz, CDCl$_3$) δ 167.6, 165.4, 155.9, 155.2, 135.5, 135.4, 135.3, 135.2, 130.0 (2C), 129.6 (2C), 129.5 (2C), 128.7, 128.6 (2C), 128.2, 119.1 (4C), 51.3, 50.2, 43.1, 21.09, 21.06, 20.3, 18.4; HRMS (ESI-TOF) calcd for C$_{29}$H$_{27}$N$_4$O$_2$ [M + H]$^+$ 463.2134, found 463.2110.
4. Copies of NMR Spectra for 3

Figure S1. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3a

Figure S2. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3a
Figure S3. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3b

Figure S4. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3b
Figure S5. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3c

Figure S6. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3c
Figure S7. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3d

Figure S8. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3d
Figure S9. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3e

Figure S10. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3e
Figure S11. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3f

Figure S12. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3f
Figure S13. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3g

Figure S14. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3g
Figure S15. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3h

Figure S16. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3h
Figure S17. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3i

Figure S18. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3i
Figure S19. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3j

Figure S20. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3j
Figure S21. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3k

Figure S22. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3k
Figure S23. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3l

Figure S24. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3l
Figure S25. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3m

Figure S26. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3m
Figure S27. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3n

Figure S28. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3n
Figure S29. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3o

Figure S30. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3o
Figure S31. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3p

Figure S32. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3p
Figure S33. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3q

Figure S34. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3q
Figure S35. $^1$H NMR (500 MHz, CDCl$_3$) of compound 3r

Figure S36. $^{13}$C NMR (125 MHz, CDCl$_3$) of compound 3r
5. References


