Supporting Information

One Pot Highly Efficient Synthesis of Substituted Pyrroles and N-Bridgehead Pyrroles
by Zinc-Catalyzed Multicomponent Reaction

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General methods: Propargylic acetates 1 and enoxysilanes 2 were prepared according to published procedures. All other compounds are commercially available and were used without further purification. Infrared spectra were recorded on a Nicolet AVATAR FTIR360 spectrometer. NMR spectra were recorded on a Bruker AVANCE DPX-400 instrument at 400 MHz (1H) or 100 MHz (13C). The chemical shift values (δ) are given in parts per million (ppm) and are referred to the residual peak of the deuterated solvent (CDCl3). MS measurements were performed on Bruker Reflex III mass spectrometer. Elemental analyses were performed with a Perkin–Elmer 2400 microanalyser. Flash chromatography was performed with QingDao silica gel (300–400 mesh).

General Procedure for the Synthesis of Substituted Pyrroles (5aa-5ja, 6aa)

To a 10-mL flask, propargylic acetates 1 (0.5 mmol), enoxysilanes 2 (1.0 mmol), chlorobenzene (2.0 mL) and ZnCl2 (0.05 mmol) were successively added. The reaction was allowed to stir at 75 °C for 0.3 h, followed by the addition of primary amines 3 (1.0 mmol). The reaction mixture was heated to reflux temperature for an additional 1.5-12 h until completion by TLC. Upon cooling to room temperature, the reaction mixture was then quenched with 1M HCl (2 mL), the organic and aqueous layers were separated, and the aqueous layer was extracted with Et2O (3×5 mL). The combined organic layers were dried over MgSO4 and filtered. The filtrate was concentrated in vacuo, and then the residue was purified by silica gel column chromatography (EtOAc/hexane = 1/100) to afford corresponding substituted pyrroles.

2-Methyl-1,3,5-triphenyl-1H-pyrrole (5aa): A white solid, m.p. 158-160 °C; Yield: 83 % (0.128 g); 1H NMR (400 MHz, CDCl3): δ = 7.50-7.53 (m, 2H), 7.34-7.43 (m, 5H), 7.21-7.27 (m, 3H), 7.09-7.17 (m, 5H), 6.57 (s, 1H), 2.25 (s, 3H) ppm; 13C NMR (100 MHz, CDCl3): δ = 139.3, 137.0, 134.0, 133.3, 129.2, 128.8, 128.5, 128.2, 128.1, 128.0, 127.7, 126.0, 125.6, 122.9, 109.4, 12.6 ppm; IR (film): 1489, 1595, 3023 cm⁻¹; MS (ESI): m/z (%): 310 (100) [M + H⁺]; element analysis calcd (%) for C23H19N: C 89.28, H 6.19, N 4.53; found: C 89.39, H 6.04, N 4.56.

2-Methyl-1,3-diphenyl-4,5,6,7-tetrahydro-1H-indole (5ab or 5bb): A yellow oil; Yield: 78 % (0.112 g) or 73 % (0.104 g); 1H NMR (400 MHz, CDCl3): δ = 7.44-7.48 (m, 2H), 7.36-7.39 (m, 5H), 7.27-7.30 (m, 3H), 7.20-7.24 (m, 1H), 2.60 (t, J = 5.6 Hz, 2H), 2.39 (t, J = 6.0 Hz, 2H), 2.12 (s, 3H), 1.75-1.81 (m, 4H) ppm; 13C NMR (100 MHz, CDCl3): δ = 138.7,
136.7, 129.5, 129.1, 128.2, 128.0, 127.5, 125.3, 124.9, 120.4, 116.0, 24.0, 23.6, 23.0, 22.9, 11.7 ppm; IR (film): 1497, 1599, 3038 cm\(^{-1}\); MS (ESI): m/z (%): 288 (100) \([M + H]^+\); elemental analysis calcd (%) for C\(_{21}\)H\(_{21}\)N: C 87.76, H 7.36, N 4.87; found: C 87.86, H 7.28, N 4.80.

Data are in accordance with previously reported results.\(^1\)

**2-Methyl-3,5-diphenyl-1-p-tolyl-1H-pyrrole(5ac):** A yellow oil; Yield: 84 % (0.136 g); \(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta = 7.53\) (d, \(J = 7.2\) Hz, 2H), 7.40-7.44 (m, 2H), 7.11-7.27 (m, 10H), 6.58 (s, 1H), 2.40 (s, 3H), 2.26 (s, 3H) ppm; \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta = 137.5, 137.1, 136.8, 134.0, 133.4, 129.8, 128.5(2), 128.2, 128.1, 128.0, 125.9, 125.5, 122.7, 109.2, 21.3, 12.5 ppm; IR (film): 1516, 1602, 3027 cm\(^{-1}\); MS (ESI): m/z (%): 324 (100) \([M + H]^+\); elemental analysis calcd (%) for C\(_{24}\)H\(_{21}\)N: C 89.12, H 6.54, N 4.33; found: C 89.26, H 6.48, N 4.37.

**1-(4-Chlorophenyl)-2-methyl-3,5-diphenyl-1H-pyrrole(5ad):** A yellow solid, m.p. 106-107 °C; Yield: 81 % (0.139 g); \(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta = 7.48-7.50\) (m, 2H), 7.38-7.42 (m, 2H), 7.32-7.36 (m, 2H), 7.22-7.26 (m, 1H), 7.08-7.20 (m, 7H), 6.55 (s, 1H), 2.23 (s, 3H) ppm; \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta = 138.0, 136.8, 134.1, 133.5, 133.1, 130.0, 129.4, 128.6, 128.3, 128.2, 128.1, 127.9, 126.3, 125.8, 123.3, 109.8, 12.5 ppm; IR (film): 1493, 1606, 3027 cm\(^{-1}\); MS (ESI): m/z (%): 344 (100) and 346(29) \([M + H]^+\); elemental analysis calcd (%) for C\(_{23}\)H\(_{18}\)ClN: C 80.34, H 5.28, N 4.07; found: C 80.26, H 5.35, N 4.06.

**2-Methyl-1-octyl-3,5-diphenyl-1H-pyrrole(5ae):** A yellow oil; Yield: 80 % (0.138 g); \(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta = 7.33-7.44\) (m, 8H), 7.27-7.31 (m, 1H), 7.16-7.21 (m, 1H), 6.29 (s, 1H), 3.88 (t, \(J = 8.0\) Hz, 2H), 2.42 (s, 3H), 1.59-1.62 (m, 2H), 1.18-1.29 (m, 10H), 0.86 (t, \(J = 7.2\) Hz, 3H) ppm; \(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta = 137.5, 134.2, 133.7, 129.2, 128.5, 128.3, 128.1, 127.9, 126.3, 125.8, 123.3, 109.8, 12.5 ppm; IR (film): 1493, 1606, 3027 cm\(^{-1}\); MS (ESI): m/z (%): 344 (100) \([M + H]^+\); elemental analysis calcd (%) for C\(_{27}\)H\(_{29}\)N: C 87.86, H 7.28, N 4.80; found: C 87.86, H 7.28, N 4.80.
2,5-Dimethyl-1,3-diphenyl-1H-pyrrole(5af or 5ba): A yellow oil; Yield: 86 % (0.106 g) or 77 % (0.095 g); $^1$H NMR (400 MHz, CDCl$_3$): $\delta = 7.34-7.50$ (m, 7H), 7.25-7.28 (m, 2H), 7.17-7.22 (m, 1H), 6.15 (d, $J = 0.8$ Hz, 1H), 2.15 (s, 3H), 2.07 (s, 3H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta = 139.0, 137.5, 129.3, 128.8, 128.4, 128.0, 125.3, 125.1, 121.2, 106.7, 13.0, 12.4$ ppm; IR (film): 1502, 1597, 3027 cm$^{-1}$; MS (ESI): m/z (%): 248 (100) [M + H$^+$]; elemental analysis calcd (%) for C$_{18}$H$_{17}$N: C 87.41, H 6.93, N 5.66; found: C 87.36, H 7.02, N 5.55.

Data are in accordance with previously reported results.$^1$

1-benzyl-2-methyl-3-phenyl-4,5,6,7-tetrahydro-1H-indole(5bc): A yellow oil; Yield: 72 % (0.108 g); $^1$H NMR (400 MHz, CDCl$_3$): $\delta = 7.29-7.36$ (m, 6H), 7.17-7.25 (m, 2H), 6.97-6.99 (m, 2H), 5.02 (s, 2H), 2.55 (t, $J = 6.0$ Hz, 2H), 2.49 (t, $J = 6.0$ Hz, 2H), 2.20 (s, 3H), 1.80-1.86 (m, 2H), 1.70-1.75 (m, 2H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta = 138.8, 137.1, 129.6, 128.8, 128.2, 127.2, 127.1, 126.1, 125.1, 124.1, 120.1, 115.6, 46.8, 24.1, 23.6, 22.9, 22.2, 10.7$ ppm; IR (film): 1491, 1600, 3028 cm$^{-1}$; MS (ESI): m/z (%): 302 (100) [M + H$^+$]; elemental analysis calcd (%) for C$_{22}$H$_{23}$N: C 87.66, H 7.69, N 4.65; found: C 87.59, H 7.74, N 4.59.

Data are in accordance with previously reported results.$^2$

2-Pentyl-3,5-diphenyl-1-$p$-tolyl-1H-pyrrole(5ca): A yellow solid, m.p. 85-86 $^\circ$C; Yield: 86 % (0.163 g); $^1$H NMR (400 MHz, CDCl$_3$): $\delta = 7.51$ (dd, $J = 7.6$ and 1.2 Hz, 2H), 7.39-7.43 (m, 2H), 7.23-7.27 (m, 1H), 7.08-7.20 (m, 9H), 6.55 (s, 1H), 2.66 (t, $J = 8.0$ Hz, 2H), 2.40 (s, 3H), 1.26-1.33 (m, 2H), 1.06-1.12 (m, 4H), 0.72 (t, $J = 7.2$ Hz, 3H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta = 137.7, 137.4, 136.8, 134.0, 133.4, 133.2, 129.7, 128.8, 128.5, 128.2, 128.1, 128.0, 125.9, 125.6, 122.6, 109.5, 31.6, 29.7, 25.3, 22.1, 21.3, 13.9$ ppm; IR (film): 1510, 1605, 3027 cm$^{-1}$; MS (ESI): m/z (%): 380 (100) [M+
H⁺]; elemental analysis calcd (%) for C_{28}H_{29}N: C 88.61, H 7.70, N 3.69; found: C 88.55, H 7.73, N 3.66.

1-Octyl-2-pentyl-3,5-diphenyl-1H-pyrrole(5cb): A yellow oil; Yield: 80 % (0.160 g); ¹H NMR (400 MHz, CDCl₃): \( \delta = 7.29-7.46 \) (m, 9H), 7.19-7.24 (m, 1H), 6.29 (s, 1H), 3.93 (t, \( J = 8.0 \) Hz, 2H), 2.76 (t, \( J = 8.0 \) Hz, 2H), 1.63-1.71 (m, 2H), 1.51-1.55 (m, 2H), 1.34-1.41 (m, 4H), 1.17-1.28 (m, 1OH), 0.92 (t, \( J = 6.8 \) Hz, 3H), 0.87 (t, \( J = 6.8 \) Hz, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): \( \delta = 137.7, 134.4, 133.5, 131.2, 129.1, 128.5, 128.4, 128.1, 126.9, 125.3, 122.0, 109.2, 44.5, 32.1, 31.8, 31.5, 30.7, 29.2, 29.1, 26.8, 25.4, 22.7, 22.5, 14.2(2) \) ppm; IR (film): 1466, 1600, 3028 cm⁻¹; MS (ESI): m/z (%): 402 (100) \([M + H⁺]\); elemental analysis calcd (%) for C_{29}H_{39}N: C 86.72, H 9.79, N 3.49; found: C 86.65, H 9.83, N 3.50.

1-Benzyl-2-pentyl-3,5-diphenyl-1H-pyrrole(5cc): A yellow oil; Yield: 83 % (0.157 g); ¹H NMR (400 MHz, CDCl₃): \( \delta = 7.48-7.50 \) (m, 2H), 7.23-7.39 (m, 11H), 6.93-6.95 (m, 2H), 6.44 (s, 1H), 5.22 (s, 2H), 2.61 (t, \( J = 8.0 \) Hz, 2H), 1.50-1.56 (m, 2H), 1.23-1.27 (m, 4H), 0.82 (t, \( J = 6.8 \) Hz, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): \( \delta = 139.4, 137.5, 134.3, 133.7, 131.7, 129.0, 128.8, 128.5, 128.0, 127.2, 127.0, 125.8, 125.4, 122.6, 109.3, 47.9, 32.0, 30.5, 25.5, 22.4, 14.1 \) ppm; IR (film): 1497, 1600, 3028 cm⁻¹; MS (ESI): m/z (%): 380 (100) \([M + H⁺]\); elemental analysis calcd (%) for C_{28}H_{29}N: C 86.72, H 9.79, N 3.49; found: C 86.65, H 9.83, N 3.71.

1-(2-Bromophenyl)-5-methyl-2-pentyl-3-phenyl-1H-pyrrole(5cd): A yellow oil; Yield: 82 % (0.156 g); ¹H NMR (400 MHz, CDCl₃): \( \delta = 7.74 \) (dd, \( J = 8.0 \) and 1.2 Hz, 1H), 7.42-7.46 (m, 3H), 7.30-7.38 (m, 4H), 7.17-7.21 (m, 1H), 6.16 (d, \( J = 0.8 \) Hz, 1H), 2.50-2.58 (m, 1H), 2.32-2.40 (m, 1H), 1.98 (d, \( J = 0.4 \) Hz, 3H), 1.29-1.37 (m, 2H), 1.04-1.10 (m, 4H), 0.71 (t, \( J = 6.8 \) Hz, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): \( \delta = 138.6, 137.6, 133.5, 131.2, 130.0, 128.5, 128.4, 128.2, 127.9, 125.2, 124.9, 121.4, 106.9, 31.6, 29.8, 25.5, 22.1, 13.9, 12.6 \) ppm; IR (film): 1482, 1602, 3028 cm⁻¹; MS (ESI): m/z (%): 382 (100) and 384 (100) \([M + H⁺]\); elemental analysis calcd (%) for C_{22}H_{24}BrN: C 69.11, H 6.33, N 3.66; found: C 69.23, H 6.30, N 3.62.
2-Benzyl-1,3,5-triphenyl-1H-pyrrole (5da): A yellow solid, m.p. 146-147 °C; Yield: 87 % (0.167 g); $^1$H NMR (400 MHz, CDCl$_3$): δ = 7.50-7.52 (m, 2H), 7.33-7.37 (m, 2H), 7.07-7.24 (m, 12H), 6.95-6.97 (m, 2H), 6.88-6.90 (m, 2H), 6.66 (s, 1H), 4.04 (s, 2H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): δ = 140.5, 139.1, 136.9, 134.8, 133.2, 130.2, 129.0, 128.8, 128.7, 128.3, 128.2, 128.1, 128.0, 127.7, 126.1, 125.9(3), 124.4, 109.6, 31.5 ppm; IR (film): 1493, 1599, 3024 cm$^{-1}$; MS (ESI): m/z (%): 386 (100) [M + H$^+$]; elemental analysis calcd (%) for C$_{29}$H$_{23}$N: C 90.35, H 6.01, N 3.63; found: C 90.38, H 6.00, N 3.63. Data are in accordance with previously reported results.$^3$

2-Benzyl-5-methyl-1,3-diphenyl-1H-pyrrole (5db): A yellow solid, m.p. 120-121 °C; Yield: 91 % (0.146 g); $^1$H NMR (400 MHz, CDCl$_3$): δ = 7.44-7.47 (m, 2H), 7.23-7.33 (m, 5H), 7.15-7.19 (m, 1H), 7.06-7.12 (m, 3H), 6.96-6.99 (m, 2H), 6.81-6.83 (m, 2H), 6.23 (d, $J = 0.8$ Hz, 1H), 3.95 (s, 2H), 2.03 (d, $J = 0.8$ Hz, 3H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): δ = 140.6, 138.6, 137.3, 129.6, 128.8(2), 128.5, 128.2(2), 127.9, 127.8, 127.4, 125.7, 125.5, 122.9, 106.8, 31.4, 12.9 ppm; IR (film): 1493, 1599, 3027 cm$^{-1}$; MS (ESI): m/z (%): 324 (100) [M + H$^+$]; elemental analysis calcd (%) for C$_{24}$H$_{21}$N: C 89.12, H 6.54, N 4.33; found: C 89.23, H 6.46, N 4.30.

2-Benzyl-1,3-diphenyl-4,5,6,7-tetrahydro-1H-indole (5dc): A yellow oil; Yield: 86 % (0.156 g); $^1$H NMR (400 MHz, CDCl$_3$): δ = 7.38-7.41 (m, 2H), 7.31-7.35 (m, 2H), 7.17-7.26 (m, 4H), 7.00-7.05 (m, 5H), 6.71-6.74 (m, 2H), 3.93 (s, 2H), 2.60 (d, $J = 5.2$ Hz, 2H), 2.30 (d, $J = 5.6$ Hz, 2H), 1.75-1.79 (m, 4H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): δ = 140.8, 138.6, 136.8, 129.5, 128.8, 128.7, 128.6, 128.3, 128.2, 128.0, 127.5, 127.2, 125.6, 125.5, 122.0, 116.0, 30.9, 24.0, 23.5, 22.8 ppm; IR (film): 1493, 1597, 3024 cm$^{-1}$; MS (ESI): m/z (%): 364 (100) [M + H$^+$]; elemental analysis calcd (%) for C$_{27}$H$_{25}$N: C 89.21, H 6.93, N 3.85; found: C 89.10, H 7.03, N 3.86.
2-Benzyl-3,5-diphenyl-1-p-tolyl-1H-pyrrole(5dd): A yellow solid, m.p. 167-169 °C; Yield: 90 % (0.180 g); ¹H NMR (400 MHz, CDCl₃): δ = 7.52-7.55 (m, 2H), 7.34-7.39 (m, 2H), 7.10-7.27 (m, 9H), 6.94-7.01 (m, 4H), 6.86-6.89 (m, 2H), 6.69 (s, 1H), 4.06 (s, 2H), 2.32 (s, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 140.7, 137.5, 136.9, 136.5, 134.8, 133.3, 130.3, 129.4, 128.7, 128.6, 128.3, 128.2, 128.1, 128.0 (2), 126.0, 125.9, 125.8, 124.3, 109.5, 31.5, 21.2 ppm; IR (film): 1512, 1600, 3023 cm⁻¹; MS (ESI): m/z (%): 400 (100) [M + H⁺]; elemental analysis calcd (%) for C₃₀H₂₅N: C 90.19, H 6.31, N 3.51; found: C 90.27, H 6.26, N 3.48.

Data are in accordance with previously reported results.³

2-Benzyl-1-(4-chlorophenyl)-3,5-diphenyl-1H-pyrrole(5de): A yellow solid, m.p. 164-165 °C; Yield: 85 % (0.178 g); ¹H NMR (400 MHz, CDCl₃): δ = 7.49-7.51 (m, 2H), 7.32-7.36 (m, 2H), 7.09-7.24 (m, 11H), 6.85-6.91 (m, 4H), 6.65 (s, 1H), 4.02 (s, 2H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 140.3, 137.8, 136.6, 134.9, 133.6, 132.9, 130.2, 130.1, 129.0, 128.7, 128.5, 128.3, 128.2, 128.1, 126.4, 126.1, 124.9, 110.0, 31.5 ppm; IR (film): 1491, 1602, 3023 cm⁻¹; MS (ESI): m/z (%): 420 (100) and 422 (31) [M + H⁺]; elemental analysis calcd (%) for C₂₉H₂₂ClN: C 82.94, H 5.28, N 3.34; found: C 82.82, H 5.31, N 3.29.

Data are in accordance with previously reported results.³

2-Benzyl-1-octyl-3,5-diphenyl-1H-pyrrole (5df): A yellow oil; Yield: 80 % (0.168 g); ¹H NMR (400 MHz, CDCl₃): δ=7.36-7.44 (m, 6H), 7.28-7.32 (m, 5H), 7.16-7.23 (m, 4H), 6.38 (s, 1H), 4.21 (s, 2H), 2.18 (t, J=8.0 Hz, 2H), 1.30-1.37 (m, 2H), 1.19-1.24 (m, 2H), 0.97-1.13 (m, 8H), 0.84 ppm (t, J=7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃): δ=140.4, 137.3, 134.3(2), 129.2, 128.8, 128.5(2), 128.1, 128.0, 127.6, 127.0, 126.4, 125.6, 124.0, 109.1, 44.7, 31.8, 31.3, 31.2, 29.1, 29.0, 26.7, 22.7, 14.2 ppm; IR (film): 1491, 1608, 3031 cm⁻¹; MS (ESI): m/z (%): 422 (100) [M⁺+H⁺]; elemental analysis calcd (%) for C₃₁H₃₅N: C 88.31, H 8.37, N 3.32; found: C 88.45, H 8.26, N 3.28.

Data are in accordance with previously reported results.³
1,2-Dibenzyl-3,5-diphenyl-1H-pyrrole(5dg): A yellow solid, m.p. 134-135 °C; Yield: 83 % (0.165 g); $^1$H NMR (400 MHz, CDCl$_3$): $\delta$ = 7.43-7.46 (m, 2H), 7.15-7.36 (m, 14H), 7.08-7.10 (m, 2H), 6.54 (s, 1H), 6.85-6.87 (m, 2H), 6.54 (s, 1H), 4.93 (s, 2H), 3.98 (s, 2H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ = 140.1, 139.1, 137.1, 135.1, 133.5, 128.9(2), 128.8, 128.6, 128.5, 128.1, 128.0, 127.9, 127.2, 127.1, 126.4, 125.7, 124.6, 109.1, 47.9, 31.1 ppm; IR (film):1493, 1602, 3026 cm$^{-1}$; MS (ESI): m/z (%): 400 (100) [M + H$^+$]; elemental analysis calcd (%) for C$_{30}$H$_{25}$N: C 90.19, H 6.31, N 3.51; found: C 90.11, H 6.40, N 3.48.

2-Benzyl-1-(2-methoxyphenyl)-3,5-diphenyl-1H-pyrrole(5dh): A yellow oil; Yield: 86 % (0.178 g); $^1$H NMR (400 MHz, CDCl$_3$): $\delta$ = 7.53-7.55 (m, 2H), 7.31-7.35 (m, 2H), 7.02-7.21 (m, 10H), 6.92-6.94 (m, 1H), 6.84-6.86 (m, 2H), 6.68-6.76(m, 2H), 6.65(d, $J$ = 1.2 Hz,1H), 4.00 (q, $J$ = 17.2 Hz, 2H), 3.38 (s, 3H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ = 155.9, 140.1, 137.1, 135.1, 133.6, 130.7, 130.2, 129.6, 128.6, 128.3, 128.0(3), 127.9, 127.6, 126.1, 125.7, 125.6, 124.0, 120.3, 111.7, 108.8, 55.2, 31.5 ppm; IR (film):1502, 1603, 3027 cm$^{-1}$; MS (ESI): m/z (%): 416 (100) [M + H$^+$]; elemental analysis calcd (%) for C$_{30}$H$_{25}$NO: C 86.71, H 6.06, N 3.37; found: C 86.77, H 6.01, N 3.49.

Ethyl 4-(2-benzyl-3,5-diphenyl-1H-pyrrol-1-yl)benzoate(5di): A yellow solid; m.p. 141-142 °C; Yield: 76 % (0.174 g); $^1$H NMR (400 MHz, CDCl$_3$): $\delta$ = 7.83-7.87 (m, 2H), 7.49-7.52 (m, 2H), 7.33-7.37 (m, 2H), 7.21-7.25 (m, 1H), 7.07-7.17 (m, 8H), 7.00-7.03 (m, 2H), 6.88-7.00 (m, 2H), 6.67 (s, 1H), 4.34 (q, $J$ = 7.2 Hz, 2H), 4.04 (s, 2H), 1.37 (t, $J$ = 7.2 Hz, 3H) ppm; $^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ = 166.0, 143.3, 140.2, 136.6, 134.9, 132.9, 130.2, 130.0, 129.6, 128.8, 128.7, 128.5, 128.3, 128.1(2), 126.4, 126.1, 125.2, 110.4, 61.3, 31.4, 14.4 ppm; IR (film):1516, 1602, 1722, 3028 cm$^{-1}$; MS (ESI): m/z (%): 458 (100) [M + H$^+$]; elemental analysis calcd (%) for C$_{32}$H$_{27}$NO$_2$: C 84.00, H 5.95, N 3.06; found: C 84.13, H 5.90, N 3.11.
2-Benzyl-1-(2-chloroethyl)-3,5-diphenyl-1H-pyrrole(5dk): A yellow oil; Yield: 67% (0.124 g); ¹H NMR (400 MHz, CDCl₃): δ = 7.40-7.43 (m, 6H), 7.31-7.36 (m, 5H), 7.20-7.26 (m, 4H), 6.39 (d, J = 2.8 Hz, 1H), 4.24(s, 2H), 4.08 (td, J = 6.4 and 2.8 Hz, 2H), 3.14 (td, J = 6.4 and 2.0 Hz, 2H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 139.8, 136.8, 134.2, 133.3, 129.1, 129.0, 128.8, 128.6, 128.1(2), 127.9, 127.6, 126.7, 126.0, 124.6, 110.1, 45.8, 41.8, 31.2 ppm; IR (film):1498, 1597, 3029 cm⁻¹; MS (ESI): m/z (%): 372 (100) and 374 (30) [M + H⁺]; elemental analysis calcd (%) for C₂₅H₂₂ClN: C 80.74, H 5.96, N 3.77; found: C 80.66, H 6.03, N 3.68.

3-(4-Bromophenyl)-2-pentyl-1,5-diphenyl-1H-pyrrole(5ea): A yellow solid, m.p. 107-109 °C; Yield: 81 % (0.179 g); ¹H NMR (400 MHz, CDCl₃): δ = 7.50-7.53 (m, 2H), 7.36-7.39 (m, 5H), 7.22-7.25 (m, 2H), 7.07-7.17 (m, 5H), 6.50 (s, 1H), 2.63 (t, J = 8.0 Hz, 2H), 1.21-1.29 (m, 2H), 1.02-1.10 (m, 4H), 0.71 (t, J = 6.8 Hz, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 139.2, 136.3, 134.3, 133.2, 133.1, 131.6, 129.8, 129.1(2), 128.1(2), 128.0, 126.1, 121.6, 119.4, 109.4, 31.6, 29.6, 25.3, 22.1, 13.9 ppm; IR (film):1493, 1595, 3027 cm⁻¹; MS (ESI): m/z (%): 444 (100) and 446 (100) [M + H⁺]; elemental analysis calcd (%) for C₂₇H₂₆BrN: C 72.97, H 5.90, N 3.15; found: C 72.88, H 5.92, N 3.18.

Methyl 4-(2-pentyl-1,5-diphenyl-1H-pyrrol-3-yl)benzoate(5fa): A white solid, m.p. 157-158 °C; Yield: 77 % (0.163 g); ¹H NMR (400 MHz, CDCl₃): δ = 8.07 (d, J = 8.4 Hz, 2H), 7.57 (d, J = 8.4 Hz, 2H), 7.36-7.42 (m, 3H), 7.23-7.26 (m, 2H), 7.07-7.17 (m, 5H), 6.58 (s, 1H), 3.93 (m, 3H), 2.68 (t, J = 8.0 Hz, 2H), 1.25-1.32 (m, 2H), 1.04-1.09 (m, 4H), 0.70 (t, J = 6.8 Hz, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 167.5, 142.2, 139.1, 134.6, 134.0, 133.0(2), 129.2, 129.1, 128.2, 128.1, 127.7, 127.0, 126.2, 121.7, 109.4, 52.1, 31.6, 29.6, 25.5, 22.0, 13.9 ppm; IR (film):1499, 1599, 1712, 3027 cm⁻¹; MS (ESI): m/z (%): 424 (100) [M + H⁺]; elemental analysis calcd (%) for C₂₉H₂₉NO₂: C 82.24, H 6.90, N 3.31; found: C 82.31, H 6.87, N 3.32.
2-Benzyl-3-(4-methoxyphenyl)-1,5-diphenyl-1H-pyrrole (5ga): A white solid, m.p. 112-114 °C; Yield: 91 % (0.189 g); 1H NMR (400 MHz, CDCl3): δ = 7.41-7.44 (m, 2H), 7.06-7.22 (m, 11H), 6.94-6.96 (m, 2H), 6.88-6.91 (m, 4H), 6.62 (s, 1H), 4.01 (s, 2H), 3.79 (s, 3H) ppm; 13C NMR (100 MHz, CDCl3): δ = 158.0, 140.6, 139.2, 134.6, 133.2, 129.8, 129.4, 129.1, 129.0, 128.8, 128.3, 128.2, 128.1, 128.0, 127.7, 126.0, 125.9, 124.0, 114.1, 109.6, 55.4, 31.4 ppm; IR (film): 1493, 1602, 3024 cm⁻¹; MS (ESI): m/z (%): 416 (100) [M + H⁺]; elemental analysis calcd (%) for C30H25NO: C 86.71, H 6.06, N 3.37; found: C 86.59, H 6.15, N 3.41. Data are in accordance with previously reported results.³

3-(2-Methoxyphenyl)-2-pentyl-1,5-diphenyl-1H-pyrrole (5ha): A yellow oil; Yield: 89 % (0.175 g); 1H NMR (400 MHz, CDCl3): δ = 7.33-7.37 (m, 4H), 7.24-7.29 (m, 3H), 7.05-7.13 (m, 5H), 6.96-7.02 (m, 2H), 6.51 (s, 1H), 3.85 (s, 3H), 2.56 (t, J = 8.0 Hz, 2H), 1.09-1.16 (m, 2H), 0.96-1.01 (m, 4H), 0.65 (t, J = 6.8 Hz, 3H) ppm; 13C NMR (100 MHz, CDCl3): δ = 157.1, 139.8, 134.1, 133.6, 133.3, 131.8, 129.1, 129.0, 128.1, 127.9, 127.6, 127.5, 126.4, 125.6, 120.6, 118.8, 111.4, 111.0, 55.6, 31.6, 29.1, 25.8, 22.1, 13.9 ppm; IR (film): 1493, 1595, 3031 cm⁻¹; MS (ESI): m/z (%): 396 (100) [M + H⁺]; elemental analysis calcd (%) for C28H29NO: C 85.02, H 7.39, N 3.54; found: C 85.13, H 7.27, N 3.58.

2-Methyl-3-(naphthalen-1-yl)-1,5-diphenyl-1H-pyrrole (5ia): A yellow solid, m.p. 115-116 °C; Yield: 79 % (0.142 g); 1H NMR (400 MHz, CDCl3): δ = 8.19-8.21 (m, 1H), 7.89-7.91 (m, 1H), 7.81 (dd, J = 6.8 and 2.8Hz, 1H), 7.47-7.55 (m, 4H), 7.34-7.43 (m, 3H), 7.29-7.31 (m, 2H), 7.08-7.19 (m, 5H), 6.59 (s, 1H), 2.04 (s, 3H) ppm; 13C NMR (100 MHz, CDCl3): δ = 139.7, 135.1, 134.1, 133.5, 133.4, 132.8, 129.5, 129.2, 128.8, 128.4, 128.2, 127.9(2), 127.6, 127.0, 126.8, 125.9, 125.7(2), 125.6, 121.1, 111.8, 12.3 ppm; IR (film): 1493, 1591, 3039 cm⁻¹; MS (ESI): m/z (%): 360 (100) [M + H⁺]; elemental analysis calcd (%) for C27H21N: C 90.21, H 5.89, N 3.90; found: C 90.26, H 6.00, N 3.92.
2-Pentyl-1,5-diphenyl-3-(thiophen-2-yl)-1H-pyrrole(5ja): A yellow oil; Yield: 83 % (0.154 g); ¹H NMR (400 MHz, CDCl₃): δ = 7.34-7.39 (m, 3H), 7.18-7.23 (m, 3H), 7.05-7.15 (m, 7H), 6.58 (s, 1H), 2.69 (t, J = 8.0 Hz, 2H), 1.33-1.41 (m, 2H), 1.12-1.16 (m, 4H), 0.75 (t, J = 7.2 Hz, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 139.5, 139.1, 134.1, 133.5, 133.0, 129.1(2), 128.1(2), 128.0, 127.4, 126.2, 122.7(2), 115.8, 109.3, 31.7, 29.6, 25.7, 22.2, 14.0 ppm; IR (film): 1493, 1602, 3031, 3063 cm⁻¹; MS (ESI): m/z (%): 372 (100) [M + H⁺]; elemental analysis calcd (%) for C₂₅H₂₅NS: C 80.82, H 6.78, N 3.77; found: C 80.73, H 6.81, N 3.69.

2-Benzhydryl-1,3-diphenyl-4,5,6,7-tetrahydro-1H-indole(6aa): A yellow oil; Yield: 61 % (0.134 g); ¹H NMR (400 MHz, CDCl₃): δ = 7.16-7.23 (m, 3H), 7.04-7.06 (m, 9H), 6.91-6.95 (m, 4H), 6.86-6.88 (m, 4H), 5.51 (s, 1H), 2.38 (t, J = 4.8 Hz, 2H), 2.22 (t, J = 5.2 Hz, 2H), 1.71-1.77 (m, 4H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 142.9, 138.9, 136.8, 130.4, 129.6, 129.4, 129.2, 128.7, 128.5, 127.7, 127.5(2), 125.8, 125.3, 122.7, 116.9, 48.6, 23.8, 23.5, 22.9, 22.3 ppm; IR (film): 1493, 1599, 3020 cm⁻¹; MS (ESI): m/z (%): 440 (100) [M + H⁺]; elemental analysis calcd (%) for C₃₃H₂₉N: C 90.16, H 6.65, N 3.19; found: C 90.08, H 6.69, N 3.21.

2-Benzyl-1-(4-(2-benzyl-5-methyl-3-phenyl-1H-pyrrol-1-yl)phenyl)-5-methyl-3-phenyl-1H-pyrrole(5dj): To a 10-mL flask, propargylic acetate 1d (1.0 mmol), enoxysilane 2b (2.0 mmol), chlorobenzene (4.0 mL) and ZnCl₂ (0.20 mmol) were successively added. The reaction was allowed to stir at 75°C for 0.3 h, followed by the addition of primary amine 3i (0.4 mmol). The reaction mixture was heated to reflux temperature for an additional 10 h until completion by TLC. Upon cooling to room temperature, the reaction mixture was then quenched with 1M HCl (2 mL), the organic and aqueous layers were separated, and the aqueous layer was extracted with Et₂O (3×5 mL). The combined organic layers were dried over MgSO₄ and filtered. The filtrate was concentrated in vacuo, and then the residue was purified by silica gel column chromatography (EtOAc/hexane = 1/100) to afford substituted pyrrole 5dj. A yellow solid, m.p. 200-201°C; yield 64 % (0.146 g). ¹H NMR (400 MHz, CDCl₃): δ = 7.46 (d, J = 7.2 Hz, 4H), 7.31-7.35 (m, 4H), 7.18-7.22 (m, 2H), 7.05 (s, 6H), 6.78-6.83 (m, 8H), 6.22 (s, 2H), 3.94 (s, 4H), 2.03 (s, 6H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 140.4, 138.0, 137.1, 129.5, 129.1, 128.6, 128.2, 128.1, 128.0, 127.4, 125.9, 125.7, 123.4, 110.2, 31.5, 12.9 ppm; IR (film): 1516, 1598, 3023 cm⁻¹; MS (ESI): m/z (%): 569 (100) [M + H⁺]; elemental analysis calcd (%) for C₄₁H₂₆N₂: C 88.69, H 6.38, N 4.93; found:
General Procedure for the Synthesis of Substituted Pyrroles (5la-5ma)
To a 10-mL flask, propargylic acetates 1 (0.5 mmol), enoxysilanes 2 (1.0 mmol), nitromethane (2.0 mL) and ZnCl₂ (0.05 mmol) were successively added. The reaction was allowed to stir at r.t. for 1 h, nitromethane was removed in vacuo, followed by the addition of chlorobenzene (2 mL) and amine 3 (1.0 mmol) was added directly to the reaction. The reaction mixture was heated to reflux temperature for an additional 3-10 h until completion by TLC. Upon cooling to room temperature, the reaction mixture was then quenched with 1M HCl (2 mL), the organic and aqueous layers were separated, and the aqueous layer was extracted with Et₂O (3×5 mL). The combined organic layers were dried over MgSO₄ and filtered. The filtrate was concentrated in vacuo, and then the residue was purified by silica gel column chromatography (EtOAc/hexane = 1/100) to afford corresponding substituted pyrroles.

2-Benzyl-5-methyl-3-pentyl-1-phenyl-1H-pyrrole(5la): A yellow oil; Yield: 72 % (0.114 g); ¹H NMR (400 MHz, CDCl₃): δ = 7.24-7.29 (m, 3H), 7.04-7.15 (m, 3H), 6.96-6.99 (m, 2H), 6.80-6.82 (m, 2H), 5.90 (s, 1H), 3.74 (s, 2H), 2.43 (t, J = 8.0 Hz, 2H), 1.54-1.62 (m, 2H), 1.32-1.36 (m, 4H), 1.26 (s, 3H), 0.89 (t, J = 7.2 Hz, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 141.0, 139.2, 128.8(2), 128.4, 128.2, 128.1, 127.6, 127.2, 125.6, 121.3, 106.7, 32.2, 31.2, 30.9, 26.5, 22.8, 14.2, 13.0 ppm; IR (film):1497, 1602, 3027 cm⁻¹; MS (ESI): m/z (%): 318 (100) [M + H⁺]; elemental analysis calcd (%) for C₂₃H₂₇N: C 87.02, H 8.57, N 4.41; found: C 87.00, H 8.52, N 4.45.

2-Benzyl-1-octyl-3-pentyl-5-phenyl-1H-pyrrole(5lb): A yellow oil; Yield: 63 % (0.131 g); ¹H NMR (400 MHz, CDCl₃): δ = 7.32-7.37 (m, 4H), 7.23-7.29 (m, 3H), 7.13-7.19 (m, 3H), 6.08 (m, 1H), 4.01 (s, 2H), 3.69 (t, J = 7.8 Hz, 2H), 2.45 (t, J = 7.6 Hz, 2H), 1.55-1.61 (m, 2H), 1.18-1.34 (m, 8H), 0.93-1.13 (m, 8H), 0.87 (t, J = 6.8 Hz, 3H), 0.84 (t, J = 7.6 Hz, 3H) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 140.6, 134.7, 133.4, 128.9, 128.6, 128.4, 128.1, 127.7, 126.5, 126.1, 122.3, 108.9, 44.6, 32.1, 31.8, 31.3, 31.1, 30.8, 29.1, 29.0, 26.7, 26.5, 22.7, 14.2 ppm; IR (film):1489, 1606, 3024 cm⁻¹; MS (ESI): m/z (%): 416 (100) [M + H⁺]; elemental analysis calcd (%) for C₃₀H₄₁N: C 86.69, H 9.54, N, 3.37; found: C 86.72, H 9.83, N 3.31.
2-Benzyl-3-methyl-1,5-diphenyl-1H-pyrrole(5ma): A yellow oil; Yield: 71 % (0.115 g); 1H NMR (400 MHz, CDCl₃): δ = 7.15-7.24 (m, 5H), 7.08-7.12 (m, 3H), 7.02-7.05 (m, 3H), 6.89-6.95 (m, 4H), 6.33 (s, 1H), 3.84 (s, 2H), 2.16 (s, 3H) ppm; 13C NMR (100 MHz, CDCl₃): δ = 140.4, 139.6, 133.5(2), 130.7, 129.0, 128.8, 128.3, 128.2, 128.0, 127.8, 127.5, 125.8, 125.7, 117.2, 110.9, 30.9, 11.7 ppm; IR (film):1493, 1595, 3027 cm⁻¹; MS (ESI): m/z (%): 324 (100) [M + H⁺]; elemental analysis calcd (%) for C₂₄H₂₁N: C 89.12, H 6.54, N 4.33; found: C 89.08, H 6.52, N 4.37.

2-Benzyl-3,5-diphenyl-1H-pyrrole(7aa): Sodium hydride in mineral oil (60 %, 24 mg, 0.6 mmol) was added to a stirred solution of 5dk (0.186 g, 0.5 mmol) in dry acetonitrile (3.0 mL) maintained in a nitrogen atmosphere. The solution was heated at 50 °C for 2 h and 6 M hydrochloric acid (0.84 mL, 5 mmol) was added dropwise. After an additional 6 h, a solution of sodium acetate (494 mg, 6 mmol) in water (1.0 mL) was added and the solution was heated at reflux temperature for 0.5 h. Upon cooling to room temperature, the solution was extracted with ether (3×5 mL). The combined organic layers were dried over MgSO₄ and filtered. The filtrate was concentrated in vacuo, and then the residue was purified by silica gel column chromatography (EtOAc/hexane = 1/10) to afford N-H pyrrole 7aa. A white solid, m.p. 85-86 °C; yield 61% (0.113 g). 1H NMR (400 MHz, CDCl₃): δ = 8.02 (s, 1H), 7.46-7.48 (m, 2H), 7.30-7.41 (m, 8H), 7.21-7.27 (m, 4H), 7.13-7.18 (m, 1H), 6.67 (d, J = 2.8 Hz, 1H), 4.19 (s, 2H) ppm; 13C NMR (100 MHz, CDCl₃): δ = 139.3, 136.7, 132.6, 131.1, 129.0(2), 128.8, 128.6, 127.9, 127.7, 126.8, 126.3, 125.9, 124.2, 123.7, 106.6, 32.8 ppm; IR (film):1489, 1599, 3023, 3423 cm⁻¹; MS (ESI): m/z (%): 310 (100) [M + H⁺]; elemental analysis calcd (%) for C₂₃H₁₉N: C 89.28, H 6.19, N 4.53; found: C 89.40, H 6.09, N 4.49.

General Procedure for the Synthesis of N-bridgehead Pyrroles (8aa-8ea)
A. the synthesis of the γ-alkynyl ketone 4
To a 10-mL flask, propargylic acetates 1 (0.5 mmol), enoxysilanes 2 (1.0 mmol), chlorobenzene (2.0 mL) and ZnCl₂ (0.05 mmol) were successively added. The reaction was allowed to stir at 75 °C for 0.3 h. The solvent was removed under reduced pressure by an aspirator, and then the residue was purified by silica gel column chromatography (EtOAc/hexane = 1/10) to afford the γ-alkynyl ketone 4.

B. the synthesis of N-bridgehead pyrroles 8
To a stirred solution of Pd(PPh₃)₄ (0.025 mmol), CuI (0.025 mmol) in anhydrous Et₂N (3 mL), amines 3 (0.5 mmol) and the γ-alkynyl ketone 4 (0.5 mmol) in Et₂N (2 mL) and THF (1 mL) were added. The reaction mixture was heated at reflux temperature under argon atmosphere for 2 h and then the solvent was removed under reduced pressure, followed by the addition of chlorobenzene (2.0 mL) and ZnCl₂ (0.05 mmol). The reaction was stirred at reflux until completion by TLC.
Upon cooling to room temperature, the reaction mixture was then quenched with 1M HCl (2 mL), the organic and aqueous layers were separated, and the aqueous layer was extracted with Et2O (3×5 mL). The combined organic layers were dried over MgSO4 and filtered. The filtrate was concentrated in vacuo, and then the residue was purified by silica gel column chromatography (EtOAc/hexane = 1/100) to afford corresponding N-bridgehead pyrroles.

3-Methyl-1-phenyl-9H-pyrrolo[1,2-a]indole(8aa): A yellow solid, m.p. 145-146 °C; Yield: 63 % (0.077g); 1H NMR (400 MHz, CDCl3): δ = 7.53-7.55 (m, 2H), 7.36-7.45 (m, 4H), 7.28-7.32 (m, 1H), 7.14-7.18 (m, 1H), 7.08-7.10 (m, 1H), 6.38 (d, J = 0.8 Hz, 1H), 4.03 (s, 2H), 2.61 (d, J = 0.8 Hz, 3H) ppm; 13C NMR (100 MHz, CDCl3): δ = 141.7, 135.9, 135.0, 131.0, 128.8, 127.6, 126.1, 125.1, 125.0, 123.7, 122.9, 116.3, 110.8, 109.7, 30.4, 13.5 ppm; IR (film):1489, 1602, 3027 cm⁻¹; MS (ESI): m/z (%): 246 (100) [M + H⁺]; elemental analysis calcd (%) for C18H15N: C 88.13, H 6.16, N 5.71; found: C 88.19, H 6.09, N 5.66.

1,3-Diphenyl-9H-pyrrolo[1,2-a]indole(8ba): A white solid, m.p. 171-172 °C; Yield: 61 % (0.094 g); 1H NMR (400 MHz, CDCl3): δ=7.59-7.63 (m, 4H), 7.38-7.49 (m, 6H), 7.19-7.25 (m, 1H), 7.07-7.15 (m, 3H), 6.68 (s, 1H), 4.14 (s, 2H) ppm; 13C NMR (100 MHz, CDCl3): δ=141.4, 135.5, 135.1, 133.3, 133.0, 129.2, 128.9, 128.5, 127.7, 127.3, 125.9, 125.4, 125.3, 123.3, 117.7, 112.1, 112.0, 30.4 ppm; IR (film):1487, 1602, 3023 cm⁻¹; MS (ESI): m/z (%): 308 (100) [M + H⁺]; elemental analysis calcd (%) for C23H17N: C 89.87, H 5.57, N 4.56; found: C 89.81, H 5.63, N 4.51.
11-Phenyl-2,3,4,10-tetrahydro-1H-indolo[1,2-a]indole (8ca): A yellow solid, m.p. 160-161 °C; Yield: 59 % (0.084 g); 1H NMR (400 MHz, CDCl3): δ = 7.51 (d, J = 7.6 Hz, 2H), 7.38-7.41 (m, 3H), 7.25-7.34 (m, 2H), 7.27 (dd, J = 7.2 and 7.6 Hz, 1H), 7.05 (dd, J = 7.2 and 7.6 Hz, 1H), 4.01 (s, 2H), 3.02 (t, J = 6.0 Hz, 2H), 2.78 (t, J = 6.0 Hz, 2H), 1.94-1.98 (m, 2H), 1.81-1.86 (m, 2H) ppm; 13C NMR (100 MHz, CDCl3): δ = 141.7, 136.4, 134.6, 130.9, 128.6, 127.5, 127.0, 125.9, 125.1, 122.8, 122.5, 120.7, 115.6, 110.5, 29.9, 24.4, 23.8, 23.2, 23.1 ppm; IR (film): 1491, 1603, 3031 cm⁻¹; MS (ESI): 286 (100) [M + H⁺]; elemental analysis calcd (%) for C21H19N: C 88.38, H 6.71, N 4.91; found: C 88.27, H 6.80, N 4.78.

3-Methyl-1-(naphthalen-1-yl)-9H-pyrrolo[1,2-a]indole (8da): A yellow oil; Yield: 65 % (0.096 g); 1H NMR (400 MHz, CDCl3): δ = 8.21 (dd, J = 7.2 and 2.4 Hz, 1H), 7.89 (dd, J = 8.0 and 2.4 Hz, 1H), 7.77 (d, J = 8.0 Hz, 1H), 7.45-7.55 (m, 4H), 7.29-7.37 (m, 2H), 7.06-7.10 (m, 1H), 6.31 (d, J = 0.8 Hz, 1H), 3.82 (s, 2H), 2.68 (d, J = 0.8 Hz, 3H) ppm; 13C NMR (100 MHz, CDCl3): δ = 142.1, 135.1, 134.6, 134.1, 132.4, 131.7, 128.5, 127.5, 126.6(2), 126.3, 126.1, 125.7, 123.0, 122.8, 115.8, 113.7, 110.8, 29.5, 13.5 ppm; IR (film): 1486, 1599, 3034 cm⁻¹; MS (ESI): m/z (%): 296 (100) [M + H⁺]; elemental analysis calcd (%) for C22H17N: C 89.46, H 5.80, N 4.74; found: C 89.39, H 5.84, N 4.75.

3-Methyl-1-(naphthalen-1-yl)-5,10-dihydropyrrolo[1,2-b]isoquinoline (8ea): A yellow oil; Yield: 63 % (0.097 g); 1H NMR (400 MHz, CDCl3): δ = 8.11 (d, J = 8.0 Hz, 1H), 7.88 (d, J = 7.2 Hz, 1H), 7.78 (d, J = 7.6 Hz, 1H), 7.39-7.53 (m, 4H), 7.29-7.31 (m, 1H), 7.19-7.26 (m, 2H), 7.13-7.15 (m, 1H), 6.17 (d, J = 0.8 Hz, 1H), 5.06 (s, 2H), 3.94 (s, 2H), 2.43 (s, 3H) ppm; 13C NMR (100 MHz, CDCl3): δ = 135.3, 134.1, 133.9, 132.6, 132.4, 128.5, 128.3, 127.5, 127.4, 127.1, 126.5, 126.4(2), 126.1, 125.7, 124.3, 116.7, 109.0, 45.8, 28.3, 12.1 ppm; IR (film): 1488, 1589, 3039 cm⁻¹; MS (ESI): m/z (%): 310 (100) [M + H⁺]; elemental analysis calcd (%) for C23H19N: C 89.28, H 5.80, N 4.53; found: C 89.33, H 6.03, N 4.51.
References


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