tives with *both* the N-7 and the N-9 alkyl purines,[16] an assignment of N-7 as the predominant point of attachment of the chloromercury and mercury groups in the case of 3-benzylhypoxanthine and theophylline and of N-9 as the predominant point of attachment in the case of 1-benzylhypoxanthine, 1-benzylpurine-6(1H)-thione, and 6-dimethylaminopurine seems warranted.

Because it is known that the mercury derivatives of 3-benzylhypoxanthine and theophylline couple with acylglycosyl halides at N-7,[6,7] whereas those of 1-benzylhypoxanthine,[7] 1-benzylpurine-6(1H)-thione,[7] and 6-dimethylaminopurine[18] couple at N-9, the correlation between the structure of the mercury derivatives and the point of attack by the halides appears good, and thus supports the mechanism involving direct displacement of the mercury or chloromercury group from nitrogen by the incoming acylglycosyl halide.

(16) In the case of 6-dimethylaminopurine the chloromercury group could conceivably be attached to N-3. Fortunately the ultraviolet spectra of the 3-substituted purines resemble those of the 7-substituted purines[17] and thus attachment at N-3 can also be eliminated.

(17) N. J. Leonard, K. L. Carraway, and J. P. Helgeson, *J. Heterocyclic Chem.*, **2**, 291 (1965).

(18) The reaction of the chloromercury derivative of 6-dimethylaminopurine with acylglycosyl halides is less clear cut than the other examples, since in some cases lesser amounts of the 3-glycosylpurines[19-22] are obtained and in the case of one sugar, α-bromoacetoglucose, apparently only the 3-isomer is obtained.[23] These results may be due to the unusual electron density at N-3 of this purine because of the 6-dimethylamino group. Other observations in these laboratories show that this purine has an unusual propensity for attack at N-3 by alkyl halides.[24]

(19) The compounds described in the following references[20-23] as 7-glycosylpurines have been shown to be 3-glycosylpurines [L. B. Townsend, R. K. Robins, R. N. Loeppky, and N. J. Leonard, *J. Am. Chem. Soc.*, **86**, 5320 (1964)].

(20) H. M. Kissman, C. Pidacks, and B. R. Baker, *ibid.*, **77**, 18 (1955).

(21) B. R. Baker and R. E. Schaub, *ibid.*, **77**, 5900 (1955).

(22) B. R. Baker, J. P. Joseph, and R. E. Schaub, *ibid.*, **77**, 5905 (1955).

(23) B. R. Baker, J. P. Joseph, R. E. Schaub, and J. H. Williams, *J. Org. Chem.*, **19**, 1780 (1954).

(24) J. A. Montgomery and K. Hewson, unpublished observations.

Experimental Section

The ultraviolet spectra were determined with a Cary Model 14 spectrophotometer in aqueous solution at three different pH values, except for the spectra of the mercury derivatives which, because of solubility, were determined in aqueous ethanol.

The pmr spectra were determined in 10% (w/v) DMSO-d_6 solutions with a Varian A-60 spectrometer using tetramethylsilane as an internal reference.

The synthesis of most of the benzylpurines and mercury derivatives whose spectra are reported here have already been described.[7,9,10,14] The sodium salts of 1- and 3-benzylhypoxanthine were prepared by dissolving the purines in a stoichiometric amount of 1 *N* sodium hydroxide and evaporating the solutions to dryness. The salts were dried for 2.5 hr at 78° (0.07 mm) over P_2O_5.

1,9-Dibenzylpurine-6(1H)-thione.—A mixture of 1.26 g (4.00 mmoles) of 1,9-dibenzylhypoxanthine and 3.02 g (13.6 mmoles) of phosphorus pentasulfide was stirred and refluxed for 5 hr. The dark solution was evaporated *in vacuo* to about 8 ml and then slowly added to 1100 ml of boiling water. The gum that resulted gradually crystallized during 30 min of boiling and stirring of the aqueous mixture. After cooling, the mixture was filtered, and a crystalline material, which was a 1:1 mixture of 1,9-dibenzylhypoxanthine and product weighing 1.13 g, was obtained. Several recrystallizations from ethanol and finally from acetonitrile were necessary to obtain pure product: yield 127 mg (9.6%); mp 163–165°; ν_{max}, cm^{-1}, 3100, 3060, 3025 (CH), 1590, 1545, 1490 (C=C, C=N), 1450 (CH_2), 1160 and 1075, 735, 710 (monosubstituted phenyl).

Anal. Calcd for $C_{19}H_{16}N_4S$: C, 68.68; H, 4.85; N, 16.86. Found: C, 68.58; H, 5.03; N, 16.99.

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7-Glycosylpurines. II. Arabinofuranosides of Hypoxanthine and Adenine[1]

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A convenient method for the preparation of 3-substituted hypoxanthines, the requisite intermediates for the preparation of 7-glycosylhypoxanthines, from the easily prepared 3-substituted adenines by treatment with nitrosyl chloride has been developed. Reaction of the mercury derivatives of the 3-substituted hypoxanthines IIIa and IIIb with tri-O-acylglycosyl halides gave 3-substituted-7-(tri-O-glycosyl)hypoxanthines, from which the blocking groups were removed by hydrogenolysis and treatment with base to give 7-α-D-arabinofuranosylhypoxanthine (IX) and 7-β-D-ribofuranosylhypoxanthine (V). 7-α-D-Arabinofuranosyladenine (XIV) was prepared from the mercury derivative of N-benzoyl-3-benzyladenine (X) by the same reaction sequence.

The classical method for the synthesis of a glycosyl derivative of a purine—the coupling of a poly-O-acylglycosyl halide with the heavy metal derivative of the purine—normally leads to 9-glycosylpurines,[2] a result probably attributable to the fact that in most cases these heavy metals are attached to N-9 of the purine, since the glycosylpurines appear to be formed by direct displacement of the heavy metal.[6]

Recently we attacked the problem of the synthesis of 7-glycosylpurines and found that substitution of a purine at N-3 by a removable blocking group allowed the preparation of this type of nucleoside,[7,8] and 7-α-D-

(1) This work was supported by funds from the C. F. Kettering Foundation and the Cancer Chemotherapy National Service Center, National Cancer Institute, National Institutes of Health, Contract No. PH-43-64-51. A preliminary account of part of this work has been given: J. A. Montgomery and H. J. Thomas, Abstracts, 147 National Meeting of the American Chemical Society, Philadelphia, Pa., April 1964, p 24M.

(2) Some 3-glycosylpurines[3] and 7-glycosylpurines[4,5] have been obtained.

(3) B. R. Baker, R. E. Schaub, and J. P. Joseph, *J. Org. Chem.*, **19**, 638 (1954); B. R. Baker, J. P. Joseph, R. E. Schaub, and J. H. Williams, *ibid.*, **19**, 1780 (1954); H. M. Kissman, C. Pidacks, and B. R. Baker, *J. Am. Chem. Soc.*, **77**, 18 (1955); B. R. Baker and R. E. Schaub, *ibid.*, **77**, 5900 (1955); B. R. Baker, J. P. Joseph, and R. E. Schaub, *ibid.*, **77**, 5905 (1955); L. B. Townsend, R. K. Robins, R. N. Loeppky, and N. J. Leonard, *ibid.*, **86**, 5320 (1964).

(4) Z. A. Sabarova, Z. P. Polyakova, and M. A. Prokofov, *Zh. Obshch. Khim.*, **29**, 215 (1959).

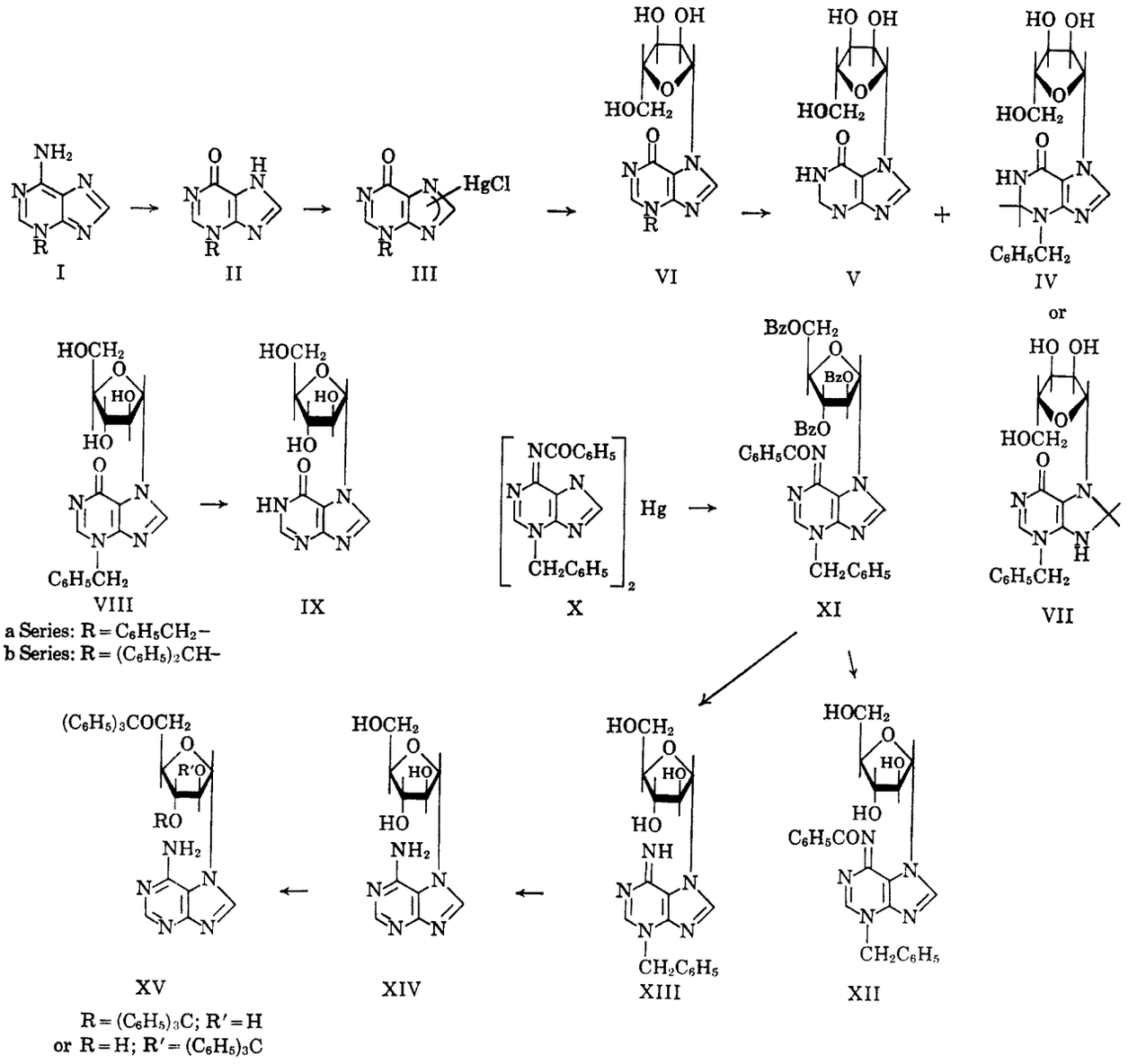
(5) S. R. Jenkins, F. W. Holly, and E. Walton, *J. Org. Chem.*, **30**, 2851 (1965).

(6) J. A. Montgomery and H. J. Thomas, *ibid.*, **31**, 1411 (1966).

(7) J. A. Montgomery and H. J. Thomas, *ibid.*, **28**, 2304 (1962).

(8) J. A. Montgomery and H. J. Thomas, *J. Am. Chem. Soc.*, **85**, 2672 (1963); **87**, 5442 (1965).

CHART I



ribofuranosyladenine was synthesized and identified as the nucleoside from pseudovitamin B_{12}.[8] By inference, the other purine nucleosides isolated from the B_{12} family also have the α-configuration. Since it is also known that the heavy metal derivatives of purines react with 2,3,5-tri-O-benzoylarabinofuranosyl bromide to give α-arabinofuranosylpurines,[9] the preparation of 7-α-arabinofuranosylpurines as analogs of the natural nucleosides from the B_{12} family seemed a logical choice, and the biologic activity of "cytosine arabinoside"[10] certainly did not mitigate against this selection.

In our earlier work on 7-glycosylpurines we prepared the requisite 3-substituted purines by a long sequence starting with the appropriate thiourea as described by Bergmann,[11] but later[12] we found that adenine could be conveniently alkylated at N-3 by the method of Jones and Robins.[13] Consequently, a satisfactory conversion of 3-substituted adenines to the corresponding 3-substituted hypoxanthines would provide the method of choice for the preparation of these compounds. It is well known, however, that the conversion of adenine to hypoxanthine by nitrous acid treatment is an unsatisfactory and incomplete reaction. With 3-benzyladenine (Ia) (Chart I), nitrous acid proved equally unsatisfactory, although some 3-benzylhypoxanthine (IIa) was obtained. Aqueous sodium hydroxide (2 *N*) gave a mixture of 3-benzylhypoxanthine (IIa) and what appeared to be an imidazole resulting from rupture of the pyrimidine ring. Isoamyl nitrite was also unsatisfactory. Finally 3-benzyladenine (Ia) was converted to 3-benzylhypoxanthine in 61% yield by means of nitrosyl chloride.[14] This method also proved superior for the preparation of 3-benzhydrylhypoxanthine (IIb) from Ib.

(9) B. R. Baker, CIBA Foundation Symposium, Chemistry and Biology of Purines, Little, Brown and Co., Boston, Mass., 1957, p 120.

(10) J. S. Evans, E. A. Musser, G. D. Mengel, K. R. Forsblad, and J. H. Hunter, *Proc. Soc. Exptl. Biol. Med.*, **106**, 350 (1961).

(11) F. Bergmann, G. Levin, A. Kalmus, and H. Kwietny-Govrin, *J. Org. Chem.*, **26**, 1504 (1961).

(12) H. J. Thomas and J. A. Montgomery, *J. Heterocyclic Chem.*, **1**, 115 (1964).

(13) J. W. Jones and R. K. Robins, *J. Am. Chem. Soc.*, **84**, 1914 (1962).

(14) L. J. Beckman, W. A. Fessler, and M. A. Kise, *Chem. Rev.*, **48**, 319 (1951).

The preparation of 3-benzyl-7-β-D-ribofuranosylhypoxanthine (VIa)[15] has already been described.[7] Catalytic hydrogenolysis of the benzyl group gave a low yield of 7-β-D-ribofuranosylhypoxanthine (V) and a second product whose elemental analyses and proton magnetic resonance (pmr) spectrum established it as a ring-reduced purine. The pmr spectrum reveals that in the ring-reduced compound the benzyl methylene peak occurs at τ = 5.54 ppm, an upfield shift of 1 ppm from its position (τ = 4.52) in VI, whereas the chemical shift of the proton at C-1 of the sugar is not changed appreciably. From these data, it would appear that reduction of the pyrimidine rather than the imidazole ring took place to give IV rather than VII. Reaction of the chloromercuri derivative of 3-benzhydrylhypoxanthine with 2,3,5-tri-O-acetylribofuranosyl chloride followed by removal of the acetyl groups gave 3-benzhydryl-7-β-D-ribofuranosylhypoxanthine (VIb). Catalytic hydrogenolysis of the 3-benzhydryl group proved easier than removal of the 3-benzyl group and provided an improved synthesis of 7-β-D-ribofuranosylhypoxanthine (V).[7] Attempts to thiate the 2,3,5-tri-O-acetyl derivative of V by the procedure used for the preparation of 6-mercaptopurine ribonucleoside[16] were unsuccessful.

Although debenzylation of 7-α-D-arabinofuranosyl-3-benzylhypoxanthine (VIII)[7] at room temperature and atmospheric pressure failed, the reaction took place at elevated temperature and pressure to give 7-α-D-arabinosuranosylhypoxanthine (IX). Reaction of 7-α-D-arabinofuranosyl-3-benzylhypoxanthine (VIII) with 2 equiv of trityl chloride in the usual manner gave a 27% yield of 3-benzyl-7-[3(2),5-di-O-trityl-α-D-arabinofuranosyl]hypoxanthine. The use of 1 equiv of trityl chloride merely reduced the yield of ditrityl compound to 10% with a correspondingly higher recovery of unchanged starting material.[17]

Reaction of bis(N-benzoyl-3-benzyladenine)mercury (X)[8] with 2,3,5-tri-O-benzoyl-D-arabinofuranosyl bromide gave 7-(2,3,5-tri-O-benzoyl-α-D-arabinofuranosyl)-N-benzoyl-3-benzyladenine (XI) which was isolated as an analytically pure crystalline solid. Treatment of the blocked nucleoside with methanolic sodium methoxide in the usual manner unexpectedly gave 7-α-D-arabinofuranosyl-N-benzoyl-3-benzyladenine (XII), also isolated as an analytically pure solid. This treatment was expected to remove the N-benzoyl as well as the O-benzoyl groups; however, to obtain this result it was necessary to employ 3 equiv of methoxide, which gave a good yield of the desired 7-α-D-arabinofuranosyl-3-benzyladenine (XIII). Catalytic debenzylation, under the vigorous conditions found necessary, gave 7-α-D-arabinofuranosyladenine (XIV), an analog of the nucleoside of pseudo-vitamin B_{12} in which the 2′-hydroxyl is inverted. Tritylation of 7-α-D-arabinofuranosyladenine gave a ditrityl derivative (XV), just as in the case of 7-α-D-arabinofuranosylhypoxanthine. Although tritylation in this case could occur on the amino group, the ultraviolet spectrum of XV showed that, in fact, it did not.

The assignment of the position of attachment of the sugar moiety of these nucleosides is based on previous work[7,8] and on their ultraviolet spectra, which are definitive.

Experimental Section[19]

3-Benzylhypoxanthine (IIa).—A solution of 2.64 g (11.7 mmoles) of 3-benzyladenine in 13.5 ml of pyridine, 7.8 ml of acetic anhydride, and 18.2 ml of acetic acid was chilled in an ice bath and stirred with exclusion of moisture while a solution of 3.4 g of nitrosyl chloride in 26 ml of acetic anhydride was added slowly. The ice bath was removed and stirring was continued for 1.5 hr. When, at the end of this time, a positive potassium iodide–starch test was obtained, the solution was evaporated to a syrup *in vacuo*. The residue was dissolved in 200 ml of water and the aqueous solution extracted with three 100-ml portions of chloroform. The chloroform extracts were combined, dried over magnesium sulfate, and evaporated to dryness *in vacuo*. The residue crystallized from ethanol: yield 1.61 g (61%); mp 245–247°; λ_{max} mμ ($\epsilon \times 10^{-3}$): pH 1–254 (11.3), pH 7–265 (13.8), pH 13–264 (10.5) and 277 (sh) (9.24). This material was identical to that previously prepared.[7]

3-Benzhydrylhypoxanthine (IIb). **A.**—A solution of 1.81 g of 3-benzhydryladenine (Ib) in 300 ml of 0.5 *N* sodium hydroxide solution containing enough ethanol to cause complete solution was refluxed for 3 hr. On cooling, the solution deposited 265 mg of Ib, which was removed by filtration. Upon neutralization the filtrate deposited 630 mg of impure IIb. This material was dissolved in chloroform and precipitated by the addition of ether: yield 487 mg (27%). This material was further purified by crystallization from methanol. The first crop of crystals from this methanol recrystallization contained a small amount of impurity, but the second crop was pure IIb: mp 154–158° (solidifies and remelts at 204°); λ_{max} mμ ($\epsilon \times 10^{-3}$): pH 1–253 (11.4), pH 7–264 (13.6), pH 13–264, 280 (sh) (10.4, 8.48); ν_{max} cm^{-1}: 3110, 3050, 3030, 2960, 2930, 2850, 2800–2500 (CH, acidic H), 1650 (C=O), 1600 (sh) 1580 (sh), 1540 (phenyl and purine ring stretch).

Anal. Calcd for $C_{18}H_{14}N_4O$: C, 71.51; H, 4.67; N, 18.53. Found: C, 71.43; H, 4.92; N, 18.29.

B.—A solution of 16.0 g (53.2 mmoles) of 3-benzhydryladenine in 65 ml of pyridine, 37.5 ml of acetic anhydride, and 87.5 ml of acetic acid was chilled in an ice bath and stirred with exclusion of moisture while a solution of 25 g of nitrosyl chloride in 125 ml of acetic anhydride was slowly added over a period of 1 hr. The ice bath was removed and stirring was continued for 1.5 hr. When, at the end of this time, a negative potassium iodide–starch test was obtained, another 5 g of nitrosyl chloride in 25 ml of acetic anhydride was added and stirring continued for 1 hr. Since a positive potassium iodide–starch test was obtained at the end of this time, the dark reaction solution was evaporated to a syrup *in vacuo*. Trituration of the syrup with 1 l. of water produced a solid, which crystallized from 50 ml of methanol: yield 3.72 g; mp 154–157° (resolidifies and melts at 204°).

The aqueous solution from the trituration was extracted with four 200-ml portions of chloroform. The chloroform extracts were combined, dried over magnesium sulfate, and evaporated to dryness *in vacuo*. The residue crystallized from methanol: yield 1.88 g; mp 154–158° (total yield 5.60 g, 35%). This material was identical to that prepared as described in **A**.

Chloromercuri-3-benzhydrylhypoxanthine (IIIb).—To a solution of 2.25 g of 3-benzhydrylhypoxanthine (IIb) and 2.02 g of mercuric chloride in 200 ml of absolute ethanol was added 400 g of Celite and 62.3 ml of 0.12 *N* sodium hydroxide. The resulting yellow suspension became white after boiling for 10 min. The mixture was chilled and the solid was removed by filtration and dried: yield (with Celite) 7.79 g (95%).

7-β-D-Ribofuranosylhypoxanthine (V).—The reaction in the usual manner of 2,3,5-tri-O-acetylribofuranosyl chloride (from

(15) Since the *trans* rule[9] has been shown to hold in the preparation of 7-β-D-ribofuranosyladenine,[8] the assumption has been made that all the 7-glycosylpurines prepared herein have the predicted anomeric configuration.

(16) J. J. Fox, I. Wempen, A. Hampton, and I. L. Doerr, *J. Am. Chem. Soc.*, **80**, 1669 (1958).

(17) Reaction of methyl D-arabinofuranoside with 1 equiv of trityl chloride gave the 5-monotrityl derivative, whereas 2 equiv gave the 3,5-ditrityl derivative.[18]

(18) G. J. Halliburton and R. J. McIlroy, *J. Chem. Soc.*, 299 (1949).

(19) The melting points reported were determined on a Kofler Heizbank, unless otherwise stated, and are corrected. The ultraviolet spectra were determined in aqueous solution with a Cary Model 14 spectrophotometer; the infrared spectra were determined in pressed potassium bromide disks with a Perkin-Elmer Model 221 spectrophotometer; the proton magnetic resonance spectra were determined with a Varian Associates Model A-60 spectrometer.

2.0 g of tetraacetylribose) and chloromercuri-3-benzhydrylhypoxanthine (IIIb) (3.88 g) gave crude 7-(2,3,5-tri-O-acetyl-β-D-ribofuranosyl)-3-benzhydrylhypoxanthine as an orange syrup. Removal of the acetyl groups by means of methanolic sodium methoxide gave a 41% yield (1.13 g) of crude 3-benzhydryl-7-β-D-ribofuranosylhypoxanthine (VIb) as a buff solid. Compound VIb (797 mg) in 96 ml of ethanol–water (80:11) was hydrogenolyzed in the presence of 320 mg of 5% palladium–on–charcoal catalyst at 46 psi of hydrogen at 80° for 16 hr. The crude V was purified by column chromatography on cellulose using butanol–water (86:14). The analytical sample (60 mg, 13%) melted at 218–220°: $[\alpha]^{20}D$ + 43.6 ± 0.5° (*c* 0.3918 in water); λ_{max} mμ (ε × 10^{-3}): pH 1–249 (8.95), pH 7–251 (8.55), pH 13–261 (8.53); $\bar{\nu}_{max}$ cm^{-1}: 3500, 3420, 3315, 3140, 3060, 2930, 2860–2500 (OH, CH, acidic H), 1720 (C=O), 1585, 1540 (purine ring stretch), 1235, 1210 (COC), 1120, 1110, 1100, 1060, 1030 (C–O–).

Anal. Calcd for $C_{10}H_{12}N_4O_5$: C, 44.79; H, 4.51; N, 20.90. Found: C, 44.94; H, 4.69; N, 20.60.

The Catalytic Hydrogenolysis of 3-benzyl-7-β-D-ribofuranosylhypoxanthine.—The crude reaction product, 3-benzyl-7-β-D-ribofuranosylhypoxanthine[2] (1.75 g, 4.6 mmoles), was dissolved in 100 ml of ethanol and hydrogenolyzed in the presence of 350 mg of 5% palladium–on–charcoal catalyst at 46.5 psi of hydrogen and at 80° for 4 hr. The catalyst was removed by filtration and washed with ethanol and then with hot water. The filtrate and washes were combined and evaporated to dryness *in vacuo*. Trituration of the residue with three 50-ml portions of butanol gave 1.03 g of a solid that was a mixture of 7-β-D-ribofuranosylhypoxanthine (V) and the ring reduced material IV or VII. From this mixture a low yield of V was isolated;[2] there was also obtained, by ethanol recrystallization, 262 mg (16%) of IV or VII: mp 163–167; λ_{max} mμ (ε × 10^{-3}): pH 1–250 (sh) (4.23) and 299 (4.94), pH 7–308 (5.16), pH 13–308 (5.16); $\bar{\nu}_{max}$ cm^{-1}: 3420, 3280, 3250, 3105, 2950, 2920, 2845 (NH, OH, CH), 1640 (C=O), 1590, 1565, 1525 (purine and phenyl ring), 1125, 1090, 1070, 1060 (C–O–); τ ppm: 6.35 d ($H_{5'}$), 6.05 m ($H_{2'}$, $H_{3'}$ or $H_{4'}$), 5.79 d over m (ring methylene over $H_{2'}$, $H_{3'}$ or $H_{4'}$), 5.54 (benzyl methylene), 5.00 t over m (5′OH over 3′OH or 2′OH), 4.63 d (2′OH or 3′OH), 3.94 d ($H_{1'}$, 2.66 (phenyl ring protons), 1.94 (H_8); $J_{1'2'}$ = 4.3 cps.

Anal. Calcd for $C_{17}H_{20}N_4O_5$: C, 56.50; H, 5.58; N, 15.50. Found: 56.65; H, 5.52; N, 15.66.

7-α-D-Arabinofuranosylhypoxanthine (IX).—7-α-D-Arabinofuranosyl-3-benzylhypoxanthine (VIII, 716 mg)[2] in 200 ml of aqueous ethanol (50%) was hydrogenolyzed in the presence of 340 mg of 5% palladium–on–charcoal catalyst for 16 hr at 51 psi and 80°. The crude IX was purified by recrystallization from water: yield 260 mg (49%). A small sample was recrystallized once more for analysis: mp 173–175°; $[\alpha]^{25.5}D$ +19.2 ± 0.2° (*c* 0.3484 in water); λ_{max} mμ (ε × 10^{-3}): pH 1–250 (8.9), pH 7–256 (8.25), pH 13–262 (9.08); $\bar{\nu}_{max}$ cm^{-1}: 3380 br, 3040, 2910, 2840–2500 (OH, CH, acidic H); 1685 (C=O), 1595, 1560, 1510 (purine ring stretch), 1220, (COC), 1120, 1060 (C–O–); τ ppm: 6.36 d ($H_{5'}$), 5.90 d and 5.64 d ($H_{2'}$ and $H_{3'}$), 5.47 t ($H_{4'}$), 5.09 t (5′OH), 4.52 (benzyl methylene over 3′OH or 2′OH), 4.22 d (2′OH or 3′OH), 3.73 d ($H_{1'}$), 2.63 (phenyl ring protons), 1.53 and 1.39 (H_8 and H_2); $J_{1'2'}$ = 4.5 cps.

Anal. Calcd for $C_{10}H_{12}N_4O_5$: C, 44.79; H, 4.51; N, 20.90. Found: C, 44.74; H, 4.67; N, 20.73.

3-Benzyl-7-[3(2),5-di-O-trityl-α-D-arabinofuranosyl]hypoxanthine.—To a solution of 580 mg of 7-α-D-arabinofuranosyl-3-benzylhypoxanthine (VIII) in 50 ml of dry pyridine was added 945 mg of trityl chloride, and this solution was heated at 56° for 3 days. The resulting solution was concentrated *in vacuo* to 19 ml before it was poured into 100 ml of ice and sodium bicarbonate solution (294 mg of sodium bicarbonate). The aqueous layer was decanted from the oily residue which was triturated with water before dissolving it in ethanol. The ethanol solution was filtered, evaporated to dryness, and the residue was dissolved in chloroform. The chloroform solution was evaporated to dryness and the residue was recrystallized from ethanol: yield 379 mg (27%); mp 184–186°; λ_{max} mμ (ε × 10^{-3}): pH 1–254–257 br (12.2), pH 7–260–264 br (19.2), pH 13–265–266 (13.2); $\bar{\nu}_{max}$ cm^{-1}: 3350, 3015, 2910, 2840, 2735–2500 (H_2O, CH, acidic H), 1665 (C=O), 1615, 1585, 1540 (phenyl and purine rings tretch), 1220 (COC), 1090, 1050, 1020 (C–O–).

Anal. Calcd for $C_{55}H_{46}N_4O_5 \cdot H_2O$: C, 76.71; H, 5.62; N, 6.51. Found: C, 76.51; H, 5.59; N, 6.84.

7-[2,3,5-Tri-O-benzoyl-α-D-arabinofuranosyl]-N-benzoyl-3-benzyladenine (XI).—Coupling of the dipurinylmercury derivative of N-benzoyl-3-benzyladenine (X)[2] with 2,3,5-tri-O-benzoyl-D-arabinofuranosyl bromide in the usual manner gave a 41% yield of essentially pure XI: mp 201–202°. A small sample was recrystallized from chloroform–methanol for analysis: mp 201–202°; λ_{max} mμ (ε × 10^{-3}): pH 1–233, 306 (47.2, 18.7), pH 7, 13–243, 339, 355 (sh) (48.0, 22.6, 19.0); $\bar{\nu}_{max}$ cm^{-1}: 3000 br (CH), 1730 (ester C=O), 1640 (C=O, C=N), 1605, 1575, 1520 (phenyl and purine ring stretch), 1270 (COC), 1110 (sh), 1095, 1070 (C–O–).

Anal. Calcd for $C_{45}H_{35}N_5O_8$: C, 69.83; H, 4.56; N, 9.05. Found: C, 69.98; H, 4.50; N, 9.12.

7-α-D-Arabinofuranosyl-N-benzoyl-3-benzyladenine (XII).—The blocked nucleoside XI (500 mg) was refluxed for 0.5 hr with 1 equiv of sodium methoxide in 21 ml of methanol. The crude product was recrystallized from ethanol: yield 28 mg; mp 197–200°; λ_{max} mμ (ε × 10^{-3}): pH 1–223, 301 (18.9, 24.8), pH 7, 13–236, 336 (13.8, 20.8); $\bar{\nu}_{max}$ cm^{-1}: 3400 (sh), 3310 (OH), 2950, 2935, 2910 (CH), 1645 (C=O, C=N), 1600, 1570, 1540 (phenyl and purine ring stretch), 1210 (COC), 1100, 1065, 1045 (C–O–).

Anal. Calcd for $C_{24}H_{23}N_5O_5$: C, 62.46; H, 5.02; N, 15.18; O. 17.33. Found: C, 62.82; H, 5.26; N, 15.02; O, 17.42.

7-α-D-Arabinofuranosyl-3-benzyladenine (XIII).—Deblocking of XI with 3 equiv of sodium methoxide in methanol gave an 81% yield of XIII: mp 232–233°. A small sample was recrystallized from methanol–water to obtain the analytical sample: mp 242°; λ_{max} mμ (ε × 10^{-3}): pH 1, 7–225 (sh), 276 (15.6, 14.9), pH 13–227 (sh), 277 (11.8, 10.9); $\bar{\nu}_{max}$ cm^{-1}: 3310, 3200, 3150, 3060, 2940, 2910, 2860, 2800–2500 (OH, NH, CH), 1638 (C=N), 1605, 1590, 1530 (phenyl and purine ring stretch), 1210 (COC), 1120, 1085, 1060, 1045, 1030 (C–O).

Anal. Calcd for $C_{17}N_{19}N_5O_4$: C, 57.13; H, 5.36; N, 19.60. Found: C, 57.21; H, 5.35; N, 19.70.

7-α-D-Arabinofuransoyladenine (XIV).—A solution of XIII (650 mg) in 200 ml of 50% aqueous ethanol was hydrogenolyzed in the presence of 300 mg of 5% palladium–on–charcoal catalyst at 80° and 47 psi for 16 hr: yield 390 mg (80%), mp 130–135°. A small sample of XIV was recrystallized from water for analysis: mp 240–242° dec; $[\alpha]^{22}D$ −55 ± 3° [*c* 0.0666 in DMF–ethanol (1:4)]; λ_{max} mμ (ε × 10^{-3}): pH 1–272 (12.5), pH 7, 13–270 (8.95); $\bar{\nu}_{max}$ cm^{-1}: 3400, 3330, 3200, 2910, 2850, 2800–2500 (OH, NH, CH), 1640 (NH), 1605, 1560 (purine ring stretch), 1225 (COC), 1050 br (C–O–).

Anal. Calcd for $C_{10}H_{13}N_5O_4$: C, 44.94; H, 4.90; N, 26.20. Found: C, 44.70; H, 5.11; N, 26.10.

7-[3(2),5-Di-O-trityl-α-D-arabinofuranosyl]adenine.—A solution of 7-α-D-arabinofuranosyladenine (100 mg) and trityl chloride (218 mg) in 20 ml of pyridine was heated for 3 days at 56°. The solution was concentrated *in vacuo* to a thick sludge which was triturated with ice and sodium bicarbonate solution followed by cold water. The ultraviolet spectrum of the crude material showed maxima at 270 mμ (pH 1) and 268 mμ (pH 7, 13). The chloroform solution of the crude product was evaporated to dryness, the residue was triturated with boiling hexane and then recrystallized first from ethanol and then from benzene: yield 47 mg (16.5%).

Anal. Calcd for $C_{48}H_{41}N_5O_4 \cdot 0.5\ H_2O$: C, 75.76; H, 5.56. Found: C, 75.91; H, 5.90.

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