

## **Synthesis and antitumor activity of new alkyl glycolipids**

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### **General methods**

All solvents for column chromatography were distilled before using. Molecular sieves were activated at 180°C under reduced pressure for 2 h. Thin layer chromatography was performed using pre-coated aluminum plates (Kieselgel 60 F<sub>254</sub>, Merck), which were visualized with the phosphomolybdic acid – ceric sulfate reagent. Flash column chromatography (FC) was performed on Kieselgel 60 (40–63µm, Merck). Optical rotations were recorded on a Digytor Yasco DIP 360 (Japan) photoelectric spectropolarimeter as  $[\alpha]_D$  values. <sup>1</sup>H and <sup>13</sup>C NMR spectra were recorded at 24°C in Bruker DPX-300 in CDCl<sub>3</sub> as a solvent unless otherwise stated. The signals of SiMe<sub>4</sub> ( $\delta$  = 0.00 ppm) and CDCl<sub>3</sub> ( $\delta$  = 77.16 ppm) were used as internal references. *J* values are given in Hz. Mass spectra were recorded in a Bruker Ultraflex time-of-flight mass spectrometer (MALDI-TOF MS) using 2,5-dihydroxybenzoic acid as a matrix.

### **Syntheses of glycosides 8a-c, 9a-c and 10a-c (general procedure)**

Hg(CN)<sub>2</sub> (2.4 mmol), HgBr<sub>2</sub> (2.4 mmol) and calcined 4 Å molecular sieves (0.5 g) were added to a solution of diglycerides **5** or **7a-c** (0.8 mmol) in dry dichloromethane (7 ml) at 20 °C under vigorous stirring. After 60 min, the solution of corresponding acetoglycopyranosyl bromide (2.4 mmol) in dry dichloromethane (7 ml) was added dropwise within 30 min. After disappearance of the diglyceride spot (TLC) the reaction mixture was filtered through Celite<sup>®</sup> 545 pad, and washed with 20% aqueous KI and water. The organic layer was dried (Na<sub>2</sub>SO<sub>4</sub>), filtered, and concentrated under reduced pressure. The residue was purified by column chromatography (Kieselgel 60, 40-63µm, Merck) using toluene–ethyl acetate–chloroform (10:1:1) for **8a,b**, toluene–ethyl acetate (4:1) for **8c**, light petroleum–ethyl acetate (2:1) for **9a-c**, **10 a-c** and toluene–ethyl acetate (2:1) for **11a-c**.

**(2RS)-2-O-Ethyl-3-O-(2-hydroxyethylaminocarbonyl)-1-O-octadecylglycerol 7a:** Yield 75%, <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) 0.81 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.13 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.43-1.54 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 3.26 (t, 2 H, *J* = 5.1, NHCH<sub>2</sub>), 3.31-3.46 (m, 4 H, CH<sub>2</sub>OCH<sub>2</sub>), 3.57 (q, 2 H, *J* = 7.0, OCH<sub>2</sub>CH<sub>3</sub>), 3.56-3.64 (m, 3 H, CH<sub>2</sub>OH, CHO), 4.02 (dd, 1 H, *J* = 5.5, 11.5) and 4.17 (dd, 1 H, *J* = 4.1, 11.5, CH<sub>2</sub>OCO), 5.35 (br. s, 1 H, NH). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) 14.20, 14.26, 15.57, 21.11, 22.77, 26.17, 29.46, 29.58, 29.71, 29.74, 29.75, 29.80, 32.02, 43.60, 62.06, 64.52, 65.83, 70.36, 71.91, 76.67, 77.36, 157.20. MS, *m/z*: 482.082 [M+Na]<sup>+</sup>. Calculated for C<sub>26</sub>H<sub>53</sub>NO<sub>5</sub>Na: 482.382 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-3-O-(3-hydroxypropylaminocarbonyl)-1-O-octadecylglycerol 7b:** Yield 89 %, <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) 0.81 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.13 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.43-1.54 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 1.58-1.68 (m, 2 H, NHCH<sub>2</sub>CH<sub>2</sub>), 3.27 (t, 2 H, *J* = 6.1, NHCH<sub>2</sub>), 3.32-3.45 (m, 4 H, CH<sub>2</sub>OCH<sub>2</sub>), 3.57 (q, 2 H, *J* = 7.0, OCH<sub>2</sub>CH<sub>3</sub>), 3.56-3.64 (m, 3 H, CH<sub>2</sub>OH, CHO), 4.03 (dd, 1 H, *J* = 5.3, 11.5) и 4.17 (dd, 1 H, *J* = 4.0, 11.5, CH<sub>2</sub>OCO), 5.00 (br. s, 1 H, NH). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) 14.20, 15.57, 22.78, 26.17, 29.46, 29.58, 29.71, 29.73, 29.75, 29.80, 32.02, 43.60, 62.06, 64.52, 65.83, 70.36, 71.91, 76.67, 77.36, 157.20. MS, *m/z*: 496.593 [M+Na]<sup>+</sup>. Calculated for C<sub>27</sub>H<sub>55</sub>NO<sub>5</sub>Na: 496.719 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-3-O-(4-hydroxybutylaminocarbonyl)-1-O-octadecylglycerol 7c:** Yield 68%. <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) 0.82 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.13 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.43-1.60 (m, 6 H, OCH<sub>2</sub>CH<sub>2</sub>, NHCH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>), 3.14 (t, 2 H, *J* = 6.1, NHCH<sub>2</sub>), 3.33-3.43 (m, 4 H, CH<sub>2</sub>OCH<sub>2</sub>), 3.57 (q, 2 H, *J* = 7.0, OCH<sub>2</sub>CH<sub>3</sub>), 3.56-3.64 (m, 3 H, CH<sub>2</sub>OH, CHO), 4.02 (dd, 1 H, *J* = 5.4, 11.5) и 4.15 (dd, 1 H, *J* = 4.1, 11.5, CH<sub>2</sub>OCO), 4.85 (br. s, 1 H, NH). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) 14.22, 15.63, 22.80, 25.24, 26.19, 26.64, 29.47, 29.60, 29.73, 29.77, 29.81, 32.03, 40.97, 62.41, 64.42, 65.83, 70.49, 71.91, 76.74, 77.37, 156.71. MS, *m/z*: 488.108 [M+H]<sup>+</sup>, 526.094 [M+K]<sup>+</sup>. Calculated for C<sub>28</sub>H<sub>57</sub>NO<sub>5</sub>: 487.424 [M]<sup>+</sup> and for C<sub>28</sub>H<sub>57</sub>NO<sub>5</sub>K: 526.522 [M+K]<sup>+</sup>.

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-(2,3,4,6-tetra-O-acetyl-β-D-galactopyranosyl)glycerol 8a:** Yield 80 %, [α]<sub>D</sub><sup>25</sup> -3.0 (*c* 1, CHCl<sub>3</sub>). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) 0.81 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.12 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.43-1.53 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 1.92 (s, 3 H, CH<sub>3</sub>CO), 1.96 (s, 3 H, CH<sub>3</sub>CO), 2.06 (s, 3 H, CH<sub>3</sub>CO), 2.10 (s, 3 H, CH<sub>3</sub>CO), 3.29 – 3.44 (m, 4 H, CH<sub>2</sub>OCH<sub>2</sub>), 3.46 – 3.65 (m, 4 H, OCH<sub>2</sub>CH<sub>3</sub>, CHO, CH<sub>2</sub>HO-Gal), 3.79-3.92 (m, 2 H, CH<sub>2</sub>HO-Gal, H-5 Gal), 4.06 (dd, 1 H, *J* = 5.5, 9.9) and 4.11 (dd, 1H, *J* = 5.4, 9.9, H-6 Gal), 4.45 (d, 0.5 H, *J* = 7.9) and 4.49 (d, 0.5 H, *J* = 7.9 H-1 Gal), 4.94 (dd, 1H, *J* = 3.4, 10.5, H-3 Gal), 5.15 (dd, 1 H, *J* = 7.9, 10.5, H-2 Gal), 5.32 (dd, 1H, *J* = 1.0, 3.4, H-4 Gal).

$^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.25, 15.77, 20.73, 20.81, 20.87, 22.83, 26.22, 29.50, 29.63, 29.79, 29.84, 32.06, 61.39, 66.24, 67.22, 69.06, 70.57, 70.75, 70.81, 70.88, 71.14, 71.94, 77.87, 101.69, 169.48, 170.34, 170.44, 170.53. MS,  $m/z$ : 725.579  $[\text{M}+\text{Na}]^+$ . Calculated for  $\text{C}_{37}\text{H}_{66}\text{O}_{12}\text{Na}$ : 725.455  $[\text{M}+\text{Na}]^+$ .

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-(2,3,4,6-tetra-O-acetyl- $\alpha$ -D-mannopyranosyl)glycerol**

**8b**: Yield 45%,  $[\alpha]_{\text{D}}^{25}$  -2.9 ( $c$  1,  $\text{CHCl}_3$ ),  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ ) 0.82 (t, 3 H,  $J$  = 6.7 Hz,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.14 (t, 3 H,  $J$  = 7.0 Hz,  $\text{OCH}_2\text{CH}_3$ ), 1.17 (br. s, 30 H,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.45-1.55 (m, 2 H,  $\text{OCH}_2\text{CH}_2$ ), 1.92 (s, 3 H,  $\text{OCOCH}_3$ ), 1.96 (s, 3 H,  $\text{OCOCH}_3$ ), 2.03 (s, 3 H,  $\text{OCOCH}_3$ ), 2.09 (s, 3 H,  $\text{OCOCH}_3$ ), 3.29 – 3.48 (m, 4 H,  $\text{CH}_2\text{OCH}_2$ ), 3.46 – 3.80 (m, 5 H,  $\text{OCH}_2\text{CH}_3$ , CHO,  $\text{CH}_a\text{HO-Man}$ , H-5 Man), 3.98-4.01 (m, 2 H, H-6 Man), 4.18-4.27 (m, 1 H,  $\text{CH}_b\text{HO-Man}$ ), 4.79 (d, 0.5 H,  $J$  = 1.3 Hz) and 4.80 (d, 0.5 H,  $J$  = 1.3 Hz, H-1 Man), 5.18-5.33 (m, 3 H, H-2, H-3, H-4 Man).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.12, 15.57, 20.68, 20.73, 20.87, 26.12, 29.37, 29.51, 29.66, 29.71, 30.90, 31.94, 62.41, 65.93, 66.04, 66.13, 67.85, 68.00, 68.46, 69.17, 69.54, 70.05, 71.83, 77.27, 97.48, 97.86, 169.75, 169.91, 170.03, 170.68. MS,  $m/z$ : 725.534  $[\text{M}+\text{Na}]^+$ . Calculated for  $\text{C}_{37}\text{H}_{66}\text{O}_{12}\text{Na}$ : 725.455  $[\text{M}+\text{Na}]^+$ .

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-(2,2',3,3',4,6,6'-hepta-O-acetyl- $\beta$ -lactosyl)glycerol** **8c**:

Yield 79%,  $[\alpha]_{\text{D}}^{25}$  -6.2 ( $c$  1,  $\text{CHCl}_3$ ).  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ ) 0.81 (t, 3 H,  $J$  = 6.7 Hz,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.11 (t, 3 H,  $J$  = 7.0 Hz,  $\text{OCH}_2\text{CH}_3$ ), 1.18 (br. s, 30 H,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.44-1.55 (m, 2 H,  $\text{OCH}_2\text{CH}_2$ ), 1.89 (s, 3 H,  $\text{OCOCH}_3$ ), 1.97 (s, 9 H, 3  $\text{OCOCH}_3$ ), 2.05 (s, 3 H,  $\text{OCOCH}_3$ ), 2.10 (s, 3H,  $\text{OCOCH}_3$ ), 3.27 – 3.40 (m, 4 H,  $\text{CH}_2\text{OCH}_2$ ), 3.46 – 3.58 (m, 4 H,  $\text{OCH}_2\text{CH}_3$ , CHO,  $\text{CH}_a\text{HO-Lac}$ ), 3.68-3.85 (m, 3 H,  $\text{CH}_b\text{HO-Lac}$ , H-5 and H-5' Lac), 4.04-4.25 (m, 2 H, H-6 and H-6' Lac), 4.41 (d, 1 H,  $J$  = 7.9, H-1' Lac), 4.34-4.45 (m, 1 H, H-4 Lac), 4.46 (d, 0.5 H,  $J$  = 7.9) and 4.50 (d, 0.5 H,  $J$  = 7.9, H-1 Lac), 4.82 (dd, 1 H,  $J$  = 7.9, 9.5, H-2 Lac), 4.48 (dd, 1 H,  $J$  = 3.4, 10.5, H-3' Lac), 5.04 (dd, 1 H,  $J$  = 7.9, 10.5, H-2' Lac), 5.18 (dd, 1 H,  $J$  = 9.1, 9.5 H-3 Lac), 5.28 (dd, 1 H,  $J$  = 1.0, 3.4, H-4' Lac).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.24, 15.71, 20.62, 20.75, 20.82, 20.94, 20.97, 22.81, 26.19, 26.22, 29.48, 29.62, 29.76, 29.82, 32.04, 60.93, 62.17, 65.77, 66.19, 66.74, 69.24, 69.32, 70.36, 70.53, 70.74, 70.81, 71.13, 71.86, 71.91, 72.69, 72.73, 72.94, 73.02, 76.43, 77.32, 79.28, 100.92, 100.97, 101.21, 169.20, 169.68, 169.90, 170.19, 170.28, 170.48, 170.50. MS,  $m/z$ : 1013.32  $[\text{M}+\text{Na}]^+$ . Calculated for  $\text{C}_{49}\text{H}_{84}\text{O}_{20}\text{Na}$ : 1013.52  $[\text{M}+\text{Na}]^+$ .

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-[2-(2,3,4,6-tetra-O-acetyl- $\beta$ -D-**

**galactopyranosyloxy)ethylaminocarbonyl]glycerol** **9a**: Yield 66%,  $[\alpha]_{\text{D}}^{27}$  -6.5 ( $c$  0.5,  $\text{CHCl}_3$ ).  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ ) 0.81 (t, 3 H,  $J$  = 6.7,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.13 (t, 3 H,  $J$  = 7.0 Hz,  $\text{OCH}_2\text{CH}_3$ ), 1.19 (br. s, 30 H,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.43-1.54 (m, 2 H,  $\text{OCH}_2\text{CH}_2$ ), 1.92 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 1.98 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 2.00 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 2.10 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 3.31 – 3.42 (m, 6

H,  $\text{CH}_2\text{OCH}_2$ ,  $\text{NHCH}_2$ ), 3.51 – 3.64 (m, 4 H,  $\text{OCH}_2\text{CH}_3$ , CHO,  $\text{CH}_a\text{HO-Gal}$ ), 3.77-3.90 (m, 2 H,  $\text{CH}_b\text{HO-Gal}$ , H-5 Gal), 3.96-4.21 (m, 4 H, H-6 Gal,  $\text{CH}_2\text{OCO}$ ), 4.41 (d, 1H,  $J = 7.9$ , H-1 Gal), 4.95 (dd, 1H,  $J = 3.4, 10.5$ , H-3 Gal), 5.00-5.08 (m, 1 H, NH), 5.10 (dd, 1 H,  $J = 7.9, 10.5$ , H-2 Gal), 5.32 (dd, 1H,  $J = 0.9, 3.4$ , H-4 Gal).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.17, 15.60, 20.61, 20.69, 20.78, 20.80, 22.74, 26.14, 29.41, 29.54, 29.67, 29.70, 29.74, 31.97, 40.89, 61.35, 64.56, 65.76, 67.04, 68.89, 69.42, 70.39, 70.85, 71.85, 76.65, 77.36, 101.55, 156.42, 169.66, 170.13, 170.26, 170.40. MS,  $m/z$ : 812.913  $[\text{M}+\text{Na}]^+$ . Calculated for  $\text{C}_{40}\text{H}_{71}\text{NO}_{14}\text{Na}$ : 812.477  $[\text{M}+\text{Na}]^+$ .

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-[3-(2,3,4,6-tetra-O-acetyl- $\beta$ -D-**

**galactopyranosyloxy)propylaminocarbonyl]glycerol 10a:** Yield 46%,  $[\alpha]_{\text{D}}^{20}$  -16.4 ( $c$  0.5,  $\text{CHCl}_3$ ).  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ ) 0.81 (t, 3 H,  $J = 6.7$ ,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.13 (t, 3 H,  $J = 7.0$  Hz,  $\text{OCH}_2\text{CH}_3$ ), 1.18 (br. s, 30 H,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.42-1.56 (m, 2 H,  $\text{OCH}_2\text{CH}_2$ ), 1.60-1.78 (m, 2 H,  $\text{NHCH}_2\text{CH}_2$ ), 1.92 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 1.99 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 2.00 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 2.09 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 3.10-3.26 (m, 2 H,  $\text{NHCH}_2$ ), 3.32-3.44 (m, 4 H,  $\text{CH}_2\text{OCH}_2$ ), 3.46 – 3.62 (m, 4 H,  $\text{OCH}_2\text{CH}_3$ , CHO,  $\text{CH}_a\text{HO-Gal}$ ), 3.80-3.92 (m, 2 H,  $\text{CH}_b\text{HO-Gal}$ , H-5 Gal), 3.96-4.18 (m, 4 H, H-6 Gal,  $\text{CH}_2\text{OCO}$ ), 4.40 (d, 1H,  $J = 7.9$ , H-1 Gal), 4.89 (br. s, 1 H, NH), 4.95 (dd, 1H,  $J = 3.4, 10.5$ , H-3 Gal), 5.13 (dd, 1 H,  $J = 7.9, 10.5$ , H-2 Gal), 5.32 (dd, 1H,  $J = 0.9, 3.4$ , H-4 Gal).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.23, 15.66, 19.95, 20.69, 20.78, 20.86, 22.80, 26.20, 29.47, 29.61, 29.76, 29.81, 31.30, 32.03, 38.23, 61.41, 64.45, 65.83, 67.16, 67.69, 68.65, 68.90, 70.53, 70.86, 70.98, 71.90, 76.74, 77.36, 101.36, 156.56, 169.65, 170.25, 170.37, 170.52. MS,  $m/z$ : 826.976  $[\text{M}+\text{Na}]^+$ . Calculated for  $\text{C}_{41}\text{H}_{73}\text{NO}_{14}\text{Na}$ : 826.493  $[\text{M}+\text{Na}]^+$ .

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-[4-(2,3,4,6-tetra-O-acetyl- $\beta$ -D-**

**galactopyranosyloxy)butylaminocarbonyl]glycerol 11a:** Yield 50%,  $[\alpha]_{\text{D}}^{28}$  -2.4 ( $c$  1,  $\text{CHCl}_3$ ).  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ ) 0.81 (t, 3 H,  $J = 6.7$ ,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.13 (t, 3 H,  $J = 7.0$  Hz,  $\text{OCH}_2\text{CH}_3$ ), 1.18 (br. s, 30 H,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.43-1.61 (m, 6 H,  $\text{OCH}_2\text{CH}_2$ ,  $\text{NHCH}_2\text{CH}_2\text{CH}_2$ ), 1.91 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 1.98 (s, 6 H, 2  $\text{CH}_3\text{CO}$ ), 2.08 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 3.07-3.15 (m, 2 H,  $\text{NHCH}_2$ ), 3.33-3.48 (m, 4 H,  $\text{CH}_2\text{OCH}_2$ ), 3.53 – 3.61 (m, 4 H,  $\text{OCH}_2\text{CH}_3$ , CHO,  $\text{CH}_a\text{HO-Gal}$ ), 3.80-3.88 (m, 2 H,  $\text{CH}_b\text{HO-Gal}$ , H-5 Gal), 3.97-4.18 (m, 4 H, H-6 Gal,  $\text{CH}_2\text{OCO}$ ), 4.40 (d, 1H,  $J = 7.9$ , H-1 Gal), 4.78 (br. s, 1 H, NH), 4.95 (dd, 1H,  $J = 3.4, 10.5$ , H-3 Gal), 5.13 (dd, 1 H,  $J = 7.9, 10.5$ , H-2 Gal), 5.32 (dd, 1H,  $J = 0.9, 3.4$ , H-4 Gal).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.18, 15.61, 20.64, 20.73, 20.81, 22.75, 26.15, 26.59, 29.42, 29.55, 29.68, 29.71, 29.75, 31.98, 40.59, 61.34, 65.77, 67.13, 68.97, 69.65, 70.47, 70.72, 70.98, 71.85, 76.71, 77.36, 101.38, 156.51, 169.52, 170.21, 170.34, 170.45. MS,  $m/z$ : 840.327  $[\text{M}+\text{Na}]^+$ . Calculated for  $\text{C}_{42}\text{H}_{75}\text{NO}_{14}\text{Na}$ : 840.508  $[\text{M}+\text{Na}]^+$ .

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-[2-(2,3,4,6-tetra-O-acetyl- $\alpha$ -D-mannopyranosyloxy)ethylaminocarbonyl]glycerol 9b:** Yield 71%,  $[\alpha]_D^{22} +13.3$  (*c* 0.5, CHCl<sub>3</sub>). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) 0.81 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.13 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.43-1.54 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 1.93 (s, 3 H, CH<sub>3</sub>CO), 1.98 (s, 3 H, CH<sub>3</sub>CO), 2.03 (s, 3 H, CH<sub>3</sub>CO), 2.09 (s, 3 H, CH<sub>3</sub>CO), 3.30 – 3.42 (m, 6 H, CH<sub>2</sub>OCH<sub>2</sub>, NHCH<sub>2</sub>), 3.45-3.56 (m, 2 H, CHO, CH<sub>a</sub>HO-Man), 3.57 (q, 2 H, *J* = 7.0, OCH<sub>2</sub>CH<sub>3</sub>), 3.65-3.75 (m, 1 H, CH<sub>b</sub>HO-Man), 3.86-3.94 (m, 1 H, H-5 Man), 3.99-4.08 (m, 2 H, H-6 Man), 4.13-4.26 (m, 2 H, CH<sub>2</sub>OCO), 4.75 (d, 1 H, *J* = 1.4, H-1 Man), 5.09 (br. s, 1 H, NH), 5.16-5.20 (m, 1 H, H-2 Man), 5.22-5.29 (m, 2 H, H-3 Man, H-4 Man). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) 14.25, 15.68, 20.82, 20.84, 20.99, 22.83, 26.23, 28.32, 28.73, 29.50, 29.58, 29.64, 29.68, 29.80, 29.84, 32.07, 32.99, 34.16, 40.80, 62.63, 65.89, 66.25, 67.88, 68.88, 69.11, 69.53, 70.49, 71.96, 97.94, 156.50, 169.84, 170.07, 170.16, 170.75. MS, *m/z*: 812.532 [M+Na]<sup>+</sup>. Calculated for C<sub>40</sub>H<sub>71</sub>NO<sub>14</sub>Na: 812.477 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-[3-(2,3,4,6-tetra-O-acetyl- $\alpha$ -D-mannopyranosyloxy)propylaminocarbonyl]glycerol 10b:** Yield 41%,  $[\alpha]_D^{25} +18.6$  (*c* 1.0, CHCl<sub>3</sub>). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) 0.81 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.13 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.43-1.54 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 1.70-1.82 (m, 2 H, NHCH<sub>2</sub>CH<sub>2</sub>), 1.92 (s, 3 H, CH<sub>3</sub>CO), 1.98 (s, 3 H, CH<sub>3</sub>CO), 2.04 (s, 3 H, CH<sub>3</sub>CO), 2.09 (s, 3 H, CH<sub>3</sub>CO), 3.16-3.26 (m, 2 H, NHCH<sub>2</sub>), 3.33–3.48 (m, 5 H, CH<sub>2</sub>OCH<sub>2</sub>, CH<sub>a</sub>HO-Man), 3.52-3.60 (m, 1 H, CHO), 3.57 (q, 2 H, *J* = 7.0, OCH<sub>2</sub>CH<sub>3</sub>), 3.69 (m, 1 H, *J* = 6.1, 9.9, CH<sub>b</sub>HO-Man), 3.87-3.95 (m, 1 H, H-5 Man), 3.98-4.25 (m, 4 H, H-6 Man, CH<sub>2</sub>OCO), 4.73 (d, 1 H, *J* = 1.7, H-1 Man), 4.87 (br. s, 1 H, NH), 5.16 (dd, 1 H, *J* = 1.7, 3.2, H-2 Man), 5.19-5.28 (m, 2 H, H-3 Man, H-4 Man). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) 14.22, 15.64, 20.78, 20.81, 20.85, 20.99, 22.80, 26.19, 29.47, 29.60, 29.74, 29.76, 29.81, 32.03, 38.26, 62.71, 64.51, 65.84, 65.97, 66.33, 68.56, 68.66, 68.90, 69.19, 69.67, 70.19, 70.51, 71.92, 97.79, 155.61, 169.88, 170.02, 170.20, 170.84. MS, *m/z*: 826.939 [M+Na]<sup>+</sup>. Calculated for C<sub>41</sub>H<sub>73</sub>NO<sub>14</sub>Na: 826.493 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-1-O-octadecyl-3-O-[4-(2,3,4,6-tetra-O-acetyl- $\alpha$ -D-mannopyranosyloxy)butylaminocarbonyl]glycerol 11b:** Yield 67%,  $[\alpha]_D^{22} +21.6$  (*c* 0.5, CHCl<sub>3</sub>). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) 0.81 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.13 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.19 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.42-1.64 (m, 6 H, OCH<sub>2</sub>CH<sub>2</sub>, NHCH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>), 1.93 (s, 3 H, CH<sub>3</sub>CO), 1.98 (s, 3 H, CH<sub>3</sub>CO), 2.04 (s, 3 H, CH<sub>3</sub>CO), 2.09 (s, 3 H, CH<sub>3</sub>CO), 3.09-3.20 (m, 2 H, NHCH<sub>2</sub>), 3.33–3.45 (m, 5 H, CH<sub>2</sub>OCH<sub>2</sub>, CH<sub>a</sub>HO-Man), 3.52-3.70 (m, 4 H, OCH<sub>2</sub>CH<sub>3</sub>, CHO, CH<sub>b</sub>HO-Man), 3.87-3.94 (m, 1 H, H-5 Man), 3.98-4.25 (m, 4 H, H-6 Man, CH<sub>2</sub>OCO), 4.73 (d, 1 H, *J* = 1.7, H-1 Man), 4.80 (br. s, 1 H, NH), 5.16 (dd, 1 H, *J* = 1.7, 3.2, H-2

Man), 5.17-5.24 (m, 1 H, H-4 Man) 5.26 (dd, 1 H,  $J = 3.2, 9.5$ , H-3 Man).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.25, 15.68, 20.82, 20.84, 20.88, 21.03, 22.82, 26.22, 26.62, 26.89, 29.49, 29.62, 29.75, 29.78, 29.83, 32.05, 40.81, 62.70, 64.46, 65.86, 66.38, 68.03, 68.62, 69.23, 69.76, 70.56, 70.73, 71.94, 97.70, 156.58, 169.87, 170.04, 170.22, 170.79. MS,  $m/z$ : 840.771  $[\text{M}+\text{Na}]^+$ . Calculated for  $\text{C}_{42}\text{H}_{75}\text{NO}_{14}\text{Na}$ : 840.508  $[\text{M}+\text{Na}]^+$ .

**(2RS)-2-O-Ethyl-3-O-[2-(2,2',3,3',4,6,6'-hepta-O-acetyl- $\beta$ -lactosyloxy)ethylaminocarbonyl]-1-O-octadecylglycerol 9c:** Yield 50%,  $[\alpha]_{\text{D}}^{23} +2.6$  ( $c$  1,  $\text{CHCl}_3$ ).  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ ) 0.81 (t, 3 H,  $J = 6.7$ ,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.12 (t, 3 H,  $J = 7.0$  Hz,  $\text{OCH}_2\text{CH}_3$ ), 1.19 (br. s, 30 H,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.42-1.54 (m, 2 H,  $\text{OCH}_2\text{CH}_2$ ), 1.90 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 1.98 (s, 6 H, 2  $\text{CH}_3\text{CO}$ ), 2.00 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 2.06 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 2.07 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 2.10 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 3.28 – 3.48 (m, 6 H,  $\text{CH}_2\text{OCH}_2$ ,  $\text{NHCH}_2$ ), 3.51 – 3.64 (m, 4 H,  $\text{OCH}_2\text{CH}_3$ ,  $\text{CHO}$ ,  $\text{CH}_a\text{HO-Lac}$ ), 3.73-3.90 (m, 3 H,  $\text{CH}_b\text{HO-Gal}$ , H-5 and H-5' Lac), 4.04-4.25 (m, 6 H, H-6 and H-6' Lac,  $\text{CH}_2\text{OCO}$ ), 4.46 (d, 1 H,  $J = 7.9$ , H-1 Lac), 4.48 (d, 1 H,  $J = 7.9$ , H-1' Lac), 4.44-4.53 (m, 1 H, H-4 Lac), 4.88 (dd, 1H,  $J = 7.9, 9.5$ , H-2 Lac), 4.95 (dd, 1 H,  $J = 3.4, 10.4$ , H-3' Lac), 5.10 (dd, 1 H,  $J = 7.9, 10.4$ , H-2' Lac), 5.18 (dd, 1 H,  $J = 9.1, 9.5$  H-3 Lac), 5.28 (dd, 1 H,  $J = 1.1, 3.4$ , H-4' Lac).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.23, 15.66, 20.45, 20.62, 20.75, 20.80, 20.90, 20.94, 22.80, 26.20, 29.47, 29.61, 29.76, 29.81, 31.04, 32.04, 40.96, 60.90, 62.01, 64.68, 65.81, 66.71, 69.21, 69.56, 70.12, 70.46, 71.09, 71.74, 71.92, 72.78, 72.87, 76.14, 76.31, 100.77, 100.93, 101.21, 156.46, 169.18, 169.82, 170.17, 170.25, 170.46. MS,  $m/z$ : 1100.712  $[\text{M}+\text{Na}]^+$ . Calculated for  $\text{C}_{52}\text{H}_{87}\text{NO}_{22}\text{Na}$ : 1100.562  $[\text{M}+\text{Na}]^+$ .

**(2RS)-2-O-Ethyl-3-O-[3-(2,2',3,3',4,6,6'-hepta-O-acetyl- $\beta$ -lactosyloxy)propylaminocarbonyl]-1-O-octadecylglycerol 10c:** Yield 45%,  $[\alpha]_{\text{D}}^{23} +6.7$  ( $c$  1,  $\text{CHCl}_3$ ).  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ ) 0.81 (t, 3 H,  $J = 6.7$ ,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.12 (t, 3 H,  $J = 7.0$  Hz,  $\text{OCH}_2\text{CH}_3$ ), 1.18 (br. s, 30 H,  $(\text{CH}_2)_{15}\text{CH}_3$ ), 1.43-1.55 (m, 2 H,  $\text{OCH}_2\text{CH}_2$ ), 1.64-1.75 (m, 2 H,  $\text{NHCH}_2\text{CH}_2$ ), 1.89 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 1.98 (s, 6 H, 2  $\text{CH}_3\text{CO}$ ), 1.99 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 2.06 (s, 6 H,  $\text{CH}_3\text{CO}$ ), 2.08 (s, 3 H,  $\text{CH}_3\text{CO}$ ), 3.06-3.26 (m, 2 H,  $\text{NHCH}_2$ ), 3.33-3.45 (m, 4 H,  $\text{CH}_2\text{OCH}_2$ ), 3.46 – 3.62 (m, 4 H,  $\text{OCH}_2\text{CH}_3$ ,  $\text{CHO}$ ,  $\text{CH}_a\text{HO-Gal}$ ), 3.67-3.84 (m, 3 H,  $\text{CH}_b\text{HO-Gal}$ , H-5 and H-5' Lac), 3.96-4.18 (m, 6 H, H-6 and H-6' Lac,  $\text{CH}_2\text{OCO}$ ), 4.39 (d, 1 H,  $J = 8.0$ , H-1 Lac), 4.42 (d, 1 H,  $J = 8.0$ , H-1' Lac), 4.43-4.50 (m, 1 H, H-4 Lac), 4.81 (dd, 1H,  $J = 8.0, 9.5$ , H-2 Lac), 4.89 (dd, 1 H,  $J = 3.4, 10.4$ , H-3' Lac), 4.92 (br. s, 1 H, NH), 5.04 (dd, 1 H,  $J = 8.0, 10.4$ , H-2' Lac), 5.12 (dd, 1 H,  $J = 9.1, 9.5$  H-3 Lac), 5.27 (dd, 1 H,  $J = 1.1, 3.4$ , H-4' Lac).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) 14.23, 15.66, 20.61, 20.74, 20.80, 20.91, 20.96, 22.80, 26.20, 29.47, 29.61, 29.76, 29.81, 32.03, 38.22, 38.85, 60.91, 61.97, 66.82, 66.73, 67.66, 69.24, 70.55, 70.61, 71.10, 71.73,

71.90, 72.84, 76.35, 77.36, 100.60, 101.20, 156.56, 169.18, 169.81, 169.85, 170.17, 170.25, 170.45, 170.52. MS,  $m/z$ : 1114.717  $[M+Na]^+$ . Calculated for  $C_{53}H_{89}NO_{22}Na$ : 1114.577  $[M+Na]^+$ .

**(2RS)-2-O-Ethyl-3-O-[4-(2,2',3,3',4,6,6'-hepta-O-acetyl- $\beta$ -lactosyloxy)butylaminocarbonyl]-1-O-octadecylglycerol 11c:** Yield 40%,  $[\alpha]_D^{23} +2.2$  ( $c$  1,  $CHCl_3$ ).  $^1H$  NMR (300 MHz,  $CDCl_3$ ) 0.81 (t, 3 H,  $J = 6.7$ ,  $(CH_2)_{15}CH_3$ ), 1.13 (t, 3 H,  $J = 7.0$  Hz,  $OCH_2CH_3$ ), 1.18 (br. s, 30 H,  $(CH_2)_{15}CH_3$ ), 1.43-1.61 (m, 6 H,  $OCH_2CH_2$ ,  $NHCH_2CH_2CH_2$ ), 1.89 (s, 3 H,  $CH_3CO$ ), 1.98 (s, 6 H, 2  $CH_3CO$ ), 1.99 (s, 3 H,  $CH_3CO$ ), 2.06 (s, 6 H,  $CH_3CO$ ), 2.08 (s, 3 H,  $CH_3CO$ ), 3.03-3.15 (m, 2 H,  $NHCH_2$ ), 3.30-3.44 (m, 4 H,  $CH_2OCH_2$ ), 3.49 – 3.60 (m, 4 H,  $OCH_2CH_3$ ,  $CHO$ ,  $CH_2HO$ -Gal), 3.66-3.84 (m, 3 H,  $CH_2HO$ -Gal, H-5 and H-5' Lac), 3.96-4.25 (m, 6 H, H-6 and H-6' Lac,  $CH_2OCO$ ), 4.38 (d, 1 H,  $J = 8.0$ , H-1 Lac), 4.42 (d, 1 H,  $J = 8.0$ , H-1' Lac), 4.40-4.48 (m, 1 H, H-4 Lac), 4.80 (dd, 1H,  $J = 8.0, 9.5$ , H-2 Lac), 4.91 (dd, 1 H,  $J = 3.4, 10.4$ , H-3' Lac), 4.96 (br. s, 1 H, NH), 5.05 (dd, 1 H,  $J = 8.0, 10.4$ , H-2' Lac), 5.15 (dd, 1 H,  $J = 9.1, 9.5$  H-3 Lac), 5.28 (dd, 1 H,  $J = 1.1, 3.4$ , H-4' Lac).  $^{13}C$  NMR (75 MHz,  $CDCl_3$ ) 14.06, 15.47, 20.44, 20.56, 20.63, 20.75, 20.80, 22.65, 24.53, 26.04, 28.73, 29.32, 29.40, 29.45, 29.66, 31.88, 37.06, 60.76, 65.67, 66.58, 68.85, 69.10, 70.63, 70.95, 71.29, 71.76, 72.61, 72.77, 76.21, 100.51, 101.02, 156.71 167.71, 169.07, 169.77, 170.04, 170.12, 170.32, 170.38. MS,  $m/z$ : 1128.677  $[M+Na]^+$ . Calculated for  $C_{54}H_{91}NO_{22}Na$ : 1128.593  $[M+Na]^+$ .

**(2RS)-2-O-Ethyl-3-O-( $\beta$ -D-galactopyranosyl)-1-O-octadecylglycerol 1a:** Yield 94%,  $[\alpha]_D^{25} -3.0$  ( $c$  1,  $CHCl_3$ -MeOH, 2:1).  $^1H$  NMR (300 MHz,  $CDCl_3$ - $CD_3OD$ ) 0.79 (t, 3 H,  $J = 6.7$ ,  $(CH_2)_{15}CH_3$ ), 1.12 (t, 3 H,  $J = 7.0$  Hz,  $OCH_2CH_3$ ), 1.17 (br. s, 30 H,  $(CH_2)_{15}CH_3$ ), 1.43-1.53 (m, 2 H,  $OCH_2CH_2$ ), 3.32 – 3.50 (m, 6 H,  $CH_2OCH_2$ , H-2, H-3 Gal), 3.52 – 3.63 (m, 4 H,  $OCH_2CH_3$ ,  $CHO$ ,  $CH_2HO$ -Gal), 3.63-3.79 (m, 2 H, H-5, H-6 Gal), 3.79-3.92 (m, 2 H,  $CH_2HO$ -Gal, H-4 Gal), 4.12 (d, 1 H,  $J = 7.1$ , H-1 Gal).  $^{13}C$  NMR (75 MHz,  $CDCl_3$ - $CD_3OD$ ) 13.78, 15.02, 22.48, 25.86, 29.16, 29.29, 29.38, 29.50, 31.74, 61.17, 65.40, 65.73, 68.73, 68.81, 68.98, 69.88, 70.52, 71.14, 71.46, 71.67, 73.21, 74.60, 77.49, 103.65, 103.74. MS,  $m/z$ : 557.482  $[M+Na]^+$ . Calculated for  $C_{29}H_{58}O_8Na$ : 557.763  $[M+Na]^+$ .

**(2RS)-2-O-Ethyl-3-O-( $\alpha$ -D-mannopyranosyl)-1-O-octadecylglycerol 1b:** Yield 89%,  $[\alpha]_D^{27} +3.2$  ( $c$  1,  $CHCl_3$ -MeOH, 2:1).  $^1H$  NMR (300 MHz,  $CDCl_3$ - $CD_3OD$ ) 0.81 (t, 3 H,  $J = 6.7$  Hz,  $(CH_2)_{15}CH_3$ ), 1.12 (t, 3 H,  $J = 7.0$  Hz,  $OCH_2CH_3$ ), 1.19 (br. s, 30 H,  $(CH_2)_{15}CH_3$ ), 1.41-1.57 (m, 2 H,  $OCH_2CH_2$ ), 3.29 – 3.99 (m, 4 H,  $CH_2OCH_2$ ,  $OCH_2CH_3$ ,  $CHO$ ,  $CH_2$ -Man, H-2, H-3, H-4, H-5, H-6 Man), 4.68-4.83 (m, 1 H, H-1 Man).  $^{13}C$  NMR (75 MHz,  $CDCl_3$ - $CD_3ODz$ ) 14.23, 15.70, 22.81, 26.23, 29.49, 29.67, 29.79, 29.85, 32.05, 60.98, 65.97, 67.66, 70.53, 70.99, 71.67, 71.92, 72.40, 77.32, 100.20, 100.55. MS,  $m/z$ : 557.472  $[M+Na]^+$ . Calculated for  $C_{29}H_{58}O_8Na$ : 557.763  $[M+Na]^+$ .

**(2RS)-2-O-Ethyl-3-O-( $\beta$ -lactosyl)-1-O-octadecylglycerol 1c:** Yield 89%,  $[\alpha]_D^{25}$  -6.1 (*c* 1, CHCl<sub>3</sub>-MeOH, 2:1), <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>-CD<sub>3</sub>OD) 0.86 (t, 3 H, *J* = 6.7 Hz, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.12 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.20 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.42-1.57 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 3.47 – 3.74 (m, 4 H, CH<sub>2</sub>OCH<sub>2</sub>), 3.78–4.19 (m, 17 H, OCH<sub>2</sub>CH<sub>3</sub>, CHO, CH<sub>2</sub>O-Gal and Lac protons), 4.66 (d, 1 H, *J* = 7.7, H-1 Lac), 4.87 (d, 1 H, *J* = 7.8, H-1' Lac). MS, *m/z*: 720.47 [M+Na]<sup>+</sup>. Calculated for C<sub>35</sub>H<sub>70</sub>O<sub>13</sub>Na: 719.83 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-3-O-[2-( $\beta$ -D-galactopyranosyloxy)ethylaminocarbonyl]-1-O-octadecylglycerol 2a:** Yield 84%,  $[\alpha]_D^{25}$  +2.0 (*c* 0.5, CHCl<sub>3</sub>-MeOH, 5:1). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>-CD<sub>3</sub>OD) 0.80 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.12 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.43-1.53 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 3.30 – 3.51 (m, 8 H, CH<sub>2</sub>OCH<sub>2</sub>, NHCH<sub>2</sub>, H-2, H-3 Gal), 3.53 – 3.64 (m, 5 H, OCH<sub>2</sub>CH<sub>3</sub>, CHO, CH<sub>a</sub>HO-Gal, H-5 Gal), 3.64-3.78 (m, 2 H, H-6 Gal), 3.79-3.90 (m, 2 H, CH<sub>b</sub>HO-Gal, H-4 Gal), 3.95-4.10 (m, 2 H, CH<sub>2</sub>OCO), 4.14 (d, 1 H, *J* = 6.9, H-1 Gal). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>-CD<sub>3</sub>OD) 13.81, 15.10, 22.50, 25.88, 29.19, 29.32, 29.40, 29.48, 31.76, 40.80, 61.30, 64.01, 65.65, 68.74, 69.11, 70.12, 71.21, 71.72, 73.29, 74.76, 76.56, 103.48, 157.10. MS, *m/z*: 644.777 [M+Na]<sup>+</sup>. Calculated for C<sub>32</sub>H<sub>63</sub>NO<sub>10</sub>Na: 644.435 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-3-O-[3-( $\beta$ -D-galactopyranosyloxy)propylaminocarbonyl]-1-O-octadecylglycerol 3a:** Yield 87%,  $[\alpha]_D^{25}$  -3.9 (*c* 0.5, CHCl<sub>3</sub>-MeOH, 5:1). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>-CD<sub>3</sub>OD) 0.80 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.13 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.42-1.59 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 1.60-1.78 (m, 2 H, NHCH<sub>2</sub>CH<sub>2</sub>), 3.10-3.27 (m, 2 H, NHCH<sub>2</sub>), 3.32-3.50 (m, 7 H, CH<sub>2</sub>OCH<sub>2</sub>, H-2, H-3, H-5 Gal), 3.51 – 3.63 (m, 4 H, OCH<sub>2</sub>CH<sub>3</sub>, CHO, CH<sub>a</sub>HO-Gal), 3.65-3.78 (m, 2 H, H-6 Gal), 3.81-3.92 (m, 2 H, CH<sub>b</sub>HO-Gal, H-4 Gal), 3.94-4.03 (m, 1 H) and 4.05-4.13 (m, 1 H, CH<sub>2</sub>OCO), 4.15 (d, 1H, *J* = 6.9, H-1 Gal). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>-CD<sub>3</sub>OD) 14.17, 15.49, 22.75, 26.12, 29.42, 29.56, 29.76, 31.99, 37.78, 61.83, 64.16, 65.81, 67.24, 70.37, 71.35, 71.92, 73.66, 74.62, 77.36, 103.33, 157.05. MS, *m/z*: 658.428 [M+Na]<sup>+</sup>. Calculated for C<sub>33</sub>H<sub>65</sub>NO<sub>10</sub>Na: 658.450 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-3-O-[4-( $\beta$ -D-galactopyranosyloxy)butylaminocarbonyl]-1-O-octadecylglycerol 4a:** Yield 90%,  $[\alpha]_D^{25}$  -2.8 (*c* 1, CHCl<sub>3</sub>-MeOH, 1:5). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>-CD<sub>3</sub>OD) 0.80 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.12 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.18 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.44-1.63 (m, 6 H, OCH<sub>2</sub>CH<sub>2</sub>, NHCH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>), 3.08 (t, 2 H, *J* = 6.5, NHCH<sub>2</sub>), 3.34-3.51 (m, 7 H, CH<sub>2</sub>OCH<sub>2</sub>, H-2, H-3, H-5 Gal), 3.49 – 3.63 (m, 4 H, OCH<sub>2</sub>CH<sub>3</sub>, CHO, CH<sub>a</sub>HO-Gal), 3.67 (dd, 1 H, *J* = 4.0, 9.9) and 3.72 (dd, 1 H, *J* = 4.8, 9.9, H-6 Gal), 3.78-3.90 (m, 2 H, CH<sub>b</sub>HO-Gal, H-4 Gal), 3.98 (dd, 1 H, *J* = 5.6, 11.5) and 4.08 (dd, 1 H, *J* = 4.2, 11.5, CH<sub>2</sub>OCO), 4.14 (d, 1H, *J* = 7.0, H-1 Gal). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>-CD<sub>3</sub>OD) 13.33,

14.66, 22.17, 25.57, 25.84, 26.18, 28.87, 28.98, 29.07, 29.13, 29.19, 31.45, 39.97, 60.82, 63.59, 65.35, 68.50, 68.92, 69.82, 70.90, 71.33, 73.20, 74.52, 76.31, 103.07, 156.93. MS,  $m/z$ : 672.271  $[M+Na]^+$ . Calculated for  $C_{34}H_{67}NO_{10}Na$ : 672.466  $[M+Na]^+$ .

**(2RS)-2-O-Ethyl-3-O-[2-( $\alpha$ -D-mannopyranosyloxy)ethylaminocarbonyl]-1-O-**

**octadecylglycerol 2b**: Yield 80%,  $[\alpha]_D^{25} +23.7$  ( $c$  0.5,  $CHCl_3$ -MeOH, 5:1).  $^1H$  NMR (300 MHz, Py-d5) 0.81 (t, 3 H,  $J = 6.7$ ,  $(CH_2)_{15}CH_3$ ), 1.13 (t, 3 H,  $J = 7.0$  Hz,  $OCH_2CH_3$ ), 1.18 (br. s, 30 H,  $(CH_2)_{15}CH_3$ ), 1.51-1.66 (m, 2 H,  $OCH_2CH_2$ ), 3.37 – 3.49 (m, 2 H,  $NHCH_2$ ), 3.53-3.75 (m, 6 H,  $CH_2OCH_2$ , CHO,  $CH_aHO$ -Man), 3.76-3.93 (m, 2 H, H-5, H-4 Man), 4.02-4.17 (m, 1 H,  $CH_bHO$ -Man), 4.28-4.70 ( $OCH_2CH_3$ , H-2, H-3, H-6 Man,  $CH_2OCO$ ), 4.36 (br. s, 1 H, H-1 Man).  $^{13}C$  NMR (75 MHz, Py-d5) 14.64, 16.24, 23.29, 26.83, 29.96, 30.14, 30.29, 30.35, 30.45, 32.48, 41.75, 63.46, 65.00, 66.03, 67.36, 69.48, 71.37, 72.07, 72.37, 73.37, 75.83, 77.74, 102.18, 157.85. MS,  $m/z$ : 644.433  $[M+Na]^+$ . Calculated for  $C_{32}H_{63}NO_{10}Na$ : 644.435  $[M+Na]^+$ .

**(2RS)-2-O-Ethyl-3-O-[3-( $\alpha$ -D-mannopyranosyloxy)propylaminocarbonyl]-1-O-**

**octadecylglycerol 3b**: Yield 72%,  $[\alpha]_D^{21} +28.5$  ( $c$  0.5,  $CHCl_3$ -MeOH, 5:1).  $^1H$  NMR (300 MHz,  $CDCl_3$ - $CD_3OD$ ) 0.80 (t, 3 H,  $J = 6.7$ ,  $(CH_2)_{15}CH_3$ ), 1.13 (t, 3 H,  $J = 7.0$  Hz,  $OCH_2CH_3$ ), 1.18 (br. s, 30 H,  $(CH_2)_{15}CH_3$ ), 1.43-1.55 (m, 2 H,  $OCH_2CH_2$ ), 1.65-1.75 (m, 2 H,  $NHCH_2CH_2$ ), 3.15 (dt, 2 H,  $J = 2.5, 6.6$ ,  $NHCH_2$ ), 3.32–3.48 (m, 6 H,  $CH_2OCH_2$ ,  $CH_aHO$ -Man, H-5 Man), 3.50-3.69 (m, 6 H, CHO,  $OCH_2CH_3$ ,  $CH_bHO$ -Man, H-3, H-4 Man), 3.70-3.75 (m, 2 H, H-6 Man), 3.75-3.80 (m, 1 H, H-2 Man), 4.00 (dd, 1 H,  $J = 5.0, 11.5$ ) and 4.10 (dd, 1 H,  $J = 3.9, 11.5$ ,  $CH_2OCO$ ), 4.69 (d, 1 H,  $J = 1.4$ , H-1 Man).  $^{13}C$  NMR (75 MHz,  $CDCl_3$ - $CD_3OD$ ) 13.87, 15.16, 22.54, 25.91, 29.22, 29.35, 29.43, 29.56, 31.79, 37.89, 61.38, 63.96, 64.9, 65.7, 67.01, 70.14, 70.56, 71.27, 71.75, 72.45, 76.55, 99.96, 156.57. MS,  $m/z$ : 658.653  $[M+Na]^+$ . Calculated for  $C_{33}H_{65}NO_{10}Na$ : 658.451  $[M+Na]^+$ .

**(2RS)-2-O-ethyl-3-O-[4-( $\alpha$ -D-mannopyranosyloxy)butylaminocarbonyl]-1-O-**

**octadecylglycerol 4b**: Yield 78%,  $[\alpha]_D^{25} +20.6$  ( $c$  0.5,  $CHCl_3$ -MeOH, 5:1).  $^1H$  NMR (300 MHz, Py-d5) 0.88 (t, 3 H,  $J = 6.7$ ,  $(CH_2)_{15}CH_3$ ), 1.18 (t, 3 H,  $J = 7.0$  Hz,  $OCH_2CH_3$ ), 1.31 (br. s, 30 H,  $(CH_2)_{15}CH_3$ ), 1.50-1.80 (m, 6 H,  $OCH_2CH_2$ ,  $NHCH_2CH_2CH_2$ ), 3.30-3.76 (m, 9 H,  $NHCH_2$ ,  $CH_2OCH_2$ ,  $CH_aHO$ -Man, H-5 Man, CHO), 3.81-4.05 (m, 2 H,  $CH_bHO$ -Man, H-4 Man), 4.22-4.73 (m, 8 H,  $OCH_2CH_3$ , H-2, H-3, H-6 Man,  $CH_2OCO$ ), 4.32 (br. s, 1 H, H-1 Man).  $^{13}C$  NMR (75 MHz, Py-d5) 14.64, 16.26, 23.29, 26.84, 27.71, 29.97, 30.13, 30.29, 30.35, 30.45, 32.48, 41.54, 63.64, 64.84, 65.99, 67.50, 69.64, 71.34, 72.07, 72.54, 73.50, 75.73, 77.80, 101.98, 157.74. MS,  $m/z$ : 672.493  $[M+Na]^+$ . Calculated for  $C_{34}H_{67}NO_{10}Na$ : 672.466  $[M+Na]^+$ .

**(2RS)-2-O-Ethyl-3-O-[2-(β-lactosyloxy)ethylaminocarbonyl]-1-O-octadecylglycerol 2c:**

Yield 68%,  $[\alpha]_D^{25} +2.8$  (*c* 0.5, CHCl<sub>3</sub>-MeOH, 5:1). <sup>1</sup>H NMR (300 MHz, Py-d<sub>5</sub>) 0.88 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.16 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.30 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.52-1.65 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 3.43 (t, 2 H, *J* = 6.5, NHCH<sub>2</sub>), 3.57-3.72 (m, 5 H, CH<sub>2</sub>OCH<sub>2</sub>, CHO), 3.78-4.59 (m, 18 H, OCH<sub>2</sub>CH<sub>3</sub>, CH<sub>2</sub>O-Lac, CH<sub>2</sub>OCO and Lac protons), 4.80 (d, 1 H, *J* = 7.6, H-1 Lac), 5.11 (d, 1 H, *J* = 7.8, H-1' Lac). <sup>13</sup>C NMR (75 MHz, Py-d<sub>5</sub>) 14.63, 16.24, 20.50, 23.28, 26.83, 29.95, 30.13, 30.28, 30.34, 30.45, 32.47, 34.17, 37.83, 42.10, 62.39, 62.46, 65.04, 65.19, 66.02, 68.98, 69.77, 70.42, 71.31, 72.06, 72.82, 75.02, 75.56, 76.86, 77.02, 77.62, 77.72, 82.37, 104.92, 106.18, 157.81. MS, *m/z*: 806.901 [M+Na]<sup>+</sup>. Calculated for C<sub>38</sub>H<sub>73</sub>NO<sub>15</sub>Na: 806.974 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-3-O-[3-(β-lactosyloxy)propylaminocarbonyl]-1-O-octadecylglycerol 3c:**

Yield (72%),  $[\alpha]_D^{25} +3.5$  (*c* 0.5, CHCl<sub>3</sub>-MeOH, 5:1). <sup>1</sup>H NMR (300 MHz, Py-d<sub>5</sub>) 0.88 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.16 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.30 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.50-1.65 (m, 2 H, OCH<sub>2</sub>CH<sub>2</sub>), 1.91-2.06 (m, 2 H, NHCH<sub>2</sub>CH<sub>2</sub>), 3.43 (t, 2 H, *J* = 6.5, NHCH<sub>2</sub>), 3.48-4.62 (m, 23 H, CH<sub>2</sub>OCH<sub>2</sub>, OCH<sub>2</sub>CH<sub>3</sub>, CHO, CH<sub>2</sub>O-Lac, CH<sub>2</sub>OCO and Lac protons), 4.73 (d, 1 H, *J* = 7.8, H-1 Lac), 5.10 (d, 1 H, *J* = 7.8, H-1' Lac). <sup>13</sup>C NMR (75 MHz, Py-d<sub>5</sub>) 14.63, 16.24, 23.28, 26.82, 29.80, 29.95, 30.13, 30.28, 30.34, 30.44, 30.98, 32.47, 32.74, 34.17, 37.82, 38.94, 62.39, 62.50, 64.89, 65.18, 66.00, 67.92, 68.98, 70.42, 71.34, 72.06, 72.81, 75.00, 75.55, 76.78, 77.04, 77.60, 77.77, 82.44, 104.64, 106.16, 157.79. MS, *m/z*: 820.916 [M+Na]<sup>+</sup>. Calculated for C<sub>39</sub>H<sub>75</sub>NO<sub>15</sub>Na: 820.503 [M+Na]<sup>+</sup>.

**(2RS)-2-O-Ethyl-3-O-[4-(β-lactosyloxy)butylaminocarbonyl]-1-O-octadecylglycerol 4c:**

Yield 70%,  $[\alpha]_D^{25} +3.5$  (*c* 0.5, CHCl<sub>3</sub>-MeOH, 5:1). <sup>1</sup>H NMR (300 MHz, Py-d<sub>5</sub>) 0.88 (t, 3 H, *J* = 6.7, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.17 (t, 3 H, *J* = 7.0 Hz, OCH<sub>2</sub>CH<sub>3</sub>), 1.30 (br. s, 30 H, (CH<sub>2</sub>)<sub>15</sub>CH<sub>3</sub>), 1.52-1.90 (m, 6 H, OCH<sub>2</sub>CH<sub>2</sub>, NHCH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>), 3.44 (t, 2 H, *J* = 6.5, NHCH<sub>2</sub>), 3.57-3.75 (m, 5 H, CH<sub>2</sub>OCH<sub>2</sub>, CHO), 3.80-4.63 (m, 18 H, OCH<sub>2</sub>CH<sub>3</sub>, CH<sub>2</sub>O-Lac, CH<sub>2</sub>OCO and Lac protons), 4.74 (d, 1 H, *J* = 7.7, H-1 Lac), 5.12 (d, 1 H, *J* = 7.8, H-1' Lac). <sup>13</sup>C NMR (75 MHz, Py-d<sub>5</sub>) 14.63, 16.24, 20.50, 23.28, 26.83, 27.02, 27.82, 29.95, 30.12, 30.28, 30.34, 30.44, 31.86, 37.82, 41.44, 62.39, 62.55, 64.86, 65.18, 65.99, 68.96, 70.43, 71.33, 72.07, 72.84, 74.39, 75.06, 75.56, 75.78, 77.07, 77.60, 77.79, 82.51, 104.60, 106.18, 157. MS, *m/z*: 834.895 [M+Na]<sup>+</sup>. Calculated for C<sub>40</sub>H<sub>77</sub>NO<sub>15</sub>Na: 834.519 [M+Na]<sup>+</sup>.

## **Cell culture and cytotoxicity assays**

The K562 and H160 human leukemia, HCT116 colon carcinoma and B16 murine melanoma cell lines were cultured in Dulbecco modified Eagle's medium supplemented with 5% fetal calf serum (HyClone, Logan, UT), 2 mM L-glutamine, 100 U/ml penicillin, and 100 µg/ml streptomycin at 37 °C, 5% CO<sub>2</sub> in humidified atmosphere. Cells in logarithmic phase of growth were used in the experiments.

Novel GAELs and edelfosine were dissolved in dimethyl sulfoxide as 10 mM stock solutions followed by serial dilutions in culture medium immediately before experiments. The assays were performed in 96-well microtiter plates. To each well containing  $5-7.5 \times 10^4$  tumor cells a given amount of the test compound was added. The cells were incubated for 72 h at 37 °C, 5% CO<sub>2</sub> followed by the addition of aqueous solution of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (final concentration 0.25 mg/ml) and incubation for another 1-2 h. Formazan was dissolved in acidified dimethyl sulfoxide. The optical density (OD) was measured on a Multiscan FC plate reader (Thermo Scientific, USA) at the excitation wavelength 570 nm. The percentage of cell survival at a given drug concentration (in triplicate) was calculated as OD of the drug containing well divided by OD of the untreated well (100%). The IC<sub>50</sub> was defined as the concentration of the compound that inhibited cell viability by 50%.

## **Hemolytic activity**

The blood samples taken from healthy individuals (by elbow vein puncture) were washed twice with saline (pH 7.4). After the centrifugation (2000 x g, 1 min) the pellets were resuspended in 200 µl saline. The tested GAELs and edelfosine were added up to final concentrations (indicated in Figure 2). In control specimens 200 µl dH<sub>2</sub>O was added to the cell pellets. After incubation at 37 °C for 2 h the specimens were pelleted, and ODs of supernatants were measured on a Multiscan FC plate reader (excitation wavelength 540 nm). The percentage of hemolysis was calculated as OD of the drug containing tube divided by OD of the control tube (100%). The experiments were performed 4 times with essentially the same results.

### Viability of skin fibroblasts in the presence of new GAELs 1a,b and Edelfosine

