SYNTHESIS OF DICATIONIC 2,5-DIARYLPYRROLES

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Abstract: A new series of dicationic reversed amidine derivatives **4a-f** and a substituted guanidine analog **7** of 2,5-diarylpyrrole obtained starting from the corresponding 2,5-bis(aminoaryl)pyrroles **3a-c** are reported. The results of DNA binding studies and antimicrobial screening assays for these compounds are presented.

Introduction

Aromatic diamidines have been reported as broad-spectrum antimicrobials against *Pneumocystis carinii*, [1] *Giardia Lamblia*, [2] *Leishmania* sp.,[3] *Plasmodium* sp.,[3] *Trypanosoma* sp.,[4] and others.[5] From this class of antimicrobials, only pentamidine has seen clinical use. It is effective against primary stage African trypanosomiasis, antimony-resistant leishmaniasis and AIDS-associated *Pneumocystis carinii* pneumonia (PCP).[6-8] The bis-amidine furamidine [2,5-bis(4-amidinophenyl)furan] has appreciable *in vivo* efficacy against *Trypanosoma rhodesiense* in mice and PCP in an immunosuppressed rat model.[4,9] A common feature of these dications is their binding to the DNA minor groove at A•T rich sites.[5] More recently, furamidine analogs with modified cationic centers, *viz* guanidines and reversed amidines were synthesized and found to possess promising antimicrobial activity.[10,11]

Results and Disscusion

Scheme 1 shows the synthetic pathway employed for preparing the target compounds starting with building the 2,5-diarylpyrrole ring system (**2a-c**) via the Paal-Knorr pyrrole synthesis which gave the dinitro analogs in good overall yields ranging from 70% to 98%. Reduction of **2a-c** gave the diamino derivatives **3a-c** in good yields (74% to 86%), which were used to synthesize the reversed amidine compounds **4a-f** and the substituted guanidine analog **7**. The yields of the reversed amidine derivatives **4a-f** ranged from 83% to 93%. The substituted guanidine analog **7** was obtained in an 80% yield.

The DNA-binding affinities of the dicationic diarylpyrrole derivatives as determined by the thermal melting studies with poly dA•dT are listed in the Table. Several of the compounds showed high DNA-binding affinities as reflected by their high ΔT_m values. The reversed diamidines bearing a phenyl terminal group **4a**, **4c** and **4e** displayed higher ΔTm values than those with a terminal 2-pyridyl group **4b**, **4d** and **4f**. The activity of these compounds was evaluated against *Trypanosoma brucei rhodesiense*, *Plasmodium falciparum* and *Leishmania donovani* and the results are listed in the Table. The 2-pyridyl reversed amidines displayed enhanced anti-leishmanial activity over the reference amidine **II** and in all cases these derivatives were more active than the phenyl reversed amidine analogs.

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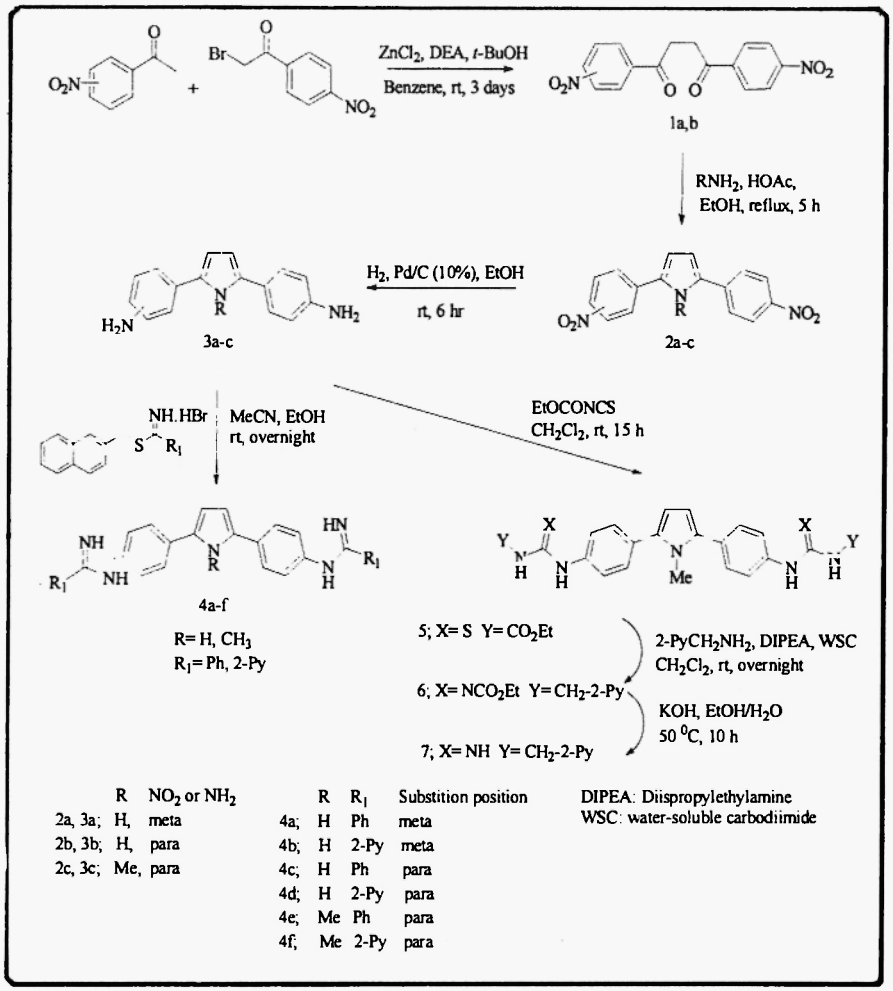

Scheme 1. General synthetic scheme for the preparation of dicationic diarylpyrroles.

Table 1. Biological Evaluation of New Dicationic Diarylpyrroles.[a]

		T. b. r.[b]	*P.f.*[c]	*L. d.*[d]
Compound	ΔT_m[e]	IC_{50} nM[f]	IC_{50} nM[f]	IC_{50} mM[f]
II[g]	25	4.5	15.5	23.3
A[h]	24	16	10.8	NT[j]
B[i]	21	103	71	NT
4a	18	911	303	>100
4b	15	869	401	12
4c	>28	225	66.8	>100
4d	23	1K	306	15
4e	10	2K	517	12
4f	18	575	100	>100
7	11.4	168	115	NT[j]

[a] See refs. 11 and 12 for experimental methods for the evaluatuions. [b]*T.b.r. = Trypanosoma brucei rhodesiense*, [c]*P.f. = Plasmodium falciparum*; [d]*L.d. = Leishmania donovani*; [e] ΔTm = difference in melting temperature of poly dA•dT and poly dA•dT plus compound; [f]IC_{50} = 50 % inhibitory concentration; [g] **II** = 2,5-bis(4-amidinophenyl)furan; [h] A = 2,5-bis(4-amidinophenyl)pyrrole; [i] B = 2-(4-amidinophenyl)-5-(3-amidinophenyl)pyrrole; [j]NT = not tested.

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Unexpectedly, these dications showed very limited anti-trypanosomal or anti-malarial activity.

Novel dicationic diarylpyrroles have been prepared employing efficient four step syntheses. The 2-pyridyl reversed amidine analogs exhibited improved anti-leishmanial activity compared to that of furamidine **II**.

Experimental

Melting points were rccorded using a Thomas-Hoover capillary melting point apparatus and are uncorrected. ^{1}H and ^{13}C- NMR spectra on a Varian GX400 or Varian Unity Plus 300 spectrometer using TMS as an internal standard. Mass spectra on a ThermoFinningan LCQ MSD (ESI) or a Schimadzu 5050A GC/MS (70ev) (GC/MS) spectrometer. All elemental analyses were within $\pm$ 0.4 of theory and are from Atlantic Microlab Inc. (Norcross, GA). Chemicals and solvents were purchased from Aldrich Chemical Co. or Fisher Scientific and were used as purchased. Acetonitrile and triethylamine were distilled from CaH_2

Preparation of Substituted 1,4-Diketones (General Procedure, Scheme 1)

Anhydrous $ZnCl_2$ (2.72 g, 20 mmol, fused under reduced pressure at 250-350 ^{0}C for 15 min), was stirred in dry benzene (10 mL), dry TEA (1.1 g, 15 mmol) and *t*-BuOH (1.4 mL, 15 mmol) till homogenous (2 h). The nitroacetophenone (2.48 g, 15 mmol) followed by the nitrophenacyl bromide (2.44 g, 10 mmol) were added. After stirring at rt for 3 days, the reaction mixture was quenched with 5% H_2SO_4. The resultant solid was filtered, washed with water, methanol, and then crystallized from ethanol.

1a: Shiny yellow crystals (3.2 g, 75%), mp 155-6 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 3.56 (s, 4H), 7.86 (t, J = 8.1 Hz, 1H), 8.24 (d, J = 8.7 Hz, 2H), 8.36 (d, J = 8.7 Hz, 2H), 8.48 (m, 2H), 8.67 (s, 1H); ^{13}C-NMR δ 197.9, 197.2, 149.9, 148.1, 140.9, 137.5, 134.2, 130.7, 129.4, 127.5, 123.9, 122.2, 33.0, 32.8; MS (ESI) *m/z* (rel. int.) 328 (M^+, 14), 300 (22), 150 (100), 104 (85), 76 (77). Anal. for $C_{16}H_{12}N_2O_6$

1b: Shiny orange red crystals (3.92 g, 80%), mp 198-200 ^{0}C, lit. mp 195-6 ^{0}C;[13] ^{1}H-NMR (DMSO-d_6) δ 3.54 (s, 4H), 8.24 (d, J = 9.0 Hz, 4H), 8.36 (d, J = 9.0 Hz, 4H).

Preparation of Bis(nitrophenyl)pyrroles (General Procedure, Scheme 1)

A solution of **1a** (2 g, 6.1 mmol) and ammonium acetate (2.35 g, 30.5 mmol) in glacial acetic acid (10 mL) and EtOH (15 mL) was heated under reflux for 5 h. The reaction mixture was cooled to rt and then poured onto ice water. The precipitated solid was collected by filtration, washed with water, and crystallized from glacial acetic acid-acetone.

2a: Dark red crystals (1.69 g, 89%), mp 228-9 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 6.99 (d, J = 6.3 Hz, 2H), 7.69 (t, J = 8.1 Hz, 1H), 8.07 (d, J = 8.4 Hz, 3H), 8.26 (d, J = 8.4 Hz, 3H), 8.77 (s, 1H), 11.92 (br s, 1H); MS (ESI) *m/z* (rel. int.) 309 (M^+, 100), 279 (28), 263 (74), 217 (77), 189 (37). Anal. for $C_{16}H_{11}N_3O_4$

2b: Bright maroon crystals (1.79 g, 96%), mp 291-2 ^{0}C, lit. mp 295-7 ^{0}C;[14] 283-6 ^{0}C;[15] ^{1}H-NMR (DMSO-d_6) δ 7.03 (s, 2H), 8.07 (d, J = 9 Hz, 4H), 8.26 (d, J = 9 Hz, 4H), 11.93 (br s, 1H).

2c: Brick red crystals (0.29 g, 98%), mp 189-91 ^{0}C, lit. mp 193-5 ^{0}C;[14] ^{1}H-NMR (DMSO-d_6) δ 3.71 (s, 3H), 6.65 (s, 2H), 7.81 (d, J = 9 Hz, 4H), 8.31 (d, J = 9 Hz, 4H). Anal. for $C_{17}H_{13}N_3O_4$.

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Preparation of Bis(aminophenyl)pyrroles (General Procedure, Scheme 1)

To a solution of the dinitro compound (9.6 mmol) in EtOH (40 mL) and EtOAc (80 mL) was added 10% palladium on carbon (0.75 g). The mixture was shaken under hydrogen at 50 psi for 6 h at rt, then filtered through Celite. Removal of the solvent gave analytically pure diamines.

3a: Off-white solid (2.42 g, 97%), mp 168-71 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 4.94 (br s, 2H), 5.05 (br s, 2H), 6.23 (d, J = 2.7 Hz, 1H), 6.30 (d, J = 2.7 Hz, 1H), 6.37 (d, J = 7.5 Hz, 1H), 6.55 (dd, J = 8.7, 3 Hz, 2H), 6.86-6.89 (m, 2H), 6.95-6.98 (m, 1H), 7.40 (dd, J = 8.7, 3 Hz, 2H), 10.77 (br s, 1H); ^{13}C-NMR δ148.6, 146.9, 133.8, 133.6, 132.1, 128.9, 125.1, 121.1, 113.9, 112.1, 111.6, 109.4, 106.6, 104.6; MS (EI) *m/z* (rel. int.) 249 (M^+, 100), 130 (81), 124 (94), 110 (43). Anal. for $C_{16}H_{15}N_3$-0.15C_2H_5OH.

3b: Light brown solid (1.38 g, 86%), mp 213-4 ^{0}C dec, lit. mp 200-1 ^{0}C;[15] ^{1}H-NMR (DMSO-d_6) δ 4.99 (br s, 4H), 6.18 (s, 2H), 6.54 (d, J = 8.4 Hz, 4H), 7.37 (d, J = 8.4 Hz, 4H), 10.58 (br s, 1H); ^{13}C-NMR δ 146.59, 132.50, 124.75, 121.49, 113.99, 104.32.

3c: Shiny yellow crystals (0.6 g, 82%), mp 225-7 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 3.43 (s, 3H), 5.14 (br s, 4H), 5.95 (s, 2H), 6.60 (dd, J = 8.4, 2.1 Hz, 4H), 7.09 (dd, J = 8.4, 2.1 Hz, 4H). ^{13}C-NMR δ147.5, 135.7, 129.0, 121.1, 113.8, 106.2, 33.7; MS (ESI) *m/z* (rel. int.) 264 (M^+ + 1, 100), 263 (M^+, 25), 195 (23). Anal. for $C_{17}H_{17}N_3$.

Preparation of Reversed Amidines (General Procedure, Scheme 1)

Free base: A chilled solution of the diamine (1.28 mmol) in dry MeCN (10 mL), dry EtOH (15 mL) was treated with *S*-(2-naphthylmethyl)thiobenzimidate hydrobromide (2.69 mmol). After stirring at rt for 24 h, the solvent was evaporated leaving an oily residue. Treatment with ether gave the hydrobromide salt, which was dissolved in EtOH, basified with 1N NaOH, extracted with EtOAc, dried over Na_2SO_4, and finally the solvent was evaporated. Hydrochloride salts: An ice-bath cold solution of the free base in dry EtOH was treated with HCl gas for 5-10 min, after which the solvent was concentrated to near dryness and the suspension was diluted with ether, and the salt was collected by filtration.

4a: Light yellow solid (0.51 g, 87%), mp 218-9 ^{0}C (dec.); ^{1}H-NMR (DMSO-d_6) δ 6.78 (s, 2H), 7.27-8.05 (m, 18H), 9.09 (br s, 2H), 9.89 (br s, 2H), 11.52 (br s, 1H); MS (ESI) *m/z* 456 (M^+ + 1, 100), 445 (4).

Salt: Brown solid (0.33 g), mp 244-7 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 6.78 (s, 2H), 7.26-8.07 (m, 18H), 9.07 (br s, 1H), 9.13 (br s, 1H), 9.88 (br s, 1H), 9.94 (br s, 1H), 11.57 (br s, 1H), 11.66 (br s, 2H), 11.70 (br s, 2H); ^{13}C-NMR δ 163.0, 135.0, 134.7, 134.1, 133.7, 132.7, 132.1, 130.2, 128.9, 128.8, 128.1, 127.5, 125.7, 125.2, 123.9, 122.8, 120.9, 108.9, 108.7. Anal. for $C_{30}H_{25}N_5$-2HCl-C_2H_5OH-0.6H_2O.

4b: Yellow solid (0.76 g, 83 %), mp 103-5 ^{0}C (dec.); ^{1}H-NMR (DMSO-d_6) δ 6.52 (s, 1H), 6.58 (s, 1H), 6.73 (d, J = 7.2 Hz, 1H), 6.95 (d, J = 8.1 Hz, 2H), 7.31 (t, J= 7.8 Hz, 1H), 7.40 (s, 2H), 7.49-7.58 (m, 2H), 7.75 (d, J = 8.1 Hz, 2H), 7.92-7.99 (m, 2H), 8.30-8.35 (m, 2H), 8.63 (s, 2H), 11.14 (br s, 1H); ^{13}C-NMR δ 151.9, 151.3, 148.1, 137.2, 134.7, 133.7, 133.3, 132.7, 132.6, 132.2, 129.5, 128.0, 127.6, 127.5, 127.2, 126.4, 126.0, 125.5, 124.9, 121.9, 121.3, 118.8, 118.3, 116.7, 107.6, 106.6; MS (GC/MS) *m/z* (rel. int.) 457 (M^+, 100), 353 (28), 336 (42), 232 (42). Salt: Brown solid (0.61 g), mp 212-5 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 6.78 (s, 2H), 7.47-7.60 (m, 4H), 7.83-8.06 (m, 6H), 8.23 (dd, J = 7.8, 4.8 Hz, 2H), 8.53 (dd, J = 7.8, 4.8 Hz, 2H), 8.9 (dd, J = 7.8, 4.8 Hz, 2H), 9.33 (br s, 1H), 9.40 (br s, 1H), 10.10 (br s, 1H), 10.17 (br s, 1H), 11.68 (br s, 1H), 11.83 (br s, 1H), 11.89 (br s, 1H); ^{13}C-NMR δ 159.3, 159.4,

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149.8, 149.8, 144.5, 138.4, 138.3, 134.8, 134.0, 132.7, 132.4, 131.8, 130.2, 128.6, 126.0, 125.1, 124.1, 123.2, 121.2, 108.9, 108.8. Anal. for $C_{28}H_{23}N_7$-2.3HCl-0.2C_2H_5OH-2H_2O.

4c: Yellow solid (92 %), mp 318-20 °C; ^{1}H-NMR (DMSO-d_6) δ 6.48 (s, 2H), 6.57 (br s, 4H), 7.90 (d, J = 7.2 Hz, 4H), 7.43-7.46 (m, 6H), 7.72 (d, J = 7.2 Hz, 4H), 7.95 (m, 4H); ^{13}C-NMR δ 154.4, 147.4, 135.6, 132.7, 130.0, 127.9, 127.1, 126.9, 124.7, 121.9, 106.3. Salt: Brown solid, mp 246-8 °C; ^{1}H-NMR (DMSO-d_6) δ 6.77 (s, 2H), 7.48 (d, J = 8.4 Hz, 4H), 7.66 (dd, J = 7.5, 4.2 Hz, 4H), 7.78 (dd, J = 7.5, 4.2 Hz, 2H), 7.95 (d, J = 7.5 Hz, 4H), 8.06 (d, J = 8.4 Hz, 4H), 9.06 (br s, 2H), 9.89 (br s, 2H), 11.59 (br s, 2H), 11.67 (br s, 1H); ^{13}C-NMR δ 162.94, 133.9, 132.8, 132.5, 132.3, 129.2, 128.9, 125.8, 125.4, 109.1. Anal. for $C_{30}H_{25}N_5$-2HCl-0.5C_2H_5OH-1.5H_2O.

4d: Orange solid (86 %), mp 321-3 °C; ^{1}H-NMR (DMSO-d_6) δ 7.42 (s, 2H), 7.50 (br s, 4H), 7.86 (d, J = 8.4 Hz, 4H), 8.47 (t, J = 7.8 Hz, 2H), 8.66 (d, J = 8.4 Hz, 4H), 8.86 (t, J = 7.8 Hz, 2H), 9.23 (d, J = 7.8 Hz, 2H), 9.55 (d, J = 7.8 Hz, 2H), 12.02 (br s, 1H); MS (ESI) *m/z* (rel. int.) 458 (M^+ + 1, 100), 229 (53), 221 (12). Salt: Reddish brown solid, mp 293-5 °C; ^{1}H-NMR (DMSO-d_6) δ 6.77 (s, 2H), 7.48 (d, J = 8.1 Hz, 4H), 7.85 (dd, J = 7.5, 4.5 Hz, 2H), 8.06 (d, J = 8.1 Hz, 4H), 8.21 (dd, J = 7.8, 7.5 Hz, 2H), 8.52 (d, J = 7.8 Hz, 2H), 8.89 (d, J = 4.5 Hz, 2H), 9.34 (br s, 2H), 10.12 (br s, 2H), 11.70 (br s, 1H), 11.85 (br s, 2H); ^{13}C-NMR δ 159.2, 149.9, 144.4, 138.5, 132.7, 132.5, 131.7, 128.7, 126.1, 125.3, 124.1, 108.9. Anal. for $C_{28}H_{23}N_7$-3.25HCl-0.25C_2H_5OH-1.5H_2O.

4e: Orange solid (93 %), mp 236-8 °C; ^{1}H-NMR (DMSO-d_6) δ 3.64 (s, 3H), 6.20, (s, 2H), 6.40 (br s, 4H), 6.93 (d, J = 8.1 Hz, 4H), 7.40-7.49 (m, 10H), 7.98 (d, J = 8.1 Hz, 4H); ^{13}C-NMR δ 153.8, 149.4, 136.0, 135.9, 130.1, 129.1, 128.0, 127.1, 126.8, 121.8, 107.5, 34.2; MS (ESI) *m/z* (rel. int.) 470 (M^+ + 1, 15), 156 (100). Salt: Brown solid, mp 242-4 °C; ^{1}H-NMR (DMSO-d_6) 3.71 (s, 3H), 6.42 (s, 2H), 7.58 (d, J = 7.8 Hz, 4H), 7.66-7.80 (m, 10H), 7.98 (d, J = 7.8 Hz, 4H), 9.16 (br s, 2H), 9.97 (br s, 2H), 11.76 (br s, 2H); ^{13}C-NMR δ 163.4, 136.2, 134.3, 133.2, 133.0, 129.8, 129.4, 129.0, 128.7, 125.9, 109.8, 34.8. Anal. for $C_{31}H_{27}N_5$-2HCl-0.25C_2H_5OH-2H_2O.

4f: Canary yellow solid (93 %), mp 224-5 °C; ^{1}H-NMR (DMSO-d_6) δ 3.63 (s, 3H), 6.21 (s, 2H), 6.61 (br s, 4H), 7.00 (d, J = 8.4 Hz, 4H), 7.46 (d, J = 8.4 Hz, 4H), 7.53-7.57 (m, 2H), 7.92-7.98 (m, 2H), 8.32 (d, J = 7.8 Hz, 2H), 8.63 (4, J = 4.5, 2H); MS (EI) *m/z* (rel. int.) 472 (M^+ + 1, 100), 156 (22); ^{13}C-NMR δ 151.6, 151.8, 148.8, 147.9, 137.1, 135.9, 128.9, 127.1, 125.4, 121.7, 121.2, 107.6, 34.1. Salt: Canary yellow solid, mp 203-5 °C; ^{1}H-NMR (DMSO-d_6) δ 3.73 (s, 3H), 6.43 (s, 2H), 7.58 (d, J = 8.1 Hz, 4H), 7.72 (d, J = 8.1 Hz, 4H), 7.85-7.89 (m, 2H), 8.22-8.27 (m, 2H), 8.48 (d, J = 7.2 Hz, 2H), 8.92 (d, J = 4.5 Hz, 2H), 9.38 (br s, 2H), 10.14 (br s, 2H), 11.87 (br s, 2H); ^{13}C-NMR δ 160.3, 150.8, 144.7, 139.2, 136.7, 133.8, 133.0, 130.2, 129.5, 126.6, 124.4, 110.4, 35.2. Anal. for $C_{29}H_{25}N_7$-2.6HCl-0.1C_2H_5OH-2.25H_2O.

Preparation of *N*-Substituted Guanidines (Scheme 1)

5: A solution of **3b** (0.3 g, 1.13 mmol) in CH_2Cl_2 (10 ml) was treated with ethyl isothiocyanatoformate (0.328 g, 2.5 mmol), and the mixture was stirred at rt for 15 h. Dilution with hexanes gave the product as an orange solid (0.48 g, 81 %), mp 216-8 °C; ^{1}H-NMR (DMSO-d_6) δ 1.26 (t, J = 5.4 Hz, 6H), 3.61 (s, 3H), 4.22 (q, J = 5.4 Hz, 4H), 6.31 (s, 2H), 7.52 (d, J = 6.6 Hz, 4H), 7.70 (d, J = 6.6 Hz, 4H), 11.28 (s, 2H), 11.60 (s, 2H); ^{13}C-NMR (DMSO-d_6) δ 178.3, 153.6, 136.6, 135.8, 130.6, 128.1, 124.4, 108.9, 62.1, 34.4, 14.2; MS (GC/MS) *m/z* (rel. int.) 525 (M^+, 8), 436 (25), 347 (51), 45 (100). Anal. for $C_{25}H_{27}N_5O_4S_2$-0.4CH_2Cl_2.

6: A stirred solution of **5** (0.5 g, 0.95 mmol), 2-(aminomethyl)pyridine (0.41 g, 3.8 mmol), and DIPEA (0.74 g, 5.7 mmol) in anhydrous CH_2Cl_2 (10 ml) was cooled to 0 °C. EDCI (0.73 g, 3.8 mmol) was added, and the solution

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stirred at rt overnight. The residue remaining after removal of the solvent was crystallized from EtOH/water to give tan white solid (0.62 g, 98 %), mp 100-2 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 1.13 (t, J = 5.1 Hz, 6H), 3.61 (s, 3H), 3.95 (q, J = 5.1 Hz, 4H), 4.65 (s, 4H), 6.26 (s, 2H), 7.32-7.49 (m, 14H), 7.80-7.83 (m, 2H), 8.56 (s, 2H); ^{13}C-NMR (DMSO-d_6) δ 163.3, 158.2, 153.4, 152.3, 148.8, 136.9, 135.7, 128.5, 123.8, 122.3, 121.3, 108.4, 99.4, 59.7, 45.9, 34.2, 14.5; MS (ESI) *m/z* (rel. int.) 674 (M^+ + 1, 100), 628 (14).

7: Free base: A suspension of 6 (0.4 g, 0.59 mmol) in EtOH (10 mL) was treated with 1N KOH (5.9 ml, 5.9 mmol) and the mixture was stirred for 10 h at 55-60 ^{0}C. The solvent was evaporated, the residue was washed with water and crystallized from aqueous EtOH to give a light orange solid (0.25 g, 80%), mp 118-20 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 3.53 (s, 3H), 4.46 (s, 4H), 5.26 (br s, 4H), 6.19 (s, 2H), 6.82 (m, 4H), 7.11 (d, J = 7.8 Hz, 4H), 7.27-7.32 (m, 2H), 7.38-7.43 (m, 6H), 7.78-7.84 (m, 2H), 8.53-8.55 (m, 2H); ^{13}C-NMR (DMSO-d_6) δ 175.3, 157.9, 153.7, 148.8, 136.8, 135.8, 128.9, 127.8, 123.4, 122.25, 121.3, 107.9, 45.9, 34.1; MS (ESI) *m/z* (rel. int.) 530 (M^+ + 1, 83), 397 (19), 265 (100). Salt: Light brown solid, mp 239-41 ^{0}C; ^{1}H-NMR (DMSO-d_6) δ 3.61 (s, 3H), 4.89 (s, 4H), 6.29 (s, 2H), 7.39 (d, J = 8.7 Hz, 4H), 7.56 (d, J = 8.7 Hz, 4H), 7.71 (dd, J = 7.5 Hz, 2H), 7.78 (d, J = 7.5 Hz, 2H), 8.14 (br s, 4H), 8.26 (dd, J = 7.5, 4.3 Hz, 2H), 8.55 (br s, 2H), 8.77 (d, J = 4.2 Hz, 2H), 10.46 (br s, 2H); ^{13}C-NMR (DMSO-d_6) δ 155.7, 154.4, 146.5, 141.7, 136.2, 134.1, 131.6, 129.8, 125.3, 124.7, 123.7, 45.1, 34.8. Anal. for $C_{31}H_{31}N_9$-4HCl-0.5C_2H_5OH-1.25H_2O.

Acknowledgement
This work was supported by the Bill and Melinda Gates Foundation.

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Received on May 12, 2004.

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