

Supplementary Information (S. I.).

Synthesis of new heteroaryldi(diindolyl)methanes: Colorimetric detection of DNA by di(diindolylmethyl)carbazoles

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Analytical Data

3,6-Di(di1*H*-3-indolylmethyl)-9-ethyl-9*H*-carbazole (3b):

m.p. 119-120°C; IR (KBr): 3406, 3047, 1602, 1483, 1413, 1232, 1089, 787, 1158, 843, 792, 689 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 1.09 (3H, t, *J* = 6.9 Hz, CH₃), 4.33 (2H, q, *J* = 6.8 Hz, CH₂), 5.97 (2H, s), 6.85-6.80 (8H, m), 7.02 (4H, t, *J* = 7.3 Hz), 7.29-7.35 (8H, m), 7.42 (4H, s), 8.03 (2H, s), 10.75 (4H, s, NH); ¹³C NMR (100 MHz, TMS, DMSO-*d*₆) δ: 14.2, 37.5, 65.4 (aliphatic C), 108.9, 111.9, 118.6, 119.3, 119.6, 121.3, 122.5, 124.1, 126.8, 127.3, 128.6, 137.2, 135.9, 139.4 (aromatic C); LC-MS: *m/z* = 682 (M+H⁺), positive mode; Anal. Calcd. for C₄₈H₃₇N₅; C, 84.31; H, 5.45; N, 10.24% found: C, 84.64; H, 5.23; N, 10.31%.

3,6-Di(di1*H*-3-indolylmethyl)-9-butyl-9*H*-carbazole (3c):

m.p. 117-118°C; IR (KBr): 3406, 3057, 2957, 2860, 1873, 1664, 1485, 1211, 1122, 1089, 785 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 0.85 (3H, t, *J* = 7.24 Hz, CH₃), 1.26-1.32 (2H, m), 1.68-1.72 (2H, m), 4.27 (2H, t, *J* = 6.6 Hz), 5.98 (2H, s), 6.82-6.85 (8H, m), 7.02 (4H, t, *J* = 7.3 Hz), 7.30-7.35 (8H, m), 7.42 (4H, s), 8.03 (2H, s), 10.76 (4H, s, NH); ¹³C NMR (100 MHz, TMS, DMSO-*d*₆) δ: 14.5, 20.4, 31.3, 42.6, 60.3 (aliphatic C), 109.1, 111.9, 118.6, 119.7, 119.9, 121.3, 122.6, 124.1, 126.7, 127.3, 129.3, 135.9, 137.1, 139.4 (aromatic C); LC-MS: *m/z* = 710 (M-H⁺), negative mode; Anal. Calcd. for C₅₀H₄₁N₅; C, 84.36; H, 5.81; N, 9.84% found: C, 84.13; H, 6.11; N, 9.97%.

3,6-Di(di1*H*-3-indolylmethyl)-9-benzyl-9*H*-carbazole (3d):

m.p. 110-111°C; IR (KBr): 3398, 3047, 1653, 1489, 1415, 1244, 1211, 1149, 1122, 1089, 785 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 5.57 (2H, s, CH₂), 5.96 (2H, s), 6.81-6.85 (8H, m), 7.01 (4H, t, *J* = 7.3 Hz), 7.29-7.34 (8H, m), 7.45 (4H, s), 7.51-7.65 (5H, m),

8.05 (2H, s), 10.76(4H, s, NH); ^{13}C NMR (100 MHz, TMS, DMSO- d_6) δ : 46.3, 65.4 (aliphatic $\underline{\text{C}}$), 109.4, 109.8, 111.9, 118.7, 118.9, 119.6, 119.8, 120.0, 121.4, 122.3, 124.2, 126.9, 127.3, 127.4, 127.7, 129.0, 129.2, 136.4, 137.2, 138.3, 138.4, 139.5, 139.6; (aromatic $\underline{\text{C}}$); LC-MS: $m/z = 744$ (M-H^+), negative mode; Anal. Calcd. for $\text{C}_{50}\text{H}_{41}\text{N}_5$; C, 84.36; H, 5.81; N, 9.84% found: C, 85.25; H, 5.50; N, 9.34%.

3,6-Di[di(1-methyl-1*H*-3-indolyl)methyl]-9-methyl-9*H*-carbazole (3e):

m.p. 120-121°C; IR (KBr): 3435, 3052, 2931, 1866, 1610, 1478, 1367, 1230, 1012, 892 cm^{-1} ; ^1H NMR (400 MHz, TMS, CDCl_3) δ : 3.60 (12H, s), 3.75 (3H, s), 6.00 (2H, s), 6.45 (4H, s), 6.92 (4H, t, $J = 7.3$ Hz), 7.13 (4H, t, $J = 7.28$ Hz), 7.20-7.24 (6H, m), 7.38 (6H, t, $J = 8.2$ Hz), 7.92 (2H, s); ^{13}C NMR (100 MHz, TMS, CDCl_3) δ : 32.7, 40.2, 60.5 (aliphatic $\underline{\text{C}}$), 108.1, 109.1, 118.7, 119.2, 120.3, 120.4, 121.4, 122.9, 126.7, 128.6, 135.1, 137.6, 140.2 (aromatic $\underline{\text{C}}$); LC-MS: $m/z = 724$ (M-H^+), negative mode; Anal. Calcd. for $\text{C}_{51}\text{H}_{43}\text{N}_5$; C, 84.38; H, 5.97; N, 9.65% found: C, 84.31; H, 6.02; N, 10.11%.

3,6-Di[di(1-methyl-1*H*-3-indolyl)methyl]-9-ethyl-9*H*-carbazole (3f):

m.p. 127-128°C; IR (KBr): 3435, 3053, 2930, 2878, 1867, 1543, 1423, 1151, 1010, 798 cm^{-1} ; ^1H NMR (400 MHz, TMS, CDCl_3) δ : 1.41 (3H, t, $J = 6.8$ Hz), 3.67 (12H, s), 4.30 (2H, q, $J = 7.2$ Hz), 6.02 (2H, s), 6.50 (4H, s), 6.95 (4H, t, $J = 7.2$ Hz), 7.16 (4H, t, $J = 7.2$ Hz), 7.27-7.25 (6H, m), 7.40 (6H, t, $J = 7.9$ Hz), 7.95 (2H, s); ^{13}C NMR (100 MHz, TMS, CDCl_3) δ : 14.1, 32.7, 40.2, 60.5 (aliphatic $\underline{\text{C}}$), 108.1, 109.1, 118.6, 119.3, 120.3, 120.5, 121.4, 123.0, 126.6, 127.7, 128.6, 135.0, 137.6, 140.2 (aromatic $\underline{\text{C}}$); LC-MS: $m/z = 738$ (M-H^+), negative mode; Anal. Calcd. for $\text{C}_{52}\text{H}_{45}\text{N}_5$; C, 84.41; H, 6.13; N, 9.46% found: C, 84.71; H, 5.93; N, 9.36%.

3,6-Di[di(1-methyl-1*H*-3-indolyl)methyl]-9-butyl-9*H*-carbazole (3g):

m.p. 123-124°C; IR (KBr): 3438, 3049, 2928, 2870, 1608, 1543, 1421, 1369, 1244, 1116, 794 cm⁻¹; ¹H NMR (400 MHz, TMS, CDCl₃) δ: 0.91 (3H, t, *J* = 6.7 Hz), 1.24-1.32 (2H, m), 1.79-1.83 (2H, m), 3.61 (12H, s), 4.21 (2H, t, *J* = 6.4 Hz), 6.02 (2H, s), 6.49 (4H, s), 7.00 (4H, t, *J* = 7.1 Hz), 7.22 (4H, t, *J* = 7.4 Hz), 7.27-7.33 (6H, m), 7.39 (6H, d, *J* = 8.0 Hz), 7.95 (2H, s); ¹³C NMR (100 MHz, TMS, CDCl₃) δ: 14.1, 20.9, 31.5, 32.7, 40.3, 60.6 (aliphatic C), 108.4, 109.2, 118.8, 119.4, 120.4, 120.7, 121.5, 123.1, 126.7, 127.8, 128.7, 135.1, 137.7, 139.8 (aromatic C); LC-MS: *m/z* = 766 (M-H⁺), negative mode; Anal. Calcd. for C₅₄H₄₉N₅; C, 84.45; H, 6.43; N, 9.12% found: C, 84.44; H, 6.43; N, 9.12%.

3,6-Di[di(1-methyl-1*H*-3-indolyl)methyl]-9-benzyl-9*H*-carbazole (3h):

m.p. 118-129°C; IR (KBr): 3436, 3047, 2930, 1610, 1473, 1369, 1230, 1116, 1010, 889, 798 cm⁻¹; ¹H NMR (400 MHz, TMS, CDCl₃) δ: 3.67 (12H, s), 5.45 (2H, s), 6.06 (2H, s), 6.53 (4H, s), 6.99 (4H, t, *J* = 7.4 Hz), 7.18-7.54 (13H, m), 7.39-7.45 (8H, m), 8.01 (2H, s); ¹³C NMR (100 MHz, TMS, CDCl₃) δ: 32.7, 46.8, 60.5 (aliphatic C), 108.5, 109.1, 118.7, 119.2, 120.3, 120.4, 121.4, 123.2, 126.7, 126.8, 127.5, 127.6, 128.6, 128.7, 135.5, 137.5, 137.7, 139.9 (aromatic C); LC-MS: *m/z* = 800 (M-H⁺), negative mode; Anal. Calcd. for C₅₇H₄₇N₅; C, 85.36; H, 5.91; N, 8.73% found: C, 84.461; H, 5.91; N, 8.63%.

3,6-Di[di(2-methyl-1*H*-3-indolyl)methyl]-9-methyl-9*H*-carbazole (3i):

m.p. 217-218°C; IR (KBr): 3396, 3049, 2914, 1618, 1460, 1338, 1246, 1151, 1012, 740 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 2.02 (12H, s), 3.82 (3H, s), 6.07 (2H, s), 6.61 (4H, t, *J* = 7.3 Hz), 6.79-6.88 (8H, m), 7.19 (4H, d, *J* = 7.9 Hz), 7.28 (2H, d, *J* = 8.5

Hz), 7.41 (2H, d, $J = 8.5$ Hz), 7.75 (2H, s), 10.66 (4H, s, NH); ^{13}C NMR (100 MHz, TMS, DMSO- d_6) δ : 14.5, 29.4, 65.4 (aliphatic $\underline{\text{C}}$), 108.7, 110.8, 113.6, 118.4, 119.1, 119.9, 120.1, 122.3, 127.2, 128.9, 132.0, 135.2, 135.6, 140.1 (aromatic $\underline{\text{C}}$); LC-MS: $m/z = 726$ ($\text{M}+\text{H}^+$), positive mode; Anal. Calcd. for $\text{C}_{51}\text{H}_{43}\text{N}_5$; C, 84.38; H, 5.97; N, 9.65%; found: C, 84.55; H, 5.89; N, 9.61%.

3,6-Di[di(2-methyl-1*H*-3-indolyl)methyl]-9-ethyl-9*H*-carbazole (3j):

m.p. 227-228°C; IR (KBr): 3395, 3057, 1878, 1614, 1298, 1230, 1118, 1012, 804, 740 cm^{-1} ; ^1H NMR (400 MHz, TMS, DMSO- d_6) δ : 1.30 (3H, t, $J = 6.8$ Hz), 2.02 (12H, s), 4.36 (2H, q, $J = 7.04$ Hz), 6.06 (2H, s), 6.62 (4H, t, $J = 7.9$ Hz), 6.80-6.88 (8H, m), 7.19 (4H, d, $J = 8.0$ Hz), 7.27 (2H, d, $J = 8.5$ Hz), 7.42 (2H, d, $J = 8.5$ Hz), 7.75 (2H, s), 10.66 (4H, s, NH); ^{13}C NMR (100 MHz, TMS, DMSO- d_6) δ : 12.5, 14.2, 37.5, 65.4 (aliphatic $\underline{\text{C}}$), 108.7, 110.8, 113.6, 118.4, 119.0, 119.9, 120.2, 122.5, 127.2, 128.9, 131.9, 135.2, 135.5, 139.0 (aromatic $\underline{\text{C}}$); LC-MS: $m/z = 738$ ($\text{M}-\text{H}^+$), negative mode; Anal. Calcd. for $\text{C}_{52}\text{H}_{45}\text{N}_5$; C, 84.41; H, 6.13; N, 9.46% found: C, 84.53; H, 5.89; N, 9.83%.

3,6-Di[di(2-methyl-1*H*-3-indolyl)methyl]-9-butyl-9*H*-carbazole (3k):

m.p. 233-234°C; IR (KBr): 3406, 3051, 2922, 1664, 1614, 1487, 1460, 1213, 1014, 800 cm^{-1} ; ^1H NMR (400 MHz, TMS, DMSO- d_6) δ : 0.85 (3H, t, $J = 7.2$ Hz), 1.25-1.30 (2H, m), 1.71-1.75 (2H, m), 2.02 (12H, s), 4.32 (2H, t, $J = 6.4$ Hz), 6.06 (2H, s), 6.61 (4H, t, $J = 7.3$ Hz), 6.79-6.88 (8H, m), 7.19 (4H, d, $J = 7.9$ Hz), 7.27 (2H, d, $J = 8.5$ Hz), 7.42 (2H, d, $J = 8.5$ Hz), 7.74 (2H, s), 10.66 (4H, s, NH); ^{13}C NMR (100 MHz, TMS, DMSO- d_6) δ : 14.9, 16.7, 22.8, 33.7, 45.1, (aliphatic $\underline{\text{C}}$), 111.5, 113.3, 116.1, 120.8, 121.5, 122.4, 122.6, 124.9, 126.2, 129.6, 131.4, 132.4, 134.9, 137.6, 138.0, 142.1 (aromatic $\underline{\text{C}}$); LC-MS: m/z

= 766 (M-H⁺), negative mode; Anal. Calcd. for C₅₄H₄₉N₅; C, 84.45; H, 6.43; N, 9.12% found: C, 84.39; H, 6.41; N, 9.35%.

3,6-Di[di(2-methyl-1H-3-indolyl)methyl]-9-benzyl-9H-carbazole (3l):

m.p. 252-253°C; IR (KBr): 3393, 3049, 1604, 1554, 1489, 1456, 1302, 1209, 1014, 925 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 2.02 (12H, s), 5.59 (2H, s), 6.06 (2H, s), 6.61 (4H, t, *J* = 7.3 Hz), 6.77-6.88 (8H, m), 7.15-7.27 (11H, m), 7.48 (2H, d, *J* = 8.5 Hz), 7.77 (2H, s), 10.66 (4H, s, NH); ¹³C NMR (100 MHz, TMS, DMSO-*d*₆) δ: 12.2, 46.1, (aliphatic C), 109.0, 110.5, 113.4, 118.1, 118.8, 119.7, 119.9, 122.4, 127.1, 127.2, 128.7, 132.1, 133.2, 135.3, 138.1, 139.5 (aromatic C); LC-MS: *m/z* = 802 (M+H⁺), positive mode Anal. Calcd. for C₅₇H₄₇N₅; C, 85.36; H, 5.91; N, 8.73% found: C, 85.41; H, 5.79; N, 8.79%.

3,6-Di[di(2-phenyl-1H-3-indolyl)methyl]-9-methyl-9H-carbazole (3m):

m.p. 148-149°C; IR (KBr): 3353, 3059, 1664, 1591, 1487, 1361, 1091, 807, 742 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 3.93 (3H, s), 6.19 (2H, s), 6.62 (4H, t, *J* = 7.2 Hz), 6.88 (4H, d, *J* = 7.4 Hz), 6.98 (4H, t, *J* = 7.3 Hz), 7.41 (12H, m), 7.49 – 7.62 (14H, m), 7.44 (2H, d, *J* = 8.3 Hz), 8.01 (2H, s), 11.52 (4H, s, NH); ¹³C NMR (100 MHz, TMS, DMSO-*d*₆) δ: 36.3, 79.6 (aliphatic C), 110.9, 111.9, 115.3, 119.0, 121.3, 121.4, 127.7, 128.6, 128.7, 128.8, 129.1, 131.9, 132.0, 133.9, 136.8, 140.5 (aromatic C); LC-MS: *m/z* = 972 (M-H⁺), negative mode; Anal. Calcd. for C₇₁H₅₁N₅; C, 87.53; H, 5.28; N, 7.19% found: C, 87.46; H, 5.13; N, 7.30%.

3,6-Di[di(2-phenyl-1H-3-indolyl)methyl]-9-ethyl-9H-carbazole (3n):

m.p. 173-174°C; IR (KBr): 3350, 3055, 1616, 1593, 1450, 1304, 1249, 1097, 808 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 1.42 (3H, t, *J* = 6.7 Hz), 4.36 (2H, q, *J* = 5.6

Hz), 6.21 (2H, s), 6.67 (4H, t, $J = 7.4$ Hz), 6.96 (4H, t, $J = 7.2$ Hz), 7.03 (4H, d, $J = 7.6$ Hz), 7.21 (12H, s), 7.35 – 7.51(14H, m), 7.76 (2H, d, $J = 8.4$ Hz), 8.02 (2H, s), 11.28 (4H, s, NH); ^{13}C NMR (100 MHz, TMS, $\text{DMSO-}d_6$) δ : 16.9, 38.8, 79.3 (aliphatic C), 114.2, 118.2, 121.4, 123.3, 123.8, 125.4, 129.6, 130.0, 131.1, 131.3, 131.4, 135.9, 138.0, 138.7, 139.2, 141.7, (aromatic C); LC-MS: $m/z = 986$ ($\text{M}+\text{H}^+$), positive mode; Anal. Calcd. for $\text{C}_{72}\text{H}_{53}\text{N}_5$; C, 87.51; H, 5.41; N, 7.09% found: C, 87.27; H, 5.63; N, 7.23%.

3,6-Di[di(2-phenyl-1*H*-3-indolyl)methyl]-9-butyl-9*H*-carbazole (3o):

m.p. 152-153°C; IR (KBr): 3395, 3055, 2957, 2870, 1670, 1599, 1452, 1211, 1099, 922, 742 cm^{-1} ; ^1H NMR (400 MHz, TMS, $\text{DMSO-}d_6$) δ : 0.89 (3H, t, $J = 7.0$ Hz), 1.31-1.38 (2H, m), 1.74-1.79 (2H, m), 4.31 (2H, t, $J = 7.2$ Hz), 6.13 (2H, s), 6.59 (4H, t, $J = 7.2$ Hz), 6.86 (4H, d, $J = 7.6$ Hz), 6.96 (4H, t, $J = 7.3$ Hz), 7.14 (12H, s), 7.27 – 7.33(14H, m), 7.43 (2H, d, $J = 8.4$ Hz), 7.67 (2H, s), 11.20 (4H, s, NH); ^{13}C NMR (100 MHz, TMS, $\text{DMSO-}d_6$) δ : 13.9, 20.1, 31.02, 42.5, 79.6 (aliphatic C), 108.7, 111.5, 115.5, 118.6, 120.4, 121, 122.5, 126.9, 127.2, 128.3, 128.7, 133.2, 135.2, 133.9, 136.4, 139.4 (aromatic C); LC-MS: $m/z = 1014$ ($\text{M}-\text{H}^+$), negative mode; Anal. Calcd. for $\text{C}_{74}\text{H}_{57}\text{N}_5$; C, 87.46; H, 5.65; N, 6.89% found: C, 87.49; H, 5.68; N, 6.82%.

3,6-Di[di(2-phenyl-1*H*-3-indolyl)methyl]-9-benzyl-9*H*-carbazole (3p):

m.p. 215-216°C; IR (KBr): 3393, 3053, 2957, 1670, 1483, 1300, 1230, 1072, 798, 742 cm^{-1} ; ^1H NMR (400 MHz, TMS, $\text{DMSO-}d_6$) δ : 5.58 (2H, s), 6.15 (2H, s), 6.60 (4H, t, $J = 7.2$ Hz), 6.84 (4H, d, $J = 8.0$ Hz), 6.96 (4H, t, $J = 7.6$ Hz), 7.13 - 7.14 (12H, s), 7.27 – 7.33(19H, m), 7.52 (2H, d, $J = 8.4$ Hz), 7.7 (2H, s), 11.21 (4H, s, NH); ^{13}C NMR (100 MHz, TMS, $\text{DMSO-}d_6$) δ : 46.4, 79.7 (aliphatic C), 109.3, 111.7, 115.7, 118.9, 120.9, 121.3, 123.0, 127.3, 127.5, 127.7, 127.8, 128.6, 128.9, 129.0, 133.5, 135.5, 136.5, 136.7,

138.4, 139.9 (aromatic C); LC-MS: $m/z = 1049$ ($M-H^+$), negative mode; Anal. Calcd. for $C_{77}H_{55}N_5$; C, 88.05; H, 5.28; N, 6.67% found: C, 88.10; H, 5.27; N, 6.90%.

3-[3,5-dichloro-4-di(1*H*-indolyl)methyl-1*H*-2-pyrrol(di(1*H*-3-indolyl)methyl)-1*H*-indole (6a):

m.p. 127-128 °C; IR (KBr): 3402, 1655, 1554, 1456, 1336, 1217, 1093, 740, 582, 449, 420 cm^{-1} ; 1H NMR (400 MHz, TMS, DMSO- d_6) δ : 5.80 (1H, s, CH), 5.90 (1H, s, CH), 6.95 – 6.85 (8H, m), 7.06 (4H, q, $J = 7.6$ Hz), 7.37-7.29 (8H, m) 10.76 (2H, s, NH), 10.87 (2H, s, NH), 11.35(1H, s, NH); ^{13}C NMR (100 MHz, TMS, DMSO- d_6) δ : 65.8 (aliphatic C), 136.6, 135.4, 131.9, 127.2, 126.7, 124.0, 123.8, 121.6, 119.9, 119.6, 119.4, 119.1, 118.9, 118.7, 118.3, 116.8, 116.2, 111.4, 110.6, 106.9 (aromatic C); LC-MS: $m/z = 622$ ($M-H^+$), negative mode; Anal. Calcd for $C_{48}H_{37}N_5Cl_2$ C, 73.08; H, 4.36; N, 11.21%; Found: C, 73.00; H, 4.37; N, 11.42%.

3-[3,5-dichloro-4-di(1-methyl-1*H*-indolyl)methyl-1*H*-2-pyrrol(di(1-methyl-1*H*-3-indolyl)methyl)-1-methyl-1*H*-indole (6b):

m.p.132-133 °C; IR (KBr): 3425, 2926, 1736, 1660, 1612, 1467, 1369, 1327, 1226, 1118, 1012, 802 cm^{-1} ; 1H NMR (400 MHz, TMS, DMSO- d_6) δ : 11.36 (1H, s, NH), 7.40 – 7.30 (8H, m), 7.14 (4H, q, $J = 7.5$ Hz), 6.95 – 6.85 (8H, m), 5.89 (1H, s), 5.80 (1H, s), 3.70 (12H, d, $J = 5.2$ Hz); ^{13}C NMR (100 MHz, TMS, DMSO- d_6) δ : 137.25, 137.20, 129.8, 128.5, 127.5, 127.2, 126.6, 122.2, 121.6, 121.4, 119.3, 119.1, 119.0, 117.7, 115.7, 115.6, 115.1, 113.5, 110.1, 110.0 (Aromatic C), 67.3, 32.84, 32.80 (Aliphatic C); LC-MS: $m/z = 678$ ($M-H^+$), negative mode; Anal. Calcd for $C_{48}H_{37}N_5Cl_2$ C, 74.11; H, 5.18; N, 10.29%; Found: C, 74.27; H, 5.13; N, 10.29%.

3-[3,5-dichloro-4-di(2-methyl-1H-indolyl)methyl-1H-2-pyrrol(di(2-methyl-1H-3-indolyl)methyl)-2-methyl-1H-indole (6c):

m.p. 149-150 °C; IR (KBr): 3402, 3053, 2968, 2852, 1699, 1618, 1558, 1487, 1460, 1338, 1219, 738 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 10.13 (2H, s, NH), 9.93 (2H, s, NH), 9.46 (1H, s, NH), 7.24 – 7.21 (4H, m), 7.04 (2H, d, *J* = 8.0 Hz), 6.94 – 6.89 (6H, m), 6.76 (4H, t, *J* = 7.6 Hz), 5.94 (1H, s), 5.92 (1H, s), 1.97 (12H, d, *J* = 2.0 Hz); ¹³C NMR (100 MHz, TMS, DMSO-*d*₆) δ: 136.2, 133.6, 130.1, 129.5, 120.9, 120.5, 119.6, 119.4, 119.2, 119.1, 119.0, 111.7, 110.2 (Aromatic C), 66.5, 13.0, 12.8 (Aliphatic C); LC-MS: *m/z* = 678 (M-H⁺), negative mode; Anal. Calcd for C₄₈H₃₇N₅Cl₂ C, 74.11; H, 5.18; N, 10.29%; Found: C, 74.28; H, 5.17; N, 10.38%

3-[3,5-dichloro-4-di(2-phenyl-1H-indolyl)methyl-1H-2-pyrrol(di(2-phenyl-1H-3-indolyl)methyl)-2-phenyl-1H-indole (6d):

m.p. 167-168 °C; IR (KBr): 3398, 3055, 1707, 1602, 1487, 1452, 1371, 1305, 1251, 1041, 844, 738. cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 11.35 (1H, s, NH), 11.20 (1H, s, NH), 11.10 (1H, s, NH), 11.07 (2H, d, *J* = 8.4 Hz, NH), 7.43 – 7.41 (4H, m), 7.33 – 7.05 (10H, m), 7.21 – 6.88 (20H, m), 6.64 – 6.59 (2H, m), 5.73 (2H, s); ¹³C NMR (100 MHz, TMS, DMSO-*d*₆) δ: 136.5, 136.4, 135.9, 135.7, 135.6, 135.2, 133.6, 133.3, 133.2, 130.6, 129.8, 129.6, 129.0, 128.7, 128.5, 128.3, 128.2, 127.4, 127.1, 121.8, 121.1, 120.9, 120.2, 119.3, 119.2, 119.0, 118.6, 114.3, 113.9, 112.6, 111.6, 110.4 (Aromatic C), 67.2 (Aliphatic C); LC-MS: *m/z* = 926 (M-H⁺), negative mode; Anal. Calcd for C₄₈H₃₇N₅Cl₂ C, 80.16; H, 4.67; N, 7.54% Found: C, 80.22; H, 4.65; N, 7.81%.

3-[3,5-dichloro-4-di(2-phenyl-1H-indolyl)methyl-1methyl-H-2-pyrrol(di(2-phenyl-1H-3-indolyl)methyl)-2-phenyl-1H-indole (6e):

m.p. 143-144 °C; IR (KBr): 3402, 3051, 2922, 1716, 1602, 1550, 1454, 1305, 1242, 1014, 740. cm^{-1} ; ^1H NMR (400 MHz, TMS, $\text{DMSO-}d_6$) δ : 11.30-11.23 (4H,m, NH), 7.43 (3H, s), 7.41 – 7.28 (15H, m), 7.17 – 6.95 (16H, m), 6.57 – 6.38 (2H, m), 5.85 (1H, s), 5.72 (1H, s), 2.89 (3H, d, $J = 12.96$ Hz), ^{13}C NMR (100 MHz, TMS, $\text{DMSO-}d_6$) δ : 136.5, 136.4, 135.9, 135.7, 135.6, 135.2, 133.6, 133.3, 133.2, 130.6, 129.5, 129.0, 128.9, 128.8, 128.77, 128.7, 128.5, 128.4, 128.3, 128.2, 128.1, 128.0, 127.6, 121.1, 121.0, 120.1, 118.6, 114.5, 113.5, 111.7, 111.4, 110.9. (Aromatic C), 67.5, 34.3 (Aliphatic C); LC-MS: $m/z = 941$ ($\text{M}+\text{H}^+$), positive mode; Anal. Calcd for $\text{C}_{48}\text{H}_{37}\text{N}_5\text{Cl}_2$ C, 80.24; H, 4.81; N, 7.43% Found: C, 80.22; H, 4.82; N, 7.37%.

3-[3,5-dichloro-4-di(2-(4-bromophenyl)-1H-indolyl)methyl-1H-2-pyrrol(di(2-(4-bromophenyl)-1H-3-indolyl)methyl)-2-(4-bromophenyl)-1H-indole (6f):

m.p.173-174 °C; IR (KBr): 3431, 3393, 3053, 2953, 1890, 1575, 1483, 1454, 1429, 1388, 1242, 744 cm^{-1} ; ^1H NMR (400 MHz, TMS, $\text{DMSO-}d_6$) δ : 11.32 (1H, s, NH), 11.20 (1H, s, NH), 11.10 (1H, s, NH), 11.04 (2H, s, NH), 7.45 – 7.40 (16H, m), 7.21 – 7.04 (5H, m) 6.93 – 6.88 (4H, m), 6.73 – 6.69 (7H, m), 5.55 (2H, s), 3.66(6H, s), 3.63(6H, s) ^{13}C NMR (100 MHz, TMS, $\text{DMSO-}d_6$) δ : 139.6, 139.1, 137.4, 136.5, 135.1, 134.8, 134.1, 133.8, 133.0, 132.6, 132.0, 131.8, 131.5, 131.2, 126.2, 124.2, 124.0, 123.9, 123.4, 123.2, 122.8, 122.0, 121.7, 121.4, 116.9, 116.6, 115.8, 115.0, 114.4, 114.1, 113.0, 111.0 (Aromatic C), 62.8 (Aliphatic C); LC-MS: $m/z = 1243$ ($\text{M}-\text{H}^+$), negative mode; Anal. Calcd for $\text{C}_{62}\text{H}_{39}\text{N}_5\text{Cl}_2\text{Br}_4$ C, 59.83; H, 3.16; N, 5.63% Found: C, 59.99; H, 3.12; N, 5.56%.

3-[3,5-dichloro-4-di(2-(4-methoxyphenyl)-1H-indolyl)methyl-1H-2-pyrrol(di(2-(4-methoxyphenyl)-1H-3-indolyl)methyl)-2-(4-methoxyphenyl)-1H-indole (6g):

m.p. 163-162 °C; IR (KBr): 3398, 3051, 1702, 1607, 1477, 1439, 1370, 1319, 1251, 1061, 842, 738. cm^{-1} ; ^1H NMR (400 MHz, TMS, $\text{DMSO-}d_6$) δ : 11.32 (1H, s, NH), 11.20 (1H, s, NH), 11.10 (1H, s, NH), 11.04 (2H, s, NH), 7.43 – 7.39 (16H, m), 7.19 – 7.01 (5H, m), 6.99 – 6.89 (4H, m), 6.71 – 6.50 (7H, m), 5.55 (2H, s), 3.66(6H, s), 3.63(6H, s) ^{13}C NMR (100 MHz, TMS, $\text{DMSO-}d_6$) δ : 142.5, 138.8, 138.2, 134.6, 132.5, 132.2, 132.0, 128.1, 126.7, 124.2, 123.3, 122.6, 121.8, 121.3, 120.1, 119.3, 118.8, 118.5, 117.6, 116.7, 116.6, 116.5, 116.3, 116.1, 115.7, 115.0, 114.3, 114.1, 113.9, 113.0, 113.7, 111.0 (Aromatic C), 67.4, 58.4, 58.0 (Aliphatic C); LC-MS: $m/z = 1046$ (M-H^+), negative mode; Anal. Calcd for $\text{C}_{66}\text{H}_{51}\text{N}_5\text{Cl}_2\text{O}_4$ C, 75.56; H, 4.90; N, 6.68% Found: C, 75.64; H, 4.99; N, 6.541%.

3-[3,5-dichloro-4-di(1-benzyl-1H-indolyl)methyl-1H-2-pyrrol(di(1-benzyl-1H-3-indolyl)methyl)-1-benzyl-1H-indole (6h):

m.p. 139-140 °C; IR (KBr): 3734, 3055, 2957, 2860, 1651, 1572, 1452, 1331, 1172, 1014, 881, 787 cm^{-1} ; ^1H NMR (400 MHz, TMS, CDCl_3) δ : 7.52 (2H, d, $J = 7.76$ Hz), 7.37 (2H, d, $J = 8.04$ Hz), 7.23-6.89 (32H, m), 6.94 – 6.95 (6H, m), 6.89 (2H, s), 6.72 (2H, s), 6.03 (2H, s), 5.21(4H, d, $J = 5.16$ Hz), 5.17 (4H, d, $J = 2.36$ Hz) ^{13}C NMR (100 MHz, TMS, $\text{DMSO-}d_6$) δ : 138.9, 138.8, 137.6, 136.7, 129.4, 128.9, 128.8, 128.3, 128.2, 127.9, 127.7, 127.6, 127.5, 127.3, 127.2, 127.1, 121.7, 121.5, 119.6, 119.5, 119.4, 119.2, 119.0, 117.5, 116.0, 115.6, 113.2, 110.6, 110.5, 110.2, 107.7. (Aromatic C), 68.2, 49.5, 49.4 (Aliphatic C); LC-MS: $m/z = 1138$ (M-H^+), negative mode; Anal. Calcd for $\text{C}_{78}\text{H}_{61}\text{N}_5\text{Cl}_2$ C, 82.23; H, 5.40; N, 6.15% Found: C, 80.56; H, 5.19; N, 7.41%

3-[3,5-dichloro-4-di(5-bromo-1*H*-indolyl)methyl-1*H*-2-pyrrol(di(5-bromo-1*H*-3-indolyl)methyl)-5-bromo-1*H*-indole (6i):

m.p 152-153 °C; IR (KBr): 3407, 1645, 1544, 1453, 1376, 1212, 1097, 760, 586, 439, 415 cm⁻¹; ¹H NMR (400 MHz, TMS, DMSO-*d*₆) δ: 5.82 (1H, s, CH), 5.88 (1H, s, CH), 6.95 – 6.85 (4H, m), 7.08 (5H, m), 7.35-7.26 (9H, m), 10.78 (2H, s, NH), 10.86 (2H, s, NH), 11.33(1H, s, NH), ¹³C NMR (100 MHz, TMS, DMSO-*d*₆) δ: 65.7 (aliphatic C), 136.4, 135.7, 131.7, 127.2, 126.3, 124.1, 123.9, 121.4, 120.1, 119.6, 119.3, 119.1, 118.6, 118.7, 118.3, 117.0, 116.2, 111.7, 110.6, 106.9 (aromatic C); LC-MS: m/z = 940 (M+H⁺), positive mode; Anal. Calcd for C₄₈H₃₇N₅Cl₂ C, 48.55; H, 2.47; N, 7.45% Found: C, 48.31; H, 2.52; N, 7.40%.

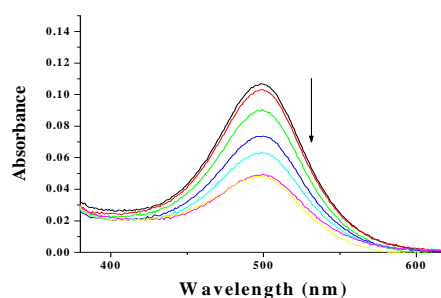


Figure 1. Family of UV/vis spectras taken in the course of the titration of a DMSO solution in **3f** (40 μM) with CT-DNA in Tris buffer. DNA concentrations: 0, 2.5, 5, 7.5, 10, 15, 20 μM.

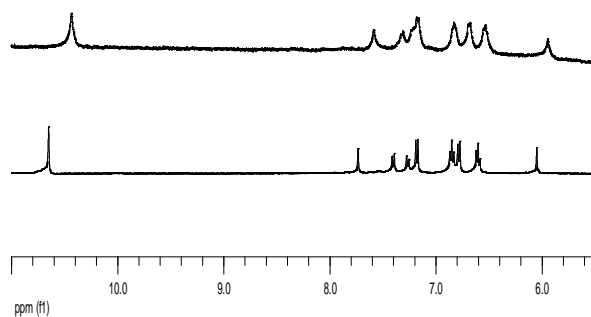


Figure 2. Partial ^1H NMR spectra for the titration of **3i** in DMSO with CT-DNA in Tris buffer. Bottom: **3i**, top: **3i** + CT-DNA.

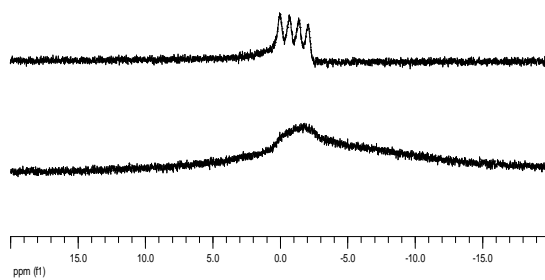


Figure 3. ^{31}P NMR spectra for the titration of CT-DNA in Tris-HCl buffer with **3i**. Bottom: CT-DNA, top: CT-DNA + **3i**.