

## SUPPLEMENTARY INFORMATION

### Results and Discussion

#### PI-4-Ps as substrates for SopB

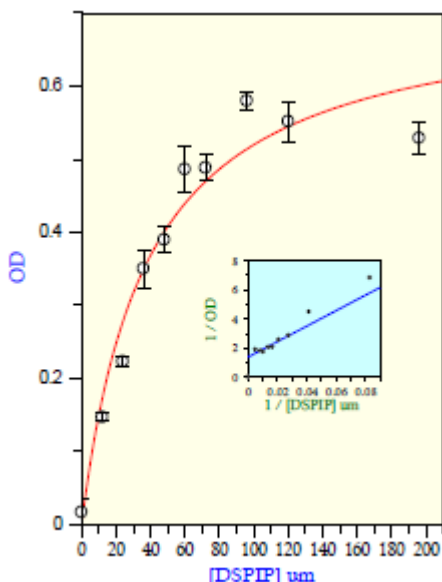
IP <sub>2</sub> presentation	[IP <sub>2</sub> ] (μM)	ΔOD <sub>625</sub>
Aqueous solution	10	0.02 (±0.002)
	20	0.01 (±0.006)
	40	0.01 (±0.003)
Micelles	10	0.09 (±0.004)
	20	0.09 (±0.012)
	40	0.09 (±0.006)

Supplementary Table 1. Attempted dephosphorylation of IP<sub>2</sub> by SopB phosphatase in aqueous and detergent-based solution, measured colorimetrically (malachite green endpoint assay, 10 μg/well, 20 min). No significant reaction was observed.

### Experimental

#### Calculation of K<sub>M</sub> and V<sub>max</sub>

Kinetic parameters, K<sub>M</sub> and Activity (relative V<sub>max</sub>, expressed as a percentage in Table 1, were calculated using Grafit software (courtesy of Professor Robin Leatherbarrow). An example screen shot of a graph fitted from one set of results for one lipid is shown in Supplementary Graph 1.



Supplementary Graph 1. An example of the fitting of colorimetric data from malachite green endpoint assays of *Salmonella* phosphatase SopB, with PI-4-P using Michaelis-Menten kinetics. OD = optical density (625 nm), DSPIP = *sn*-1,2-Distearoylphosphatidylinositol 4-phosphate.

#### Additional procedures

**S-Acetyl mandelic acid, 8a.** *S*-Mandelic acid (5.00 g, 32.9 mmol) was stirred in acetyl chloride (10 mL) for 1 h, during which time the solid dissolved. The volatile components were removed *in vacuo* and the residual white solid dissolved in water (50 mL) with gentle

heating. This was diluted further with water (400 mL) and cooled in an ice-water bath to afford the product as needle-shaped, colourless crystals. Upon standing, a second crop of crystals formed (combined yield 6.06 g, 95%).  $[\alpha]_D^{25} +154.0^\circ$  (*c* 2.0, acetone, *lit.* +153.0°);  $\delta_H$  (400 MHz, CDCl<sub>3</sub>) 7.48-7.47 (2H, m), 7.40-7.39 (3H, m), 5.93 (1H, s), 2.19 (3H, s);  $\delta_C$  (125 MHz, CDCl<sub>3</sub>) 173.9, 170.6 (2 × C=O), 133.2 (Ph C), 129.4, 128.9 (2C), 127.7 (CH) (5 × Ph CH), 74.2 (CH), 20.6 (CH<sub>3</sub>); HRMS (EI+) *m/z* found [M]<sup>+</sup> = 194.0581, C<sub>10</sub>H<sub>9</sub>O<sub>4</sub> requires 194.0579.

***sn*-3-*O*-Benzyl-1,2-*O*-isopropylidene glycerol.** *S*-(+)-1,2-*O*-isopropylidene glycerol (1.00 g, 7.57 mmol) was dissolved in DMF (20 mL), cooled in an ice-water bath, and sodium hydride (60% dispersion in mineral oil, 334 mg, 8.32 mmol, 1.05 eq.) added. Once the effervescence had subsided, benzyl chloride (871 μL, 7.57 mmol, 1.0 eq.) was added in one portion. After stirring for 36 h, water (4 mL) and diethyl ether (100 mL) were added. The organic solution was washed with water (2 × 800 mL), dried (MgSO<sub>4</sub>), and the solvent removed *in vacuo* to afford the *title compound* as a pale yellow oil (1.55 g, 100%) requiring no further purification. *R*<sub>f</sub> (EtOAc-pet. spirit, 1:1) 0.80;  $\delta_H$  (400 MHz, CDCl<sub>3</sub> with 0.01 M triethylamine) 7.38-7.28 (5H, m, 5 × Ph CH), 4.65-4.55 (2H, m, PhCH<sub>2</sub>O), 4.33 (1H, quin., *J* 6.1, Gly 2-CH<sub>2</sub>), 4.11-4.07 (2H, m, Gly 1-CH<sub>2</sub>), 3.58 (1H, dd, *J* 9.7, 6.1), 3.50 (1H, dd, *J* 9.8, 5.6) (Gly 3-CH<sub>2</sub>), 1.44 (3H, s, CH<sub>3</sub>), 1.39 (3H, s, CH<sub>3</sub>); MS (CI+, NH<sub>3</sub>) *m/z* found [M]<sup>+</sup> = 222.1, C<sub>13</sub>H<sub>18</sub>O<sub>3</sub><sup>+</sup> requires 222.1, also observed [M+NH<sub>4</sub>]<sup>+</sup> = 240. These data agree with those reported for this compound<sup>1</sup>.

**3-*O*-Benzyl-*sn*-glycerol.** *sn*-3-*O*-Benzyl-1,2-*O*-isopropylidene glycerol (2.0 g, 9.0 mmol) was dissolved in DCM (50 mL) to which water (5 mL) and trifluoroacetic acid (10 mL) were added. After stirring vigorously for 16 h, sodium carbonate (10 g, 1.4 eq.) and EtOAc (300 mL) were added. The organic solution was washed with water (2 × 200 mL), dried (MgSO<sub>4</sub>), and the solvents removed *in vacuo*. The translucent yellow oil was adsorbed onto silica and fractionated through a column of flash silica using a gradient CH<sub>2</sub>Cl<sub>2</sub>-methanol (1:0 → 3:17) to afford the *title compound* (1.08 g, 66%). *R*<sub>f</sub> (pet. spirit-EtOAc 1:1) 0.20; (CH<sub>2</sub>Cl<sub>2</sub>-methanol 9:1) 0.50;  $\delta_H$  (400 MHz, CDCl<sub>3</sub>) 7.41-7.30 (5H, m, 5 × Ph CH), 4.57 (2H, s, PhCH<sub>2</sub>O), 3.95 (1H, dt, *J* 5.1, 4.0, Gly 2-CH), 3.76-3.64 (2H, m, Gly 1-CH<sub>2</sub>), 3.57 (2H, dd, *J* 9.8, 5.1, Gly 3-CH<sub>2</sub>), 2.96 (2H, bs, 2 × OH); HRMS (ESI+) *m/z* found [M+H]<sup>+</sup> = 182.0942, C<sub>10</sub>H<sub>15</sub>O<sub>3</sub>, requires 182.0943. These data agree with those reported for this compound<sup>1</sup>.

**3-*O*-Benzyl-*sn*-1,2-*O*-distearoyl glycerol.** *sn*-3-*O*-Benzyl-glycerol (811 mg, 4.45 mmol) was evaporated from acetonitrile (3 × 3 mL) and dissolved in CH<sub>2</sub>Cl<sub>2</sub> (20 mL). Stearic acid (1.00 g, 9.12 mmol, 2.05 eq.), *N*-methyl imidazole (3.55 mL, 44.5 mmol, 10.0 eq.), and finally DebCl (1.59 mL, 11.2 mmol, 2.5 eq.) were added and the mixture stirred for 16 h. After this water (10 mL) was added, the mixture diluted with diethyl ether (300 mL), the organic layer dried over MgSO<sub>4</sub>, and the solvent removed *in vacuo* affording the *title compound* as a white solid (3.00 g, 94%) requiring no further purification. *R*<sub>f</sub> (CH<sub>2</sub>Cl<sub>2</sub>) 0.80;  $\delta_H$  (400 MHz, CDCl<sub>3</sub>) 7.40-7.30 (5H, m, 5 × Ph CH), 5.29-5.24 (1H, m, Gly 2-CH), 4.62-4.54 (2H, d, *J*

12:1) (PhCH<sub>2</sub>O), 4:36-4:21 (2H, m, Gly 1-CH<sub>2</sub>), 3:61 (2H, d, *J* 5:4, Gly 3-CH<sub>2</sub>), 2:34 (2H, t, *J* 7:6, CH<sub>2</sub>COOR), 2:29 (2H, t, *J* 7:6, CH<sub>2</sub>COOR), 1:68-1:55 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>COOR), 1:35-1:20 (56H, m, 28 × CH<sub>2</sub>), 0:90 (6H, t, *J* 6:8, 2 × CH<sub>3</sub>); δ<sub>C</sub> (125 MHz, CDCl<sub>3</sub>) 173:44, 173:14 (2C, C=O), 137:72 (Ph C), 128:43 (2C), 127:80, 127:64 (2C) (5 × Ph CH), 73:32 (PhCH<sub>2</sub>O), 70:01 (Gly 2-CH) 68:26 (Gly 3-CH<sub>2</sub>), 62:67 (Gly 1-CH<sub>2</sub>), 34:35, 34:14, 31:95 (2C), 29:73-29:13 (m, 26C), 24:98 (2C), 24:91 (2C), 22:72 (2C) (32 × CH<sub>2</sub>), 14:15 (2C, 2 × CH<sub>3</sub>); HRMS (ESI+) *m/z* found [M+Na]<sup>+</sup> = 737:6077, C<sub>46</sub>H<sub>82</sub>O<sub>5</sub>Na requires 737:6060.

***sn*-1,2-*O*-Distearoyl glycerol, 19a.** *sn*-3-*O*-Benzyl-1,2-*O*-distearoyl glycerol (3.00 g, 4.19 mmol) was dissolved in reagent grade EtOAc, (undried, 40 mL), palladised charcoal (10 mol%, 200 mg) was added and the suspension placed under a nitrogen atmosphere. After evacuating briefly and letting down to nitrogen five times, the final time the flask was opened to hydrogen. After stirring briskly for 48 h, the reaction flask was evacuated and let down to nitrogen three times, the suspension was dried (MgSO<sub>4</sub>), filtered through Celite filter aid, washed with liberally with CHCl<sub>3</sub>, and the solvent removed *in vacuo* to give the *title compound* (2.59 g, 99%) as a low melting point (<35 °C) white solid. *R*<sub>f</sub> (CH<sub>2</sub>Cl<sub>2</sub>) 0:17; δ<sub>H</sub> (400 MHz, CDCl<sub>3</sub>) 5:15-5:09 (1H, m, Gly 2-CH), 4:34-4:25 (2H, m, Gly 2-CH<sub>2</sub>), 3:75 (2H, d, *J* 5:0, Gly 3-CH<sub>2</sub>), 2:35 (4H, t, *J* 7:6, 2 × CH<sub>2</sub>COOR), 1:65-1:60 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>COOR), 1:35-1:2 (56H, m, 28 × CH<sub>2</sub>), 0:90 (6H, t, *J* 6:8, 2 × CH<sub>3</sub>); δ<sub>C</sub> (125 MHz, CDCl<sub>3</sub>) 173:82, 173:46 (C=O), 72:12 (Gly 2-CH), 62:01 (Gly 3-CH<sub>2</sub>), 61:57 (Gly 1-CH<sub>2</sub>), 34:31, 34:12, 31:93 (2C), 29:8-29:0 (m, 22C), 24:9 (2C), 22:7 (2C), 14:12 (2C) (32 × CH<sub>2</sub>); HRMS (ESI+) *m/z* found [M+H]<sup>+</sup> = 625:5143, C<sub>39</sub>H<sub>77</sub>O<sub>5</sub> requires 625:5145. These data agree with those reported for this compound<sup>2</sup>.

***sn*-1-*O*-Stearoyl-2-*O*- $\gamma$ -linolenoyl-3-*O*-(9-phenylxanthen-9-yl) glycerol.** *sn*-1-*O*-Stearoyl-3-*O*-(9-phenylxanthen-9-yl) glycerol (**20**, 921 mg, 1.50 mmol) was dissolved in CH<sub>2</sub>Cl<sub>2</sub> (40 mL), to which was added  $\gamma$ -linolenic acid (509 mg, 1.80 mmol, 1.2 eq), *N*-methylimidazole (726  $\mu$ L, 8.99 mmol, 6.0 eq), then 2,6-dichlorobenzoyl chloride (536  $\mu$ L, 3.75 mmol, 2.5 eq). After stirring for 16 h, water (10 mL) then diethyl ether (200 mL) were added. The organic layer was washed with water (2 × 300 mL), dried (Na<sub>2</sub>SO<sub>4</sub>) and the solvent removed *in vacuo*. The resulting translucent yellow oil (1.45 g) was fractionated by flash chromatography, eluting with diethyl ether-pet. spirit (1:49), to afford the *title compound* as a colourless oil (1.05 g, 80%). *R*<sub>f</sub> (diethyl ether-pet. spirit, 3:17) 0:45; δ<sub>H</sub> (400 MHz, CDCl<sub>3</sub>) 7:46-7:05 (13H, m, 13 × Px CH), 5:48-5:32 (6H, m, 3 × CH=CH), 5:24-5:17 (1H, m, 2-CH), 4:35 (1H, dd, *J* 11:8, 3:8), 4:25 (1H, dd, *J* 11:8, 6:5) (1-CH<sub>2</sub>), 3:11 (2H, dd, *J* 9:8, 5:0, 3-CH<sub>2</sub>), 2:88-2:78 [4H, m, 2 × (CH=CH)<sub>2</sub>CH<sub>2</sub>], 2:29 (2H, t, *J* 7:2, CH<sub>2</sub>CO<sub>2</sub>), 2:22 (2H, t, *J* 7:7, CH<sub>2</sub>CO<sub>2</sub>), 2:15-2:01 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>CH=CH), 1:70-1:50 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>COOR), 1:50-1:30 (36H, m, 18 × CH<sub>2</sub>), 0:91 (6H, t, *J* 6:8, 2 × CH<sub>3</sub>); δ<sub>C</sub> (125 MHz, CDCl<sub>3</sub>) 172:9, 172:7 (2 × C=O), 151:3 (2C), 148:7 (3 × Px C), 130:5, 129:5 (3C), 129:3, 128:5, 128:3, 128:0, 127:9, 127:6 (3C), 126:7, 126:3 (4C), 123:6, 123:5, 116:4 (2C) [(13 × Px CH) + (3 × HC=CH) + (2 × Px C)], 75:6 (Px COCH<sub>2</sub>), 70:2 (Gly 2-CH), 62:7, 61:7 (Gly 1-CH<sub>2</sub> + Gly 3-CH<sub>2</sub>), 34:17, 34:10 (2 × CH<sub>2</sub>COOR), 31:9,

31:5, 29:7, 29:5 (8C), 29:3 (3C), 29:1, 27:2, 26:9, 25:6, 24:8, 24:5, 22:70 (2C), 22:58 (2C) (24 × CH<sub>2</sub>), 14:1 (2 × CH<sub>3</sub>); HRMS (ESI+) *m/z* found [M+Na]<sup>+</sup> = 897:6018, C<sub>58</sub>H<sub>82</sub>O<sub>6</sub>Na requires 897:6009.

***sn*-1-*O*-Stearoyl-2-*O*- $\gamma$ -linolenoyl glycerol, 19c.** To *sn*-1-*O*-stearoyl-2-*O*- $\gamma$ -linolenoyl-3-*O*-(9-phenylxanthen-9-yl) glycerol (1.03 g, 1.17 mmol) dissolved in CH<sub>2</sub>Cl<sub>2</sub> (15 mL) were added pyrrole (814  $\mu$ L, 11.7 mmol, 10.0 eq.) and dichloroacetic acid (194  $\mu$ L, 2.35 mmol, 2.0 eq.). After stirring for 2 min, 0.2 M sodium acetate buffer (5 mL) was added and the mixture was diluted with CH<sub>2</sub>Cl<sub>2</sub> (20 mL). The organic layer was washed with water (20 mL), dried (Na<sub>2</sub>SO<sub>4</sub>), and the solvent removed *in vacuo*. The pale yellow oil was triturated with pet. spirit-acetic acid (99:1, 10 mL) and the solids discarded. The supernatant was evaporated and the residual colourless oil fractionated through a column of flash silica; the silica was pre-acidified by flushing with EtOAc-EtOH-AcOH (179:20:1, v/v/v), then eluted with a gradient of diethyl ether-pet. spirit (0:1→1:3) to afford the *title compound* as a colourless oil (547 mg, 75%). *R*<sub>f</sub> (EtOAc-pet. spirit, 1:4) 0:34; δ<sub>H</sub> (400 MHz, CDCl<sub>3</sub>) 5:50-5:30 (6H, m, 3 × HC=CH), 5:11 (1H, m, 2-CH), 4:34 (1H, dd, *J* 11:9, 4:5), 4:26 (1H, dd, *J* 12:0, 5:6) (1-CH<sub>2</sub>), 3:80-3:72 (2H, m, 3-CH<sub>2</sub>), 2:83-2:80 [4H, m, 2 × CH<sub>2</sub>(CH=CH)<sub>2</sub>], 2:39 (2H, t, *J* 7:6), 2:35 (2H, t, *J* 7:7) (2 × CH<sub>2</sub>CO<sub>2</sub>), 2:14-2:00 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>-CH=CH), 1:73-1:60 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>CO<sub>2</sub>), 1:47-1:20 (36H, m, 18 × CH<sub>2</sub>), 0:91 (6H, t, *J* 6:7, 2 × CH<sub>3</sub>); δ<sub>C</sub> (125 MHz, CDCl<sub>3</sub>) 173:8, 173:2 (2 × C=O), 130:5, 129:5, 128:5, 128:4, 128:0, 127:6 (3 × HC=CH), 72:2 (Gly 2-CH), 62:0, 61:5 (2 × Gly CH<sub>2</sub>), 34:16, 34:11 (2 × CH<sub>2</sub>CO<sub>2</sub>), 31:9, 31:5, 29:7 (8C), 29:48 (3C), 29:39, 29:33, 29:28, 29:14, 29:02, 27:2, 26:8 (2C), 25:6, 24:9, 24:5 (24 × CH<sub>2</sub>), 14:1 (2 × CH<sub>3</sub>); HRMS (ESI+) *m/z* found [M+H]<sup>+</sup> = 619:5006, C<sub>39</sub>H<sub>71</sub>O<sub>5</sub> requires 619:5050.

**1-*O*-Stearoyl-*sn*-2-oleoyl-3-*O*-(9-phenylxanthen-9-yl) glycerol.** Oleic acid (500 mg, 1.80 mmol, 1.2 eq.) was used instead of  $\gamma$ -linolenic acid (above), with *sn*-1-*O*-stearoyl-3-*O*-(9-phenylxanthen-9-yl) glycerol (**20**, 921 mg, 1.50 mmol), *N*-methylimidazole (726  $\mu$ L, 8.99 mmol, 6.0 eq.) and 2,6-dichlorobenzoyl chloride (536  $\mu$ L, 3.75 mmol, 2.5 eq.). This reaction afforded *title compound* as a colourless oil (988 mg, 75%). *R*<sub>f</sub> (diethyl ether-pet. spirit, 3:17) 0:45; δ<sub>H</sub> (400 MHz, CDCl<sub>3</sub>) 7:40-7:00 (13H, m, 13 × Px CH), 5:42-5:32 (2H, m, HC=CH), 5:24-5:18 (1H, m, Gly 2-CH), 4:35-4:24 (2H, m, Gly 1-CH<sub>2</sub>), 3:11 (2H, dd, *J* 5:1, 9:8, Gly 3-CH<sub>2</sub>), 2:25 (4H, t, *J* 7:7, 2 × CH<sub>2</sub>COOR), 2:03 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>CH=CH), 1:65-1:52 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>COOR), 1:50-1:30 (48H, m, 24 × CH<sub>2</sub>), 0:91 (6H, t, 2 × CH<sub>3</sub>); δ<sub>C</sub> (125 MHz, CDCl<sub>3</sub>) 173:40, 172:88 (2 × C=O), 151:3, 151:2, 148:7 (3 × Px C), 130:01, 129:7, 129:5, 129:3, 129:2, 127:9 (2C), 126:6 (2C), 126:3, 123:6, 123:5, 122:7, 122:6, 116:4 (2C), [(13 × Px CH) + HC=CH + (2 × Px C)], 75:6 (Px COCH<sub>2</sub>), 70:1 (Gly 2-CH), 62:7, 61:7 (Gly 1-CH<sub>2</sub> + Gly 3-CH<sub>2</sub>), 34:3, 34:1 (2 × CH<sub>2</sub>COORs), 31:9 (2C), 31:6, 29:8, 29:7 (8C), 29:54, 29:49, 29:37, 29:33 (2C), 29:29, 29:23, 29:13 (3C), 27:23, 27:18, 24:9, 24:8, 22:7 (2C) (28 × CH<sub>2</sub>), 14:12 (2C) (2 × CH<sub>3</sub>); HRMS (ESI+) *m/z* found [M+Na]<sup>+</sup> = 901:6354, C<sub>58</sub>H<sub>86</sub>O<sub>6</sub>Na requires 901:6322.

**sn-1-O-Stearoyl-2-O-oleoyl glycerol, 19b.** *sn-1-O-Stearoyl-2-O-oleoyl-3-O-(9-phenylxanthen-9-yl) glycerol* (970 mg, 1.10 mmol) was used instead of *sn-1-O-stearoyl-2-O- $\gamma$ -linolenoyl-3-O-(9-phenylxanthen-9-yl) glycerol* (above) with pyrrole (763  $\mu$ L, 11.0 mmol, 10.0 eq.) and dichloroacetic acid (182  $\mu$ L, 2.20 mmol, 2.0 eq.). This reaction afforded *title compound* as a colourless oil (634 mg, 93%).  $R_f$  (diethyl ether-pet. spirit, 3:17) 0.45;  $\delta_H$  (400 MHz, CDCl<sub>3</sub>) 5.40-5.30 (2H, m, HC=CH), 5.13-5.07 (1H, m, Gly 2-CH), 4.35-4.27 (2H, m, Gly 1-CH<sub>2</sub>), 3.76 (2H, dd,  $J$  1.0, 4.6, Gly 3-CH<sub>2</sub>), 2.38 (2H, t,  $J$  7.5, CH<sub>2</sub>COOR), 2.36 (2H, t,  $J$  7.5, CH<sub>2</sub>COOR), 2.08-1.99 (4H, m, CH<sub>2</sub>CH=CHCH<sub>2</sub>), 1.70-1.60 (4H, m, 2  $\times$  CH<sub>2</sub>CH<sub>2</sub>COOR), 1.40-1.20 (48H, m, 24  $\times$  CH<sub>2</sub>), 0.90 (6H, t,  $J$  6.8, 2  $\times$  CH<sub>3</sub>);  $\delta_C$  (125 MHz, CDCl<sub>3</sub>) 173.9, 173.5 (2  $\times$  C=O), 130.0, 129.7 (HC=CH), 72.1 (Gly 2-CH), 62.0, 61.6 (2  $\times$  Gly CH<sub>2</sub>), 34.3, 34.0 (2  $\times$  CH<sub>2</sub>COORs), 31.9 (2C), 31.6, 29.76, 29.69 (7C), 29.52, 29.47, 29.32 (3C), 29.27, 29.17, 29.11 (2C), 29.06, 27.22 (2C), 27.16, 24.89 (2C), 22.68 (2C) (28  $\times$  CH<sub>2</sub>), 14.11 (2C, 2  $\times$  CH<sub>3</sub>); HRMS (ESI+)  $m/z$  [M+H]<sup>+</sup> = 623.5623, C<sub>39</sub>H<sub>75</sub>O<sub>5</sub><sup>+</sup> requires 623.5610.

**3-(Trimethylsilyloxy)propionitrile, 12.** 3-Hydroxypropionitrile (40.3 mL, 590 mmol) and triethylamine (84.5 mL, 610 mmol, 1.03 eq.) were dissolved in diethyl ether (100 mL) and cooled to 0 °C. A solution of trimethylsilyl chloride (76.6 mL, 600 mmol, 1.02 eq.) in diethyl ether (200 mL) was added dropwise to the briskly stirred solution. After 16 h, the reaction mixture was filtered under a flow of nitrogen gas, washing with diethyl ether. The solvent was then removed *in vacuo* and the remaining pale brown oil was distilled (20 mmHg, 75-85 °C) to afford the *title compound* as a colourless oil (78.0 g, 92%).  $\delta_H$  (400 MHz, CDCl<sub>3</sub>) 3.77 (2H, t,  $J$  6.3, SiOCH<sub>2</sub>), 2.52 (2H, t,  $J$  6.3, CH<sub>2</sub>CN), 0.01 (9H, s, 3  $\times$  CH<sub>3</sub>);  $\delta_C$  (101.3 MHz, CDCl<sub>3</sub>) 165.8, 139.2, 8.1 ppm. These data are consistent with other studies that use this compound<sup>3,4</sup>.

**1-O-[(Cyanooethoxy)(sn-1,2-O-distearoylglyceroyloxy)phosphoryl]-2,3,5,6-O-dicyclohexylidene-myoinositol, 23a.** To 1-O-(dicyanoethoxyphosphoryl)-2,3,5,6-O-dicyclohexylidene-myoinositol (**11**, 180 mg, 0.30 mmol) were added CH<sub>2</sub>Cl<sub>2</sub> (3 mL), MeCN (1 mL), and triethylamine (3 mL). After stirring the solution for 36 h, the solvent was removed *in vacuo* to give the putative phosphodiester salt as a white solid (169 mg). To this were added 1,2-O-distearoyl glycerol (**19a**, 551 mg, 0.88 mmol, 3.0 eq.), then 3-nitro triazole (**22**, 269 mg, 2.35 mmol, 8.0 eq.), and the mixture was co-evaporated from pyridine (3  $\times$  2 mL). The residue was dissolved in CH<sub>2</sub>Cl<sub>2</sub>-MeCN-pyridine (2:2:1, 5 mL) to which a solution of mesitylene sulfonyl chloride (258 mg, 1.18 mmol, 4.0 eq.) in pyridine (1 mL) was added dropwise over 25 min. The reaction mixture was stirred for a further 2 h after which water (2 mL) was added. The mixture was diluted with EtOAc (100 mL), washed with water (3  $\times$  300 mL), dried (MgSO<sub>4</sub>), and flash silica was added before stripping off the solvent. The silica was poured onto a flash column that was eluted with a gradient of EtOAc-pet. spirit (0:1  $\rightarrow$  1:0) to afford the *title compound* (238 mg, 75%).  $R_f$  (EtOAc) 0.90;  $\delta_H$  (400 MHz, CDCl<sub>3</sub>) 5.30-5.23 (1H, m, Gly 2-CH), 4.78-4.70 (1H, m, Ins 1-H), 4.64-4.60 (1H, m, Ins 2-H), 4.40-4.15 [6H, m, (2  $\times$  POCH<sub>2</sub>) + Gly 1-CH<sub>2</sub>], 4.12-4.01

(2H, m, Ins 3-H + Ins 6-H), 3.90 (1H, dd,  $J$  10.7, 6.6, Ins 4-H), 3.39 (1H, t,  $J$  10.1, Ins 5-H), 2.83 (2H, t,  $J$  6.6, CH<sub>2</sub>CN), 2.34 (4H, t,  $J$  7.8, 2  $\times$  CH<sub>2</sub>CO<sub>2</sub>), 1.80-1.20 (80H, m, 40  $\times$  CH<sub>2</sub>), 0.90 (6H, t,  $J$  6.8, 2  $\times$  CH<sub>3</sub>);  $\delta_P$  (162 MHz, CDCl<sub>3</sub>) -2.74 (0.3P), -2.92 (0.7P);  $\delta_C$  (125 MHz, CDCl<sub>3</sub>) 173.2, 172.8 (2  $\times$  C=O), 116.0 (C $\equiv$ N), 113.8, 111.3 (2  $\times$  acetal C), 81.4, 77.5, 76.0, 75.4, 74.9, 74.8 (6  $\times$  Ins CH), 69.1 (Gly 2-CH), 66.2 (Gly 3-CH<sub>2</sub>), 62.2 (P-O-CH<sub>2</sub>), 61.7 (Gly 1-CH<sub>2</sub>), 37.8, 36.33 (2  $\times$  CH<sub>2</sub>COORs), 36.26, 35.08, 35.03, 34.14, 33.98, 31.9 (2C), 29.7 (14C), 29.49 (2C), 29.35 (2C), 29.29 (2C), 29.13, 29.10, 24.82 (2C), 24.77, 24.0, 23.81, 23.76, 23.71, 23.68, 22.7 (2C), 19.4 (2C) [(30  $\times$  fatty acid CH<sub>2</sub>) + (10  $\times$  cyclohexylidene CH<sub>2</sub>) + CH<sub>2</sub>CN], 14.18, 14.11 (2  $\times$  CH<sub>3</sub>); HRMS (ESI+)  $m/z$  found [M+H]<sup>+</sup> 1,080.7462, C<sub>60</sub>H<sub>107</sub>NO<sub>13</sub>P requires 1,080.7480.

**1-O-[(Cyanooethoxy)(sn-1-O-stearoyl-2-oleoylglyceroyloxy)phosphoryl]-2,3,5,6-O-dicyclohexylidene-myoinositol, 23b.** This compound was prepared by the same procedure as for **23a**, first treating 1-O-(dicyanoethoxyphosphoryl)-2,3,5,6-O-dicyclohexylidene-myoinositol (**11**, 253 mg, 0.44 mmol) with Et<sub>3</sub>N (1 mL) in CH<sub>2</sub>Cl<sub>2</sub> (2 mL), MeCN (1 mL). The residual salt, plus *sn-1-O-stearoyl-2-O-oleoyl glycerol* (**19b**, 551 mg, 0.88 mmol, 2.0 eq.) and 3-nitrotriazole (**22**, 402 mg, 3.52 mmol, 8 eq.) in CH<sub>2</sub>Cl<sub>2</sub>-MeCN-pyridine (2:2:1, 5 mL) were then reacted with mesitylene sulfonyl chloride (385 mg, 1.76 mmol, 4 eq.) in pyridine (1 mL), added dropwise, to afford the *title compound* (356 mg, 75%).  $R_f$  (EtOAc) 0.90;  $\delta_H$  (400 MHz, CDCl<sub>3</sub>) 5.40-5.37 (2H, m, HC=CH), 5.37-5.31 (1H, m, Gly 2-CH), 4.82-4.76 (1H, m, Ins 1-CH), 4.62 (1H, dd,  $J$  4.4, 8.8, Ins 2-CH), 4.42-4.15 (6H, m, POCH<sub>2</sub> + Gly 3-CH<sub>2</sub> + Gly 1-CH<sub>2</sub>), 4.10 (1H, t,  $J$  5.4, Ins 3-CH), 4.03 (1H, t,  $J$  3.9, 9.9, Ins 6-CH), 3.92 (1H, dd,  $J$  6.5, 10.7, Ins 4-CH), 3.40 (1H, t,  $J$  10.2, Ins 5-CH), 2.85 (2H, t,  $J$  6.5, CH<sub>2</sub>CN), 2.40-2.30 (4H, t,  $J$  7.7, 2  $\times$  CH<sub>2</sub>COOR), 2.10-2.00 (4H, m, CH<sub>2</sub>CH=CHCH<sub>2</sub>), 1.80-1.10 (68H, m, 34  $\times$  CH<sub>2</sub>), 0.90 (6H, t,  $J$  6.8, 2  $\times$  CH<sub>3</sub>) ppm;  $\delta_P$  (162 MHz, CDCl<sub>3</sub>) -2.81 (0.5P), -2.94 (0.5P) ppm; HRMS (ESI+)  $m/z$  found [M+H]<sup>+</sup> = 1,078.7323, C<sub>60</sub>H<sub>105</sub>NO<sub>13</sub>P requires 1,078.7324.

**1-O-[(Cyanooethoxy)(sn-1-O-stearoyl-2-O- $\gamma$ -linolenoylglyceroyloxy)phosphoryl]-2,3,5,6-O-dicyclohexylidene-myoinositol, 23c.** This compound was prepared by the same procedure as for **23a**, first treating 1-O-(dicyanoethoxyphosphoryl)-2,3,5,6-O-dicyclohexylidene-myoinositol (**11**, 198 mg, 0.376 mmol) with Et<sub>3</sub>N (1 mL) in CH<sub>2</sub>Cl<sub>2</sub> (2 mL), MeCN (1 mL). The residual salt, plus *sn-1-O-stearoyl-2-O- $\gamma$ -linolenoyl glycerol* (**19b**, 547 mg, 0.88 mmol, 2.35 eq.) and 3-nitrotriazole (**22**, 343 mg, 3.01 mmol, 8.0 eq.) in CH<sub>2</sub>Cl<sub>2</sub>-MeCN-pyridine (2:2:1, 5 mL) were then reacted with mesitylene sulfonyl chloride (329 mg, 1.50 mmol, 4.0 eq.) in pyridine (1 mL), added dropwise 80  $\mu$ L/2 min, to afford the *title compound* as an off-white solid (380 mg, 94%).  $R_f$  (EtOAc-pet. spirit, 1:1) 0.40;  $\delta_H$  (400 MHz, CDCl<sub>3</sub>) 5.47-5.25 [7H, m, (3  $\times$  HC=CH) + Gly 2-CH], 4.83-4.72 (1H, m, Ins 1-H), 4.61 (1H, t,  $J$  4.5, Ins 2-H), 4.40-4.25 (5H, m, OCH<sub>2</sub>CH<sub>2</sub>CN + Gly 3-CHH), 4.19 (1H, dd, Gly 3-CHH), 4.10 (1H, t, Ins 3-H), 4.04 (0.5H, t,  $J$  10.0), 4.02 (0.5H, t,  $J$  9.9 Hz), (Ins 6-H), 3.90 (1H, dd,  $J$  10.7, 6.5, Ins 4-H), 3.40 (1H, t,  $J$  9.8 Hz, Ins 5-H), 2.87-2.80 [6H, m, CH<sub>2</sub>CN

+ 2 × CH<sub>2</sub>(CH=CH)<sub>2</sub>], 2.34 (2H, t, *J* 7.6), 2.30 (2H, t, *J* 7.6) (2 × CH<sub>2</sub>CO<sub>2</sub>), 2.12-2.02 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>CH=CH), 1.80-1.20 (48H, m, 24 × CH<sub>2</sub>), 0.90 (6H, t, *J* 6.8, 2 × CH<sub>3</sub>); δ<sub>p</sub> (162 MHz, CDCl<sub>3</sub>) -2.79 (0.5P), -2.92 (0.5P); δ<sub>c</sub> (125 MHz, CDCl<sub>3</sub>) 173.2, 173.0 (2 × C=O), 130.5, 128.51, 128.4 (2C), 128.0, 127.6 (3 × HC=CH), 116.0 (C≡N), 111.0, 114.0 (2 × acetal C), 81.5 (2C), 76.5, 76.0, 74.9 (2C) (6 × Ins-CH), 69.4 (Gly 2-CH<sub>2</sub>), 66.0 (Gly 3-CH<sub>2</sub>), 62.5 (POCH<sub>2</sub>), 61.0 (Gly 1-CH<sub>2</sub>), 36.3, 35.1 (2 × CH<sub>2</sub>COORs), 34.0, 31.9, 31.5, 29.71 (10C), 29.51 (3C), 29.33 (2C), 29.16, 29.0, 27.2, 26.9, 25.6 (4C), 24.8 (3C), 24.4, 24.0, 22.7, 21.0, 19.61, 19.50 [(24 × fatty acid CH<sub>2</sub>) + (10 × cyclohexylidene CH<sub>2</sub>) + CH<sub>2</sub>CN], 14.22, 14.13 (2 × CH<sub>3</sub>); HRMS (ESI+) *m/z* found [M+H]<sup>+</sup> = 1,074.7007, C<sub>60</sub>H<sub>101</sub>NO<sub>13</sub>P requires 1,074.7011.

**1-*O*-[(Cyanooxyloxy)(*sn*-1,2-*O*-distearoylglyceroyloxy)phosphoryl]-4-*O*-(dicyanoethoxyphosphoryl)-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol, 24a.** 1-*O*-[(Cyanooxyloxy)(*sn*-1,2-*O*-distearoylglyceroyloxy)phosphoryl]-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol (**23a**, 250 mg, 0.231 mmol) was evaporated from pyridine (3 × 2 mL) then dissolved in CH<sub>2</sub>Cl<sub>2</sub>-pyridine (3:2, 2.5 mL) to which *N*-methyl imidazole (222 μL, 2.78 mmol, 12.0 eq.) then dicyanoethylphosphorochlorodite in CH<sub>2</sub>Cl<sub>2</sub> (**15**, 0.1 g/mL stock, 8.2 mL, 2.78 mmol, 12.0 eq.) were added. After 16 h cyanoethanol (157 μL, 2.57 mmol, 11.1 eq.) was added and the mixture stirred for 30 min. The solution was then cooled to 0 °C and 5M *tert*-butyl hydroperoxide in decanes (249 μL, 1.25 mmol, 5.0 eq.) was added. After 12 h water (5 mL) was added and the solution was concentrated *in vacuo*. The resulting mixture was suspended in MeCN-water (1:9, 100 mL) and fractionated through a column of silanised silica, eluting with a gradient of MeCN-water (1:4 → 7:3, and flushed with EtOAc). The appropriate fractions were combined, dried (MgSO<sub>4</sub>), and adsorbed onto silica. The dry powder was poured onto a column of silica and fractionated, eluting with a gradient of first diethyl ether-pet. spirit (0:1 → 1:0) then methanol-EtOAc (0:1 → 1:1), to afford the *title compound* as a white greasy solid (248 mg, 85%). *R*<sub>f</sub> (EtOAc) 0.26; δ<sub>H</sub> (400 MHz, CDCl<sub>3</sub>) 5.33-5.27 (1H, m, Gly 2-CH), 4.82-4.73 (1H, m, Ins 1-H), 4.71-4.62 (2H, m, Ins 4-H + Ins 2-H), 4.45-4.15 [11H, m, (3 × OCH<sub>2</sub>CH<sub>2</sub>CN) + Gly 3-CH<sub>2</sub> + Gly 1-CH<sub>2</sub> + Ins 3-H], 4.15-4.08 (1H, m, Ins 6-H), 3.51 (1H, t, *J* 10.2, Ins 5-H), 2.86-2.80 (6H, m, 3 × CH<sub>2</sub>CN), 2.40-2.30 (4H, m, 2 × CH<sub>2</sub>CO<sub>2</sub>), 1.85-1.20 (80H, m, 40 × CH<sub>2</sub>), 0.90 (6H, t, *J* 6.8, 2 × CH<sub>3</sub>); δ<sub>p</sub> (162 MHz, CDCl<sub>3</sub>) -2.31 (1P), -2.78 (0.4P), -2.97 (0.6P); δ<sub>c</sub> (125 MHz, CDCl<sub>3</sub>) 173.2, 172.8, (2 × C=O), 116.23, 116.13, 116.10 (3 × C≡N), 114.4, 112.1 (2 × acetal C), 81.0, 79.4, 76.1, 75.8, 75.1, 74.6, 69.1 [(6 × Ins-CH) + Gly 2-CH], 66.0, 62.2, 62.1, 61.7, 60.4 [(2 × Gly-CH<sub>2</sub>) + (3 × POCH<sub>2</sub>)], 37.5, 36.2 (2 × CH<sub>2</sub>COORs), 35.1 (2C), 34.14 (4C), 33.99 (4C), 31.9 (3C), 29.70 (7C), 29.50 (6C), 29.35 (3C), 29.1 (2C), 24.84, 24.67, 23.9 (5C), 22.7, 21.0 (2C), 19.61, 19.50 [(30 × fatty acid CH<sub>2</sub>) + (10 × cyclohexylidene CH<sub>2</sub>) + (3 × CH<sub>2</sub>CN)], 14.24, 14.11 (2 × CH<sub>3</sub>); MS (ESI+) *m/z* found [M+Na]<sup>+</sup> = 1,288.7 (62%), C<sub>66</sub>H<sub>113</sub>N<sub>3</sub>O<sub>16</sub>P<sub>2</sub>Na requires 1,288.7, also observed [M+NH<sub>4</sub>]<sup>+</sup> 1,283.7 (40%), [M-C<sub>6</sub>H<sub>5</sub>]<sup>+</sup> 1186.6 (78%), [DAG]<sup>+</sup> 607.5 (25%).

**1-*O*-[(Cyanooxyloxy)(*sn*-1-*O*-stearoyl-*sn*-2-oleoylglycer-3-*oxyloxy*)phosphoryl]-4-*O*-[di(2cyanoethoxy)phosphoryl]-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol, 24b.** This was prepared by the same procedure as for **24a**, above, but using 1-*O*-[(cyanoethoxy)(*sn*-1-*O*-stearoyl-2-oleoylglycer-3-*oxyloxy*)phosphoryl]-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol (**23b**, 629 mg, 0.50 mmol) in CH<sub>2</sub>Cl<sub>2</sub>-pyridine (3:2, 5 mL) with *N*-methyl imidazole (480 μL, 6.0 mmol, 12.0 eq.) and 0.34 M dicyanoethylphosphorochlorodite in CH<sub>2</sub>Cl<sub>2</sub> (**15**, 0.1 g/mL stock, 2.15 mL, 6 mmol, 12.0 eq.) for 16 h, followed by cyanoethanol (340 μL, 5.55 mmol, 11.1 eq.), then 5 M *tert*-butyl hydroperoxide in decanes (499 μL, 2.5 mmol, 5.0 eq.) to afford the *title compound* (546 mg, 85%). *R*<sub>f</sub> (EtOAc) 0.26; δ<sub>H</sub> (400 MHz, CDCl<sub>3</sub>) 5.41-5.36 (2H, m, HC=CH), 5.35-5.25 (1H, m, Gly 2-CH), 4.82-4.72 (1H, m, Ins 1-CH), 4.72-4.60 (2H, m, Ins 4-CH + Ins 2-CH), 4.45-4.15 [11H, m, (3 × POCH<sub>2</sub>) + Gly 3-CH<sub>2</sub> + Ins 3-CH], 4.11 (1H, dd, *J* 10.0, 4.0, Ins 6-CH), 3.52 (1H, t, *J* 10.0, Ins 5-CH), 2.86-2.80 (6H, m, 3 × CH<sub>2</sub>CN), 2.40-2.30 (4H, t, *J* 7.7, 2 × CH<sub>2</sub>COOR), 2.07-2.203 (4H, m, CH<sub>2</sub>CH=CHCH<sub>2</sub>), 1.90-1.10 (68H, m, 34 × CH<sub>2</sub>), 0.90 (6H, t, *J* 6.8, 2 × CH<sub>3</sub>); δ<sub>p</sub> (162 MHz, CDCl<sub>3</sub>) -2.81 (0.5P), -2.94 (0.5P) ppm; MS (ESI+) *m/z* [M+Na]<sup>+</sup> = 1,286.7 (85%), C<sub>66</sub>H<sub>111</sub>N<sub>3</sub>O<sub>16</sub>P<sub>2</sub>Na requires 1,286.7, also observed [M-C<sub>6</sub>H<sub>7</sub>]<sup>+</sup> = 1184.6 (100%), [DAG+Na]<sup>+</sup> = 651.8 (22%), [Dag-OH]<sup>+</sup> = 605.5 (40%).

**1-*O*-[(Cyanooxyloxy)(*sn*-1-*O*-stearoyl-2-*O*-*γ*-linolenoylglyceroyloxy)phosphoryl]-4-*O*-(dicyanoethoxyphosphoryl)-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol, 24c.** This was prepared by the same procedure as for **24a**, but using 1-*O*-[(cyanoethoxy)(*sn*-1-*O*-stearoyl-2-*O*-*γ*-linolenoylglyceroyloxy)phosphoryl]-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol (**23c**, 280 mg, 0.26 mmol) in CH<sub>2</sub>Cl<sub>2</sub>-pyridine (3:2, 5 mL) with *N*-methyl imidazole (84 μL, 1.04 mmol, 4.0 eq.) and 0.34 M dicyanoethylphosphorochlorodite in CH<sub>2</sub>Cl<sub>2</sub> (**15**, 2.16 mL, 1.04 mmol, 4.0 eq.) for 16 h, followed by cyanoethanol (53 μL, 0.81 mmol, 3.1 eq.), then 5 M *tert*-butyl hydroperoxide in decanes (313 μL, 1.56 mmol, 6.0 eq.) to afford the *title compound* as an off-white solid (260 mg, 79%). *R*<sub>f</sub> (EtOAc) 0.27; δ<sub>H</sub> (400 MHz, CDCl<sub>3</sub>) 5.47-5.30 (7H, m, 3 × HC=CH + Gly 2-CH), 4.81-4.74 (m, 1H, Ins 1-H), 4.68-4.60 (2H, m, Ins 4-H + Ins 2-H), 4.40-4.15 [11H, m, (3 × OCH<sub>2</sub>CH<sub>2</sub>CN) + Gly 3-CH<sub>2</sub> + Gly 1-CH<sub>2</sub> + Ins 3-H], 4.10 (0.5H, t, *J* 9.6), 4.08 (0.5H, t, *J* 9.6) (Ins 6-H), 3.51 (1H, t, *J* 9.8, Ins 5-H), 2.90-2.60 [10H, m, 3 × CH<sub>2</sub>CN + (2 × (CH=CH)<sub>2</sub>CH<sub>2</sub>)], 2.43-2.30 (4H, m, 2 × CH<sub>2</sub>CO<sub>2</sub>), 2.12-2.0 (4H, m, 2 × CH<sub>2</sub>CH<sub>2</sub>CH=CH), 1.85-1.15 (48H, m, 24 × CH<sub>2</sub>), 0.90 (6H, t, *J* 6.8, 2 × CH<sub>3</sub>); δ<sub>p</sub> (162 MHz, CDCl<sub>3</sub>) -2.32 (1P), -2.78 (0.5P), -2.96 (0.5P); δ<sub>c</sub> (125 MHz, CDCl<sub>3</sub>) 173.2, 172.6 (2 × C=O), 130.4, 129.4, 128.45, 128.32, 127.9, 127.5 (6 × CH, C=C), 116.35, 116.18, 116.08, (3 × C≡N), 114.35, 112.0 (2 × acetal C), 80.9 (d, *J*<sub>P-C</sub> 5.0, Ins 4-CH), 79.3, 76.0, 75.7, 75.0 (4 × Ins CH), 74.6 (d, *J*<sub>P-C</sub> 5.0, Ins 1-CH), 69.2, (d, *J*<sub>P-C</sub> 6.3, Gly 2-CH), 66.17 (2C, d, *J*<sub>P-C</sub> 4.4, 2 × POCH<sub>2</sub>), 66.0 (d, *J*<sub>P-C</sub> 5.0, POCH<sub>2</sub>), 62.11 (d, *J*<sub>P-C</sub> 5.0, Gly 3-CH<sub>2</sub>), 61.6 (Gly 1-CH<sub>2</sub>), 37.45, 36.16 (2 × CH<sub>2</sub>COORs), 35.05, 34.99, 33.93, 31.87, 31.46, 29.65 (8C), 29.45 (3C), 29.31, 29.26 (2C), 29.09, 28.97, 27.16, 26.8 (4C), 26.47, 25.57, 24.37, 23.87, 23.69, 22.64, 22.52, 19.51, 19.45, 19.39, 19.35 [(24 × fatty

acid  $\text{CH}_2$ ) + (10 × cyclohexylidene  $\text{CH}_2$ ) + (3 ×  $\text{CH}_2\text{CN}$ ), 14.08, 14.03 (2 ×  $\text{CH}_3$ ); MS (ESI+)  $m/z$  found  $[\text{M}+\text{Na}]^+ = 1,282.6$  (48%),  $\text{C}_{66}\text{H}_{107}\text{N}_3\text{O}_{16}\text{P}_2\text{Na}$  requires 1,282.6, also observed  $[\text{M}+\text{NH}_4]^+ = 1,277.7$  (30%),  $[\text{M}-\text{C}_6\text{H}_9]^+ = 1180.6$  (53%),  $[\text{DAG}]^+ = 601.5$  (22%).

***sn*-1,2-Distearoylphosphatidylinositol 4-phosphate, triethylammonium salt, 2a.** 1-*O*-[(Cyanoethoxy)(*sn*-1,2-*O*-distearoylglyceroyloxy)phosphoryl]-4-*O*-[dicyanoethoxyphosphoryl]-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol (**24a**, 250 mg, 0.197 mmol) was evaporated from MeCN (3 × 2 mL), and dissolved in  $\text{CH}_2\text{Cl}_2$ -MeCN (1:1, 6 mL). To this was added trimethylsilyl chloride (1 mL) then *N,N,N',N'*-tetramethyl-*N''*-*tert*-butyl-guanidine (90%, 774  $\mu\text{L}$ , 5.92 mmol, 30.0 eq.). After 16 h, the volatile components were removed *in vacuo* and the residue was triturated with TmsCl-pet. spirit (1:19) under  $\text{N}_2$ . The filtrate was evaporated to dryness *in vacuo*, when  $^{31}\text{P}$  NMR [-11.2 (1P), -19.5 (1P) ppm] demonstrated complete exchange of cyanoethyl esters. The filtrate was re-dissolved in  $\text{Et}_3\text{N}$ -MeOH (3:2, 5 mL) and stirred for 20 min before again stripping off the solvent *in vacuo*. The residue was then redissolved in AcOH-water (2:1, 6 mL) and after stirring for 48 h the mixture was freeze-dried. The off-white solid was triturated with MeCN, then diethyl ether to afford the *title compound* as an off-white solid (186 mg, 99%).  $\delta_{\text{H}}$  (500 MHz  $\text{CDCl}_3$ - $\text{CD}_3\text{OD}$ , 1:1, 40 °C) 5.00-5.05 (1H, m, Gly 2-**CH**), 4.40-4.35 (1H, m, Ins 2-**CH**), 4.20-3.95 (5H, m, Gly 3-**CH**<sub>2</sub> + Gly 1-**CH**<sub>2</sub> + Ins 4-**H**), 3.92 (1H, ddd, *J* 9.7, 8.1, 2.6, Ins 1-**H**), 3.84 (1H, t, *J* 9.3, Ins 6-**H**), 3.54 (1H, dd, *J* 9.6, 2.7, Ins 3-**H**), 3.20 (1H, t, *J* 9.0, Ins 5-**H**), 3.08 (6H, q, *J* 7.3, 3 × TEA **CH**<sub>2</sub>), 2.32-2.22 (4H, m, 2 × **CH**<sub>2</sub>COOR), 1.49-1.56 (4H, m, 2 × **CH**<sub>2</sub>CH<sub>2</sub>CO<sub>2</sub>), 1.18-1.38 [65H, m, (28 × **CH**<sub>2</sub>) + (3 × TEA **CH**<sub>3</sub>)], 0.80 (6H, t, *J* 7.0, 2 × **CH**<sub>3</sub>);  $\delta_{\text{P}}$  (202 MHz  $\text{CDCl}_3$ - $\text{CD}_3\text{OD}$ , 1:1, 40 °C) 2.0 (1P), 0.02 (1P); HRMS (ESI-)  $m/z$  found  $[\text{M}-\text{H}]^- = 945.5505$ ,  $\text{C}_{45}\text{H}_{87}\text{O}_{16}\text{P}_2^-$  requires 945.5469.

***sn*-1-Stearoyl-2-oleoylphosphatidylinositol 4-phosphate, triethylammonium salt, 2b.** 1-*O*-[(Cyanoethoxy)(*sn*-1-*O*-stearoyl-*sn*-2-oleoylglycer-3-yloxy)phosphoryl]-4-*O*-[di(cyanoethoxy)phosphoryl]-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol (**24b**, 253 mg, 0.20 mmol) was evaporated from MeCN (3 × 2 mL), and dissolved in  $\text{CH}_2\text{Cl}_2$ -MeCN (1:1, 6 mL). To this was added trimethylsilyl chloride (1 mL) then *N,N,N',N'*-tetramethyl-*N''*-*tert*-butyl-guanidine (90%, 784  $\mu\text{L}$ , 6.00 mmol, 30.0 eq.). After 16 h, the volatile components were removed *in vacuo* and the residue was triturated with TmsCl-pet. spirit (1:19) under  $\text{N}_2$ . The filtrate was evaporated to dryness *in vacuo*, when  $^{31}\text{P}$  NMR [-11.2 (1P), -19.5 (1P) ppm] demonstrated complete exchange of cyanoethyl esters. The filtrate was re-dissolved in  $\text{Et}_3\text{N}$ -MeOH (3:2, 5 mL) and stirred for 20 min before again stripping off the solvent *in vacuo*. The residue was then re-dissolved in AcOH-water (2:1, 6 mL) and after stirring for 48 h the mixture was freeze-dried. The off-white solid was triturated with MeCN, then diethyl ether to afford the *title compound* as an off-white solid (188 mg, 99%).  $\delta_{\text{H}}$  (400 MHz,  $\text{CDCl}_3$ - $\text{CD}_3\text{OD}$  3:2 v/v, 40 °C) 5.35 (2H, m, **HC=CH**), 5.3 (1H, m, Gly 2-**CH**), 4.30-3.90 (7H, m, Ins 4-**CH** + Ins 1-**CH** + Ins 2-**CH** + Gly 3-**CH**<sub>2</sub> + Gly 1-**CH**<sub>2</sub>), 3.88-3.80 (1H, m, Ins 6-**CH**), 3.65-3.63 (1H, m, Ins 3-**CH**), 3.58-3.50 (1H, m, Ins 5-**CH**), 3.30 (12H, q,

*J* 7.0, 6 × TEA **CH**<sub>2</sub>), 2.33-2.21 (4H, m, 2 × **CH**<sub>2</sub>COOR), 2.03-1.95 (4H, m, 2 × **CH**<sub>2</sub>CH<sub>2</sub>COOR) 1.61-1.49 (4H, m, **CH**<sub>2</sub>CH=CH**CH**<sub>2</sub>), 1.50-1.10 [70H, m, (26 × **CH**<sub>2</sub>) + (6 × TEA **CH**<sub>3</sub>)], 0.83 (6H, t, *J* 6.8, 2 × **CH**<sub>3</sub>);  $\delta_{\text{P}}$  (202 MHz,  $\text{CDCl}_3$ - $\text{CD}_3\text{OD}$  [3:2], 313K) 1.3 (1P), -0.3 (1P);  $m/z$  found  $[\text{M}-\text{H}]^- = 943.5346$ ,  $\text{C}_{45}\text{H}_{85}\text{O}_{16}\text{P}_2^-$  requires 943.5313.

***sn*-1-Stearoyl-2- $\gamma$ -linolenoylphosphatidylinositol 4-phosphate triethylammonium salt, 2c.** 1-*O*-[(Cyanoethoxy)(*sn*-1-*O*-stearoyl-2-*O*- $\gamma$ -linolenoylglyceroyloxy)phosphoryl]-4-*O*-[dicyanoethoxyphosphoryl]-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol (**24c**, 100 mg, 0.08 mmol) was evaporated from MeCN (3 × 2 mL), and dissolved in  $\text{CH}_2\text{Cl}_2$ -MeCN (1:1, 6 mL). To this was added trimethylsilyl chloride (1 mL) then *N,N,N',N'*-tetramethyl-*N''*-*tert*-butyl-guanidine (90%, 784  $\mu\text{L}$ , 6.00 mmol, 30.0 eq.). After 16 h, the volatile components were removed *in vacuo* and the residue was triturated with TmsCl-pet. spirit (1:19) under  $\text{N}_2$ . The filtrate was evaporated to dryness *in vacuo*, when  $^{31}\text{P}$  NMR [-11.2 (1P), -19.5 (1P) ppm] demonstrated complete exchange of cyanoethyl esters. The filtrate was re-dissolved in  $\text{Et}_3\text{N}$ -MeOH (3:2, 5 mL) and stirred for 20 min before again stripping off the solvent *in vacuo*. The residue was then re-dissolved in AcOH-water (2:1, 6 mL) and after stirring for 48 h the mixture was freeze-dried. The off-white solid was triturated with MeCN, then diethyl ether to afford the *title compound* as an off-white solid (75 mg, 99%).  $\delta_{\text{H}}$  (400 MHz  $\text{CDCl}_3$ - $\text{CD}_3\text{OD}$  [2:1], 25 °C) 5.25-5.12 (6H, m, 3 × **HC=CH**), 5.08-5.05 (1H, m, Gly 2-**CH**), 4.25-3.85 (7H, m, Ins 4-**CH** + Ins 1-**CH** + Ins 2-**CH** + Gly 3-**CH**<sub>2</sub> + Gly 1-**CH**<sub>2</sub>), 3.70 (1H, m, Ins 6-**H**, obscured by  $\text{CD}_3\text{OH}$  signal), 3.48-3.40 (1H, m, Ins 3-**H**), 3.28-3.20 (1H, m, Ins 5-**H**, obscured), 3.18-3.12 (12H, q, *J* 7.0, TEA **CH**<sub>2</sub>), 3.10 (1H, m, Ins 5-**H**), 2.20 (4H, m, **CH**<sub>2</sub>COOR), 1.90 (4H, m, 2 × **CH**<sub>2</sub>**CH**<sub>2</sub>CH=CH), 1.45 (4H, m, 2 × **CH**<sub>2</sub>CH<sub>2</sub>COOR), 1.00-1.30 [62H, m, (22 × **CH**<sub>2</sub>) + (6 × TEA **CH**<sub>3</sub>)], 0.83 (6H, t, 2 × **CH**<sub>3</sub>);  $\delta_{\text{P}}$  (202 MHz  $\text{CDCl}_3$ - $\text{CD}_3\text{OD}$  [3:2], 50 °C) 1.00 (1P), -1.00 (1P); HRMS (ESI-)  $m/z$  found  $[\text{M}-\text{H}]^- = 945.5505$ ,  $\text{C}_{45}\text{H}_{87}\text{O}_{16}\text{P}_2^-$  requires 945.5474.

### Nuclear Magnetic Resonance Spectra

The following are the NMR spectra for the compounds:

S-Acetyl Mandelic Acid, **8a**.

1,4-*O*-Di(S-acetylmandeloyl)-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol, **6**.

3,6-*O*-Di(S-acetylmandeloyl)-1,2,4,5-*O*-dicyclohexylidene-*myo*-inositol, **7**.

(+)-2,3,5,6-*O*-Dicyclohexylidene-*myo*-inositol, **D-5** from **6**.

3-(Trimethylsilyloxy)propionitrile, **12**.

Tricyanoethyl phosphite, **13**.

(-)-1-*O*-(Dicyanoethoxy)phosphoryl-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol, **11**.

*myo*-Inositol-1-phosphate, **26**.

*sn*-1-*O*-Stearoyl-2-*O*- $\gamma$ -linolenoyl, **19b**.

1-*O*-[(Cyanoethoxy)(*sn*-1,2-*O*-distearoylglyceroyloxy)phosphoryl]-2,3,5,6-*O*-dicyclohexylidene-*myo*-inositol, **23a**.

1-*O*-(cyanoethoxy)phosphatidyl(1-*O*-stearoyl-*sn*-2-oleoyl)glycerol-(2,3)-(5,6)-*O*-dicyclohexylidene-*myo*-inositol, **23b**.

1-*O*-[(Cyanoethoxy)(*sn*-1-*O*-stearoyl-2-*O*- $\gamma$ -linolenoylglyceroyloxy)phosphoryl]-2,3:5,6-*O*-dicyclohexylidene-*myo*-inositol, **23c**.

1-*O*-[(Cyanoethoxy)(*sn*-1-*O*-stearoyl-2-*O*-arachidonoylglyceroyloxy)phosphoryl]-2,3:5,6-*O*-dicyclohexylidene-*myo*-inositol, **23d**.

Dicyanoethyl phosphorochloridite, **15**.

1-*O*-[(Cyanoethoxy)(*sn*-1,2-*O*-distearoylglyceroyloxy)phosphoryl]-4-*O*-(dicyanoethoxyphosphoryl)-2,3:5,6-*O*-dicyclohexylidene-*myo*-inositol, **24a**.

1-*O*-(1-*O*-stearoyl-*sn*-2-oleoyl glycer-3-yloxy)(2-cyanoethoxy)phosphoryl-4-*O*-di(2-cyanoethoxy)phosphoryl-2,3:5,6-*O*-dicyclohexylidene-*myo*-inositol, **24b**.

1-*O*-[(Cyanoethoxy)(*sn*-1-*O*-stearoyl-2-*O*- $\gamma$ -linolenoylglyceroyloxy)phosphoryl]-4-*O*-(dicyanoethoxyphosphoryl)-2,3:5,6-*O*-dicyclohexylidene-*myo*-inositol, **24c**.

1-*O*-[(Cyanoethoxy)(*sn*-1-*O*-stearoyl-2-*O*-arachidonoylglyceroyloxy)phosphoryl]-4-*O*-(dicyanoethoxyphosphoryl)-2,3:5,6-*O*-dicyclohexylidene-*myo*-inositol, **24d**.

Distearoylphosphatidylinositol 4-Phosphate, triethylammonium salt, **2a**.

Stearoyl-oleoyl-phosphatidylinositol-4-phosphate, triethylammonium salt, **2b**.

Stearoyl- $\gamma$ -linolenoyl-phosphatidylinositol-4-phosphate triethylammonium salt, **2b**.

Stearoyl-arachidonoyl-phosphatidylinositol-4-phosphate, triethylammonium salt, **2c**.

## Supplementary References

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