Supporting Information

NMR spectra (300 or 500 MHz ^{1}H NMR and 75 or 125 MHz ^{13}C NMR) were recorded using Varian Unity Inova 300 and Varian 500 with Auto-Tuner. Chemical shifts are reported in parts per million (ppm). ^{1}H and ^{13}C NMR chemical shifts are referenced to TMS as internal standard. Melting points were determined with an Original Mel-Temp Laboratory devices INC apparatus (USA). All chemicals and solvents were purchased from Aldrich Chemical or Acros Organics. Betulin was used as starting compound for **(1) – (21)** synthesis. It was isolated from the extract of outer birch bark of *Betula papyrifera* in accordance with the previously developed procedure[1]. Betulinic aldehyde **(16)** and betulinic acid were obtained by the recently developed electrooxidation of betulin to betulinic aldehyde which was subsequently converted to betulinic acid with sodium chlorite[2]. 3β-Acetoxylup-20-en-28-oic acid was synthesized from betulinic acid by the procedure described bellow. It was used for 3β-acetoxylup-20-en-28-amide **(1)** and 3β-hydroxy-18α-oleanan-28,19β-olide **(8)** synthesis.

3β-Acetoxylup-20-en-28-oic acid. Acetic anhydride (100 ml, 1.06 mol) was added to betulinic acid (51.4 g, 0.11 mol). The mixture was carefully heated until thinning and then refluxed and stirred for 4 hr. Reaction mixture was evaporated in vacuum (20 torr, 90 ^{o}C) and white solid residue was treated with ethanol (100 ml) for 14 hr at ambient temperature. Then water (100 ml) was added and white solid was filtered off after 1 hr, washed with water (1 l) and dried in vacuum oven (500 torr, 50 ^{o}C, 10 hr) to give 3β-acetoxylup-20-en-28-oic acid (44.7 g, 80% yield). m.p. 287-289 ^{o}C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 4.74 (s, 1H), 4.61 (s, 1H), 4.47 (dd, 1H), 3.01 (dt, 1H), 2.30-0.78 (m, 49H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 183.13, 171.44, 150.66, 110.05, 81.28, 56.74, 55.69, 50.66, 49.54, 47.26, 42.71, 40.97, 38.69, 38.09, 37.41, 37.41, 34.52, 32.48, 30.89, 29.99, 28.23, 25.73, 23.99, 21.64, 21.15, 19.66, 18.46, 16.75, 16.75, 16.45, 16.36, 14.95. HRMS (ESI): *m/z* calcd for $C_{32}H_{50}NaO_4^+$ [M+Na^+] 521.3601; found 521.3612.

3β-Acetoxylup-20-en-28-amide (1). 3β-Acetoxylup-20-en-28-oic acid (3.03 g, 6.05 mmol) was dissolved in dichloromethane (50 ml). Oxalyl chloride (2.15 ml, 25.04 mmol) was added. Solution was stirred for 30 min at ambient temperature and then refluxed for 1 hr. Reaction solution was evaporated in vacuum (80 torr, 60 ^{o}C) . Dry residue was dissolved in dichloromethane (100 ml), cooled (ice bath) and dry ammonia was bubbled in for 40 min. Cooling bath was removed and mixture was stirred at ambient temperature for 1 hr. Reaction suspension was evaporated in vacuum (80 torr, 60 ^{o}C). Residue was mixed with water (100 ml), filtered, washed with water (2x100 ml) and dried. Solid was refluxed with ethanol (70 ml), cooled, white precipitate was filtered, washed with ethanol (3x10 ml) and dried to give titled compound (2.60 g, 86% yield). m.p. 340-341 ^{o}C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 5.56 (s, 1H), 5.44 (s, 1H), 4.74 (m, 1H), 4.60 (m, 1H), 4.47 (m, 1H), 3.09 (m, 1H), 2.46 (m, 1H), 2.05-0.77 (m, 44H). HRMS (ESI): *m/z* calcd for $C_{32}H_{51}NNaO_3^+$ [M+Na^+] 520.3761; found 520.3765.

3β-Acetoxy-18α-oleanane-28,19β-lactame (2). 3β-Acetoxylup-20-en-28-amide **(1)** (1.31 g, 2.64 mmol) and trifluoroacetic acid (4.5 ml, 60.69 mmol) were dissolved in chloroform (30 ml). The mixture was stirred and refluxed for 1 hr. Resulting solution was washed with saturated aqueous solution of sodium hydrocarbonate (100 ml). Organic phase was dried over calcium chloride, filtered and evaporated. Solid residue was refluxed with ethanol (10 ml), cooled and precipitate was filtered off, washed with ethanol (3 ml) and with water (100 ml). Product appears as white powder after drying (0.98 g, 75% yield). m.p. 334-337 ^{o}C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 4.48 (dd, 1H), 3.79 (s, 1H), 2.05 (s, 3H), 1.80-0.78 (m, 45H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 175.21, 170.97, 86.29, 80.83, 55.59, 51.14, 47.06, 45.50, 40.57, 40.20, 38.61, 37.78, 37.16, 35.56, 34.07, 33.93, 33.70, 32.39, 28.80, 27.90, 27.32, 26.57, 26.36, 24.16, 23.65, 21.30, 20.93, 18.07, 16.57, 16.47, 15.56, 13.64. HRMS (ESI): *m/z* calcd for $C_{32}H_{51}NNaO_3^+$ [M+Na^+] 520.3761; found 520.3769.

3β-Hydroxy-18α-oleanane-28,19β-lactame (3). 3β-Acetoxy-18α-oleanane-28,19β-lactame **(2)** (1.00 g, 2.01 mmol) was suspended in ethanol (50 ml). Potassium hydroxide powder (1.13 g, 20.14 mmol) was added to the stirred mixture. It was stirred and refluxed for 7 hrs. Reaction mixture was cooled, evaporated in vacuum (150 torr, 70 ^{o}C), diluted with water (100 ml) and treated with acetic acid (7 ml). Precipitate was filtered off, washed with water (3x100 ml) and dried to give titled compound as white powder (0.83 g, 87% yield). m.p. 270-272 ^{o}C. ^{1}H NMR

(300 MHz, $CDCl_3$): δ 3.79 (s, 1H), 3.19 (dd, 1H), 1.81-0.67 (m, 45H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 175.43, 86.38, 78.55, 55.48, 51.14, 47.01, 45.54, 40.49, 40.12, 38.94, 38.84, 37.19, 35.50, 33.98, 33.82, 33.73, 32.32, 28.77, 27.98, 27.28, 27.27, 26.43, 26.33, 24.11, 20.85, 18.16, 16.47, 15.51, 15.43, 13.63. HRMS (ESI): *m/z* calcd for $C_{30}H_{49}NNaO_2^+$ [M+Na^+] 478.3656; found 478.3659.

2,2-Dimethyl-4-[(19β,28-epimino-28-oxo-18α-oleanan-3β-yl)oxy]-4-oxobutanoic acid (4). 3β-Hydroxy-18α-oleanane-28,19β-lactame **(3)** (0.14 g, 0.30 mmol) was mixed with 2,2-dimethylsuccinic anhydride (0.31 g, 2.40 mmol) and 4-(dimethylamino)pyridine (0.29 g, 2.40 mmol) in dry pyridine (2 ml). Resulting solution was stirred and heated (oil bath, 60 ^oC) for 24 hrs. Reaction solution was poured in hydrochloric acid (7% assay, 25 ml). White precipitate was filtered, washed with hot water (50 ^oC, 3x20 ml) and dried to give white solid (0.13 g). This product contained 2,2-dimethylsuccinic acid as admixture (12 mol%). It was heated to reflux with potassium carbonate (1 g) solution in water (10ml). Mixture was then stirred at ambient temperature for 20 hrs. Precipitate was filtered, washed with water (2x20 ml), then with 10% aqueous acetic acid (2x15 ml) and again with water (3x30 ml) and dried to give titled compound (46.3 mg, 26% yield). m.p. 313-316 ^oC decomp. ^1H NMR (300 MHz, $CDCl_3$): δ 6.55 (s, 2H), 4.48 (m, 1H), 3.81 (s, 1H), 2.68 (d, 1H), 2.57 (d, 1H), 1.76-0.81 (m, 51H). HRMS (ESI): *m/z* calcd for $C_{36}H_{57}NNaO_5^+$ [M+Na^+] 606.4129; found 606.4138.

28-Cyanolup-20-en-3β-yl acetate (5). 3β-Acetoxylup-20-en-28-amide **(1)** (5.00 g, 10.05 mmol) was mixed with trifluoroacetic anhydride (17 ml, 122.22 mmol) in chloroform (120 ml). Solution was stirred and heated to reflux for 10 min. Then water (18 ml) was added to the cooled to ambient temperature reaction solution. It was refluxed again for 1 hr. Reaction mixture was diluted with water (100 ml) and neutralized with sodium bicarbonate powder. Chloroform phase was separated and dried over sodium sulfate, filtered and evaporated in vacuum (120 torr, 60 ^oC) to give white solid. It was refluxed with ethanol (37 ml), cooled, filtered, washed with ethanol (10 ml) and water (3x20 ml) and dried. Product appeared as white powder (4.10 g, 85% yield). m.p. 244-246 ^oC. ^1H NMR (300 MHz, $CDCl_3$): 4.77 (s, 1H), 4.66 (s, 1H), 4.48 (m, 1H), 2.67 (m, 1H), 2.27-0.78 (m, 45H). ^{13}C NMR (75 MHz, $CDCl_3$): 171.04, 148.09, 123.47, 110.95, 80.82, 55.35, 50.32, 49.08, 48.99, 48.55, 42.26, 41.13, 40.58, 38.36, 37.75, 37.06, 35.80, 34.26, 31.01, 29.46, 29.02, 27.92, 24.87, 23.63, 21.34, 20.66, 19.33, 18.11, 16.48, 16.22, 15.92, 14.79. HRMS (ESI): *m/z* calcd for $C_{32}H_{49}NNaO_2^+$ [M+Na^+] 502.3656; found 502.3657.

3β-Hydroxylup-20-en-28-nitrile (6). 28-Cyanolup-20-en-3β-yl acetate **(5)** (2.06 g, 4.29 mmol) was mixed with potassium hydroxide powder (1.01 g, 18.00 mmol) in methanol (50 ml). It was stirred and refluxed for 9 hr. Reaction mixture was treated with hydrochloric acid (7% assay, 20 ml). Precipitate was filtered, washed with water (8x30 ml) and dried. Titled compound was obtained as white solid (1.87 g, 99% yield). m.p. 266-268 ^oC. ^1H NMR (300 MHz, $CDCl_3$): δ 4.77 (s, 1H), 4.65 (s, 1H), 3.19 (m, 1H), 2.66 (m, 1H), 2.04-0.67 (m, 42H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.14, 123.46, 110.91, 78.95, 55.34, 50.47, 49.16, 49.04, 48.57, 42.32, 41.21, 40.63, 38.85, 38.75, 37.20, 35.85, 34.40, 31.07, 29.54, 29.08, 28.00, 27.37, 24.98, 20.70, 19.38, 18.27, 16.17, 15.97, 15.37, 14.86. HRMS (ESI): *m/z* calcd for $C_{30}H_{47}NNaO^+$ [M+Na^+] 460.3550; found 460.3561.

2,2-Dimethyl-4-[(28-nitrilolup-20-en-3β-yl)oxy]-4-oxobutanoic acid (7). 3β-Hydroxylup-20-en-28-nitrile **(6)** (0.16 g, 0.36 mmol) was mixed with 2,2-dimethylsuccinic anhydride (0.37 g, 2.87 mmol) and 4-(dimethylamino)pyridine (0.35 g, 2.87 mmol) in dry pyridine (2.5 ml). Resulting solution was stirred and heated (oil bath, 60 ^oC) for 28 hr. Reaction mixture was poured in hydrochloric acid (7% assay, 37 ml). White precipitate was filtered, washed with hot water (80 ^oC, 7x30 ml) and dried to give titled compound (0.15 g, 74% yield). m.p. 254-257 ^oC. ^1H NMR (300 MHz, $CDCl_3$): δ 4.77 (s, 1H), 4.65 (s, 1H), 4.49 (dd, 1H), 2.71-2.54 (m, 3H), 2.23-0.75 (m, 48H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 183.23, 170.92, 148.12, 123.45, 110.93, 81.48, 55.45, 50.53, 49.13, 49.02, 48.58, 44.73, 42.31, 41.18, 40.63, 40.49, 38.43, 37.71, 37.08, 35.82, 34.30, 31.04, 29.51, 29.06, 27.90, 25.61, 24.98, 24.92, 23.56, 20.71, 19.36, 18.12, 16.47, 16.17, 15.97, 14.84. HRMS (ESI): *m/z* calcd for $C_{36}H_{55}NNaO_4^+$ [M+Na^+] 588.4023; found 588.4033.

3β-Hydroxy-18α-oleanan-28,19β-olide (8). 3β-Acetoxylup-20-en-28-oic acid (40.0 g, 0.08 mol) was dissolved in chloroform (200 ml). *p*-Toluenesulfonic acid monohydrate (15.3 g, 0.08 mol) was added to the solution. The mixture was stirred and refluxed for 12 hr. Then it was evaporated in vacuum (20 torr, 60 ^{o}C). Solid residue was treated with saturated aqueous sodium bicarbonate solution (200 ml). Precipitate was filtered, washed with water (1 l) and dried in vacuum oven (500 torr, 50 ^{o}C, 10 hr). The crude product was heated to reflux with tetrahydrofuran (150 ml) and suspension was then cooled (0 ^{o}C). Precipitate was filtered off and dried in vacuum oven (500 torr, 50 ^{o}C, 10 hr) to give 3β-acetoxy-18α-oleanan-28,19β-olide as white powder (25.3 g, 63% yield). m.p. 325-327^{o}C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 4.47 (dd, 1H), 3.94 (s, 1H), 2.05 (s, 3H), 1.88-0.78 (m, 45H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 180.15, 171.32, 86.33, 81.11, 55.89, 51.47, 47.00, 46.39, 40.87, 40.21, 38.93, 38.09, 37.47, 36.31, 33.96, 33.84, 32.61, 32.23, 29.03, 28.18, 28.11, 26.79, 25.83, 24.23, 23.94, 21.64, 21.19, 18.34, 16.95, 16.81, 15.85, 13.97. HRMS (ESI): *m/z* calcd for $C_{32}H_{50}NaO_4^+$ [M+Na$^+$] 521.3601; found 521.3610. 3β-Acetoxy-18α-oleanan-28,19β-olide (56.3 g, 0.11 mol) was placed in 3 l reactor fitted with mechanical stirrer and back flow condenser. It was suspended in ethanol (2 l). Potassium hydroxide powder (31.7 g, 0.56 mol) was then added. The reaction mixture was stirred and refluxed for 5 hr. Then solvent was evaporated in vacuum (20 torr, 50 ^{o}C) up to about 200 ml slurry paste remained. It was thoroughly treated with 7% hydrochloric acid (600 ml) and white precipitate was filtered off, washed with water (1.5 l) and dried in vacuum oven (500 torr, 50 ^{o}C, 24 hr). 3β-Hydroxy-18α-oleanan-28,19β-olide **(8)** (48.3 g, 94% yield) was obtained as white powder. m.p. 336-339 ^{o}C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 3.94 (s, 1H), 3.19 (dd, 1H), 1.89-0.67 (m, 45H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 180.22, 86.38, 79.25, 55.82, 51.57, 47.04, 46.43, 40.88, 40.24, 39.27, 39.27, 37.58, 36.34, 34.05, 33.87, 32.64, 32.26, 29.07, 28.22, 28.22, 27.67, 26.84, 25.87, 24.27, 21.21, 18.48, 16.85, 15.80, 15.73, 13.96. HRMS (ESI): *m/z* calcd for $C_{30}H_{48}NaO_3^+$ [M+Na$^+$] 479.3496; found 479.3493.

2,2-Dimethyl-4-[(19β,28-epoxy-28-oxo-18α-oleanan-3β-yl)oxy]-4-oxobutanoic acid (9). 3β-Hydroxy-18α-oleanan-28,19β-olide **(8)** (0.10 g, 0.23 mmol) was mixed with 2,2-dimethylsuccinic anhydride (0.23 g, 1.80 mmol) and 4-(dimethylamino)pyridine (0.22 g, 1.80 mmol) in dry pyridine (2 ml). Resulting mixture was stirred and heated (oil bath, 60 ^{o}C) for 42 hr. Reaction mixture was poured in hydrochloric acid (7% assay, 20 ml). White precipitate was filtered, washed with hot water (70 ^{o}C, 5x20 ml) and dried to give titled compound (0.13 g, 96% yield). m.p. 376-381 ^{o}C decomp. ^{1}H NMR (300 MHz, Py-d_5): δ 4.75 (dd, 1H), 4.05 (s, 1H), 2.99 (d, 1H), 2.91 (d, 1H), 2.01-0.74 (m, 24H), 1.56 (s, 3H), 1.56 (s, 3H), 1.02 (s, 3H), 0.97 (s, 3H), 0.94 (s, 3H), 0.92 (s, 3H), 0.85 (s, 3H), 0.77 (s, 3H), 0.74 (s, 3H). HRMS (ESI): *m/z* calcd for $C_{36}H_{56}NaO_6^+$ [M+Na$^+$] 607.3969; found 607.3973.

3β,19β-Dihydroxy-18α-oleanan-28-oic acid (10). Potassium hydroxide (1.29 g, 29.99 mmol) was added to the stirred suspension of 3β-hydroxy-18α-oleanan-28,19β-olide **(8)** (0.21 g, 0.45 mmol) in *tert*-butanol (12 ml). Mixture was stirred and heated to reflux for 24 hr under nitrogen atmosphere. Then it was evaporated in vacuum (40 torr, 60 ^{o}C). Solid residue was diluted with water (5 ml) and treated with 7% hydrochloric acid (15 ml). Precipitate was filtered, washed with water (3x20 ml) and dried. Crude product was treated with chloroform (5 ml) at ambient temperature, filtered, washed with chloroform (5 ml) and dried to give titled compound as white powder (0.21 g, 97%). m.p.355-356 ^{o}C. ^{1}H NMR (300 MHz, Py-d_5): δ 3.52 (s, 1H), 3.46 (t, 1H), 2.57 (t, 1H), 2.45 (d, 1H), 2.30 (d, 1H), 2.15 (d,1H), 1.86-0.80 (m, 41H). ^{13}C NMR (75 MHz, Py-d_5): δ 182.68, 78.08, 73.36, 55.95, 50.74, 50.44, 42.41, 42.32, 41.24, 39.51, 39.21, 37.44, 36.44, 36.23, 35.70, 34.64, 34.47, 31.19, 29.65, 29.06, 28.67, 28.30, 25.77, 24.57, 21.24, 18.75, 16.40, 16.34, 16.14, 15.13. HRMS (ESI): *m/z* calcd for $C_{30}H_{50}NaO_4^+$ [M+Na$^+$] 497.3601; found 497.3590.

Methyl 3β,19β-dihydroxy-18α-oleanan-28-oate (11). 3β,19β-Dihydroxy-18α-oleanan-28-oic acid **(10)** (0.19 g, 0.40 mmol) was stirred with potassium carbonate (0.17 g, 1.19 mmol) in *N*,*N*-dimetylformamide (5 ml). Dimethylsulfate (0.05 ml, 0.52 mmol) was added to the mixture. It was stirred at ambient temperature for 20 hr. Reaction mixture was diluted with water (20 ml). Precipitate was filtered off, washed with water (5x20 ml) and dried to give white solid product (0.14 g 70% yield). Product was additionally purified by crystallization from chloroform. m.p. 347-349 ^{o}C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 5.20 (d, 1H), 3.72 (s, 3H), 3.19 (m, 2H), 2.14-1.95 (m,

3H), 1.79-0.66 (m, 42H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 179.66, 78.09, 73.28, 55.95, 52.28, 50.65, 49.11, 42.94, 42.12, 41.22, 39.54, 39.20, 37.44, 36.20, 35.32, 34.90, 34.42, 34.16, 31.06, 29.08, 28.92, 28.69, 28.33, 25.71, 24.57, 21.10, 18.76, 16.40, 16.37, 15.99, 14.92. HRMS (ESI): *m/z* calcd for $C_{31}H_{52}NaO_4^+$ [M+Na$^+$] 511.3758; found 511.3750.

Methyl 3β-acetoxy-19β-hydroxy-18α-oleanan-28-oate (12). Methyl 3β,19β-dihydroxy-18α-oleanan-28-oate **(11)** (2.39 g, 4.89 mmol) was suspended in anhydrous pyridine (40 ml). Acetic anhydride (4.62 ml, 48.89 mmol) was added to the suspension. Mixture was stirred at ambient temperature for 69 hr. Reaction mixture was poured in water (300 ml). White precipitate was filtered, washed with water (3x100 ml) and dried to give titled compound as white powder (2.36 g, 91% yield). m.p. 352-355 ^{o}C decomp. ^{1}H NMR (300 MHz, $CDCl_3$): δ 5.22 (d, 1H), 4.48 (m, 1H), 3.72 (s, 3H), 3.19 (m, 1H), 2.13-0.79 (m, 48H). ^{13}C NMR (125 MHz, $CDCl_3$): δ 179.61, 170.63, 80.69, 72.88, 55.43, 52.28, 50.25, 49.71, 41.98, 41.77, 40.80, 38.36, 37.70, 36.99, 35.78, 35.04, 34.92, 33.89, 33.60, 30.36, 28.95, 28.15, 27.88, 25.62, 23.97, 23.60, 21.20, 20.76, 18.10, 16.45, 16.16, 15.74, 14.83. HRMS (ESI): *m/z* calcd for $C_{33}H_{54}NaO_5^+$ [M+Na$^+$] 553.3864; found 553.3859.

Methyl 3β-acetoxyolean-18-en-28-oate (13). Phosphorus oxychloride (10.54 ml, 115.19 mmol) was added to the methyl 3β-acetoxy-19β-hydroxy-18α-oleanan-28-oate **(12)** (2.91 g, 5.49 mmol) stirred solution in anhydrous pyridine (60 ml). Solution was stirred and refluxed for 4 hr. Then it was cooled to ambient temperature and poured in saturated aqueous sodium bicarbonate solution (1.5 l) (gas evolving and foaming). Precipitate was filtered, washed with water (3x100 ml) and dried to give crude solid product. It was recrystallized from hexanes to give pure titled compound as colorless crystals (1.46 g, 52% yield). m.p. 266-268 ^{o}C. ^{1}H NMR (300 MHz, $CDCl_3$): δ 5.12 (s, 1H), 4.48 (m, 1H), 3.68 (s, 3H), 2.18-0.76 (m, 47H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 177.24, 171.04, 137.08, 132.56, 80.88, 55.54, 51.93, 51.04, 48.17, 42.50, 41.25, 40.60, 38.57, 37.78, 37.09, 34.45, 33.50, 33.50, 33.50, 32.03, 30.38, 29.37, 29.11, 27.88, 25.95, 23.65, 21.35, 20.94, 18.08, 16.72, 16.50, 15.95, 14.95. HRMS (ESI): *m/z* calcd for $C_{33}H_{52}NaO_4^+$ [M+Na$^+$] 535.3758; found 535.3760.

3β-Hydroxyolean-18-en-28-oic acid (14). Methyl 3β-acetoxyolean-18-en-28-oate **(13)** (0.38g, 0.74 mmol) was mixed with potassium hydroxide (2.13 g, 37.90 mmol) in tert-butanol (20 ml). Mixture was stirred under nitrogen atmosphere and refluxed for 23 hr. Reaction mixture was evaporated in vacuum (90 torr, 80 ^{o}C). Solid residue was mixed with water (10 ml) and resulting suspension was treated with 7% hydrochloric acid (20 ml) (pH~1). White precipitate was filtered, washed with water (3x50 ml) and dried to give pure morolic acid **(14)** as white powder (0.34 g, 99% yield). m.p. 273-274 ^{o}C decomp. ^{1}H NMR (300 MHz, Py-d_5): δ 5.32 (s, 1H), 3.47 (m, 1H), 2.72 (m, 1H), 2.58 (m, 1H), 2.33 (m, 1H), 2.08-0.81 (m, 20H), 1.23 (s, 3H), 1.15 (s, 3H), 1.09 (s, 3H), 1.05 (s, 3H), 1.03 (s, 1H), 0.96 (s, 1H), 0.85 (s, 1H). ^{13}C NMR (75 MHz, Py-d_5): δ 179.14, 139.00, 132.03, 78.01, 56.01, 51.54, 48.59, 42.98, 41.68, 40.99, 39.52, 39.36, 37.48, 35.03, 34.33, 34.22, 34.17, 32.43, 30.83, 30.03, 29.35, 28.62, 28.31, 26.54, 21.30, 18.69, 16.94, 16.40, 16.34, 15.37. HRMS (ESI): *m/z* calcd for $C_{30}H_{48}NaO_3^+$ [M+Na$^+$] 479.3496; found 479.3504.

3β-[(3-Carboxy-3-methylbutanoyl)oxy]olean-18-en-28-oic acid (15). Morolic acid **(14)** (71.7 mg, 0.16 mmol) was mixed with 2,2-dimethylsuccinic anhydride (0.16 g, 1.26 mmol) and 4-(dimethylamino)pyridine (0.15 g, 1.26 mmol) in dry pyridine (2 ml). Resulting solution was stirred and heated (oil bath, 60 ^{o}C) for 26 hr. Reaction mixture was poured in water (30 ml). White precipitate was filtered, washed sequentially with water (30 ml), hot water (90 ^{o}C, 2x30 ml), hydrochloric acid (7% assay, 30 ml), hot water (90 ^{o}C, 3x30 ml) and dried to give white solid product (48.7 mg, 53% yield). m.p. 233-236 ^{o}C decomp. ^{1}H NMR (300 MHz, $CDCl_3$): δ 5.16 (s, 1H), 4.51 (m, 1H), 2.76 (d, 1H), 2.52 (d, 1H), 2.19-0.77 (m, 51H). HRMS (ESI): *m/z* calcd for $C_{36}H_{56}NaO_6^+$ [M+Na$^+$] 607.3969; found 607.3977.

3β-Hydroxylupan-28-al (17). Betulinic aldehyde **(16)** (1.00 g, 2.28 mmol) was dissolved in tetrahydrofuran/methanol mixture (1/1, 10 ml). It was hydrogenated with hydrogen over 20% Pd/C (0.30 g, 20%wt) for 2 hr at ambient temperature. Precipitate was filtered off. Filtrate was evaporated in vacuum (50 torr, 50 ^{o}C) to give crude product. Crystallization from chloroform gave 3β-hydroxylupan-28-al **(17)** (0.78 g, 78% yield). m.p. 192-

195 °C decomp. ^{1}H NMR (300 MHz, $CDCl_3$) δ 9.63 (s, 1H), 3.2 (dd , 1H), 2.25-1.85 (m, 4H), 1.75-0.6 (m, 44H). HRMS (ESI): *m/z* calcd for $C_{30}H_{50}NaO_2^+$ [M+Na$^+$] 465.3703; found 465.3692.

2,2-Dimethyl-4-[(28-oxolupan-3β-yl)oxy]-4-oxobutanoic acid (18). 2,2-Dimethylsuccinic anhydride (1.00 g, 8.00 mmol) was added to stirred mixture of 3β-hydroxylupan-28-al **(17)** (1.00 g, 2.00 mmol) and 4-(dimethylamino)pyridine (0.55 g, 4.00 mmol) in anhydrous pyridine (15 ml). The reaction mixture was stirred at 60°C for 20 hr and cooled down to ambient temperature. The mixture was diluted with 5% hydrochloric acid (20 ml) and dichloromethane (50 ml). The organic layer was separated, washed with 5% hydrochloric acid (2x10 ml), water (2x20 ml), dried with sodium sulfate, filtered and evaporated in vacuum (50 torr, 50 °C) to give crude product. Crystallization from methanol gave white solids (0.83 g, 67% yield). m.p. 184-186 °C decomp. ^{1}H NMR (300 MHz, $CDCl_3$): 9.65 (s, 1H), 4.48 (dd, 1H), 2.68 (d, 1H), 2.55 (d, 1H), 2.03 (m, 2H), 1.85-0.45 (m, 52H). HRMS (ESI): *m/z* calcd for $C_{36}H_{58}NaO_5^+$ [M+Na$^+$] 593.4177; found 593.4180.

2,2-Dimethyl-4-[(28-oxolup-20-en-3β-yl)oxy]-4-oxobutanoic acid (19). 2,2-Dimethylsuccinic anhydride (1.00 g, 8.00 mmol) was added to stirred mixture of betulinic aldehyde **(16)** (1.00 g, 2.00 mmol) and 4-(dimethylamino)pyridine (0.55 g, 4.00 mmol) in anhydrous pyridine (10 ml). The reaction mixture was stirred for 20 hr at 32 °C and cooled down to ambient temperature. The mixture was diluted with 5% hydrochloric acid (20 ml) and dichloromethane (50ml). The organic layer was separated, washed with 5% hydrochloric acid (2x10 ml), water (2x20 ml), dried with sodium sulfate, filtered and evaporated in vacuum (50 torr, 50 °C) to give crude product. Crystallization from methanol gave white solid (0.88 g, 69% yield). m.p. 155-158 °C decomp. ^{1}H NMR (300 MHz, $CDCl_3$): 9.67 (s, 1H), 4.75 (s, 1H), 4.62 (s, 1H), 4.48 (dd, 1H), 2.86 (m, 1H), 2.68 (d, 1H), 2.55 (d, 1H), 2.07 (m, 2H), 1.70 (s, 3H), 1.85-0.74 (m, 44H). HRMS (ESI): *m/z* calcd for $C_{36}H_{56}NaO_5^+$ [M+Na$^+$] 591.4020; found 591.4029.

***N*-Methyl-D-glucamine 2,2-dimethyl-4-[(28-oxolup-20-en-3β-yl)oxy]-4-oxobutanoate (20).** *N*-Methyl-D-glucamine (0.069 g, 0.350 mmol) was dissolved in methyl alcohol (200 ml). 2,2-Dimethyl-4-[(28-oxolup-20-en-3β-yl)oxy]-4-oxobutanoic acid **(19)** (0.200 g, 0.350 mmol) was added. Reaction mixture was stirred for 24 hr. Reaction solution was evaporated to 20 ml total volume. Diethyl ether (100 ml) was added. Precipitate was filtered and dried in vacuum (500 torr, 50 °C) to give titled compound (0.120 g, 45% yield).

***N*-Methyl-D-glucamine 2,2-dimethyl-4-[(28-oxolupan-3β-yl)oxy]-4-oxobutanoate (21).** *N*-Methyl-D-glucamine (0.034 g, 0.175 mmol) was dissolved in methyl alcohol (100 ml). 2,2-Dimethyl-4-[(28-oxolupan-3β-yl)oxy]-4-oxobutanoic acid **(18)** (0.100 g, 0.175 mmol) was added. Reaction mixture was stirred for 24 hr. Reaction solution was evaporated to 20 ml total volume. Diethyl ether (100 ml) was added. Precipitate was filtered and dried in vacuum (500 torr, 50 °C) to give titled compound (0.048 g, 36% yield).

Supporting Information References and Notes

1. Krasutsky, P. A.; Kolomitsyn, I. V.; Krastuskyy, D. A. WO/2007/121482**,** *WIPO IP Services* **2007**.
2. Krasutsky, P. A.; Khotkevych, A. B.; Pushechnikov A.; Rudnitskaya, A. WO/2006/105357**,** *WIPO IP Services* **2006**.