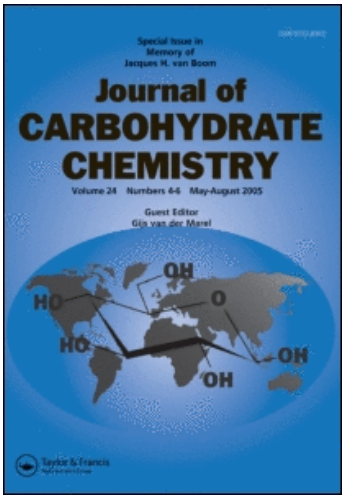


Journal of Carbohydrate Chemistry
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713617200

Synthesis of 4-Epi-L-Rhodosamine Containing Disaccharide

Christiane Ramiliarison[a]; Claude Monneret[a]
[a] Département de Pharmacognosie associé au CNRS n° 484, Université Paris V, Paris, France

To cite this Article Ramiliarison, Christiane and Monneret, Claude(1989) 'Synthesis of 4-Epi-L-Rhodosamine Containing Disaccharide', Journal of Carbohydrate Chemistry, 8: 5, 723 — 734
To link to this Article: DOI: 10.1080/07328308908048034
URL: http://dx.doi.org/10.1080/07328308908048034

J. CARBOHYDRATE CHEMISTRY, 8(5), 723-734 (1989)

SYNTHESIS OF 4-EPI-L-RHODOSAMINE CONTAINING DISACCHARIDE

Christiane Ramiliarison and Claude Monneret*

Département de Pharmacognosie associé au CNRS n° 484
Université Paris V, Faculté des Sciences Pharmaceutiques et Biologiques
4 Avenue de l'Observatoire, 75006 Paris, France.

Received September 13, 1988 - Final Form June 22, 1989

ABSTRACT

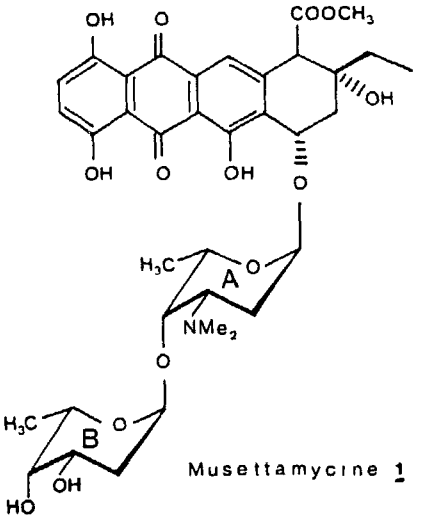
Condensation of benzyl 3-azido-2,3,6-trideoxy-α-L-*arabino*-hexopyranoside (**9**) with 3,4-di-*O*-acetyl-2-deoxy-L-fucosyl chloride (**10**) gave **11**. Catalytic hydrogenation of **11** followed by *N,N*-dimethylation of **12** and deprotection afforded the benzyl glycoside of the title compound, 2-deoxy-L-fucose (1 -> 4) 4-*epi*-L-rhodosamine, **14**.

INTRODUCTION

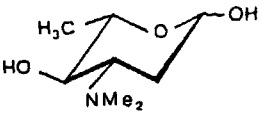
Musettamycine **1** is an anthracycline antibiotic obtained from a fermentation broth of an Actinosporangium species.[1] Structure analysis has shown that musettamycine is a disaccharide derivative and that its sugar sequence included an L-rhodosamine (or *N,N'*-dimethyl-L-daunosamine) and a 2-deoxy-L-fucose. In a previous publication[2] we described the synthesis of this disaccharide along with the synthesis of the trisaccharide moieties of marcellomycine and aclacinomycine A, two other anthracycline antibiotics.

In order to evaluate the antitumor activity of anthracycline analogues, including other disaccharide chains linked to 9-alkyl anthracyclinones such as ß-rhodomycinone,[3] we synthesized a new disaccharide having 4-epi-L-rhodosamine **2**

and the 2-deoxy-L-fucose in the sequence, namely benzyl 2,3,6-trideoxy-3-*N*,*N*'-dimethylamino-4-*O*-(2,6-dideoxy-α-L-*lyxo*-hexopyranosyl)-α-L-arabino-hexopyranoside (**14**). The synthesis of the corresponding 3-trifluoroacetamido analogue **16** is also reported.



Musettamycine **1**

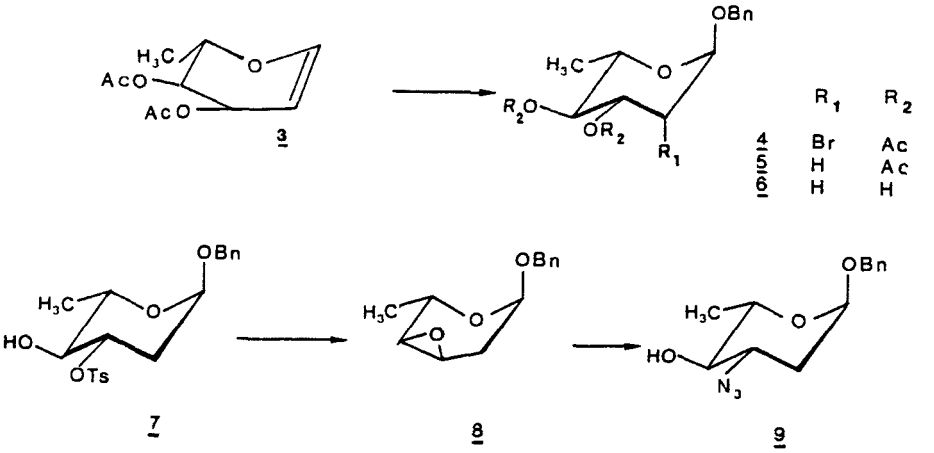


2

RESULTS AND DISCUSSION

The starting materials for the synthesis were di-*O*-acetyl-L-rhamnal **3**[4] and 3,4-di-*O*-acetyl-2,6-dideoxy-α-L-*lyxo*-hexopyranosyl chloride **10**[5] as respective precursors of units A and B.

Treatment of **3** with benzyl alcohol in the presence of *N*-bromosuccinimide[6] stereoselectively afforded the α-L-glycoside of *manno* configuration **4**, in 90 % yield. Hydrogenolysis of the C-Br bond (10 % Pd/C, H_2, Et_3N) with subsequent transesterification of the 2-deoxy compound **5**, afforded the benzyl 2-deoxy-α-L-rhamnopyranoside (**6**). Regioselective *p*-toluenesulfonylation of **6** at 0 °C under conditions previously reported[7] for the corresponding α-L-methyl glycoside (TsCl 1.2 equiv., pyridine) gave the 3-*O*-tosyl compound **7** in only 24 % yield. A better yield was obtained[8] when prior to the *p*-toluenesulfonylation, the 3,4-stannylidene derivative was prepared. Thus treatment of **6** with dibutyltin oxide followed by addition of TsCl in the presence of tetrabutylammonium iodide[9] selectively afforded the desired compound **7** in 85 % yield.



The epoxide **8** which was isolated in 85 % yield by reacting **7** with a methanolic solution of 1M NaOMe at room temperature, gave regioselectively in an almost quantitative yield, the azido sugar **9** by azidolysis in methanolic solution in the presence of ammonium chloride. Coupling of **9** with the chloro-sugar **10**, readily prepared[5] from the di-*O*-acetyl-L-fucal, under Koenigs-Knorr conditions (yellow HgO, $HgBr_2$, molecular sieves 4A) led to the disaccharide **11** in 72 % yield after chromatography. The α-L interglycosidic linkage was unambiguously established from NMR data, since H-1' located at δ 5.37 appeared as a doublet of doublet with a small coupling constant (J=2.5, J'< 1 Hz) whereas other signals corresponding to H-3', H-4' and H-5' were in agreement with a $^1C_4$ conformation of the 2-deoxy-L-fucosyl residue.

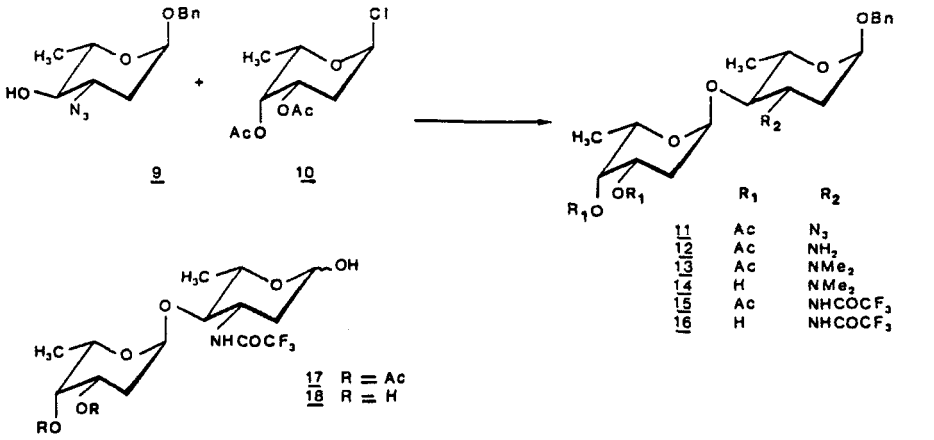


TABLE 1. ^{1}H NMR Spectral Data [a] for compounds 4-9 and first order coupling constants [b]

Compounds	4	5	6	7	8	9
Protons						
H-1	5.26(bs)[c]	4.97(bs)	4.95(bs)	4.89(bs)	4.79(dd)	4.91(bs)
H-2a	-	1.81(m)	1.68(m)	1.86(m)	2.02(m)	1.60(m)
H-2e	5.17(bs)	2.27(m)	2.15(m)	2.11(m)		2.18(m)
H-3	5.06(d)	5.33(m)	3.95(m)	4.82(m)	2.97(d)	3.82(m)
H-4	4.66(m)	4.72(dd)	-	3.33(m)	3.24(bs)	3.11(dd)
H-5	3.95(qd)	3.91(qd)	3.65(qd)	3.70(qd)	4.27(q)	3.73(qd)
CH_3-6	1.22(d)	1.17(d)	1.30(d)	1.29(d)	1.33(d)	1.26(d)
Ph	7.37(m)	7.35(m)	7.32(m)	7.28(m)	7.32(m)	7.30(m)
CH_2	4.73(d) 4.55(d)	4.66(d) 4.46(d)	4.68(d) 4.44(d)	4.64(d) 4.48(d)	4.73(d) 4.46(d)	4.66(d) 4.44(d)
$J_{1,2a}$	-	3.5	3.5	4	5	3.5
$J_{1,2e}$	< 1	< 1	< 1	< 1	3.5	< 1
$J_{2a,2e}$	-	12.5	12.5	12.5	12.5	13
$J_{2a,3}$	-	10	10	10	-	12.5
$J_{2e,3}$	3	5	5	5	-	4.5
$J_{3,4}$	-	10	10	10	3.5	9
$J_{4,5}$	-	10	10	10	< 1	10
$J_{5,6}$	6.5	6.5	6.5	6.5	6.5	6.5
$J_{gem}CH_2Ph$	12	12	12	12	12	12

a. Chemical shifts are relative to $(CH_3)_4Si$ (0 ppm) ; b. in Hertz ; c. s : singulet ; bs : broad singulet; d : doublet ; q : quadruplet.

Catalytic hydrogenation of **11** (MeOH, Raney nickel) followed by *N,N*-dimethylation (HCHO, $NaBH_3CN$) afforded successively **12** and **13** in 90% overall yield. Finally the target molecule **14** was obtained from transesterification of **13** with a methanolic solution of 1M MeONa.

On the other hand, the amino disaccharide **12** was *N*-trifluoroacetylated to give **15** and then **16**, after *O*-deacylation (70% overall yield). Alternatively, the free disaccharide **17** resulted from hydrogenolysis (EtOH, 10% Pd-C, H_2) of **15** and **18** from transesterification of **17**.

Glycosidation of **17** with ß-rhodomycinone [3] and 4-deoxy-ß-rhodomycinone [10] is now under investigation.

EXPERIMENTAL

General Methods and Material.

Melting points were determined on a Kofler hot-stage microscope and are uncorrected. IR spectra were recorded on a Perkin-Elmer Model 257 spectrophotometer, calibrated against polystyrene film and are expressed in cm^{-1}. ^1H NMR were obtained on a Bruker HX 270 in $CDCl_3$. Silica gel for chromatography and flash chromatography were Merck silica gel No. 7736 and 9385, respectively. Microanalyses were performed by the "Laboratoire de microanalyses du C.N.R.S." Gif-sur-Yvette and Lyon.

Benzyl 3,4-Di-O-acetyl-2-bromo-2,6-dideoxy-α-L-manno-hexopyranoside (4). To a solution of di-*O*-acetyl-**L**-rhamnal (**3**, 12 g, 56 mmol) in acetonitrile (60 mL) were successively added, benzyl alcohol (6.7 g, 62 mmol) and *N*-bromosuccinimide (10 g, 56 mmol). The reaction mixture was stirred for 3 h at room temperature, water (500 mL) was added and the crude mixture extracted with ether. The organic layer was washed with 10% aqueous sodium thiosulfate, water, and dried over sodium sulfate before concentration under reduced pressure. This led to **4** (22.3 g, 90%) pure enough for the next step. An analytical sample was obtained by crystallization from methanol: mp 106 °C; $[\alpha]^{20}_D$ -61° (c 1.2, chloroform); IR (Nujol) 1740 cm^{-1} (ester); ^1H NMR: see table data and δ 2.06 and 2.02 (2s, 6H, 2 OAc).

TABLE 2. ^{1}H NMR spectral Data[a] for disaccharides 11-18 and first order coupling constants[b]

	11[c]	12[c]	13[c]	14[d]	15[c]	16[d]	17[c]	18[d e]
H-1	4.93(dd)[f]	4.89(dd)	4.88(dd)	4.88(dd)	4.88(dd)	5.06(dd)	5.12(dd) 4.97(d)	4.90(dd)
H-2a	1.73(m)	1.58(m)					1.82-1.62(m)	
H-2e	2.22(m)	2.06(m)	2.22-1.48(m)	2.20-1.44(m)	2.16-1.73(m)	2.10-1.55	2.32-2.08(m)	2.15-1.50(m)
H-3	3.86(m)	3.25(m)	3.04(m)	3.60(m)	4.35(m)	4.44(m)	4.37(m)	4.24(m)
H-4	3.15(dd)	3.00(dd)	3.28(dd)	3.22(dd)	3.34(dd)	3.66(dd)	3.35(dd)	3.20(dd)
H-5	3.75(qd)	3.72(qd)	3.75(qd)	3.70(qd)	3.82(qd)	4.15(qd)	4.19-3.95(m)	3.75(qd)
Me-6	1.27(d)	1.29(d)	1.27(d)	1.11(d)	1.22(d)	1.26(d)	1.33/1.25(d)	1.20/1.11(d)
H-1'	5.37(dd)	5.40(dd)	5.80(dd)	5.21(dd)	5.06(dd)	5.00(dd)	5.31(dd)	4.88(dd)
H-2'a	1.95(m)	1.94(m)						
H-2'e	2.08(m)	2.08(m)	2.22-1.48(m)	2.20-1.44(m)	2.16-1.73(m)	2.10-1.55(m)	2.32-1.82(m)	2.15-1.50(m)
H-3'	5.26(m)	5.26(m)	5.17(m)	4.20(m)	5.17-5.13(m)		5.21-5.12(m)	4.15(m)
H-4'	5.18(bd)	5.20(bd)	5.12(bd)	3.50(m)		3.40(m)		3.55(m)
H-5'	4.05(qd)	4.10(qd)	4.10(qd)	3.77(qd)	4.08(qd)	3.80(qd)	4.19-3.95(m)	4.15(m)
Me-6'	1.13(d)	1.13(d)	1.13(d)	1.02(d)	1.11(d)	0.84(d)	1.11(d)	0.95(d)
CH_2-Ph	7.33(m)	7.35(m)	7.39(m)	7.26(m)	7.30(m)	7.26(m)		
CH_2-Ph	4.66(d) 4.44(d)	4.68(d) 4.40(d)	4.70(d) 4.48(d)	4.50(d) 4.30(d)	4.66(d) 4.46(d)	4.71(m) 4.51(d)		

$J_{1,2a}$	3.5	3.5	3.5	3	3.5	2	2	2
$J_{1,2e}$	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
$J_{2a,2e}$	13	12.5	12.5	12.5	12.5	12.5	12.5	-
$J_{2a,3}$	9	9	9	-	-	-	-	-
$J_{2e,3}$	5	3.5	3.5	3.5	-	-	-	-
$J_{3,4}$	9	9	9	9	9	9	9	9
$J_{4,5}$	9	9	9	9	9	9	9	9
$J_{5,6}$	6	6.5	6.5	6.5	6.5	6.5	6.5	6.5
$J_{1',2'a}$	2.5	3.5	3.5	3.5	3	3	3	3
$J_{1',2'e}$	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
$J_{2'a,2'e}$	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-
$J_{2'a,3'}$	5	-	-	-	-	-	-	-
$J_{2'e,3'}$	4	3	-	4	-	-	-	-
$J_{3',4'}$	3	2	2	-	2	-	-	-
$J_{4',5'}$	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
$J_{5',6'}$	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5

a. Chemical shifts are relative to $(CH_3)_4Si$: (0 ppm); b. in Hertz; c. in $CDCl_3$; d. in DMSO-d_6; e. mixture of anomers; f. d = doublet; bd = broad doublet; m = multiplet; q = quadruplet.

Anal. Calcd for $C_{17}H_{21}O_6Br$ (401.3): C, 50.88; H, 5.27. Found: C, 51.02; H, 5.19.

Benzyl 3,4-Di-O-acetyl-2,6-dideoxy-α-L-arabino-hexopyranoside (5). An ethanolic solution of **4** (26.8 g in 200 mL) was stirred for 4 h under H_2 atmosphere (1 atm) in the presence of 10% Pd-on-charcoal (2.7 g) and Et_3N (11.3 mL). The catalyst was removed by filtration and the filtrate concentrated under reduced pressure. The resulting syrup was dissolved in dichloromethane, washed with water and dried over sodium sulfate before concentration. Flash chromatography using dichloromethane as eluent gave pure **5** (30 g) as a syrup: $[\alpha]^{20}_D$ - 125° (c 3.2, chloroform); IR (neat): 1740 cm^{-1} (ester); ^1H NMR: see table data and δ 2.05 and 2.01 (2s, 6H, 2 OAc).

Anal. Calcd for $C_{17}H_{22}O_6$ (322.4): C, 63.34; H, 6.88. Found: C, 63.50; H, 6.79.

Benzyl 2,6-Dideoxy-α-L-arabino-hexopyranoside (6). To a stirred methanolic solution of **5** (8 g, 24.8 mmol in 100 mL), was added 50 mL of 1M NaOMe in methanol. After 3 h at room temperature, the solution was neutralized by elution from a chromatography column over Amberlite IR 50 H^+ ion-exchange resin and concentration under reduced pressure. The crude product was crystallized from hexane-EtOAc to afford **6** (5.9 g, 99%): mp 98°C; $[\alpha]^{20}_D$ - 88° (c 1, chloroform); IR (Nujol) 3420-3360 cm^{-1} (OH); ^1H NMR ($CDCl_3$) see table data.

Anal. Calcd for $C_{13}H_{18}O_4$ (238.28): C, 65.52; H, 7.61. Found: C, 65.60; H, 7.55.

Benzyl 2,6-Dideoxy-3-O-p-toluenesulfonyl-α-L-arabino-hexopyranoside (7). First process : To a cooled (0-5 °C) solution of **6** (1.74 g, 7.3 mmol) in pyridine (10 mL) was added *p*-toluenesulfonyl chloride (1.5 g, 8 mmol)). After the mixture was stirred for 48 h at 0-5°C, the crude mixture was extracted with ethyl acetate. Usual work-up afforded a residue (1.5 g) which was chromatographed over silica gel with toluene-EtOAc (90:10) as eluent.

This gave pure **7** (688 mg, 24%) as a syrup: $[\alpha]^{20}_D$ -110° (c 0.6, chloroform); IR (neat) 3500 (OH) and 1600 cm^{-1}; ^1H NMR ($CDCl_3$) see table data and δ 7.84 and 7.37 (2d, 4H arom), 2.44 (s, Me).

Anal. Calcd for $C_{20}H_{24}O_6S$ (392.5): C, 61.20; H, 6.16. Found: C, 61.23; H, 6.30.

Second process: Dibutyltin oxide (3 g, 12 mmol) was added to a solution of **6** (2 g, 8.4 mmol) in benzene (100 mL) and the resulting milky suspension was refluxed for 4 h with continuous removal of water. It was then concentrated to half

volume and cooled to room temperature before addition of *p*-toluenesulfonyl chloride (1.9 g, 10 mmol) and tetrabutylammonium chloride (1.5 g, 4.5 mmol). The resulting mixture was stirred for 24 h under N_2 at room temperature and then concentrated under reduced pressure. The residue was flash chromatographed over silica gel with hexane-EtOAc (5:1) as eluent to yield **7** (2.75 g, 85%).

Benzyl 3,4-Anhydro-2,6-dideoxy-α-L-ribo-hexopyranoside (8). A methanolic solution of **7** (1.2 g, 3 mmol in 33 mL) was stirred overnight at room temperature after addition of 1M NaOMe in methanol (32.6 mL, 32 mmol). Neutralization was carried out by filtration over Amberlite IR 5O H^+ and the filtrate afforded a crude residue (1 g) after concentration under reduced pressure. Column chromatography with hexane-acetone (7:1) led to **8** (572 mg, 85 %): syrup, $[\alpha]^{20}_D$ -128° (c 0.28, chloroform); IR (neat) 1600 cm^{-1} (Ar); ^1H NMR: see table data.

Anal. Calcd for $C_{13}H_{16}O_3$ (220.3): C, 70.88; H, 7.32. Found: C, 70.98; H, 7.25.

Benzyl 3-Azido-2,3,6-trideoxy-α-L-arabino-hexopyranoside (9). To an ethanolic solution of **8** (1.77 g, 8 mmol in 80 mL), were added sodium azide (1.6 g, 25 mmol) and NH_4Cl (0.4 g) before heating under reflux overnight. After cooling, concentration under reduced pressure to ca 10 mL and extraction with dichloromethane afforded a crude residue (2.2 g). Purification by column chromatography with hexane-EtOAc (4:1) as eluent led to **9** (2 g, 95%) as a syrup: $[\alpha]^{20}_D$ - 99° (c 2.2, chloroform); IR (neat) 3340 (OH) and 2100 cm^{-1} (N_3); ^1H NMR : see table data.

Anal. Calcd for $C_{13}H_{17}N_3O_3$ (263.3): C, 59.30; H, 6.50; N, 15.95. Found: C, 59.15; H, 6.47; N, 16.03.

Benzyl 3-Azido-4-O-(3,4-di-O-acetyl-2,6-dideoxy-α-L-lyxo-hexopyranosyl)-2,3,6-trideoxy-α-L-arabino-hexopyranoside (11). To a solution of **9** (157 mg, 0.6 mmol) in anhydrous dichloromethane (100 mL) were successively added, molecular sieves 4A (4.5 g), yellow HgO (1.8 g) and $HgBr_2$ (0.62 g), and the 3,4-di-*O*-acetyl-α-L-fucosyl chloride **8** [prepared *in situ* according to El Khadem et al.[5] from 250 mg (1 mmol) of 2,6-di-*O*-acetyl-L-fucal]. After the reaction mixture was stirred for 18 h at room temperature, filtration was carried out to remove the salts which were washed with dichloromethane. The organic layer was washed with 30% aqueous solution of KI and then with water. Concentration under reduced pressure afforded a residue (400 mg) which was chromatographed over silica gel with toluene-

acetone (99:1) as eluent . This led to **11** (208 mg, 72%) as a syrup: $[\alpha]^{20}_D$ - 147° (c 6.2, chloroform); IR (neat) 2100 (N_3), 1740 (ester) and 1610 cm^{-1} (arom.); ^1H NMR: see table data and δ 2.10 and 2.00 (2s, 6H, 2 OAc).

Anal. Calcd for $C_{23}H_{31}N_3O_8$ (477.5): C, 57.85; H, 6.54; N, 8.80. Found: C, 57.80; H, 6.62; N, 8.91.

Benzyl 3-Amino-4-O-(3,4-di-O-acetyl-2,6-dideoxy-α-L-lyxo-hexopyranosyl)-2,3,6-trideoxy-α-L-arabino-hexopyranoside (12). To a solution of **11** (145 mg, 0.3 mmol) in methanol (30 mL) were added Et_3N and Raney nickel (300 mg). After the mixture was stirred for 30 min under H_2 atmosphere (1 atm), the catalyst was removed by filtration and the filtrate concentrated under reduced pressure. Compound **12** was obtained (140 mg, 98%) as a syrup: $[\alpha]^{20}_D$ - 132° (c 2.1, chloroform); IR (neat) 3680, 3620 and 1520 (amine), 1740 (OAc) and 1600 cm^{-1} (Ar); ^1H NMR: see table data and δ 2.15 and 2.00 (2s, 6H, 2 OAc).

Anal. Calcd for $C_{23}H_{33}O_8N$ (441.4): C, 61.18; H, 7.36; N, 3.10. Found: C, 61.25; H, 7.30; N, 3.25.

Benzyl 3-N,N'-Dimethylamino-4-O-(3,4-di-O-acetyl-2,6-dideoxy-α-L-lyxo-hexopyranosyl)-2,3,6-trideoxy-α-L-arabino-hexopyranoside (13). To a solution of **12** (350 mg, 0.7 mmol) in acetonitrile (30 mL) was added 37% aqueous HCHO (4 mL) and $NaBH_3CN$ (300 mg). After the mixture was stirred for 45 min at room temperature, the crude mixture was concentrated under reduced pressure and the residue was chromatographed over silica gel using dichloromethane-MeOH (99:1) as eluent. Compound **13** was isolated (330 mg, 90%) as a syrup: $[\alpha]^{20}_D$ - 121° (c 0.5, chloroform); IR (neat) 1740 (OAc) and 1600 cm^{-1} (Ar); ^1H NMR: see table data and δ 2.13 and 1.97 (2s, 6H, 2 OAc) and 2.24 (s, 6H, Me_2).

Anal. Calcd for $C_{25}H_{37}NO_8$ (479.6): C, 62.61; H, 7.77; N, 2.92. Found: C, 62.28; H, 7.83; N, 3.05.

Benzyl 3-N,N'-Dimethylamino-4-O-(2,6-dideoxy-α-L-lyxo-hexopyranosyl)-2,3,6-trideoxy-α-L-arabino-hexopyranoside (14). To a stirred solution of **13** (200 mg, 0 .4 mmol) in methanol (30 mL) were added 2 mL of 1M NaOMe in methanol. After 2 h at room temperature and neutralization by filtration over Amberlite IR 50 H^+ ion-exchange resin, concentration of the filtrate afforded **14** (130 mg, 80%) as a syrup: $[\alpha]^{20}_D$ - 125° (c 0 .5, methanol); IR (film) 3560 cm^{-1} (OH); ^1H NMR: see table data and δ 2.17 (s, 6H, NMe_2).

Anal. Calcd for $C_{21}H_{33}NO_6$ (395.5): C, 63.77; H, 8.45; N, 3.54. Found: C, 63.87; H, 8.51; N, 3.60.

Benzyl 4-O-(3,4-Di-O-acetyl-2,6-dideoxy-α-L-lyxo-hexopyranosyl)-2,3,6-trideoxy-3-N-trifluoroacetamido-α-L-arabino-hexopyranoside (15). To a solution of **12** (92 mg, 0.19 mmol) in anhydrous dichloromethane (7 mL) and triethylamine (0.4 mL), trifluoroacetic anhydride (0.2 mL) was added dropwise. After the mixture was stirred for 20 h at room temperature, the reaction mixture was concentrated under reduced pressure and the residue dissolved into 10 mL of methanol. Filtration over Amberlite IR 450 OH^- afforded a neutral solution which was concentrated. The residue was crystallized from methanol giving **15** (77 mg, 72%): mp 91 °C; $[\alpha]^{20}_D$ - 130° (c 2, chloroform): IR (Nujol) 3420 (NH), 1720 (amide) and 1740cm^{-1} (ester); ^{1}H NMR: see table data and δ 2.13 and 1.97 (2s, 6H, 2 OAc).

Anal. Calcd for $C_{25}H_{32}NO_9F_3$ (547.5): C, 54.84; H, 5.89; N, 2.55. Found: C, 54.97; H, 5.77; N, 2.62.

Benzyl 3-N-Trifluoroacetamido-4-O-(2,6-dideoxy-α-L-lyxohexopyranosyl)-2,3,6,trideoxy-α-L-arabino-hexopyranoside (16). Under similar conditions as those used for the preparation of **14**, compound **15** (300 mg, 0.55 mmol) was converted into **16** (250 mg, 98%) which crystallized from methanol: mp 219 °C; $[\alpha]^{20}_D$ - 63° (c 0.2, chloroform); IR (Nujol) 3560 cm^{-1} (OH); ^{1}H NMR: see table data and 6.48 (d, 1H, J = 10 Hz, NH).

Anal. Calcd for $C_{21}H_{28}NO_7F_3$ (463.5): C, 54.42; H, 6.09; N, 3.02. Found: C, 54.50; H, 6.17; N, 3.12.

3-N-Trifluoroacetamido-4-O-(3,4-di-O-acetyl-2,6-dideoxy-α-L-lyxo-hexopyranosyl)-2,3,6-trideoxy-L-arabino-hexopyranose (17). An ethanolic solution of **15** (170 mg in 20 mL) was stirred for 18 h under H_2 atmosphere (1 atm) in the presence of 10% Pd-on-charcoal (100 mg). After the catalyst was filtered off, concentration of the filtrate under reduced pressure gave **17** as a crystalline residue (140 mg, 98%): mp 187°C; $[\alpha]^{20}_D$ - 103° (c 1, methanol); IR (Nujol) 3560 cm^{-1} (OH); ^{1}H NMR: see table data and δ 6.59 (d, 1H, J = 10 Hz, NH), 2.55 and 1.99 (2s, 6H, 2 OAc).

Anal. Calcd for $C_{18}H_{26}NO_9F_3$ (457.4): C, 47.26; H, 5.72; N, 3.06. Found:C, 47.38; H, 5.80; N, 3.12.

3-N-Trifluoroacetamido-4-O-(2,6-dideoxy-α-L-lyxo-hexopyranosyl)-2,3,6-trideoxy-L-arabino-hexopyranose(18). Deacetylation of **17** (100 mg) under conditions previously used to prepare **14**, afforded 80 mg of **18**: mp 207 °C; $[\alpha]^{20}_D$ -91° (c 0.7, MeOH); IR (Nujol) 3560 cm $^{-1}$ (OH); ^{1}H NMR: see table data.

Anal. Calcd for $C_{14}H_{22}NO_7F_3$ (373.3): C, 45.04; H, 5.94; N, 3.75. Found: C, 45.10; H, 6.03; N, 3.72.

REFERENCES

1. D. E. Nettleton Jr, W. T. Bradner, J. A. Bush, A. B. Coon, J. E. Moseley, R. W. Myllymaki, F. A. O'Herron, R. H. Schreiber and A. L. Vulcano, *J. Antibiot.*, **30** (1977).

2. C. Monneret, A. Martin and M. Païs, *J. Carbohydr. Chem.*, 7, 417 (1988).

3. H. Brockmann, *Fortschr. Chem. Organ. Naturst.*, **21**, 121 (1963).

4. W. Roth and W. Pigman, *Methods Carbohydr. Chem.* 405 (1963).

5. H. S. El Khadem, D. L. Swartz, J. K. Nelson and L. A. Berry, *Carbohydr. Res.*, **58**, 230 (1977).

6. K. Tatsuta, K. Fujimoto, M. Kinoshita and S. Umezawa, *Carbohydr. Res.*, **54**, 85 (1977).

7. J. P. Marsh Jr., C. W. Mosher, E. M. Acton and L. Goodman, *J. Chem. Soc., Chem. Comm.*, 973 (1967); G. Grethe, T. Mitt, T. H. Williams and M. R. Uskokovic, *J. Org. Chem.*,**48**, 5309 (1983); P. Bartner, D. L. Boxler, R. Brambilla, A. K. Mallams, J. B. Morton, P. Reichert, F. D. Sancilio, H. Surprenant, G. Tomalesky, G. Lukacs, A. Olesker, T. T. Thang, L. Valente and S. Omura, *J. Chem. Soc., Perkin Trans I*, 1600 (1979).

8. C. Monneret, R. Gagnet and J.C. Florent, *J. Carbohydr. Chem.*, **6**, 221 (1987).

9. J. Alais and A. Veyrières, *J. Chem. Soc., Perkin Trans I*, 377 (1981).

10. C. Monneret, A. Genot, B. Deguin and J.C. Florent, *Unpublished results.*