**Preparation of Hypermonomer 1**. In a typical experiment allyl amine (3.2 gm, 56 mmol) was allowed to react with ethyl bromohexanoate (25.0 gm, 112 mmol) in the presence of  $K_2CO_3$  (30.9 gm, 224 mmol) in DMF (100 mL) at 50 °C for 12 hrs. After cooling, the reaction mixture was passed through a bed of celite to remove the inorganic base. The filtrate was concentrated under reduced pressure. Pure product was obtained either by column chromatography (35-40% EtOAc in hexane) or by vacuum distillation. Yield 17.8 gm, 93%. <sup>1</sup>H NMR, CDCl<sub>3</sub>,  $\delta$  5.8-5.7 (m, 1H), 5.1-5.0 (m, 2H), 4.14-4.01 (m, 4H), 3.0 (br t, 2H), 2.40-2.18 (m, 8H), 1.61-1.15 (m, 18H). <sup>13</sup>C NMR CDCl<sub>3</sub>,  $\delta$  173.58, 135.94, 116.83, 60.01, 57.13, 53.43, 34.19, 26.94, 24.81, 14.13.

**Compound 2.**  $Pd(PPh_3)_4$  (20 mg) was added under argon to a round bottom flask. A solution of N,N dimethyl barbituric acid (4.68 gm, 30 mmol)in 30 mL of dichloromethane (DCM) and hypermonomer **1** (6.84 gm, 20 mmol) in 20 mL of DCM was added to the round bottom flask under argon. Once the reaction was over (TLC analysis), the mixture was diluted with ether and concentrated. Purification was performed by ion-exchange chromatography (Dowex 50 X2). The crude product was loaded on to the ion-exchange resin. The resin was washed with DCM (25 mL), diethyl ether (25 mL). The pure product was obtained by washing the resin column using 10% triethyl amine in DCM. The pure fractions of the product were combined and concentrated. Yield 5.35 gm, 89%. <sup>1</sup>H NMR, CDCl<sub>3</sub>,  $\delta$  4.03 (q, 4H), 2.51 (t, 3H), 2.21 (t, 4H), 1.75 (br, NH), 1.61-1.56 (m, 4H) 1.54-1.38 (m, 4H), 1.32-1.23 (m, 4H), 1.16 (t, 6H). <sup>13</sup>C NMR CDCl<sub>3</sub>,  $\delta$  173.57, 60.07, 49.61, 34.14, 29.50, 26.79, 24.74, 14.14.

**Compound 3**. The hypermonomer **1** (6.84 gm, 20 mmol) was dissolved in 25 mL of MeOH. To this at 0 °C 5N NaOH (15 mL) was added slowly. The reaction was monitored using TLC with ninhydrin staining. Once the hydrolysis was complete, the reaction mixture was neutralized with HCl and concentrated under high vacuum. Using silica gel chromatography (25:75 MeOH/CHCl<sub>3</sub>), the pure product was isolated from the residue.<sup>24</sup> Yield 5.2 gm, 92%. <sup>1</sup>H NMR, CD<sub>3</sub>OD,  $\delta$  6.1-5.9 (m, 1H), 5.6-5.53 (d, 2H), 3.76 (d, 2H), 3.07 (t, 4H), 2.25 (t, 4H), 1.75-1.60 (m, 8H), 1.42-1.37 (m, 4H). <sup>13</sup>C NMR CD<sub>3</sub>OD,  $\delta$  174.72, 127.08, 125.17, 54.84, 51.93, 49.12, 33.70, 26.01, 24.20, 23.01. ESI-Mass (C<sub>15</sub>H<sub>28</sub>NO<sub>4</sub>) 286.05.

**Compound 4.** In a typical experiment compound **3** (906 mg, 3 mmol) was dissolved in minimum amount of DMF. To this, a solution of HBTU (1.08 gm, 2.85 mmol) was added followed by the addition of DIEA (1.04 mL, 6 mmol). The mixture was stirred for few min. Finally the compound **2** (427 mg, 1.5 mmol) in 1.0 mL of DMF was added to this stirring mixture, and the reaction was continued over night (12-14 hrs). Once all the starting materials were consumed (TLC analysis), the reaction was quenched with addition of 1 mL of water, and the reaction mixture was diluted with ether. The major portion of DMF was removed by aqueous workup. The organic layer was dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated under reduced pressure. Chromatography of the residue was performed using silica gel and 5:95 MeOH/CHCl<sub>3</sub>. Thus the tetrameric dendrimer (**4**) was obtained in high yield 1.10 gm, 86%. <sup>1</sup>H NMR, CDCl<sub>3</sub>,  $\delta$  5.72-5.67 (m, 1H), 5.04-4.94 (d, 2H), 4.01 (q, 8H), 3.20-3.0 (m, 12H), 2.95 (d, 2H), 2.25 (t, 4H), 2.20-2.10 (m, 12H), 1.70 (t, 4H), 1.60-1.25 (m, 16H). 1.22-1.15 (m, 24H). <sup>13</sup>C NMR CDCl<sub>3</sub>,  $\delta$  173.41, 173.18, 172.28, 135.32, 117.26, 60.09, 59.97, 56.95, 53.41, 47.62, 45.49, 40.82, 34.03, 33.91, 32.89, 28.73, 28.15, 27.30, 27.25, 26.52, 26.36, 26.22, 25.21, 24.54, 24.47, 14.09. Analysis C, H, N.

**Compound 5.** In a typical experiment compound **4** (530 mg, 0.62 mmol) in DCM was added to Pd(PPh<sub>3</sub>)<sub>4</sub> under argon. A solution of N,N dimethyl barbituric acid (146 mg, 0.93 mmol) was added under argon to the reaction mixture. Once the reaction was over (as analyzed by TLC), the mixture was diluted with ether and concentrated. Purification was performed by ion-exchange chromatography. The crude product was loaded on to the ion-exchange resin. The resin was washed with DCM (15 mL), diethyl ether (10 mL). The pure product was obtained by washing the resin column using 10% triethyl amine in DCM. The pure fractions of the product were combined and concentrated. Yield 422 mg, 84%. <sup>1</sup>H NMR, CDCl<sub>3</sub>,  $\delta$  4.13-4.04 (2q, 8H), 3.28-3.10 (m, 12H), 2.95 (t, 4H), 2.25 (qt, 12H), 1.80 (t, 4H), 1.65-1.31 (m, 20H) 1.29-1.19 (m, 20). <sup>13</sup>C NMR CDCl<sub>3</sub>,  $\delta$  173.61, 173.42, 172.26, 60.31, 60.19, 50.59, 47.72, 47.44, 45.82, 34.12, 34.00, 32.23, 28.68, 27.36, 26.32, 25.70, 24.60, 24.53, 14.189. Analysis C, H, N.

**Compound 6**. A solution of compound 4 (530 mg, 0.62 mmol) in 5 mL of MeOH was cooled to 0 °C. To this 2 mL of 5N NaOH was added slowly. The reaction was monitored using TLC with ninhydrin staining. Once the hydrolysis was complete, the reaction mixture was neutralized with HCl and concentrated under high vacuum. Using silica gel chromatography, the pure product was isolated from the residue<sup>24</sup>. Yield 325 mg, 71%. <sup>1</sup>H NMR, CD<sub>3</sub>OD,  $\delta$  6.1-5.9 (m, 1H), 5.7-5.53 (d, 2H), 3.76 (d, 2H), 3.35 (t, 8H), 3.16 (br, 4H), 2.5-2.25 (m, 12H), 1.9-1.78 (m, 4H), 1.78-1.50 (m, 24H), 1.5-1.32 (m, 12H). <sup>13</sup>C NMR CD<sub>3</sub>OD,  $\delta$  175.92, 174.42, 173.76, 126.29, 125.27, 54.93, 52.26, 48.50, 45.84, 33.37, 33.24, 33.22, 32.98, 32.00, 28.24, 26.86, 26.00, 25.83, 24.58, 24.28, 23.96. ESI-Mass (C<sub>39</sub>H<sub>69</sub>N<sub>3</sub>O<sub>10</sub>) 740.5.

**Compound 7.** In a typical experiment compound **6** (74 mg, 0.1 mmol) was dissolved in minimum amount of DMF. To this solution HBTU (151 mg, 0.4 mmol) was added followed by DIEA (140  $\mu$ L, 0.8 mmol). The mixture was stirred for few min. Finally compound **5** (324 mg, 0.4 mmol) in 1.0 mL of DMF was added to this stirring mixture, and the reaction was continued over night (12-14 hrs). Once all the starting materials were consumed (TLC analysis), the reaction was quenched with addition of 1 mL of water, and the reaction mixture was diluted with ether. The major portion of DMF was removed by aqueous workup. The organic layer was dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated under reduced pressure. Chromatography of the residue was performed using silica gel and 10:90 MeOH/CHCl<sub>3</sub>. Yield 230 mg, 60%. MALDI-TOF (C<sub>215</sub>H<sub>385</sub>N<sub>15</sub>O<sub>46</sub>) Calculated 3916.54 observed 3917.14.

Compound 8. In a typical experiment N-fmoc-amino hexanoic acid (660 mg, 1.86 mmol) in 3 mL of DCM and diisopropyl ethyl amine (646 µL, 3.72 mmol) in 2 mL of DCM were added to 600 mg of 2-chlorotrityl chloride resin. After 30 min of mixing another fresh batch of amino acid and the base were added and allowed to react with the resin. The resin was then washed with DCM followed by DMF. A solution of 20% piperidine in DMF (5 mL) was added to the resin and mixed for 15 min. After the fmoc removal, the resin was washed with DMF followed by DCM and then DMF. N-fmoc Sarcosine (578 mg, 1.86 mmol) was dissolved in 2 mL of DMF. To this, a solution of HBTU (669 mg, 1.76 mmol ) in 2 mL of DMF was added followed by DIPEA (646 µL, 3.72 mmol) in 1 mL of DMF. After 30 min of coupling a second coupling was performed. N-fmoc removal was effected by piperidine as per standard protocol. Biotin (453 mg, 1.86 mmol) in 8 mL of NMP was added to the resin followed by addition of a solution of HBTU (669 mg, 1.76 mmol) in 1 mL of DMF was added followed by DIPEA (646 µL, 3.72 mmol) in 1 mL of DMF. After 30 min of coupling a second coupling was performed. Using standard protocol the product was cleaved from the resin and purified using RP-HPLC (10% to 45% of ACN in 65 min). The major peak was isolated and lyophilized. Yield 207 mg, 77%, <sup>1</sup>H NMR, CDCl<sub>3</sub>,  $\delta$  4.53-4.49 (m, 1H), 4.35-4.32 (m, 1H), 4.05 (2s, 2H), 3.56 (t, 1H), 3.32-3.30 (m, 1H), 3.26-3.18 (m, 4H), 3.10 (s, 3H), 2.95 (s, 2H), 2.7 (d, 1H), 2.50-2.42 (m, 2H), 2.40-2.25 (m, 4 H), 1.9-1.45 (m, 16H), 1.45-1.3 (m, 3H). <sup>13</sup>C NMR CD<sub>3</sub>OD, δ 174.80, 169.54, 168.99, 164.62, 163.67, 163.28, 162.88, 61.83, 60.64, 60.19, 55.57, 52.38. 50.60, 39.74, 38.96, 38.83, 36.13, 35.23, 34.94, 34.65, 34.10, 33.46, 32.37, 32.20, 29.96, 29.67, 29.39. ESI-Mass (C<sub>19</sub>H<sub>32</sub>N<sub>4</sub>O<sub>5</sub>S) 429.2.

**Compound 9.** In a typical experiment compound **8** (51 mg, 0.12 mmol) was dissolved in minimum amount of NMP, and HBTU (46 mg, 0.12 mmol) was added, followed by DIEA (31 mg, 0.24 mmol). After stirring for 1 min, compound **5** (97 mg, 0.12 mmol) in 500  $\mu$ L of NMP was added and the reaction was allowed to proceed overnight (12-14 hrs). Once all the starting materials were consumed (TLC), the reaction was quenched with addition of a few drops of water. NMP was removed using high vacuum, and the residue was purified using RP-HPLC (20% to 75% of ACN in 80 min). The major peak was isolated and lyophilized. Yield 52 mg, 35%. ESI-Mass (C<sub>63</sub>H<sub>111</sub>N<sub>7</sub>O<sub>14</sub>S) 1222.72.

**Compound 10**. In a typical experiment compound **9** was hydrolyzed using a NaOH/H<sub>2</sub>O mixture as per procedure reported for compound **3**. Following the workup method mentioned above, compound **10** was obtained as a white solid. ESI-Mass ( $C_{55}H_{95}N_7O_{14}S$ ) 1110.53.











mlz

p-4mer #724-730 RT: 36.18-36.48 AV: 7 NL: 3.75E6



Supplementary Material (ESI) for Chemical Communications This journal is © The Royal Society of Chemistry 2009



dB MHz

MHz

usec K sec sec

Hz

-

•

Supplementary Material (ESI) for Chemical Communications This journal is The Royal Society of Chemistry 2009



Supplementary Material (ESI) for Chemical Communications This journal is o The Royal Society of Chemistry 2009



MHZ

16



Supplementary Material (ESI) for Chemical Communications This journal is The Royal Society of Chemistry 2009





300.0 6.00

usec K

70

Hz Hz Sec

-----

sec sec

dB MHz

dB MHz

MHz

Chemical Communications Supplementary Materian This journal is © The Royal Society of Chemistry 2009



1H NMR

Supplementary Material (ESI) for Chemical Communications



13C NMR





Supplementary Material (ESI) for Chemical Communications This journal is  $\textcircled{\mbox{\scriptsize C}}$  The Royal Society of Chemistry 2009



Processing parameters 32768 75.4677525 MHz Acquisition Parameters 20070622 = CHANNEL f1 ====== 13C 9.00 usec 5.00 dB 75.4760107 MHz Inn 100.00 120.00 21.41 300.1312005 18832.393 0.287360 1.7400308 26.550 6.000 2.00000000 0.03000000 0.03000000 DRX300 zgdc30pad 65536 CDC13 318 EM 1.00 1.30 6 dB dB MHz usec K sec sec Hz Hz Sec Ηz

Supplementary Material (ESI) for Chemical Communications This journal is  $\textcircled{\mbox{\scriptsize C}}$  The Royal Society of Chemistry 2009





Supplementary Material (ESI) for Chemical Communications This journal is © The Royal Society of Chemistry 2009





usec K

dB dB MHz

ZHW

dB MHz