New Ligands Bearing Chiral Bioactive Fragments

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Supplementary Materials

General Procedure for the Preparation of the Tyrosine precursors.

3-Iodo-L-(tyrosine-)methylester-benzoylamide) (1). To a suspension 0.200 g (0.560 mmol) of 3-iodo-L-tyrosine methyl ester hydrochloride in 20 mL of CH_2Cl_2, 0.156 mL (1.120 mmol) of Et_3N was added. After dissolution (0.5 h), 0.065 mL (0.560 mmol) of benzoyl chloride was added. The reaction mixture was stirred at room temperature during 20 h. Purification was performed by chromatography on alumina eluting with CH_2Cl_2/CH_3OH (0 to 2 %) as eluant. The analytically pure white compound was obtained after a recristallization in CH_2Cl_2/hexane affording 0.219 g of **1** (92 %); ^1H NMR ($CDCl_3$) δ 3.12 (m, CH_2, 2H), 3.76 (s, OCH_3, 3H), 5.01 (m, CH, 1H), 5.65 (s, 1H), 6.75 (d, $^3J_{H-H}$ = 7.3 Hz, 1H), 6.84 (m, 2H), 7.45 (m, 4H), 7.71 (d, $^3J_{H-H}$ = 6.95 Hz, 2H); $^{13}C\{^1H\}$ NMR ($CDCl_3$) δ 36.4, 52.6, 53.7, 84.9, 115.2, 127.0, 128.6, 129.2, 130.6, 132.0, 133.4, 139.3, 154.8, 167.4, 172.0; FT-IR (KBr, cm^{-1}) 3425 (s), 2945 (m), 2356 (w), 1738 (s), 1641 (s), 1603 (w), 1575 (w), 1535 (s), 1487 (m), 1416 (m), 1290 (m), 1219 (s), 1024 (w), 714 (m); UV-vis (CH_2Cl_2): λ nm (ε, M^{-1} cm^{-1}) 281 (2,800), 289 (2,500); FAB^+ m/z (nature of peak, relative intensity) 426 ($[M+H]^+$, 100), 367 ($[M-CO_2CH_3+H]^+$, 30); $[\alpha]_D$ = +11° (in CH_2Cl_2, concentration of 5 gL^{-1}); Anal. Calcd for $C_{17}H_{16}NO_4I$: C, 48.02; H, 3.79; N, 3.29. Found: C, 47.89; H, 3.57; N, 2.99.

3-Iodo-4-benzoyl-L-(tyrosine-methylester-benzoylamide) (2). Following the procedure described above for **1** using 0.200 g (0.560 mmol) of 3-iodo-L-tyrosine methyl ester hydrochloride 3-iodo-L-tyrosine methyl ester hydrochloride in 40 mL of CH_2Cl_2, 0.468 mL (3.356 mmol) of Et_3N and 0.064 mL (0.560 mmol) of benzoyl chloride. The reaction mixture was stirred at room temperature during 8 h. Purification was performed by chromatography on alumina eluting with CH_2Cl_2 as eluant and and afforded 0.216 g of **2** (73 %); ^1H NMR ($CDCl_3$) δ 3.28 (m, CH_2, 2H), 3.81 (s, OCH_3, 3H), 5.11 (m, CH, 1H), 6.71 (d, $^3J_{H-H}$ = 6.9 Hz, 1H), 7.20 (m, 2H), 7.52 (m, 5H), 7.69 (m, 4H), 8.26 (m, 2H); $^{13}C\{^1H\}$ NMR ($CDCl_3$) δ 36.8, 52.6, 53.5, 90.4, 123.0, 127.0, 128.6, 128.7, 129.0, 130.3, 130.4, 131.9, 133.7, 133.9, 135.7, 140.2, 150.5, 164.2, 167.0, 171.7; FT-IR (KBr, cm^{-1}) 3328 (s), 2944 (m), 2362 (w), 1733 (s), 1638 (s), 1602 (w), 1578 (w), 1527 (s), 1487 (m), 1449 (m), 1373 (m), 1320 (m), 1260 (s), 1203 (s), 1160 (m), 1081 (m), 1063 (m), 705 (m); UV-vis (CH_2Cl_2): λ nm (ε, M^{-1} cm^{-1}) 269 (3,500); FAB^+ m/z (nature of peak, relative intensity) 530 ($[M+H]^+$, 100), 425 ($[M-PhCO+H]^+$, 20), 319 ($[M-2PhCO+H]^+$, 5); $[\alpha]_D$ = +17° (in CH_2Cl_2, concentration of 5 gL^{-1}); Anal. Calcd for $C_{24}H_{20}NO_5I$: C, 54.46; H, 3.81; N, 2.65. Found: C, 54.15; H, 3.62; N, 2.47.

General Procedure for the Preparation of the monotopic and ditopic ligands.

A Schlenk flask was charged with 3-iodo-L-tyrosine derivatives **1** or **2** and 4'-ethynyl-2,2':6',2''-terpyridine, 5-ethynyl-2,2'-bipyridine, 6,2"-diethynyl-2,2':6',2''-terpyridine, 5,5'-diethynyl-2,2'-bipyridine or 5-(2,2'-bipyridine-5-yl-ethynyl)-5'-ethynyl-2,2'-bipyridine in argon degassed THF, then ($[Pd(PPh_3)_2Cl_2]$ and CuI) (6 mol %) were added as a solid and finally argon degassed diisopropylamine was added. The solution was allowed to stir during 3 days at room temperature. After consumption of the starting material (determined by TLC), the solvent was evaporated and the residue was purified by chromatography on alumina using dichloromethane with gradient of methanol.

4'-{(3-Ethynyl-yl)-L-(tyrosine-methylester-benzoylamide)}-2,2':6',2''-terpyridine (3a). This ligand was prepared according the procedure general, from 0.110 g (0.258 mmol) of 3-iodo-L-tyrosine methyl ester benzyl amide **1** in 10 mL of THF, 0.080 g (0.310 mmol) of 4'-ethynyl-2,2':6',2''-terpyridine, 0.010 g (0.014 mmol) of $[Pd(PPh_3)_2Cl_2]$, 0.003 g (0.016 mmol) of CuI and 3 mL of diisopropylamine. Purification was performed by chromatography on alumina with CH_2Cl_2/CH_3OH (0 to 4 %) as eluant and afforded 0.060 g of **3a** (42 %); ^1H NMR ($CDCl_3$) δ 3.37 (m, CH_2, 2H), 3.79 (s, OCH_3, 3H), 5.12 (m, CH, 1H), 6.72 (d, $^3J_{H-H}$ = 7.8 Hz, 1H), 7.11 (d, $^3J_{H-H}$ = 8.4 Hz, 1H), 7.41 (m, 8H), 7.74 (dd, $^3J_{H-H}$ = 8.0 Hz, $^4J_{H-H}$ = 1.8 Hz, 2H), 7.86 (td, $^3J_{H-H}$ = 8.0 Hz, $^4J_{H-H}$ = 1.8 Hz, 2H), 8.62 (dd, $^3J_{H-H}$ = 8.0 Hz, $^4J_{H-H}$ = 0.7 Hz, 2H), 8.73(m, 2H), 8.83 (m, 2H); FT-IR (KBr, cm^{-1}) 3261 (m), 3057 (m), 2951 (m), 2923 (m), 2854 (m), 1737 (s), 1644 (s), 1608 (s), 1581 (s), 1540 (s), 1466 (s), 1438 (m), 1400 (s), 1347 (w), 1262 (m), 1229 (m), 1177 (w), 1121 (w); FAB$^+$ m/z (nature of peak, relative intensity) 555 ($[M+H]^+$, 100), 496 ($[M-CO_2CH_3+H]^+$, 20). $[\alpha]_D$ = +41° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{34}H_{26}N_4O_4$: C, 73.63; H, 4.73; N, 10.10. Found: C, 73.43; H, 4.42; N, 9.72.

4'-{(3-Ethynyl-yl)-4-benzoyl-L-(tyrosine-methylester-benzoylamide)}2,2':6',2''-terpyridine (3b) This ligand was prepared according the procedure general, from 0.100 g (0.189 mmol) of 3-iodo-4-benzoyl-L-tyrosine methyl ester benzyl amide **2** in 8 mL of THF, 0.058 g (0.227 mmol) of 4'-ethynyl-2,2':6',2''-terpyridine, 0.008 g (0.011 mmol) of $[Pd(PPh_3)_2Cl_2]$, 0.002 g (0.011 mmol) of CuI and 2 mL of diisopropylamine. Purification was performed by chromatography on alumina with CH_2Cl_2/CH_3OH (0 to 10 %) as eluant and afforded 0.061 g of **3b** (49 %); ^1H NMR ($CDCl_3$) δ 3.23 (m, CH_2, 2H), 3.82 (s, OCH_3, 3H), 5.11 (m, CH, 1H), 6.64 (d, $^3J_{H-H}$ = 6.7 Hz, 1H), 6.92 (d, $^3J_{H-H}$ = 8.3 Hz, 1H), 7.11 (d, $^3J_{H-H}$ = 8.5 Hz, 1H), 7.23 (d, $^4J_{H-H}$ = 2.0 Hz, 1H), 7.41 (m, 11H), 7.78 (dd, $^3J_{H-H}$ = 7.8 Hz, $^4J_{H-H}$ = 1.7 Hz, 2H), 7.87 (td, $^3J_{H-H}$ = 7.8 Hz, $^4J_{H-H}$ = 1.7 Hz, 2H), 8.53 (s, 2H), 8.60(d, $^3J_{H-H}$ = 7.8 Hz, 2H), 8.73 (m, 2H); FT-IR (KBr, cm^{-1}) 3272 (m), 3058 (w), 2954 (m), 2923 (s), 2851 (m), 2211 (w), 1739 (s), 1637 (m), 1576 (s), 1488 (m), 1465 (s), 1391 (s), 1262 (s), 1215, (m), 1177 (m), 891 (w), 792 (s); FAB$^+$ m/z (nature of peak, relative intensity)

659 ([M+H]$^+$, 100), 600 ([M-CO_2CH_3+H]$^+$, 30), 495 ([M-CO_2CH_3-PhCO+H]$^+$, 10). $[\alpha]_D$ = +49° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{41}H_{30}N_4O_5$: C, 74.76; H, 4.59; N, 8.51. Found: C, 74.63; H, 4.42; N, 8.39.

5-{(3-Ethynyl-yl-)-L-(tyrosine-methylester-benzoylamide)}-2,2'-bipyridine (4a). This ligand was prepared according the procedure general, from 0.090 g (0.212 mmol) of 3-iodo-L-tyrosine methyl ester benzyl amide **1** in 7 mL of THF, 0.046 g (0.255 mmol) of 5-ethynyl-2,2'-bipyridine, 0.009 g (0.012 mmol) of [$Pd(PPh_3)_2Cl_2$], 0.0023 g (0.012 mmol) of CuI and 1.5 mL of diisopropylamine. Purification was performed by chromatography on alumina with CH_2Cl_2/CH_3OH (0 to 3 %) as eluant and afforded 0.058 g of **4a** (57 %); ^{1}H NMR ($CDCl_3$) δ 3.38 (m, CH_2, 2H), 3.79 (s, OCH_3, 3H), 5.12 (m, CH, 1H), 6.61 (d, $^3J_{H-H}$ = 7.3 Hz, 1H), 7.08 (m, 3H), 7.47 (m, 4H), 7.80 (m, 4H), 8.22(dd, $^3J_{H-H}$ = 8.5 Hz, $^4J_{H-H}$ = 2.2 Hz, 1H), 8.47 (td, $^3J_{H-H}$ = 8.5 Hz, $^4J_{H-H}$ = 2.2 Hz, 2H), 8.71(d, $^3J_{H-H}$ = 8.4 Hz, 1H), 9.15 (m, 1H); FT-IR (KBr, cm^{-1}) 3280 (s), 3047 (s), 2947 (s), 2915 (s), 2365 (w), 1748 (s), 1649 (s), 1579 (m), 1536 (s), 1459 (m), 1434 (m), 1260 (m), 1230 (s), 1009 (m), 795 (m); FAB$^+$ m/z (nature of peak, relative intensity) 478 ([M+H]$^+$, 100), 419 ([M-CO_2CH_3+H]$^+$, 50). $[\alpha]_D$ = +39° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{29}H_{23}N_3O_4$: C, 72.94; H, 4.85; N, 8.80. Found: C, 72.62; H, 4.59; N, 8.65.

5-{(3-Ethynyl-yl-)-4-benzoyl-L-(tyrosine-methylester-benzoylamide)}-2,2'-bipyridine (4b). This ligand was prepared according the general procedure, from 0.307 g (0.580 mmol) of **2**, 0.100 g (0.555 mmol) of 5-ethynyl-2,2'-bipyridine, 0.020 g (0.028 mmol) of [$Pd(PPh_3)_2Cl_2$], 0.008 g (0.042 mmol) of CuI, in 20 mL of THF and 3.0 mL of diisopropylamine. Purification was performed by chromatography on alumina with CH_2Cl_2/CH_3OH (0 to 10 %) as eluant and afforded 0.194 g of **4b** (60 %); ^{1}H NMR ($CDCl_3$) δ 3.41 (m, CH_2, 2H), 3.73 (s, OCH_3, 3H), 5.21 (m, CH, 1H), 6.69 (d, $^3J_{H-H}$ = 7.2 Hz, 1H), 7.12 (m, 2H), 7.54 (m, 5H), 7.85 (m, 6H), 8.27 (dd, $^3J_{H-H}$ = 8.3 Hz, $^4J_{H-H}$ = 2.0 Hz, 1H), 8.33 (m, 2H), 8.54 (td, $^3J_{H-H}$ = 8.3 Hz, $^4J_{H-H}$ = 2.0 Hz, 2H), 8.79 (d, $^3J_{H-H}$ = 8.2 Hz, 1H), 9.26 (m, 1H). FT-IR (KBr, cm^{-1}) 3275 (s), 3051 (s), 2954 (s), 2926 (s), 1752 (s), 1651 (s),

1581 (s), 1536 (m), 1459 (m), 1432 (m), 1241 (s), 999 (m); FAB$^+$ m/z (nature of peak, relative intensity) 582 ([M+H]$^+$, 100), 523 ([M-CO_2CH_3+H]$^+$, 10). $[\alpha]_D$ = + 45° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{36}H_{27}N_3O_5$: C, 74.34; H, 4.68; N, 7.22. Found: C,74.02; H, 4.31; N, 7.05.

6,6''-{(3-Ethynyl-yl-)-L-(tyrosine-methylester-benzoylamide)}-2,2':6',2'' terpyridine (5a). Prepared according to the general procedure from 0.100 g (0.355 mmol) of 2",6-diethynyl-2,2':6',6"-terpyridine and 0.153 g (0.360 mmol) of **1**, 0.015 g (0.021 mmol) of [$Pd(PPh_3)_2Cl_2$], 0.007 g (0.036 mmol) of CuI, in THF (25 mL) and diisopropylamine (6 mL). Purification was performed by chromatography column on alumina eluted with a gradient of methanol/CH_2Cl_2 (0 to 10%, v/v) and afforded white powder 0.218 g of ligand **5a** (70%); ^{1}H NMR ($CDCl_3$) δ 3.25 (m, CH_2, 4H), 3.79 (s, OCH_3, 6H), 5.12 (m, CH, 2H), 6.75 (d, $^3J_{H-H}$ = 7.1 Hz, 2H), 6.80 (m, 4H), 7.50 (m, 10H), 7.79 (d, $^3J_{H-H}$ = 7.0 Hz, 4H); 8.12 (m, 3H), 8.19 (dd, J = 7.9 Hz, J = 1.0 Hz, 2H), 8.75 (d, J = 8.0 Hz, 2H), 8.80 (dd, J = 7.7 Hz, J = 1.1 Hz, 2H); FT-IR (KBr, cm^{-1}) 2960 (m), 2871 (w), 1739 (s), 1651 (s), 1579 (m), 1437 (m), 1312 (m), 1259 (s), 1152 (s); FAB$^+$/MS (m/z) 876 ([M+H]$^+$, 100), 817 (M-CO_2CH_3, 35), 758 (M-2CO_2CH_3, 8). $[\alpha]_D$ = + 73° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{53}H_{41}N_5O_8$: C, 72.67; H, 4.72; N, 8.00. Found C, 72.41; H, 4.51; N, 7.76.

6,6''-{(3-Ethynyl-yl-)-4-benzoyl-L-(tyrosine-methylester-benzoylamide)}-2,2':6',2''-terpyridine (5b). Prepared according to general procedure from 0.100 g (0.355 mmol) of 2",6-diethynyl-2,2':6',6"-terpyridine, 0.196 g (0.370 mmol) of **2**, 0.015 g (0.021 mmol) of [$Pd(PPh_3)_2Cl_2$], 0.007 g (0.036 mmol) of CuI, in THF (60 mL) and diisopropylamine (6 mL). Purification was performed by chromatography on alumina eluted with a gradient of methanol /CH_2Cl_2 (0 to 15%, v/v) and afforded white powder 0.277 g of ligand **5b** (72%); ^{1}H NMR ($CDCl_3$) δ 3.33 (m, CH_2, 4H), 3.86 (s, OCH_3, 6H), 5.21 (m, CH, 2H), 6.75 (d, $^3J_{H-H}$ = 7.0 Hz, 2H), 7.25 (m, 4H), 7.59 (m, 10H), 7.73 (m, 8H), 8.14 (m, 3H), 8.21 (dd, J = 7.8 Hz, J = 1.0 Hz, 2H), 8.33 (m, 4H), 8.75 (d, J = 7.8 Hz, 2H), 8.79 (dd, J = 7.8 Hz, J = 1.2 Hz, 2H); FT-IR (KBr, cm^{-1}) 2969 (m), 2875 (w), 1738 (s), 1639

(m), 1579 (m), 1470 (w), 1436 (m), 1312 (m), 1259 (s), 1162 (s); FAB^+/MS (m/z) 1084 ($[M+H]^+$, 100), 1025 ($M-CO_2CH_3$, 35), 966 ($M-2CO_2CH_3$, 6). $[\alpha]_D$ = + 82° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{67}H_{49}N_5O_{10}$: C, 74.23; H, 4.56; N, 6.46. Found C, 74.02; H, 4.33; N, 6.28.

5,5'-{(3-Ethynyl-yl-)-L-(tyrosine-methylester-benzoylamide)}-2,2'-bipyridine (6a). Prepared following the general procedure, from 0.100 g (0.489 mmol) of 5,5'-diethynyl-2,2'-bipyridine, 0.212 g (0.499 mmol) of **1**, 0.020 g (0.028 mmol) $[PdCl_2(PPh_3)_2]$, 0.009 g (0.047 mmol) CuI, 20 mL of THF, and 2 mL of diisopropylamine, to give 0.296 g (76%) of ligand **6a**; ^1H NMR ($CDCl_3$) δ 3.12 (m, CH_2, 4H), 3.76 (s, OCH_3, 6H), 5.01 (m, CH, 2H), 6.75 (d, $^3J_{H-H}$ = 7.3 Hz, 2H), 6.84 (m, 4H), 7.45 (m, 10H), 7.71 (d, $^3J_{H-H}$ = 6.95 Hz, 4H); 7.85 (dd, J = 8.2 Hz, J = 2.0 Hz, 2H), 8.35 (d, J = 8.2 Hz, 2H), 8.71 (d, J = 2.0 Hz, 2H); IR (KBr, cm^{-1}) 2958 (s), 2161(w), 1750 (s), 1652 (s), 1588 (s), 1531(s), 1457 (s), 1363 (s), 1250 (s), 1220 (s); FAB^+ m/z 799 ($[M+H]^+$, 100), 740 ($M-CO_2CH_3$, 45), 681 ($M-2CO_2CH_3$, 15). $[\alpha]_D$ = + 74° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{48}H_{38}N_4O_8$: C, 72.17; H, 4.79; N, 7.01; Found C, 71.86; H, 4.52; N, 6.75.

5,5'-{(3-Ethynyl-yl-)-4-benzoyl-L-tyrosine-methylester-benzoylamide)}-2,2'-bipyridine (6b). Prepared following the general procedure from 0.100 g (0.489 mmol) of 5,5'-diethynyl-2,2'-bipyridine, 0.265 g (0.500 mmol) of **2**, 0.020 g (0.028 mmol) $[PdCl_2(PPh_3)_2]$, 0.009 g (0.047 mmol) CuI, 30 mL of THF, and 5 mL of diisopropylamine, to give 0.364 g (74%) of ligand **6b**; ^1H NMR ($CDCl_3$) δ 3.32 (m, CH_2, 4H), 3.96 (s, OCH_3, 6H), 5.36 (m, CH, 2H), 6.98 (d, $^3J_{H-H}$ = 7.0 Hz, 2H), 7.42 (m, 4H), 7.59 (m, 10H), 7.73 (m, 8H), 7.93 (dd, J = 8.6 Hz, J = 1.8 Hz, 2H), 8.39 (m, 4H), 8.55 (d, J = 8.6 Hz, 2H), 8.83 (d, J = 2.0 Hz, 2H); IR (KBr, cm^{-1}) 2958 (s), 2161(w), 1754 (s), 1652 (s), 1588 (s), 1531(s), 1457 (s), 1363 (s), 1250 (s), 1220 (s); FAB^+ m/z 1007 ($[M+H]^+$, 100), 948 ($M-CO_2CH_3$, 45), 889 ($M-2CO_2CH_3$, 15). $[\alpha]_D$ = + 88° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{62}H_{46}N_4O_{10}$: C, 73.95; H, 4.60; N, 5.56; Found C, 73.66; H, 4.32; N, 5.31.

5-(2,2'-Bipyridine-5-yl-ethynyl)-5'-{(3-ethynyl-yl-)-L-(tyrosine-methylester benzoylamide)}-2,2'-bipyridine (8a). The compound was prepared according to the general procedure, from 0.100 g (0.279 mmol) of 5-(2,2'-bipyridine-5-yl-ethynyl)-5'-ethynyl-2,2'-bipyridine, 0.119 g (0.280 mmol) of **1**, 0.012 g (0.017 mmol) $[PdCl_2(PPh_3)_2]$, 0.005 g (0.026 mmol) CuI, 30 mL of THF and 5 mL of diisopropylamine. Purification was performed by chromatography on alumina with CH_2Cl_2/CH_3OH (0 to 15%) as eluant and afforded 0.090 g of **7a** (49 %); ^1H NMR ($CDCl_3$) δ 3.26 (m, CH_2, 2H), 3.83 (s, OCH_3, 3H), 5.18 (m, CH, 1H), 6.77 (d, $^3J_{H-H}$ = 7.5 Hz, 1H), 6.93 (m, 2H), 7.39 (dd, J = 5.0 Hz, J = 1.1 Hz, 1H), 7.50 (m, 4H), 7.82 (d, $^3J_{H-H}$ = 7.0 Hz, 2H), 7.96 (m, 4H), 8.52 (m, 5H), 8.88 (m, 1H), 8.86 (m, 1H), 8.94 (m, 2H); FT-IR (KBr, cm^{-1}) 3460 (s), 2923 (m), 2195 (w, $\nu_{C\equiv C}$), 1754 (s), 1658 (s), 1601 (m), 1460 (s), 1313 (m), 1243 (m), 1109 (s), 841 (s); FAB^+ 656 ($[M+H]^+$, 100), 597 ($M-CO_2CH_3$, 25). $[\alpha]_D$ = + 40° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{41}H_{29}N_5O_4$: C, 75.10; H, 4.46; N, 10.68. Found: C, 74.95; H, 4.22; N, 10.36.

5-(2,2'-Bipyridine-5-yl-ethynyl)-5'-{(3-ethynyl-yl-)-4-benzoyl-L-(tyrosine-methylester-benzoylamide)}-2,2'-bipyridine (8b). The compound was prepared according to the general procedure, from 0.100 g (0.279 mmol) of 5-(2,2'-bipyridine-5-yl-ethynyl)-5'-ethynyl-2,2'-bipyridine, 0.148 g (0.280 mmol) of **2**, and 0.012 g (0.017 mmol) $[PdCl_2(PPh_3)_2]$, 0.005 g (0.026 mmol) CuI, 40 mL of THF and 10 mL of diisopropylamine. Purification was performed by chromatography on alumina with CH_2Cl_2/CH_3OH (0 to 15%) as eluant and afforded 0.106 g of **7b** (50 %); ^1H NMR ($CDCl_3$) δ 3.35 (m, CH_2, 2H), 3.85 (s, OCH_3, 3H), 5.26 (m, CH, 1H), 6.85 (d, $^3J_{H-H}$ = 7.2 Hz, 1H), 7.38 (m, 2H), 7.54 (dd, J = 5.0 Hz, J = 1.4 Hz, 1H), 7.65 (m, 5H), 7.84 (m, 4H), 7.98 (m, 4H), 8.32 (m, 2H); 8.48 (m, 4H), 8.85 (m, 1H), 8.96 (m, 1H), 9.02 (m, 2H); FT-IR (KBr, cm^{-1}) 3460 (s), 2923 (m), 2195 (w, $\nu_{C\equiv C}$), 1757 (s), 1654 (s), 1601 (m), 1460 (s), 1313 (m), 1243 (m), 1109 (s), 841 (s); UV-vis (CH_2Cl_2): λ nm (ε, $M^{-1}cm^{-1}$) 269 (1,600), 341 (11,200), 361 (9,200); FAB^+ 760 ($[M+H]^+$, 100), 701 ($M-CO_2CH_3$, 33). $[\alpha]_D$ = + 43° (in CH_2Cl_2, concentration of 5 gL^{-1}). Anal. Calcd for $C_{48}H_{33}N_5O_5$: C, 75.88; H, 4.38; N, 9.22. Found: C, 75.62; H, 4.05; N, 9.02.