Supporting Information:

Highly Fructose Selective Transport Promoted by Boronic Acids Based on a Pentaerythritol Core, *Draffin, S. P.; Duggan, P. J.; Duggan, S. A. M.*

Synthetic Procedures:

Nuclear Magnetic Resonance Spectra

^{1}H and ^{13}C nuclear magnetic resonance spectra were recorded on a Varian 300 MHz spectrometer using the solvents stated. All chemical shifts were recorded using tetramethylsilane (TMS) as the internal standard (δ 0.00). Assignments were made using the following protocol: ^{13}C spectra: chemical shift (ppm), assignment. ^{1}H spectra: chemical shift (ppm), multiplicity, coupling constant *J* (Hz), number of protons and peak assignment. The numbers on chemical structures are used for chemical shift assignments; they are not meant to indicate IUPAC numbering.

Solvents

All solvents were used as supplied except dimethyl formamide and acetonitrile which was dried over 4 Å molecular sieves.

Chromatography

Analytical thin layer chromatography was performed upon silica coated plastic sheets (Macherey-Meigel Polygram SilG / U.V. 254). Plates were viewed using either Ultraviolet Light (254 nm) or iodine to visually develop the spots. Column Chromatography was performed according to the method reported by Still *et al*[1], using the solvents stated as eluent, expressed as volume ratios.

Infra Red Spectra

All infrared spectra were recorded on a Perkin Elmer 1600 Series Fourier Transform spectrophotometer. The spectra were all recorded using sodium chloride plates with liquids and solids as Nujol (paraffin) mulls or potassium bromide pellets. The relevant absorptions were recorded in wavenumbers (cm^{-1}) with the intensities of the bands recorded as: broad (b), strong (s), medium (m), weak (w).

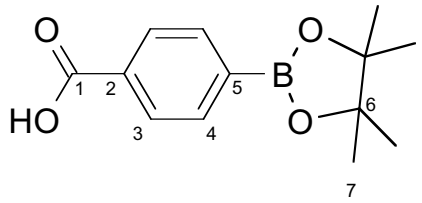
Mass Spectra

Electrospray mass spectra (ESI) of compounds were recorded on a Bruker Bioapex 47e Fourier Transform mass spectrometer. Positive ion atmospheric pressure chemical ionisation mass spectra (APCI +) were recorded on a VG Platform Quadrapole mass spectrometer. Unless otherwise stated, compounds were dissolved in methanol prior to ionisation.

Melting Points

Melting points of solid compounds were measured on a Reichert Hot stage melting point apparatus.

4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-benzoic acid[2]



(1)

4-Carboxybenzene boronic acid (4.30 g, 26 mmol), pinacol (3.05 g, 26 mmol) and toluene (70 ml) were combined and refluxed with azeotropic removal of water for 4 hours. Upon cooling, clear colourless crystals were formed and were collected via suction filtration. These crystals were washed with fresh toluene and air dried (4.78 g, 78%).

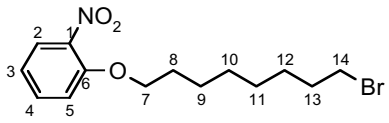
mp: decomp 236-238°C.

^{1}H n.m.r (300MHz, $CDCl_3$): δ 8.07 (d, *J*=7.8Hz, 2H, H3), 7.89 (d, *J*=7.8Hz, 2H, H4), 1.35 (s, 12H, H7).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 171.7 (C1), 134.5 (C3), 131.2 (C2), 129.0 (C4), 84.2 (C6), 25.3 (C7). (C bonded to B not observed due to broadening)

IR (Nujol): 2922 s, 2853 s, 1685 m, 1461 s, 1363 m, 1269 w, 1143 w, 1125 w, 1087 w, 1017 w, 962 w, 857 w, 789 w, 709 w, 649 w.

1-Bromo-8-(2-nitrophenoxy) octane



(2)

2-Nitrophenol (0.5 g, 3.60 mmol) was dissolved in acetonitrile (30 mL), with stirring under an argon atmosphere. Potassium carbonate (1.49 g, 12.20 mmol) and 1,8-dibromooctane (0.79 mL, 4.3 mmol) were added and the reaction mixture heated at 60°C for 24 hours. The solvent was removed *in vacuo* and the residue suspended in hexane, then adsorbed onto a plug of silica. The desired compound was washed off the silica with an ethyl acetate/hexane (1:4) solution. The solvent was removed to obtain a light yellow oil. (0.61g, 51%).

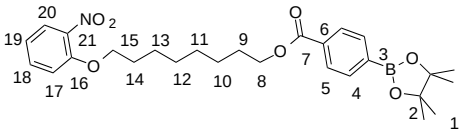
^{1}H n.m.r (300MHz, $CDCl_3$): δ 7.82 (dd, *J*=1.7 and 8.1Hz, 1H, H2), 7.51 (ddd, *J*= 1.7, 8.5 and 7.4 Hz, 1H, H4), 7.06 (dd, *J*=0.9 and 8.4 Hz, 1H, H5), 7.00 (ddd, *J*=1.7, 7.4, and 8.4 Hz, 1H, H3), 4.10 (t, *J*= 6.3 Hz, 2H, H7), 3.42 (t, *J*=6.9 Hz, 2H, H14), 1.85 (m, 4H, alkyl chain), 1.45 (m, 8H, alkyl chain).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 152.2 (C6), 139.7 (C1), 133.7 (C4), 125.3 (C2), 119.8 (C3), 114.2 (C5), 69.4 (C7), 34.0 (C14), 32.7, 29.0, 28.8, 28.5, 28.0, 25.7 (C8-13).

IR (KBr): 3443 w, 2932 s, 2850 s, 1583 m, 1527 s, 1489 w, 1466 w, 1353 m 1280 s, 1255 s 1164 w, 1150 w, 1089 m, 1044 m, 856 w, 771 w, 745 s, 724 w, 669 w, 484 w.

High Resolution Mass Spectrum (ESI, MeOH) m/z: Calculated for formula $C_{14}H_{20}N^{79}BrO_3Na$ 352.0524. Found 352.0526$[M+Na]^+$.

4-[[8-(2-Nitro-phenoxy)octyl]oxy]carbonyl-(4,4,5,5-tetramethyl)-1,3,2-dioxaborolan-2-yl benzene



(4)

2-Nitrophenoxy octyl bromide (**2**) (0.11 g, 0.35 mmol), potassium carbonate (0.14 g, 1.00 mmol) and **1** (0.09 g 0.35 mmol) were dissolved in dry dimethyl formamide (DMF) (5 mL) and the reaction was heated overnight at 60°C under argon. The solvent was then removed under reduced pressure and the residue suspended in dichloromethane and filtered through celite. The crude material was then purified using flash chromatography (hexane 100%) to give an orange oil (0.08g, 42%).

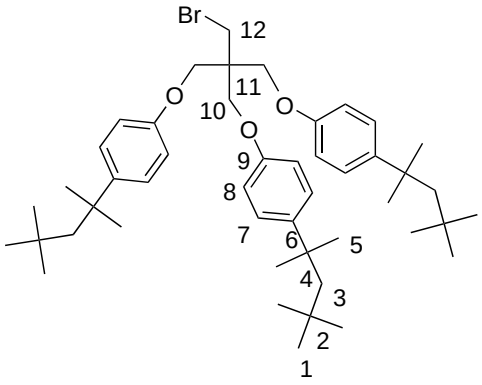
^{1}H n.m.r (300MHz, $CDCl_3$): δ 8.02 (d , *J*=7.9 Hz, 2H, H5), 7.86 (d, *J*=8.2 Hz, 2H, H4), 7.82 (dd, *J*=1.8 and 7.9 Hz, 1H, H20), 7.50 (dt, *J*=1.8, 7.9 Hz, 1H, H18), 7.06 (d, *J*=8.5 Hz, 1H, H17) 7.00 (dt, *J*=1.0, 7.7 Hz, 1H, H19), 4.32 (t, *J*=6.7 Hz, 2H, H8), 4.09 (t, *J*=6.4 Hz, H15), 1.80 (m, 4H, alkyl chain), 1.45(m, 8H, alkyl chain), 1.36 (s, 12H, H1).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 166.4 (C7), 152.2 (C16), 139.7 (C21), 134.4 (C5), 133.7 (C18), 132.4 (C6), 128.3 (C4), 125.3 (C20), 119.8 (C19), 114.2 (C17), 114.7 (C16), 84.0 (C2), 69.4 (C15), 65.1 (C8), 29.1, 28.8, 28.6, 25.9, 25.7, (C9-14) , 24.8 (C1). (C bonded to B not observed due to broadening)

Mass Spectrum (APCI +) m/z: 110.0 (65%), 231.1 (64%), 342.2 (56%), 430.2 (39%), 468.3 (42%), 498.2 (M^+ + 1, 100%).

IR (Nujol): 3460 m, 2978 s, 2933 s, 2857 s, 1957 s, 1715 s, 1682 s, 1608 s, 1583 m, 1526 s, 1488 w, 1470 m, 1399 s, 1360 s, 1271 s, 1214 w, 1166 m, 1144 s, 1111 s, 1097 s, 1044 w, 1020 s, 963 m, 857 s, 814 w, 773 m, 746 m, 710 s, 666 m, 652 s, 440 s.

Tri-(4-*tert*-octylphenoxy) pentaerythrityl bromide



(5)

Pentaerythrityl tetrabromide (2.32 g, 6 mmol), p-*t*-octyl phenol (3.70 g, 18 mmol) potassium carbonate (4.14 g, 30 mmol) and dimethyl formamide (30 ml) were combined and stirred at 100°C for 24 hours under argon. The reaction mixture was cooled and filtered. The solvents were removed *in vacuo* and the residue taken up in dichloromethane and washed with 5% HCl (20 mL), water (2 x 20 mL), brine (30 mL) and dried over $MgSO_4$. The solvent was then removed *in vacuo* to give a yellow oil (2.4 g). This oil was submitted to flash chromatography (hexane 100%) to give pure disubstituted product (**8**) (1.02 g, 22%) and trisubstituted product (**5**) (1.32 g 28%).

mp: 98.5°C.

^{1}H n.m.r (300MHz, $CDCl_3$): δ 7.24 (d, *J*=7.8 Hz, 6H, H7), 6.82 (d, *J*=7.8 Hz, 6H, H8),

4.23 (s, 6H, H10), 3.90 (s, 2H, H12), 1.69 (s, 6H, H3), 1.33 (s, 18H, H4), 0.72 (s, 27H, H1).

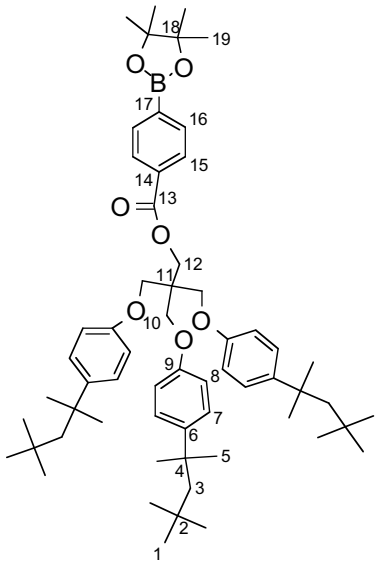
^{13}C n.m.r (75MHz, $CDCl_3$): δ 156.3 (C9), 142.8 (C6), 127.1 (C7), 114.0 (C8), 67.3 (C10), 57.1 (C3), 44.5 (C11), 38.2 (C5), 34.8 (C12), 32.5 (C4), 32.1 (C1), 31.9 (C2).

High Resolution Mass Spectrum (ESI, MeOH) m/z: Calculated for $C_{47}H_{71}BrO_3Na$ 785.4484. Found 785.4477$[M+Na]^+$.

IR (KBr): 2923 s, 2853 s, 1610 w, 1511 m, 1463 s, 1377 m, 1241 m, 1184 m, 1044 w, 824 w, 722 w.

Microanalysis: Calculated for $C_{47}H_{71}BrO_3$ %: C 73.89, H 9.37, Br 10.21. Found %: C 74.35, H 9.37, Br 10.46.

Tri-(4-*tert*-octylphenoxy) pentaerythrityl 4-[4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl]-benzoate



(6)

The monobromide (**5**), (0.20g, 0.26 mmol), the carboxylic acid (**1**), (0.06 g, 0.03 mmol), cesium carbonate (0.23 g, 0.78 mmol), potassium iodide (0.55 g, 3.30 mmol) and dimethyl acetamide (30 mL) were combined and heated at 100°C for 24 hours under an argon atmosphere. Upon cooling the solvent was removed *in vacuo* and adsorbed on a small plug of silica. This was washed with hexane then desorbed by washing with dichloromethane. Removal of the dichloromethane under vacumn gave an oil which was submitted to flash chromatography (Dichloromethane : hexane 8 : 2) to give white crystalline product (0.21g, 75%).

mp: 114-116°C.

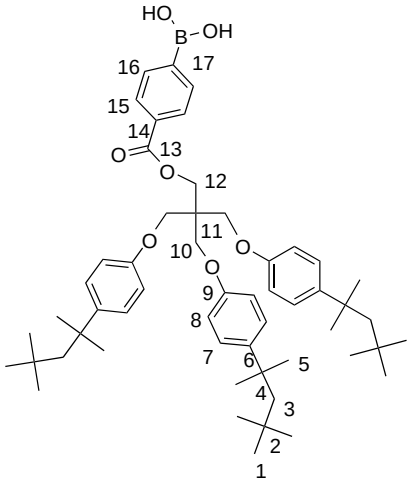
^{1}H n.m.r (300MHz, $CDCl_3$): δ 7.94 (d, *J*=7.8 Hz, 2H, H16), 7.84 (d, *J*=7.8 Hz, 2H, H15), 7.23 (d, *J*=7.8 Hz, 6H, H8), 6.82 (d, *J*=7.8 Hz, 6H, H7), 4.75 (s, 2H, H12), 4.31 (s, 6H, H10), 1.69 (s, 6H, H3), 1.34 (s, 12H, H19), 1.32 (s, 18H, H5) 0.71 (s, 27H, H1).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 166.3 (C13), 156.4 (C9), 142.7 (C6), 134.7 (C15), 132.3 (C14), 128.6 (C16), 127.1 (C7), 113.9 (C8), 84.3 (C18), 67.1 (C10), 64.5 (C12), 57.1 (C3), 44.5 (C11), 38.2 (C5), 32.5 (C4), 32.0 (C1),31.9 (C2), 25.1 (C19). (C bonded to B not observed due to broadening)

IR (Nujol): 2923 s, 2853 s, 1716 m, 1609 w, 1510 m, 1459 s, 1376 s, 1242 m, 1184 w, 1122 m, 1099 m, 1025 m, 826 w, 722 w.

Mass Spectrum (APCI +) m/z: 338.4 (78%), 725.3 (83%), 931.4 (100%, $M^+ + 1$)

4-[Tri-(4-*tert*-octylphenoxy) pentaerythrityl] benzene boronic acid



(7)

The mono pinacol ester (**6**) (0.10 g), hydrochloric acid (3ml, 1M) and acetone (30 ml) were combined and stirred for 24 hours. Solvent was removed *in vacuo* and the residue taken up in dichloromethane (30 ml). The organics were washed with water (3 x 50 ml)

and dried with $MgSO_4$ and the mixture was filtered and solvent removed *in vacuo* to give glass like crystals (0.06g, 66%).

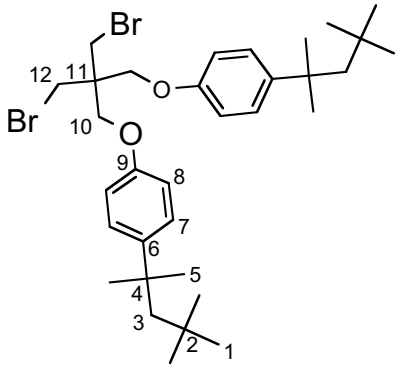
mp: 126-128°C

^{1}H n.m.r (300MHz, $CDCl_3$): δ 8.02 (d, *J*=7.8 Hz, 2H, H16), 7.96 (d, *J*=7.8 Hz, 2H, H17), 7.23 (d, *J*=7.8 Hz, 6H, H8), 6.82 (d, *J*=7.8 Hz, 6H, H9), 4.75 (s, 2H, H13), 4.31 (s, 6H, H11), 1.69 (s, 6H, H4), 1.32 (s, 18H, H6) 0.71 (s, 27H, H1).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 166.3 (C13), 156.4 (C9), 142.7 (C6), 133.7 (C15), 132.2 (C14), 128.9 (C16), 127.1 (C7), 113.9 (C8), 67.0 (C10), 64.5 (C12), 57.1 (C3), 44.5 (C11), 38.2 (C5), 32.5 (C4), 32.0 (C1), 31.9 (C2) (C bonded to B not observed due to broadening).

IR (Nujol): 3385 b, 3268 s, 2925 s, 2852 s, 1721 m, 1655 s, 1540 m, 1466 s, 1243 m, 1184 w, 1028 m, 826 w.

Di-(4-*tert*-octylphenoxy) pentaerythrityl dibromide



(8)

Pentaerythrityl tetrabromide (2.00g, 5.15 mmol), p-*t*-octyl phenol (2.13, 10.30 mmol) potassium carbonate (5.38g, 16.50 mmol) and DMF (30 ml) were combined and

stirred at 100°C for 24 hours under argon. The reaction mixture was cooled and filtered. The solvent removed and the residue taken up in dichloromethane, washed with 5% HCl (20mL), water (2 x 20 mL), brine (30 mL), and dried over Mg_2SO_4. The solvent was then removed *in vacuo* and a crude yellow oil resulted (3.56g). This was then submitted to flash chromatography (hexane 100%) to afford of pure disubstituted product (**8**) (1.58 g, 48%) and trisubstituted product (**5**) (0.42 g 12%).

mp: 109-110°C.

^{1}H n.m.r (300MHz, $CDCl_3$): δ 7.26 (d, *J*=7.8 Hz, 4H, H7), 6.82 (d, *J*=7.8 Hz, 4H, H8), 4.13 (s, 4H, H10), 3.79 (s, 4H, H12), 1.69 (s, 4H, H3), 1.33 (s, 12H, H5), 0.72 (s, 18H, H1).

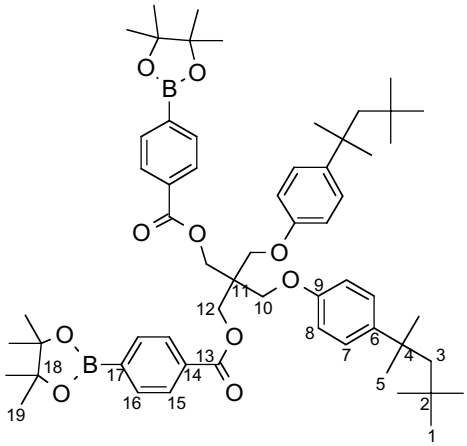
^{13}C n.m.r (75MHz, $CDCl_3$): δ 156.2 (C9), 143.3 (C6), 127.3 (C7), 114.2 (C8), 67.6 (C10), 57.2 (C3), 44.3 (C11), 38.2 (C5), 35.2 (C12), 32.7 (C4), 32.2 (C1) 32.0 (C2).

Mass Spectrum (ESI, DCM/MeOH 1:2) m/z: 163.0 (30%), 194.0 (76%), 205.0 (72%), 227.1 (92%), 233.0 (90%), 265.0 (100%), 267.1 (54%), 299.1 (19%), 318.3 (16%), 399.3 (15%), 401.3 (12%), 431.4 (10%), 559.3 (3%), 637.4 [$M^+(^{79}Br_2)$ + 1, 3%].

IR (KBr) 2924 s, 2853 s, 1511m, 1460 m, 1376 m, 1235 w, 1188 w, 1038 w, 829 w, 721 w.

Microanalysis: Calculated for $C_{33}H_{50}Br_2O_2$ %: C 62.07, H 7.89, Br 25.03. Found %: C 61.98, H 8.01, Br 24.99.

Di-(4-*tert*-octylphenoxy) pentaerythrityl di-[oxycarbonyl[4-[4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl]-benzene]



(9)

The dibromide (**8**) (1.00 g, 1.5 mmol), carboxylic acid (**1**) (0.86 g, 3.47mmol), cesium carbonate (2.26 g, 6.9 mmol), potassium iodide (2.62 g, 15.8 mmol) and dimethyl acetamide (30 mL) were combined and stirred at 100°C for 24 hours under an argon atmosphere. Upon cooling the solvent was removed *in vacuo* and the residue adsorbed onto a small plug of silica. This was washed with hexane then desorbed by washing with dichloromethane. The dichloromethane fraction was submitted to flash chromatography (eluent 100% dichloromethane) to give white crystalline product (0.40 g, 28%).

mp: 206-208°C.

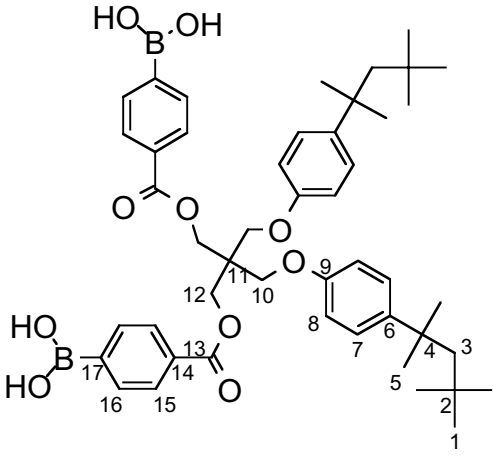
^{1}H n.m.r (300MHz, $CDCl_3$): δ 7.96 (d, *J*=7.8 Hz, 4H, H15), 7.82 (d, *J*=7.8 Hz, 4H, H16), 7.23 (d, *J*=7.7 Hz, 4H, H7), 6.82(d, *J*=7.8 Hz, 4H, H8), 4.73 (s, 4H, H11), 4.28 (s, 4H, H10), 1.68 (s, 4H, H3), 1.35 (s, 12H, H5), 1.33 (s, 24H, H19), 0.72 (s, 18H, H1).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 166.1 (C13), 156.1 (C9), 142.7 (C6), 134.6 (C15), 131.9 (C14), 128.5 (C16), 127.0 (C7), 113.7 (C8), 84.1 (C18), 67.0 (C10), 64.1 (C12), 57.0 (C3), 43.9 (C11), 38.0 (C5), 32.4 (C4), 31.9 (C1), 31.7 (C2), 25.0 (C19). (C bonded to B not observed due to broadening)

IR (Nujol): 2924 s, 2854 s, 1718 m, 1458 m, 1376 m, 1243 m, 1114 m, 1018 m, 825 w, 710 m.

Mass Spectrum (APCI +) m/z: 338.4 (42%), 725.3 (100%), 973.3 (33%, $M^+ + 1$), 995.2 (9%, $M + Na^+$).

Di-(4-*tert*-octylphenoxy) pentaerythrityl, di-[4-benzene-boronic acid]



(10)

The dipinacol ester (**9**) (0.20 g), 1M hydrochloric acid (10 mL) and an acetone/water mix(4:1, 150 mL) were combined and stirred at room temperature for 48 hours. The solvent was removed *in vacuo* and a white crystalline precipitate was collected. This was dissolved in chloroform and washed with water (20 mL x 3) and the solvent removed to leave white crystals (0.12g, 73%).

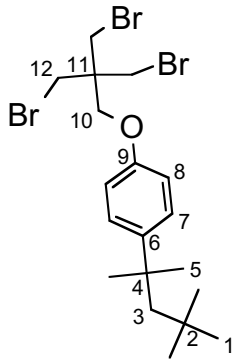
mp: 110-111°C.

^{1}H n.m.r (300MHz, $CDCl_3$):): δ 7.96 (d, *J*=7.8 Hz, 4H, H15), 7.92 (d, *J*=7.8Hz, 4H, H16), 7.23 (d, *J*=7.7 Hz, 4H, H7), 6.82(d, *J*=7.8 Hz, 4H, H8), 4.73 (s, 4H, H11), 4.28 (s, 4H, H10), 1.68 (s, 4H, H3), 1.35 (s, 12H, H5), 0.72 (s, 18H, H1).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 166.3 (C13), 156.2 (C9), 142.9 (C6), 134.8 (C15), 132.0 (C14), 128.6 (C16), 127.1 (C7), 113.9 (C8), 67.1 (C10), 64.2 (C12), 57.1 (C3), 44.0 (C11), 38.2 (C5), 32.5 (C4), 32.0 (C1), 31.9 (C2) (C bonded to B not observed due to broadening).

IR (Nujol): 3400 b, 3330 s, 2954 s, 1779 m, 1698 s, 1543 m, 1264 m, 1181 m, 1014 m, 827 w, 742 w.

(4-*Tert*-octylphenoxy) pentaerythrityl tribromide



(11)

Pentaerythrityl tetrabromide (2.32g, 6.00 mmol), p-*t*-octyl phenol (1.24 g, 6.00 mmol), cesium carbonate (2.16g, 36.60 mmol) and DMF (50 ml) were combined and stirred at 100°C for 24 hours under argon. The reaction mixture was cooled and filtered. The solvent was removed *in vacuo* and the residue taken up in dichloromethane, washed

with 5% HCl (20mL), water (2 x 20 mL), brine (30 mL), and dried over $MgSO_4$. The solvent was then removed *in vacuo* and a crude yellow oil resulted (2.52g). This was then submitted to flash chromatography (hexane 100%) to afford of pure monosubstituted product **11**. (1.02 g, 30%).

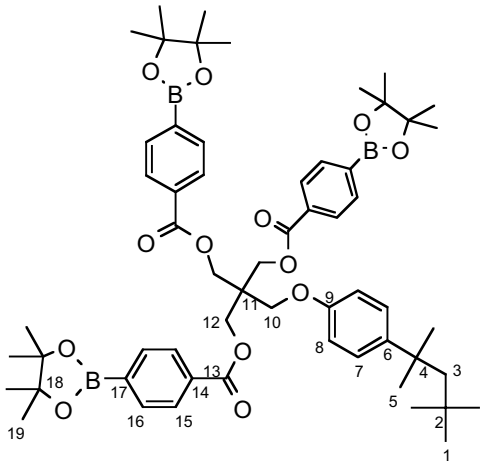
mp: 109-110°C.

^{1}H n.m.r (300MHz, $CDCl_3$): δ7.27 (d, *J*= 7.8 Hz, 2H, H7), 6.84 (d, *J*=7.8 Hz, 2H, H8), 4.03 (s, 2H, H10), 3.68 (s, 6H, H12), 1.70 (s, 2H, H3), 1.34 (s, 6H, H5), 0.72 (s, 9H, H1).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 155.8 (C9), 143.5 (C6), 127.2 (C7), 114.2 (C8), 67.6 (C10), 57.1 (C3), 43.8 (C11), 38.3 (C5), 34.9 (12), 32.6 (C4), 32.0 (C1), 31.8 (C2).

IR (KBr) 2922 s, 2852 s, 1511 w, 1463 s, 1376 s, 1242 w, 721 w.

(4-*Tert*-octylphenoxy) pentaerythrityl tri-[oxycarbonyl[4-[4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl]-benzene]



(12)

The tribromide (0.60 g, 1.15 mmol), carboxylic acid (1.20 g, 4.71mmol), cesium carbonate (5.98 g, 18.40 mmol), potassium iodide (2.98 g, 18.00 mmol) and dimethyl acetamide (30 mL) were combined and stirred at 100°C for 72 hours under an argon atmosphere. Upon cooling the solvent was removed *in vacuo* and the residue was

adsorbed onto a small plug of silica. This was washed with hexane then desorbed by washing with methanol. The solvent was removed *in vacuo* to give a white crystalline product **(12)** (0.40 g, 28%).

mp: 206-208°C.

^{1}H n.m.r (300MHz, $CDCl_3$): δ 7.98 (d, *J*=7.8 Hz, 6H, H15), 7.82 (d, *J*=7.8 Hz, 6H, H16), 7.24 (d, *J*=7.7 Hz, 2H, H7), 6.82(d, *J*=7.8 Hz, 2H, H8), 4.71 (s, 6H, H10), 4.25 (s, 2H, H12), 1.68 (s, 2H, H3), 1.35 (s, 6H, H5), 1.34 (s, 36H, H19), 0.72 (s, 9H, H1).

^{13}C n.m.r (75MHz, $CDCl_3$): δ 166.2 (C13), 156.1 (C9), 143.0 (C6), 134.8 (C15), 131.6 (C14), 128.4 (C16), 127.2 (C7), 113.9 (C8), 84.3 (C18), 66.9 (C10), 64.0 (C12), 57.1 (C3), 43.6 (C11), 38.1 (C5), 32.5 (C4), 32.0 (C1), 31.8 (C2), 24.9 (C19). (C bonded to B not observed due to broadening)

IR (Nujol): 2925 s, 2854 s, 1712 w, 1461 s, 1376 m, 1266 w, 1096 w, 1018 m, 1019 w, 721 w.

Transport Experiments:

The transport cell consisted of two identical water jacketed cylindrical halves, with a half cell volume of 34 mL and a cell membrane surface area of 12.6 cm^2. Each half cell was stirred by a magnetic stirrer at a rate of 250 rpm. The supported liquid membrane consisted of a polymer support (flat sheet of Accurel© type 1E flat membrane (thickness 0.1mm pore size 0.1μm)) coated in a solution of carrier dissolved in 2-nitrophenyl octyl ether. Membranes were prepared in duplicate by dissolving 25 μmol carrier and 25 μmol Aliquat in a suitable solvent, dividing the solution into two equal parts, then adding 0.25 g nitrophenyl octyl ether. The solvent was then removed in *vacuo*

to leave oil. The polymer support was then coated in this oil and subjected to a vacuum for 24 hours. The departure phase consisted of a solution of 0.3Mfructose, 0.3M glucose dissolved in a buffer solution of 0.5 M Na_2CO_3 at pH 11.3. The sugar solution were freshly prepared before each transport. The receiving phase consisted of a 0.1 M solution of NaH_2PO_4 at pH 6.0. Fructose and glucose assays were performed using the method described previously[3]. All transport experiments were performed in duplicate and all assays were done in triplicate.

Fluxes were calculated from the slopes of plots of Total NADPH Abs (340nm) vs time (min^{-1}) using the following equation:

$$\text{Flux (mol m}^{-2}\text{ s}^{-1}) = \frac{\text{slope (min}^{-1}\text{) x 0.034 (L)}}{\text{6220 (L mol}^{-1}\text{ cm}^{-1}\text{) x 1 (cm) x 0.00126 (m}^2\text{) x 60 (s min}^{-1}\text{)}}$$

The actual plots are shown in the Appendix.

Extraction Studies

Extraction experiments with Shinkai's diboronic acid followed a previously described procedure.[4]

References

1. Still, W. C. Kahn, M., Mitra, A., *J. Org. Chem.,* **1978**, 43, 2923-2925.
2. Guiles, J. W., Johnson, S. G., Murray, W. V *J. Org. Chem.,* **1996**, 61, 5169-5171.
3. Kinksy, S. C., *Methods in Enzymology* **1974,** 32, 501-504.
4. Karpa, M. J., Duggan, P. J., Griffin, G. J., Freudigmann, S. J., *Tetrahedron* **1997** 53, 3669- 3678.