SYNTHESIS OF 1-(3-AZIDO-2,3-DIDEOXY-4-C-HYDROXYMETHYL-α-L-*threo*-PENTOFURANOSYL)THYMINE, 1-(2,3-DIDEOXY-4-C-HYDROXYMETHYL-α-L-*glycero*-PENTOFURANOSYL)THYMINE AND 1-(2,3-DIDEOXY-4-C-HYDROXYMETHYL-α-L-*glycero*-PENT-2-ENOFURANOSYL)THYMINE

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1-(2-O-Acetyl-3,5-di-O-benzoyl-4-C-benzoyloxymethyl-α-L-arabinofuranosyl)thymine (*II*) was converted to 2,2'-anhydro derivative *V* by selective deacetylation, mesylation and treatment with 1,8-diazabicyclo[5.4.0]undec-7-ene. Cleavage of the 2,2'-anhydro ring in compound *V* with hydrogen chloride or bromide afforded the respective 2'-chloro and 2'-bromo derivatives *VI* and *VII*. Reaction of compound *VII* with Cu/Zn couple and subsequent debenzoylation led to 1-(2,3-dideoxy-4-C-hydroxymethyl-α-L-pent-2-enofuranosyl)thymine (*IX*). Catalytic hydrogenation of *IX* gave 1-(2,3-dideoxy-4-C-hydroxymethyl-α-L-*glycero*-pentofuranosyl)thymine (*X*). Dehalogenation of compound *VI* with tributyltin hydride and debenzoylation afforded 1-(2-deoxy-4-C-hydroxymethyl-α-L-*erythro*-pentofuranosyl)thymine (*XII*). Tritylation of compound *XII*, followed by mesylation, detritylation and nucleophilic substitution with azide furnished 1-(3-azido-2,3-dideoxy-4-C-hydroxymethyl-α-L-*threo*-pentofuranosyl)thymine (*XXII*).

AIDS represents one of the most serious problems of the contemporary medicine. To compounds with significant effects against HIV belong 3'-azido-2',3'-dideoxythymidine (AZT), 2',3'-dideoxy-2',3'-didehydrothymidine (d4T) and 2',3'-dideoxynucleosides[1,2], first of all derivatives of hypoxanthine (didanosine, Videx) and cytosine (zalcitadine) which are being introduced into clinical practice.

In the present study we focused on the effect of introduction of further hydroxymethyl group in position 4-C of the sugar part of the molecule on the antiviral activity of the mentioned compounds. As found by Hiebl and Zbiral[3], the homolog of AZT, 1-(3-azido-2,3,5-trideoxy-β-D-allofuranosyl)thymine, does not exhibit antiviral activity. Also allofuranosyl analogs of AZT, d4T and 2',3'-dideoxythymidine, are inactive against HIV, even though 1-(3-azido-2,3-dideoxy-β-D-allofuranosyl)thymine is active against HSV-1 (see ref.[4]). No antiviral activity has been found[5] also for analogs with reversed configuration at C(4) (1-(3-azido-2,3-dideoxy-α-L-*threo*-pentofuranosyl)thymine, 1-(2,3-dideoxy-α-L-*glycero*-pentofuranosyl)thymine and 1-(2,3-dideoxy-α-L-pent-2-enofuranosyl)thymine). Obviously, the presence of C(4)-

hydroxymethyl group and β-D-configuration of the sugar moiety are a salient requirement for preservation of antiviral activity.

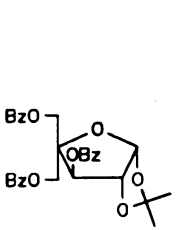
The literature reports[6] preparation of 1-(4-C-hydroxymethyl-α-L-lyxofuranosyl)- and 1-(2-deoxy-4-C-hydroxymethyl-α-L-lyxofuranosyl)nucleosides in acceptable yields by reaction of the corresponding 5'-aldehydonucleoside with formaldehyde in a strongly alkaline medium, followed by Canizzaro reduction with formaldehyde or treatment with sodium borohydride.

However, reaction of 5'-aldehydonucleoside (prepared by oxidation of 1-(3-azido-2,3-dideoxy-β-D-*ribo*-hexofuranosyl)thymine with Dowex 1 in periodate form[4]) with formaldehyde and subsequent reduction with sodium borohydride under conditions described in the literature[6] resulted only in cleavage of the nucleoside bond. Therefore, we prepared the C(4)-hydroxymethyl derivative starting from 1,2-O-isopropylidene-3,5-di-O-benzoyl-4-C-benzoyloxymethyl-β-L-arabinofuranose (*I*), prepared by benzoylation of 1,2-O-isopropylidene-4-C-hydroxymethyl-β-L-arabinofuranose[7]. Acetolysis of compound *I* and condensation of the formed acetate with silylated thymine in the presence of tin tetrachloride[8] afforded the protected nucleoside *II*. Deacetylation of *II* in dioxane (catalyzed with concentrated hydrochloric acid, 6 days at room temperature) gave nucleoside *III* with free 2'-hydroxy group which was esterified with methanesulfonyl chloride. The mesyl derivative *IV* was converted into the 2,2'-anhydro derivative *V* by treatment with 1,8-diazabicyclo[5.4.0]undec-7-ene in acetonitrile at room temperature. Heating the anhydronucleoside *V* in 1 M solution of hydrogen chloride or bromide to 100 °C produced the chloro derivative *VI* or bromo derivative *VII*.

Reaction of the bromo derivative *VII* with Cu/Zn couple[9] in dimethylformamide led to dideoxydidehydro derivative *VIII* which was debenzoylated with methanolic sodium methoxide to give free nucleoside *IX*. Hydrogenation of compound *IX* on Pd/C gave dideoxy derivative *X*.

Chloro derivative *VI* was reduced with tributyltin hydride in boiling toluene in the presence of 2,2'-azobis(2-propionitrile) and the obtained 2'-deoxynucleoside *XI* was debenzoylated to free deoxynucleoside *XII*. The 5'-hydroxy- and C(4)-hydroxymethyl groups were selectively acylated with pivaloyl chloride and the formed dipivaloyl derivative *XIII* was converted by mesylation into the mesyl derivative *XIV*. Attempts to realize nucleophilic replacement of the methanesulfonyl group with azide led only to β-elimination, giving dideoxydidehydronucleoside *XV*. Also the described[10] reaction of dipivaloyl derivative *XIII* with triphenylphosphine, tetrabromomethane and lithium azide in dimethylformamide gave only the elimination product *XV*. Tritylation and subsequent mesylation od deoxynucleoside *XII* afforded ditritylmesyl derivative *XVI* which on reaction with sodium azide afforded the elimination product *XVII*. Detritylation of compound *XVI* furnished free mesyl derivative *XVIII* which was converted into the isopropylidene derivative *XIX*. Mesyl derivative *XVIII* reacted with sodium azide in dimethylformamide at 100 °C to give azido derivative *XXII* (21%) and dideo-

xydehydronucleoside *IX* (41%). Under the same conditions, isopropylidene derivative *XIX* afforded isopropylideneazidonucleoside *XXI* (15%) and elimination product *XX* (59%). Under the reaction conditions, the dideoxydidehydronucleosides are already unstable and therefore in all the attempted nucleophilic substitutions of mesyl by azide groups we isolated also thymine from the reaction mixture.



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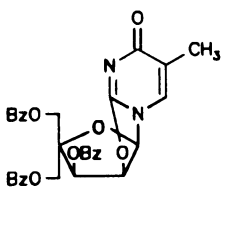

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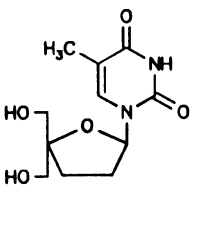
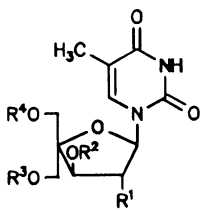
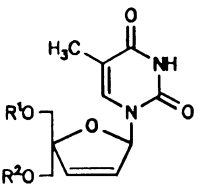


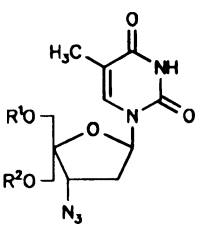
X





	R^1	R^2	R^3	R^4
II	OAc	Bz	Bz	Bz
III	OH	Bz	Bz	Bz
IV	OMs	Bz	Bz	Bz
VI	Cl	Bz	Bz	Bz
VII	Br	Bz	Bz	Bz
XI	H	Bz	Bz	Bz
XII	H	H	H	H
XIII	H	H	Piv	Piv
XIV	H	Ms	Piv	Piv
XVI	H	Ms	Tr	Tr
XVIII	H	Ms	H	H
XIX	H	Ms	$C(CH_3)_2$	

VIII, $R^1 = R^2 =$ Bz
IX, $R^1 = R^2 =$ H
XV, $R^1 = R^2 =$ Piv
XVII, $R^1 = R^2 =$ Tr
XX, $R^1, R^2 = C(CH_3)_2$



XXI, $R^1, R^2 = C(CH_3)_2$
XXII, $R^1 = R^2 =$ H

EXPERIMENTAL

Melting points were determined on a Kofler block and are uncorrected. ^{1}H NMR spectra were measured on a Varian XL-200 (200 MHz) instrument in hexadeuteriodimethyl sulfoxide with tetramethylsilane as internal standard. Chemical shifts are given in ppm (δ-scale) and coupling constants J in Hz. Column chromatography was performed on silica gel according to Pitra (30 – 60 μm, Service Laboratories of this Institute) and thin-layer chromatography (TLC) on Silufol UV 254 sheets (Kavalier, Votice) in the following systems: S1 ethyl acetate–toluene (1 : 1), S2 ethyl acetate, S3 ethyl acetate–2-propanol (21 : 4). The solvents were evaporated at bath temperature 30 – 60 °C at 2 kPa and compounds were dried at 13 Pa over phosphorus pentoxide.

Attempted Preparation of Azido Derivative *XXII* from 1-(3-Azido-2,3-dideoxy-β-D-*ribo*-hexofuranosyl)thymine

Dowex 1 (IO_4^- form, 1.7 g of dry ion exchanger) was added to a solution of 1-(3-azido-2,3-dideoxy-β-D-*ribo*-hexofuranosyl)thymine[4] (297 mg, 1 mmol) in 80% aqueous methanol (8 ml) and the mixture was stirred until the starting compound disappeared (1.5 h). The ion exchanger was filtered off and washed with methanol to disappearance of UV absorption of the eluate. The combined eluates were evaporated in vacuo and the residue was dissolved in water (2 ml). Formaldehyde (37%, 0.2 ml) was added and then 2 M sodium hydroxide (1 ml) was added dropwise. After 5 min, sodium borohydride (70 mg) was added at 0 °C. The solution was neutralized with Dowex 50 (H^+ form) and taken down, the residue was extracted with methanol, the solvent was evaporated and the residue chromatographed on a column of silica gel (25 g) in ethyl acetate–2-propanol (22 : 3). The first fraction was evaporated and the material crystallized from water to give 71 mg (27%) of 1-(3-azido-2,3-dideoxy-β-D-*erythro*-pentofuranosyl)thymine (AZT), m.p. 119 – 122 °C; (ref.[4] m.p. 119 – 122 °C). Evaporation of further fraction gave 64 mg (51%) of thymine.

3,5-Di-O-benzoyl-4-C-benzoyloxymethyl-1,2-O-isopropylidene-β-L-arabinofuranose (*I*)

Benzoyl chloride (43 ml, 0.37 mol) was added with ice-cooling and stirring to a solution of 4-C-hydroxymethyl-1,2-O-isopropylidene-β-L-arabinose (22.02 g, 0.1 mol) in pyridine (100 ml). After standing for 5 h at room temperature, the reaction mixture was again cooled in an ice bath and water (8 ml) was added. After 10 min, the mixture was concentrated to a small volume and partitioned between ethyl acetate (300 ml) and water (100 ml). The organic layer was separated and washed with water (100 ml), 5% hydrochloric acid to acidic reaction of the aqueous layer, water (100 ml) and 10% solution of sodium hydrogen carbonate until the evolution of carbon dioxide ceased. After drying over magnesium sulfate and evaporation of the solvent, the residue was dried at 40 °C and 13 Pa for 5 h, affording 51.5 g (97%) of product *I* as a solid foam. For $C_{30}H_{28}O_9$ (532.5) calculated: 67.66% C, 5.30% H; found: 67.89% C, 5.18% H. ^{1}H NMR spectrum: 1.30 s and 1.55 s, 2 × 3 H ($C(CH_3)_2$); 4.62 d, 1 H (H^aCHO, J(a,b) = 11.3); 4.71 d, 1 H (H^bCHO); 4.70 s, 2 H (CH_2O); 4.99 d, 1 H (H-2', J(2',1') = 4.3); 5.69 s, 1 H (H-3'); 6.16 d, 1 H (H-1'); 7.41 – 8.00 m, 15 H (H-arom.).

1-(2-O-Acetyl-3,5-di-O-benzoyl-4-C-benzoyloxymethyl-α-L-arabinofuranosyl)thymine (*II*)

Sulfuric acid (11.5 ml) was added dropwise during 30 min to an ice-cooled solution of isopropylidene derivative *I* (53.25 g, 0.1 mol) in a mixture of acetic acid (125 ml) and acetic anhydride (65 ml). After standing at room temperature overnight, the mixture was poured on ice (1 kg), neutralized with solid sodium hydrogen carbonate and extracted with ethyl acetate (2 × 500 ml). The combined extracts were washed with 10% solution of sodium hydrogen carbonate until the evolution of carbon dioxide ceased, dried over magnesium sulfate and the solvent was evaporated. The residue was dried in vacuo (13 Pa) at

40 °C for 3 h. To a stirred solution of the residue in dichloroethane (160 ml), was added 5-methyl-2,4-bis(trimethylsilyloxy)pyrimidine (25.65 g, 0.1 mol) and, after its dissolution, tin tetrachloride (11 ml). The mixture was set aside at room temperature overnight and poured in a vigorously stirred 10% sodium hydrogen carbonate solution (1.5 l). After standing for 1 h, the clear liquid was decanted and the residue filtered through a layer of Celite. The filter was washed with ethyl acetate (200 ml) and the combined filtrates were extracted with ethyl acetate (800 ml). The organic phase was separated, washed with 10% solution of sodium hydrogen carbonate (2 × 250 ml), dried over magnesium sulfate and the solvent was evaporated. Yield 63.1 g of product *II* as a solid foam. Chromatography of 1 g of this product on a column of silica gel (100 g) in toluene–ethyl acetate (1 : 1) afforded 728 mg of product *II* as a solid, chromatographically homogeneous foam. Total yield, calculated on the sugar derivative *I*, was 71%; R_F 0.49 (S19). For $C_{34}H_{30}N_2O_{11}$ (642.6) calculated: 63.55% C, 4.71% H, 4.36% N; found: 63.59% C, 4.73% H, 4.36% N. ^{1}H NMR spectrum: 1.66 d, 3 H (5-CH_3, J = 0.9); 2.04 s, 3 H (CH_3CO); 4.66 d, 1 H (H^aCHO, J(a,b) = 12.0); 4.73 d, 1 H (H^cCHO, J(c,d) = 12.2); 4.88 d, 1 H (H^bCHO); 4.91 d, 1 H (H^dCHO); 5.97 t, 1 H (H-2', J(2',1') = 7.0, J(2',3') = 6.6); 6.09 d, 1 H (H-3'); 6.41 d, 1 H (H-1'); 7.41 – 8.00 m, 16 H (H-6, H-arom.); 11.46 s, 1 H (H-3).

1-(3,5-Di-O-benzoyl-4-C-benzoyloxymethyl-α-L-arabinofuranosyl)thymine (*III*)

Concentrated hydrochloric acid (2 ml) was added to a solution of acetyl derivative *II* (3.21 g, 5 mmol) in dioxane (30 ml). After stirring at 30 °C for 6 days, the reaction mixture was diluted with ethyl acetate (400 ml), washed with water (100 ml), 5% solution of sodium hydrogen carbonate (100 ml), dried over magnesium sulfate and the solvent was evaporated. Column chromatography of the residue on silica gel (300 g) in toluene–ethyl acetate (2 : 3) gave 2.81 g (95%) of compound *III* as a solid foam, R_F 0.34 (S1). For $C_{32}H_{28}N_2O_{10}$ (600.6) calculated: 63.99% C, 4.70% H, 4.66% N; found: 63.82% C, 4.86% H, 4.49% N. ^{1}H NMR spectrum: 1.72 s, 3 H (5-CH_3); 4.57 d, 1 H (H^aCHO, J(a,b) = 11.7); 4.68 d, 1 H (H^cCHO, J(c,d) = 11.6); 4.77 – 4.87 m, 3 H (H-2', H^bCHO, H^dCHO); 5.79 d, 1 H (H-3', J(3',2') = 7.0); 6.21 d, 1 H (H-1', J(1',2') = 7.9); 6.25 d, 1 H (2'-OH, J(OH,2') = 5.5); 7.39 – 8.02 m, 16 H (H-6, H-arom.); 11.47 s, 1 H (H-3).

Using the same procedure, 44.1 g of the crude acetyl derivative *II* was converted into 28.16 g of compound *III*.

1-(3,5-Di-O-benzoyl-4-C-benzoyloxymethyl-2-O-methanesulfonyl-α-L-arabinofuranosyl)thymine (*IV*)

Methanesulfonyl chloride (15 ml, 195 mmol) was added dropwise at 0 °C to a stirred solution of tribenzoyl derivative *III* (30.03 g, 50 mmol) in pyridine (150 ml). After standing for 4 h at room temperature, the mixture was again cooled in an ice bath and water (5 ml) was added. After 10 min, the mixture was concentrated in vacuo and the residue partitioned between water (300 ml) and ethyl acetate (1 l). The organic layer was separated, washed with 5% hydrochloric acid to acid reaction of the aqueous layer, water and 10% solution of sodium hydrogen carbonate (300 ml), and dried over magnesium sulfate. Evaporation of the solvent afforded 32.87 g (97%) of mesyl derivative *IV* as a solid foam, R_F 0.47 (S1). For $C_{33}H_{30}N_2O_{12}S$ (678.6) calculated: 58.40% C, 4.46% H, 4.13% N, 4.72% S; found: 58.51% C, 4.61% H, 3.97% N, 4.51% S. ^{1}H NMR spectrum: 1.77 d, 3 H (5-CH_3, J = 1.0); 3.25 s, 3 H (SO_2CH_3); 4.68 d, 1 H (H^aCHO, J(a,b) = 11.7); 4.78 d, 1 H (H^cCHO, J(c,d) = 12.0); 4.92 d, 1 H (H^dCHO); 4.93 d, 1 H (H^bCHO); 5.99 t, 1 H (H-2'); 6.16 d, 1 H (H-3', J(3',2') = 7.0); 6.54 d, 1 H (H-1', J(1',2') = 7.5); 7.38 – 8.00 m, 16 H (H-6, H-arom.); 11.50 s, 1 H (H-3).

2,2'-Anhydro-1-(3,5-di-O-benzoyl-4-C-benzoyloxymethyl-α-L-ribofuranosyl)thymine (*V*)

A solution of mesyl derivative *IV* (13.57 g, 20 mmol) and 1,8-diazabicyclo[5.4.0]undec-7-ene (3.8 ml) in acetonitrile (130 ml) was allowed to stand at room temperature overnight. After evaporation of the solvent, the residue was diluted with ethyl acetate (350 ml), the solution washed with water (100 ml), 2% hydrochloric acid (100 ml), water (50 ml), and 10% solution of sodium hydrogen carbonate, and dried over magnesium sulfate. After evaporation of the solvent, the residue was chromatographed on a column of silica gel (400 g) in ethyl acetate–2-propanol (24 : 1), affording 10.95 g (94%) of anhydro derivative *V* as a solid foam, R_F 0.21 (S2). For $C_{32}H_{26}N_2O_9$ (582.5) calculated: 65.97% C, 4.50% H, 4.81% N; found: 65.95% C, 4.46% H, 4.68% N. ^{1}H NMR spectrum: 1.70 d, 3 H (5-CH$_3$, J = 1.2); 4.58 s, 2 H (CH$_2$O); 4.70 s, 2 H (CH$_2$O); 5.83 – 5.94 m, 2 H (H-2',H-3'); 6.46 d, 1 H (H-1', J(1',2') = 5.2); 7.39 – 7.99 m, 16 H (H-6, H-arom.).

1-(3,5-Di-O-benzoyl-4-C-benzoyloxymethyl-2-chloro-2-deoxy-α-L-arabinofuranosyl)thymine (*VI*)

A solution of anhydro derivative *V* (11.65 g, 20 mmol) in 1 M solution of hydrogen chloride in dimethylformamide (40 ml) was heated at 100 °C for 40 min. The solvent was then evaporated in vacuo, the residue diluted with ethyl acetate (200 ml), washed with water (70 ml), 5% solution of sodium hydrogen carbonate (70 ml), dried over magnesium sulfate and the solvent was evaporated. The remaining gel was repeatedly codistilled with acetone until solid compound *VI* was obtained (12.13 g, 98%), R_F 0.63 (S1). For $C_{32}H_{27}N_2O_9Cl$ (619.0) calculated: 62.09% C, 4.40% H, 5.73% Cl, 4.53% N; found: 62.23% C, 4.56% H, 5.61% Cl, 4.30% N. ^{1}H NMR spectrum: 1.78 s, 3 H (5-CH$_3$); 4.61 – 4.97 m, 4 H (2 × CH$_2$O); 5.40 t, 1 H (H-2'); 6.12 d, 1 H (H-3', J(3',2') = 8.5); 6.58 d, 1 H (H-1', J(1',2') = 8.9); 7.33 – 7.99 m, 16 H (H-6, H-arom.); 11.61 s, 1 H (H-3).

1-(3,5-Di-O-benzoyl-4-C-benzoyloxymethyl-2-bromo-2-deoxy-α-L-arabinofuranosyl)thymine (*VII*)

A solution of anhydro derivative *V* (11.65 g, 20 mmol) in 1 M solution of hydrogen bromide in dimethylformamide (40 ml) was heated at 100 °C for 20 min. The reaction mixture was worked up as described for the chloro derivative *VI*, yielding 13.01 g (98%) of derivative *VII* as an amorphous powder, R_F 0.63 (S1). For $C_{32}H_{27}N_2O_9Br$ (663.5) calculated: 57.93% C, 4.10% H, 12.04% Br, 4.22% N; found: 58.12% C, 4.19% H, 12.04% Br, 3.98% N. ^{1}H NMR spectrum: 1.78 s, 3 H (5-CH$_3$); 4.59 – 4.95 m, 4 H (2 × CH$_2$O); 5.36 t, 1 H (H-2', J(2',1') = 9.2, J(2',3') = 8.7); 6.16 d, 1 H (H-3'); 6.65 d, 1 H (H-1'); 7.30 – 7.97 m, 16 H (H-6, H-arom.); 11.60 s, 1 H (H-3).

1-(5-O-Benzoyl-4-C-benzoyloxymethyl-2,3-dideoxy-α-L-*glycero*-pent-2-enofuranosyl)thymine (*VIII*)

A solution of bromo derivative *VII* (6.63 g, 10 mmol) in dimethylformamide (10 ml) was added dropwise to a stirred suspension of Zn/Cu (1.66 g, see ref.[9]) in dimethylformamide (50 ml). The mixture was stirred for 1 h at room temperature. The insoluble portion was filtered off, washed with dimethylformamide, and the combined filtrates were concentrated in vacuo. The residue was dissolved in ethyl acetate (100 ml) and the solution washed successively with 2% hydrochloric acid to acid reaction of the aqueous layer, water (30 ml), 5% solution of sodium hydrogen carbonate (30 ml), dried over magnesium sulfate, and the solvent was evaporated. Crystallization of the residue from toluene–ethyl acetate afforded 3.27 g (71%) of didehydro derivative *VIII*, m.p. 99 –101 °C, R_F 0.52 (S1). Chromatography of evaporation residue from the mother liquors on a column of silica gel (100 g) in toluene–ethyl acetate (3 : 2) gave further 1.07 g (23%) of the same product. For $C_{25}H_{22}N_2O_7$ (462.4) calculated: 64.93% C, 4.80% H, 6.06% N; found: 65.11% C, 4.98% H, 5.87% N. ^{1}H NMR spectrum: 1.37 s, 3 H (5-CH$_3$); 4.51 d, 1 H (H^{a}CHO, J(a,b) = 11.3); 4.57 d, 1 H (H^{b}CHO); 4.64 s, 2 H (CH$_2$O); 6.21 dd, 1 H (H-3', J(3',1') = 1.3, J(3',2') = 6.0); 6.59 dd, 1 H (H-2', J(2',1') = 2.1); 6.93 dd, 1 H (H-1'); 7.15 – 8.00 m, 11 H (H-6, H-arom.); 11.39 s, 1 H (H-3).

1-(2,3-Dideoxy-4-C-hydroxymethyl-α-L-*glycero*-pent-2-enofuranosyl)thymine (*IX*)

A solution of benzoyl derivative *VIII* (3.70 g, 8 mmol) in 0.1 M methanolic solution of sodium methoxide (50 ml) was allowed to stand overnight at room temperature. The mixture was neutralized with Dowex 50 (H^+ form), the ion exchanger was filtered off, washed with methanol and the combined filtrates were evaporated. Crystallization of the residue from 2-propanol gave 1.89 g (93%) of didehydro derivative *IX*, m.p. 191 – 194 °C, R_F 0.23 (S3). For $C_{11}H_{14}N_2O_5$ (254.2) calculated: 51.96% C, 5.55% H, 11.02% N; found: 51.74% C, 5.56% H, 11.22% N. ^1H NMR spectrum: 1.72 d, 3 H (5-CH_3, J = 1.0); 3.26 – 3.70 m, 4 H (2 × CH_2O); 4.83 t, 1 H (OH, J = 6.0); 4.98 t, 1 H (OH, J = 5.4); 5.90 dd, 1 H (H-3', J(3',1') = 1.5, J(3',2') = 6.1); 6.27 dd, 1 H (H-2', J(2',1') = 2.0); 6.84 dd, 1 H (H-1'); 7.30 d, 1 H (H-6, J = 1.2); 11.29 s, 1 H (H-3).

1-(2,3-Dideoxy-4-C-hydroxymethyl-α-L-*glycero*-pentofuranosyl)thymine (*X*)

Didehydro derivative *IX* (1.27 g, 5 mmol) was hydrogenated in a mixture of methanol (18 ml) and water (6 ml) on 10% Pd/C (130 mg) at atmospheric pressure for 15 h. The catalyst was filtered through Celite, washed with methanol, and the combined filtrates were taken down. Crystallization of the residue from 2-propanol afforded 800 mg (62%) of dideoxy derivative *X*, m.p. 162 – 163 °C. Chromatography of the residue after concentration of the mother liquors on a column of silica gel (30 g) in ethyl acetate–acetone–ethanol–water (36 : 6 : 5 : 3), followed by crystallization from 2-propanol furnished further 323 mg (25%) of the same product, R_F 0.25 (S3). For $C_{11}H_{16}N_2O_5$ (256.2) calculated: 51.55% C, 6.29% H, 10.93% N; found: 51.48% C, 6.23% H, 10.94% N. ^1H NMR spectrum: 1.70 d, 3 H (5-CH_3, J = 0.6); 1.78 – 2.42 m, 4 H (2 × H-2', 2 × H-3'); 3.29 d, 2 H (CH_2O, J(CH_2O,OH) = 5.7); 3.41 – 3.58 m, 2 H (CH_2O); 4.81 t, 1 H (OH); 5.03 t, 1 H (OH, J = 5.1); 6.03 dd, 1 H (H-1', J(1',2a') = 5.4, J(1',2b') = 6.1); 7.82 d, 1 H (H-6, J = 1.2); 11.21 s, 1 H (H-3); after exchange with D_2O: 3.29 s, 2 H (CH_2O); 3.44 d, 1 H (H^aCHO, J(a,b) = 11.5); 3.50 d, 1 H (H^bCHO).

1-(3,5-Di-O-benzoyl-4-C-benzoyloxymethyl-2-deoxy-α-L-*erythro*-pentofuranosyl)thymine (*XI*)

1 M solution of tributyltin hydride in toluene (20 ml) and 2,2'-azobis(2-methylpropionitrile) (200 mg) were added at 100 °C to a solution of chloro derivative *VI* (6.19 g, 10 mmol) in toluene (50 ml). The solution was heated at 100 °C for 40 min, cooled and the solvent was evaporated. The residue was mixed with light petroleum (200 ml), the resulting solid was filtered, washed with light petroleum and dissolved in a minimum amount of toluene. The solution was filtered and added dropwise with stirring to light petroleum (300 ml). The precipitate was filtered and washed with light petroleum; yield 5.81 g of powdery product. Chromatography of this compound (1 g) on a column of silica gel in toluene–ethyl acetate (3 : 2) afforded 897 mg of chromatographically pure product *XI* (89%, calculated on starting chloro derivative *VI*), R_F 0.48 (S1). For $C_{32}H_{28}N_2O_9$ (584.6) calculated: 65.75% C, 4.83% H, 4.79% N; found: 65.98% C, 4.95% H, 4.58% N. ^1H NMR spectrum: 1.70 d, 3 H (5-CH_3, J = 1.0), 2.54 m, 1 H (H-2a', J(2a',1') = 5.7, J(2a',2b') = 14.0, J(2a',3') = 4.4); 3.12 m, 1 H (H-2b', J(2b',1') = 6.6, J(2b',3') = 6.6); 4.56 d, 1 H (H^aCHO, J(a,b) = 11.7); 4.70 d, 1 H (H^bCHO); 4.83 s, 2 H (CH_2O); 5.92 dd, 1 H (H-3'); 6.43 dd, 1 H (H-1'); 7.40 – 8.00 m, 16 H (H-6, H-arom.); 11.39 s, 1 H (H-3).

1-(2-Deoxy-4-C-hydroxymethyl-α-L-*erythro*-pentofuranosyl)thymine (*XII*)

A crude product, containing 89.7% of compound *XI* (4.81 g, mmol) was dissolved under stirring in 0.1 M methanolic sodium methoxide (45 ml). The solution was set aside at room temperature overnight and then neutralized with Dowex 50 (H^+ form). The ion exchanger was filtered off and washed with methanol and the combined filtrates were evaporated. Crystallization from 2-propanol afforded 1.57 g (78%) of compound *XII*, m.p. 196 – 197 °C. Chromatography of the residue after concentration of the mother liquors

on a column of silica gel (40 g) in ethyl acetate–acetone–ethanol–water (17 : 3 : 3 : 2) and subsequent crystallization from 2-propanol gave further 200 mg (10%) of the same product, R_F 0.20 (S3). For $C_{11}H_{16}N_2O_6$ (272.2) calculated: 48.52% C, 5.92% H, 10.29% N; found: 48.72% C, 5.96% H, 10.14% N. ^{1}H NMR spectrum: 1.77 d, 3 H (5-CH_3, J = 0.6); 1.86 dt, 1 H (H-2a', J(2a',1') = 3.5, J(2a',2b') = 14.2, J(2a',3') = 2.9); 2.70 m, 1 H (H-2b', J(2b',1') = 7.0, J(2b',3') = 6.8); 3.27 – 3.49 m, 2 H (CH_2O); 3.62 d, 2 H (CH_2O, J(CH_2O,OH) = 6.0); 4.24 m, 1 H (H-3'); 4.55 t, 1 H (OH, J(OH,CH_2O) = 6.0); 4.78 t, 1 H (OH, J(OH,CH_2O) = 6.0); 5.75 d, 1 H (3'-OH, J(OH,3') = 5.8); 6.09 dd, 1 H (H-1'); 7.90 s, 1 H (H-6); 11.18 s, 1 H (H-3); after exchange with D_2O: 3.32 d, 1 H (H^aCHO, J(a,b) = 11.6); 3.41 d, 1 H (H^bCHO); 3.61 s, 2 H (CH_2O).

1-(2-Deoxy-5-O-pivaloyl-4-C-pivaloyloxymethyl-α-L-*erythro*-pentofuranosyl)thymine (*XIII*)

Pivaloyl chloride (2.8 ml, 23 mmol) was added dropwise to an ice-cooled and stirred solution of compound *XII* (2.72 g, 10 mmol) in pyridine (20 ml). The mixture was stirred in an ice bath for 15 min and then set aside at room temperature for 1 h. After cooling to 0 °C, methanol (3 ml) was added and after 15 min the solvents were evaporated. The residue was partitioned between water (50 ml) and ethyl acetate (250 ml). The organic layer was separated, washed successively with water (50 ml), 2% hydrochloric acid to acid reaction of the aqueous layer, water (50 ml), 5% solution of sodium hydrogen carbonate (50 ml), dried over magnesium sulfate and the solvent was evaporated. Crystallization of the residue from butyl acetate gave 3.02 g (66%) of pivaloyl derivative *XIII*, m.p. 108 – 110 °C.

The residue after concentration of the mother liquors was chromatographed on a column of silica gel (100 g) in ethyl acetate–toluene (2 : 1); subsequent crystallization afforded further 690 mg (15%) of the same compound, R_F 0.16 (S1). For $C_{21}H_{32}N_2O_8.H_2O$ (458.5) calculated: 55.01% C, 7.47% H, 6.11% N; found: 55.12% C, 7.21% H, 5.91% N. ^{1}H NMR spectrum: 1.12 s, 1.13 s and 1.14 s, 18 H (2 × pivaloyl); 1.78 d, 3 H (5-CH_3, J = 0.6); 1.98 dt, 1 H (H-2a', J(2a',1') = 3.9, J(2a',2b') = 14.5, J(2a',3') = 3.6); 2.81 m, 1 H (H-2b', J(2b',1') = 7.6, J(2b',3') = 7.6); 3.96 d, 1 H (H^aCHO, J(a,b) = 11.7); 4.07 d, 1 H (H^bCHO); 4.21 – 4.36 m, 3 H (CH_2O, H-3'); 5.81 d, 1 H (3'-OH, J(OH,3') = 4.3); 6.20 dd, 1 H (H-1'); 7.76 s, 1 H (H-6); 11.30 s, 1 H (H-3).

1-(2-Deoxy-5-O-pivaloyl-4-C-pivaloyloxymethyl-3-O-methanesulfonyl-α-L-*erythro*-pentofuranosyl)-thymine (*XIV*)

A solution of pivaloyl derivative *XIII* (2.29 g, 5 mmol) in pyridine (20 ml) was evaporated in vacuo. The residue was dissolved in pyridine (20 ml), the solution cooled in an ice bath and methanesulfonyl chloride (2 ml, 26 mmol) was added under stirring. After standing for 4 h at room temperature, the mixture was cooled and water (1 ml) was added. After 10 min, the mixture was evaporated and the residue partitioned between water (25 ml) and ethyl acetate (100 ml). The organic layer was separated, washed successively with water (25 ml), 2% hydrochloric acid to acid reaction of the aqueous layer, water (25 ml), 10% solution of sodium hydrogen carbonate (30 ml) and dried over magnesium sulfate. The solvent was evaporated and the residue was chromatographed on a column of silica gel (250 g) in toluene–ethyl acetate (1 : 2) to give 2.36 g (91%) of mesyl derivative *XIV* as a solid foam, R_F 0.17 (S1). For $C_{22}H_{34}N_2O_{10}S$ (518.6) calculated: 50.95% C, 6.61% H, 5.40% N, 6.18% S; found: 51.04% C, 6.56% H, 5.23% N, 6.10% S. ^{1}H NMR spectrum: 1.36 s and 1.51 s, 18 H (2 × pivaloyl); 1.80 s, 3 H (5-CH_3); 2.46 m, 1 H (H-2a', J(2a',1') = 6.0, J(2a',2b') = 14.5, J(2a',3') = 4.5); 3.04 m, 1 H (H-2b', J(2b',1') = 6.6, J(2b',3') = 6.6); 3.30 s, 3 H (SO_2CH_3); 4.12 d, 1 H (H^aCHO, J(a,b) = 11.8); 4.17 d, 1 H (H^bCHO); 4.34 s, 2 H (CH_2O); 5.39 dd, 1 H (H-3'); 6.26 t, 1 H (H-1'); 7.48 s, 1 H (H-6); 11.40 s, 1 H (H-3).

1-(2,3-Dideoxy-5-O-pivaloyl-4-C-pivaloyloxymethyl-α-L-*glycero*-pent-2-enofuranosyl)thymine (*XV*)

Lithium azide (258 mg, 5.3 mmol) was added to a solution of mesyl derivative *XIV* (519 mg, 1 mmol) in dimethylformamide (6 ml) and the solution was heated at 100 °C for 7 h under argon. The solvent was evaporated and the residue dissolved in ethyl acetate (15 ml). After washing with water (5 ml) and drying over magnesium sulfate, the solvent was evaporated. The residue contained (TLC in S3), beside compound *XV*, only a minor quantity of thymine and UV-transparent sugar compounds. Chromatography on a column of silica gel (50 g) in ethyl acetate–toluene (1 : 1) and subsequent crystallization from methanol afforded 310 mg (73%) of compound *XV*, m.p. 139 – 142 °C. For $C_{21}H_{30}N_2O_7$ (422.5) calculated: 59.70% C, 7.16% H, 6.63% N; found: 59.48% C, 6.97% H, 6.85% N. ^{1}H NMR spectrum: 1.14 s, and 1.15 s, 18 H (2 × pivaloyl); 1.78 d, 3 H (5-CH_3, J = 1.2); 4.87 – 4.32 m, 4 H (2 × CH_2O); 6.15 dd, 1 H (H-3', J(3',1') = 1.2, J(3',2') = 6.1); 6.32 dd, 1 H (H-2', J(2',1') = 1.9); 6.87 dd, 1 H (H-1'); 7.23 d, 1 H (H-6, J = 0.9); 11.4 s, 1 H (H-3).

Reaction of Pivaloyl Derivative *XIII* with Triphenylphosphine, Tetrabromomethane and Sodium Azide

A solution of monohydrate of pivaloyl derivative *XIII* (92 mg, 0.2 mmol) in dimethylformamide (5 ml) was concentrated to a half. To the residue were added triphenylphosphine (105 mg, 0.4 mmol), tetrabromomethane (133 mg, 0.4 mmol) and sodium azide (123 mg, 2.5 mmol). After standing at room temperature for 24 h, methanol (0.5 ml) was added. The solvents were evaporated and the residue was partitioned between ethyl acetate (5 ml) and water (3 ml), the organic layer was separated, dried over magnesium sulfate and the solvent was evaporated. As shown by TLC, the residue contained, beside compound *XV*, a small amount of thymine and UV-nonabsorbing sugar compounds. Chromatography on a column of silica gel (30 g) in ethyl acetate–toluene (1 : 1) gave 63 mg (75%) of compound *XV*.

1-(2-Deoxy-3-O-methanesulfonyl-5-O-triphenylmethyl-4-C-triphenylmethyloxymethyl-α-L-*erythro*-pentofuranosyl)thymine (*XVI*)

A solution of deoxynucleoside *XII* (2.72 g, 10 mmol) and triphenylmethyl chloride (6.69 g, 24 mmol) in pyridine (40 ml) was heated at 100 °C for 1 h. After cooling to 0 °C, methanesulfonyl chloride (4 ml, 52 mmol) was added under stirring. The mixture was kept at 0 °C for 15 min, set aside at room temperature for 5 h, and added dropwise with vigorous stirring in water (800 ml). The precipitate was filtered, washed with water and dried on the air and then in vacuo over potassium hydroxide. It was dissolved in ethyl acetate (60 ml) and the solution was added dropwise with stirring to light petroleum (800 ml). The precipitate was collected on filter and air-dried to give 8.13 g (97%) of trityl derivative *XVI*, R_F 0.41 (S1). For $C_{50}H_{46}N_2O_8S$ (834.9) calculated: 71.92% C, 5.55% H, 3.36% N, 3.84% S; found: 71.81% C, 5.67% H, 3.17% N, 3.66% S. ^{1}H NMR spectrum: 1.54 s, 3 H (5-CH_3); 2.29 m, 1 H (H-2a', J(2a',1') = 3.7, J(2a',2b') = 14.5, J(2a',3') = 3.0); 2.45 – 2.55 m, 1 H (H-2b'); 3.04 s, 3 H (SO_2CH_3); 3.31 – 3.59 m, 4 H (2 × CH_2O); 5.04 dd, 1 H (H-3', J(3',2b') = 6.5), 6.21 dd, 1 H (H-1', J(1',2b') = 6.9); 7.20 – 7.40 m, 31 H (H-6, H-arom.); 11.40 s, 1 H (H-3).

1-(2,3-Dideoxy-5-O-triphenylmethyl-4-C-triphenylmethyloxymethyl-α-L-*glycero*-pent-2-enofuranosyl)-thymine (*XVII*)

A solution of mesyl derivative *XVI* (835 mg, 1 mmol) and lithium azide (294 mg, 6 mmol) in dimethylformamide (4 ml) was heated at 100 °C for 7 h under argon and added dropwise under stirring into water (100 ml). The precipitate was filtered, washed with water, dried on air and then in vacuo over potassium hydroxide, and chromatographed on a column of silica gel (60 g) in ethyl acetate–toluene (1 : 2). After evaporation, the residue was dissolved in ethyl acetate (3 ml) and the solution added dropwise with stirring to light petroleum (50 ml). The precipitate was collected and air-dried; yield 405 mg (55%) of

compound *XVII*, R_F 0.62 (S1). For $C_{49}H_{42}N_2O_5$ (738.8) calculated: 79.65% C, 5.73% H, 3.79% N; found: 79.43% C, 5.90% H, 3.68% N. ^{1}H NMR spectrum: 1.32 s, 3 H (5-CH_3); 3.07 d, 1 H (H^aCHO, J(a,b) = 8.9); 3.09 d, 1 H (H^cCHO, J(c,d) = 9.4); 3.19 d, 1 H (H^bCHO); 3.33 d, 1 H (H^dCHO); 6.07 dd, 1 H (H-3', J(3',1') = 1.1, J(3',2') = 6.0); 6.61 dd, 1 H (H-2', J(2',1') = 2.0); 6.87 dd, 1 H (H-1'); 7.07 d, 1 H (H-6, J = 1.2); 7.29 s, 30 H (H-arom.); 11.39 s, 1 H (H-3).

1-(2-Deoxy-4-C-hydroxymethyl-3-O-methanesulfonyl-α-L-*erythro*-pentofuranosyl)thymine (*XVIII*)

A solution of trityl derivative *XVI* (8.35 g, 10 mmol) in 80% aqueous acetic acid (30 ml) was heated at 106 °C for 25 min. Water (20 ml) was added and, after cooling, the precipitated triphenylmethanol was filtered off and washed with water. The combined filtrates were concentrated and the residue was chromatographed on a column of silica gel (200 g) in ethyl acetate–2-propanol (23 : 2). The mesyl derivative *XVIII* (2.82 g) was obtained as a solid foam. The preceding fraction from the chromatography was evaporated (638 mg), the residue was dissolved in 0.1 M methanolic sodium methoxide (10 ml) and allowed to stand at room temperature. After 3 h, the solution was neutralized with Dowex 50 (H^+ form), the ion exchanger was filtered off, washed with methanol and the combined filtrates were concentrated. Chromatography of the residue on a column of silica gel (50 g) in ethyl acetate–2-propanol (23 : 2) afforded further 233 mg of compound *XVIII*. Both portions were combined and crystallized from a minimum amount of methanol to give 2.76 g (79%) of mesyl derivative *XVIII*, m.p. 81 – 64 °C, R_F 0.51 (S3). For $C_{12}H_{18}N_2O_8S$ (350.3) calculated: 41.14% C, 5.18% H, 8.00% N, 9.15% S; found: 40.95% C, 5.05% H, 7.82% N, 8.98% S. ^{1}H NMR spectrum: 1.79 d, 3 H (5-CH_3), J = 0.6); 2.29 dt, 1 H (H-2a', J(2a',1') = 4.8, J(2a',2b') = 14.4, J(2a',3') = 3.7); 2.94 m, 1 H (H-2b', J(2b',1') = 7.1, J(2b',3') = 6.6); 3.24 s, 3 H (SO_2CH_3); 3.39 – 3.59 m, 2 H (CH_2O); 3.62 d, 2 H (CH_2O, J(CH_2O,OH) = 5.6); 5.00 t, 1 H (OH); 5.22 dd, 1 H (H-3'); 6.22 dd, 1 H (H-1'); 7.64 d, 1 H (H-6, J = 1.2); 11.32 s, 1 H (H-3); after exchange with D_2O: 3.42 d, 1 H (H^aCHO, J(a,b) = 11.6); 3.53 d, 1 H (H^bCHO).

1-{(6*R*,8*R*)-8-Methanesulfonyloxy-2,2-dimethyl-1,3,5-trioxaspiro[3.4]oct-6-yl}thymine (*XIX*)

Sulfuric acid (0.1 ml) was added to a stirred mixture of mesyl derivative *XVIII* (1.75 g, 5 mmol), acetone (15 ml) and 2,2-dimethoxypropane (15 ml). After 30 min, the reaction mixture was neutralized with finely ground sodium hydrogen carbonate. The insoluble portion was filtered off and washed with acetone. The combined filtrates were taken down, the residue was mixed with ether (20 ml) and the crystalline material was collected and washed with ether; yield 1.54 g (79%) of isopropylidene derivative *XIX*, m.p. 146 – 148 °C. Chromatography of the residue after concentration of the mother liquors on a column of silica gel (75 g) in ethyl acetate afforded further 225 mg (11%) of the same compound, R_F 0.54 (S2). For $C_{15}H_{22}N_2O_8S$ (390.4) calculated: 46.14% C, 5.68% H, 7.18% N, 8.21% S; found: 45.92% C, 5.58% H, 6.96% N, 7.97% S. ^{1}H NMR spectrum: 1.35 s, 6 H ($C(CH_3)_2$); 1.79 d, 3 H (5-CH_3, J = 0.8); 2.30 dd, 1 H (H-2a', J(2a',1') = 3.2, J(2a',2b') = 15.9); 3.06 m, 1 H (H-2b', J(2b',1') = 8.0, J(2b',3') = 5.2); 3.30 s, 3 H (SO_2CH_3); 3.68 d, 1 H (H^aCHO, J(a,b) = 12.2); 3.80 d, 1 H (H^bCHO); 3.87 d, 1 H (H^cCHO, J(c,d) = 12.2); 4.05 d, 1 H (H^dCHO); 5.20 d, 1 H (H-3'); 6.23 dd, 1 H (H-1'); 7.40 d, 1 H (H-6, J = 1.0); 11.37 s, 1 H (H-3).

1-{(6*R*,8*S*)-8-Azido-2,2-dimethyl-1,3,5-trioxaspiro[3.4]oct-6-yl}thymine (*XXI*)

Ground sodium azide (650 mg, 10 mmol) was added to a solution of mesyl derivative *XIX* (781 g, 2 mmol) in dimethylformamide (6 ml) and the mixture was stirred under argon at 100 °C for 5 h. After cooling, the insoluble portion was filtered, washed with ethyl acetate, and the combined filtrates were concentrated. The residue was dissolved in ethyl acetate (60 ml), the solution was washed with water (10 ml), the aqueous phase was washed with ethyl acetate (2 × 10 ml) and the combined organic phases were dried over magnesium sulfate. After evaporation of the solvent, the residue was chromatographed on a column

of silica gel (70 g) in ethyl acetate–toluene (7 : 1); yield 98 mg (15%) of azido derivative *XXI* as a solid foam, R_F 0.72 (S2). For $C_{14}H_{19}N_5O_5$ (337.3) calculated: 49.84% C, 5.68% H, 20.76% N; found: 49.56% C, 5.79% H, 20.50% N. ^{1}H NMR spectrum: 1.35 s and 1.37 s, 3 H and 3 H ($C(CH_3)_2$); 1.79 d, 3 H (5-CH_3, J = 1.0); 2.30 m, 1 H (H-2', J(2a',1') = 5.9, J(2a',2b') = 14.2, J(2a',3') = 2.9); 2.61 m, 1 H (H-2b', J(2b',1') = 8.3, J(2b',3') = 6.4); 3.67 – 3.95 m, 4 H (2 × CH_2O); 4.53 dd, 1 H (H-3'); 6.07 dd, 1 H (H-1'); 7.46 d, 1 H (H-6, J = 1.2); 11.38 s, 1 H (H-3).

Evaporation of the second UV-absorbing fraction afforded 346 mg (59%) of 1-{(6*R*)-2,2-dimethyl-1,3,5-trioxaspiro[3.4]oct-7-en-6-yl}thymine (*XX*) as a solid foam, R_F 0.46 (S2). For $C_{14}H_{18}N_2O_5$ (294.3) calculated: 57.13% C, 6.17% H, 9.52% N; found: 56.88% C, 6.31% H, 9.31% N. ^{1}H NMR spectrum: 1.31 s and 1.39 s, 3 H and 3 H ($C(CH_3)_2$): 1.78 s, 3 H (5-CH_3); 3.57 dd, 1 H (H^aCHO, J(a,b) = 11.9, J = 1.1); 3.65 dd, 1 H (H^cCHO, J(c,d) = 12.8, J = 1.3); 3.85 d, 1 H (H^bCHO); 4.04 d, 1 H (H^dCHO); 6.01 dd, 1 H (H-3', J(3',1') = 1.4, J(3',2') = 5.9); 6.45 dd, 1 H (H-2', J(2',1') = 2.0); 6.88 dd, 1 H (H-1'); 7.16 d, 1 H (H-6, J = 1.2); 11.40 s, 1 H (H-3).

The third fraction afforded 98 mg (18%) of thymine.

1-(3-Azido-2,3-dideoxy-4-C-hydroxymethyl-α-L-*threo*-pentofuranosyl)thymine (*XXII*)

A) A solution of isopropylidene derivative *XXI* (169 mg, 0.5 mmol) in 80% aqueous methanol (3 ml) was refluxed with Dowex 50 (H^+ form, 0.25 ml of moist ion exchanger). The Dowex was filtered off, washed with methanol and the combined filtrates were concentrated. Chromatography of the residue on a column of silica gel (10 g) in ethyl acetate–2-propanol (21 : 4) afforded 143 mg (96%) of azido derivative *XXII* as a solid foam, R_F 0.66 (S3). For $C_{11}H_{15}N_5O_5$ (297.3) calculated: 44.44% C, 5.09% H, 23.56% N; found: 44.15% C, 5.30% H, 23.33% N. ^{1}H NMR spectrum: 1.77 d, 3 H (5-CH_3, J = 0.8); 2.38 – 2.47 m, 2 H (2 × H-2'); 3.38 – 3.58 m, 4 H (2 × CH_2O); 4.50 t, 1 H (H-3', J(3',2') = 7.6); 4.89 t, 1 H (OH, J(OH,CH_2O) = 5.3); 5.25 t, 1 H (OH, J(OH,CH_2O) = 5.3); 6.17 dd, 1 H (H-1', J(1',2a') = 5.7, J(1',2b') = 6.6); 7.70 d, 1 H (H-6, J = 1.2); 11.28 s, 1 H (H-3); after exchange with D_2O: 3.43 d, 1 H (H^aCHO, J(a,b) = 11.6); 3.49 d, 1 H (H^bCHO); 3.50 s, 2 H (CH_2O).

B) Ground sodium azide (350 mg) was added to a solution of mesyl derivative *XVIII* (350 mg, 1 mmol) in dimethylformamide (3.5 ml) and the stirred mixture was heated at 100 °C for 15 h under argon. After cooling, the insoluble portion was filtered off, washed with dimethylformamide, and the combined filtrates were concentrated. Chromatography of the residue on a column of silica gel (35 g) in ethyl acetate–2-propanol (22 : 3) afforded 61 mg (21%) of azido derivative *XXII*, 32 mg (25%) of thymine and 104 mg (41%) of didehydrodideoxy derivative *IX*.

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Note: During preparation of this paper for publication, preliminary results similar to ours have been published by other authors[11].