C-Nucleoside Studies. Part 19.[1] The Synthesis of the β-D-Xylofuranosyl Analogue of Formycin.

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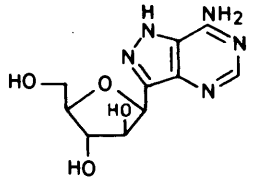
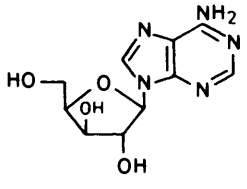
1-(2,4-Dinitrophenyl)-3-(2,3,5-tri-*O*-acetyl-β-D-xylofuranosyl)pyrazole (**15**), prepared by improved procedures from D-gulonolactone, was treated with ammonium nitrate and trifluoroacetic anhydride in trifluoroacetic acid to give, after deprotection of the pyrazole ring, 4-nitro-3(5)-(2,3,5-tri-*O*-acetyl-β-D-xylofuranosyl)pyrazole (**17**). *N*-Nitration and *cine*-substitution with cyanide ion gave 3(5)-cyano-4-nitro-5(3)-(2,3,5-tri-*O*-acetyl-β-D-xylofuranosyl)pyrazole (**19**) in 66% overall yield; this was elaborated into 7-amino-3-(β-D-xylofuranosyl)pyrazolo[4,3-*d*]pyrimidine (**3**), the xylofuranosyl analogue of the *C*-nucleoside antibiotic formycin.

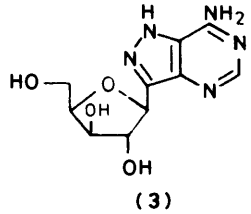
A number of analogues of the common nucleosides with structural modifications in the pentofuranosyl ring show important antitumour and antiviral activity.[2] Recently, as part of our programme of work on the synthesis and biosynthesis of *C*-nucleoside antibiotics, we reported the preparation of the D-arabinofuranosyl analogue (**1**) of the *C*-nucleoside formycin,[3] which has a close structural similarity with the important antiviral agent arabinofuranosyladenine (ara-A).



(**1**)



(**2**)



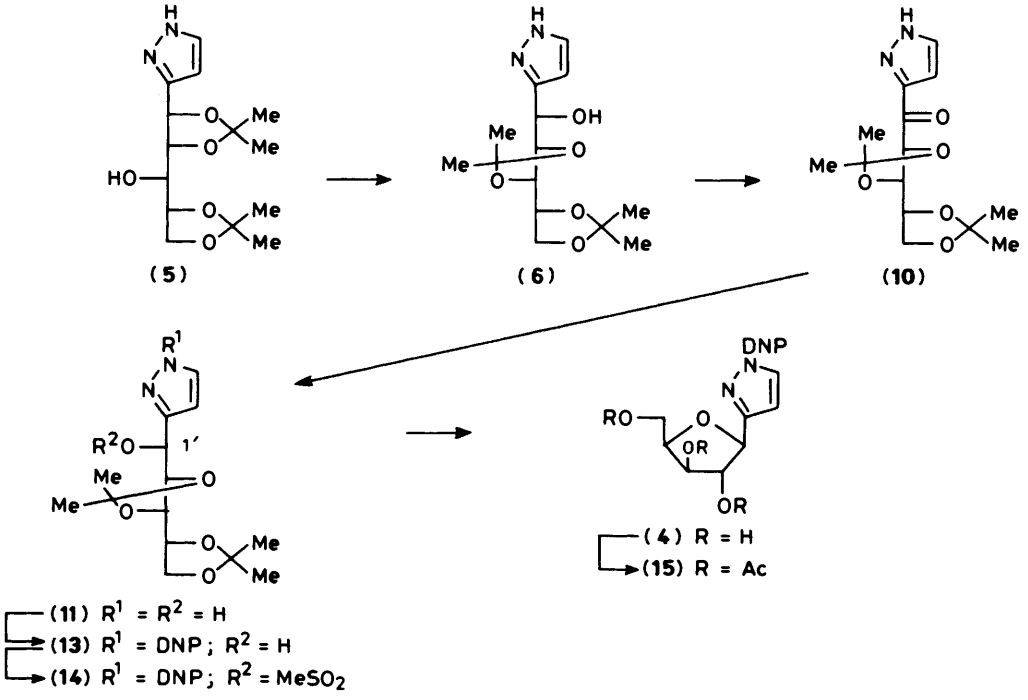
(**3**)

The xylofuranosyl analogue of adenosine (**2**) shows antitumour activity, probably acting as its triphosphate as an inhibitor of nucleic acid synthesis, this activity being potentiated by the adenosine deaminase inhibitor 2′-deoxycoformycin.[4] The analogue may also act by inhibiting both base and sugar methylation of nuclear RNA in L1210 cells *in vitro*.[5] Also, it has recently been demonstrated that the xylofuranosyl analogue of 2—5 A core [*i.e.* (xylo A 2′p)$_2$xylo A] inhibits the replication of herpes simplex viruses 1 and 2,[6] with greater activity than the previously reported[7] antiviral effect of xyloadenosine itself. The xyloside of 6-mercaptopurine also has anticancer activity, apparently without the need for phosphorylation,[8] whilst certain derivatives of xylofuranosylcytosine and 5-fluorocytosine are cytotoxic to leukaemia cell lines.[9] Such considerations prompted our interest in developing a synthesis of the xylofuranosyl analogue of formycin (**3**) (xyloformycin), and the synthesis of this compound is reported here.

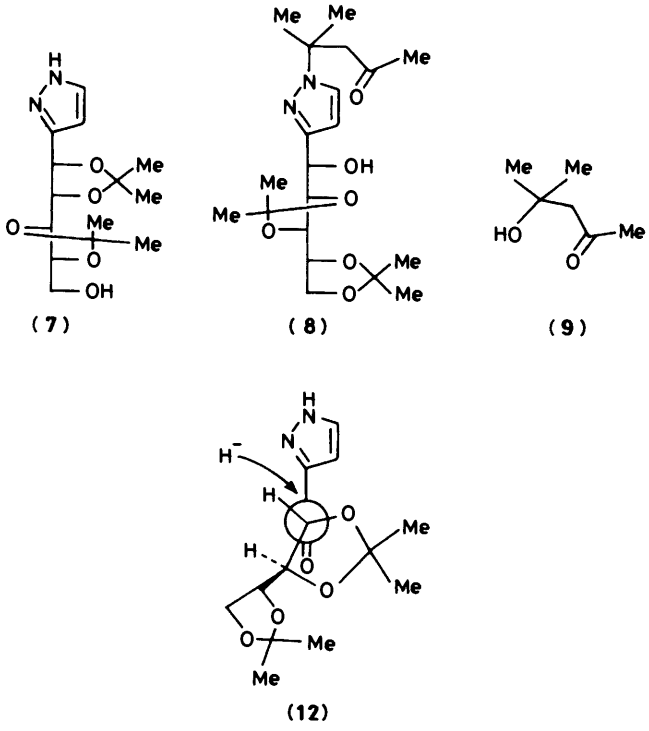
We have previously described the synthesis of the *N*-protected β-D-xylofuranosylpyrazole (**4**) from the acyclic pentitol derivative (**5**) by the reaction sequence outlined in Scheme 1,[10] where compound (**5**) is available in three steps from D-gulono-1,4-lactone. Treatment of (**5**) with acidified acetone gave[10] the rearrangement product (**6**), with the more stable *threo*-arrangement of the isopropylidene group. We have now observed that after relatively short reaction times, although no starting material remained, compound (**6**) was only present in small amounts, the major product being a new compound isomeric with both (**5**) and (**6**). The ^{1}H n.m.r. spectrum indicated that this material was also a di-*O*-isopropylidene derivative, and from the ^{13}C n.m.r. spectrum (see the Experimental section), both the isopropylidene groups were clearly part of five-membered dioxolane rings, rather than six-membered dioxane systems.[11] This new material must therefore be the 1,2:3,4-di-*O*-isopropylidene derivative (**7**). Thus a kinetic migration of the terminal isopropylidene group must precede the relatively slow rearrangement to (**6**). As previously observed,[10] compound (**6**) was the major product after longer reaction times, but another new product of lower polarity gradually accumulated. This was shown to be the adduct (**8**), a mechanism for the formation of which may involve the acid-catalysed condensation of compound (**6**) with the β-hydroxy ketone (**9**), itself formed by condensation of acetone.

Oxidation[10] of the alcohol (**6**) gave the ketone (**10**), and it had previously been demonstrated that hydride reduction of this ketone gave stereoselectively the D-*ido*-isomer (**11**).[10] In our present work we found that reduction with L-selectride was experimentally most convenient, producing compounds (**11**) and (**6**) in a ratio of 4:1, a slight improvement over other reductants. The stereoselectivity of this reduction can be rationalised in terms of the Felkin-Anh type of transition state for molecules containing a polar α-substituent, as indicated in structure (**12**). The D-*ido*-alcohol (**11**) was converted *via* (**13**) to the *N*-protected methanesulphonate (**14**) as previously.[10] We had in our earlier work induced this material to cyclise to compound (**4**), with inversion of configuration at C-1′, by deacetalisation using boron trichloride, and subsequent methanolysis.[10] We have now found that direct treatment with acidic methanol,[3] followed by acetylation of crude triol (**4**) gave the triacetate (**15**) in 77% overall yield.

The methods used for the formation of the pyrazolopyrimidine ring from the pyrazole (**15**) were modelled on our previous work.[1,3,12] Thus nitration of compound (**15**) with ammonium nitrate–trifluoroacetic anhydride in trifluoroacetic acid[13] gave the 4-nitropyrazole (**16**) (Scheme 2) in 85% yield. A similar nitration had been successfully carried out earlier[12] on the analogous ribofuranosyl compound, but nitration under these



Scheme 1.

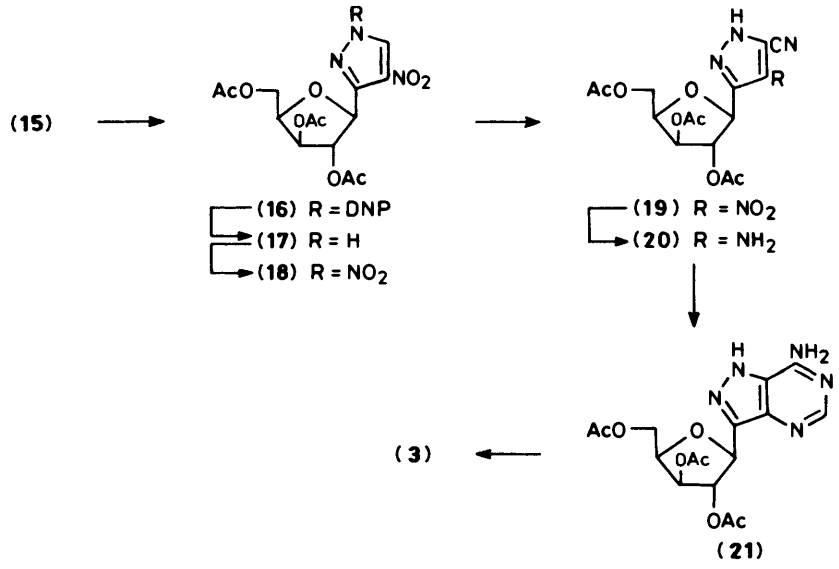


and other conditions had totally failed in the case of the corresponding arabinofuranosyl pyrazole,[3] necessitating nitration of the pyrazole prior to formation of the arabinofuranosyl ring. The successful nitration of the β-D-xylofuranosyl system under mild conditions confirms our suspicions that the failure of the nitration in the β-D-arabinofuranosyl case is due to the 'up' orientation of the 2'-acetoxy group, but whether the effect is steric or electronic remains unclear. The structure of (**16**) is supported *inter alia* by ^{1}H n.m.r. spectroscopy; the doublet due to 4-H in compound (**15**) had disappeared, and the 5-H doublet (δ 7.76) had been replaced by a singlet at significantly lower field (δ 8.62).

Attempts at selective removal of the 2,4-dinitrophenyl group did not prove satisfactory, so complete deprotection of compound (**16**) with sodium methoxide in methanol, followed by reacetylation, was used to obtain (**17**) as an oil in 86% yield after chromatography. Reaction of the triacetate (**17**) with trifluoroacetyl nitrate gave rapidly the 1,4-dinitropyrazole (**18**) (85%). The structure of the product is supported by the ^{1}H n.m.r. spectrum, in which 5-H appears as a singlet at δ 9.05, strongly shifted downfield relative to the corresponding position in compound (**17**) (δ 8.15), whilst the signals for 1'-H remain at very similar chemical shifts in both (**17**) and (**18**).

When compound (**18**) was treated with cyanide ion in aqueous ethanol, a smooth *cine*-substitution[14] occurred to give the nitro nitrile (**19**), which was reduced catalytically to amino nitrile (**20**). This, on treatment with formamidine acetate in refluxing ethanol[15] underwent ring closure to the triacetyl derivative (**21**) of xyloformycin, which without rigorous purification was treated with methoxide in methanol to give, after ion exchange chromatography, crystalline xyloformycin (**3**) in 72% yield. The structure was fully supported by spectroscopic data, with, in particular, the u.v. spectrum being virtually identical to those of formycin[12] and araformycin (**1**)[3].

Biological Data.—Xyloformycin (**3**) was tested against influenza A (HK/1/68) virus and parainfluenza type 1 (Sendai) virus in Madin-Darby canine kidney cells and against herpes simplex type 1 (HFEM) virus and herpes simplex type 2 (MS) virus in Vero (African green monkey kidney) cells. At compound concentrations up to 100 μg ml^{-1} there was no



Scheme 2.

evidence for inhibition of virus replication or for toxicity to the cells in any of the tests.

Experimental

For general directions see part 15.[3] Organic solvents were dried with anhydrous magnesium sulphate.

3(5)-(1,2:3,4-*Di*-O-*isopropylidene*-D-*pentahydroxypentyl*)*pyrazole* (**7**).—A solution of compound (**5**)[10] (1.0 g) in acetone (45 ml) containing concentrated sulphuric acid (0.35 ml) was left to stand for 1 h, when t.l.c. indicated that no starting material remained. The solution was neutralised with sodium carbonate, filtered, and evaporated to give a clear oil, chromatography of which on silica with light petroleum–ether (1:4) as the eluant yielded firstly the di-isopropylidene derivative (**6**)[10] (0.24 g, 24%). Further elution and recrystallisation from ether–dichloromethane gave the new *di*-O-*isopropylidene derivative* (**7**) (0.68 g, 68%), m.p. 185—186 °C; $[\alpha]_D$ + 81.3° (*c* 0.94 in $CHCl_3$); $\nu_{max.}$(KBr) 3 200 (OH, NH), 1 560(C=N), and 1 385 and 1 365 cm^{-1} (CMe_2); δ_H (360 MHz; $CDCl_3$) 1.18, 1.31 (× 2), 1.47 (each 3 H, s, CMe_2), 3.19 (2 H, m, 5′-H_2), 3.43 (1 H, dd, *J* 7.15, 4.45 Hz, 3′-H), 3.81 (1 H, ddd, *J* 7.4, 5.3, 4.1 Hz, 4′-H), 4.20 (1 H, dd, *J* 6.75, 4.5 Hz, 2′-H), 5.22 (1 H, d, *J* 6.75 Hz, 1′-H), 6.31 (1 H, d, *J* 1.8 Hz, 4-H), and 7.38 (1 H, d, *J* 1.8 Hz, 5-H); δ_C (50.3 MHz; $CDCl_3$) 25.5, 26.9, 27.4, and 27.7 (CMe_2), 110.4, and 110.6 (CMe_2) (Found: C, 56.8; H, 7.6; N, 9.6. $C_{14}H_{22}N_2O_5$ requires C, 56.4; H, 7.4; N, 9.4%).

1-(1,1-*Dimethyl*-3-*oxobutyl*)-3-(2,3:4,5-*di*-O-*isopropylidene*-D-gulo-*pentahydroxypentyl*)*pyrazole* (**8**).—A solution of compound (**5**)[10] (5 g) in acetone (300 ml) containing concentrated sulphuric acid (2.75 ml) was stirred for 12 h, when t.l.c. indicated two major products. Neutralisation with sodium carbonate, filtration, and evaporation gave a pale yellow oil which was chromatographed on silica gel eluting with light petroleum–ether (1:2) to give the N-*substituted pyrazole* (**8**) (1.3 g, 26%), m.p. 105—106 °C; $[\alpha]_D$ − 9.2° (*c* 1.52 in $CHCl_3$); $\nu_{max.}$(KBr) 3 450 (OH), 1 720 (C=O), and 1 380 and 1 370 cm^{-1} (CMe_2); δ_H (200 MHz; $CDCl_3$), 1.27, 1.34, 1.35, and 1.37 (each 3 H, s, CMe_2), 1.58 (6 H, s, CMe_2), 1.84 (3 H, s, COMe), 2.95 (2 H, s, CH_2), 3.22 (1 H, d, exchangeable with D_2O, OH), 3.6—3.9 (3 H, m, 4′-H, 5′-H_2), 4.02 (1 H, dd, *J* 7.3, 3.2 Hz, 3′-H), 4.18 (1 H, dd, *J* 7.3, 5.3 Hz, 2′-H), 4.85 (1 H, t, becomes d, *J* 5.3 Hz on D_2O shake, 1′-H), 6.19 (1 H, d, *J* 2.35 Hz, 4-H), and 7.41 (1 H, d, *J* 2.35 Hz, 5-H) (Found: C, 60.4; H, 8.2; N, 7.0. $C_{20}H_{32}N_2O_6$ requires C, 60.6; H, 8.1; N, 7.1%).

Further elution of the column gave the di-isopropylidene derivative (**6**)[10] (3.25 g, 65%).

Reduction of the Ketone (**10**) *with L-Selectride*.—A solution of the ketone (**10**)[10] (1.0 g, 3.4 mmol) in tetrahydrofuran (20 ml) was added dropwise to a stirred solution of lithium tri-*sec*-butylborohydride (L-Selectride, 4 mmol) in tetrahydrofuran (15 ml). The mixture was stirred overnight, then evaporated, and the residue chromatographed on silica gel eluting with light petroleum–ether (1:4) to give a mixture (0.84 g) of the D-*ido*-isomer (**11**) and the D-*gulo*-isomer (**6**) in a ratio (n.m.r.) of 4:1. Fractional crystallisation of the mixture from dichloromethane–ether gave pure D-*ido* isomer (**11**) (0.58 g, 58%), with properties as previously reported.[10]

1-(2,4-*Dinitrophenyl*)-3-(2,3,5-*tri*-O-*acetyl*-β-D-*xylofuranosyl*)*pyrazole* (**15**).—A solution of methanesulphonate (**14**)[10] (2.0 g) in methanol (50 ml) containing concentrated hydrochloric acid (1 ml) was heated under reflux overnight. Evaporation gave a yellow syrup, to which was added pyridine (15 ml) and acetic anhydride (8 ml). The mixture was left to stand overnight, poured onto crushed ice, and partitioned between water and dichloromethane. Evaporation of the dried organic layer gave a yellow syrup which was chromatographed on silica eluting with light petroleum–ether (1:2) to give the *triacetate* (**15**) (1.40 g, 77%) as a yellow oil, $[\alpha]_D$ − 16.2° (*c* 0.68 in $CHCl_3$); $\nu_{max.}$(film) 1 750 (C=O), 1 540 cm^{-1}; δ_H (200 MHz; $CDCl_3$) 2.05, 2.08, 2.12 (each 3 H, s, COMe), 4.29 (2 H, m, 5′-H_2), 4.49 (1 H, m, 4′-H), 4.99 (1 H, d, *J* 3.7 Hz, 1′-H), 5.36 (1 H, dd, *J* 3.65, 1.85 Hz, 2′-H), 5.39 (1 H, dd, *J* 4.1, 1.8 Hz, 3′-H), 6.65 (1 H, d, *J* 2.65 Hz, 4-H), 7.76 (1 H, d, *J* 2.61 Hz, 5-H), 7.82 (1 H, d, *J* 8.9 Hz, 6″-H), 8.49 (1 H, dd, *J* 8.9, 2.5 Hz, 5″-H), and 8.64 (1 H, d, *J* 2.5 Hz, 3″-H) (Found: M^+ + 1, 493.1225. $C_{20}H_{21}N_4O_{11}$ requires *M* + 1, 493.1207).

1-(2,4-*Dinitrophenyl*)-4-*nitro*-3-(2,3,5-*tri*-O-*acetyl*-β-D-*xylofuranosyl*)*pyrazole* (**16**).—Trifluoroacetic anhydride (4 ml) was

added dropwise with stirring to an ice-cooled solution of the pyrazole (**15**) (5.0 g) and ammonium nitrate (0.7 g) in trifluoroacetic acid (25 ml). The mixture was allowed to warm to room temperature, and then stirred for 45 min, when t.l.c. indicated no residual starting material. The solution was partitioned between dichloromethane and water, and the aqueous layer extracted with additional dichloromethane. The organic layer was washed with aqueous sodium hydrogen carbonate, dried, and evaporated to give a yellow residue which was chromatographed on silica gel, eluting with light petroleum–ether (2:3) to give the *4-nitropyrazole* (**16**) (4.6 g, 85%) as a yellow oil, $[\alpha]_D$ + 24.6° (*c* 2.44 in $CHCl_3$); $\nu_{max.}$(film) 1 750 (CO), 1 550, and 1 350 cm^{-1} (CNO_2); δ_H (200 MHz; $CDCl_3$) 2.04, 2.09, and 2.11 (each 3 H, s, COMe), 4.27 (2 H, m, 5′-H), 4.49 (1 H, dt, *J* 7.0, 4.5 Hz, 4′-H), 5.42 (1 H, dd, *J* 4.4, 1.6 Hz, 3′-H), 5.44 (1 H, d, *J* 4.2 Hz, 1′-H), 5.49 (1 H, dd, *J* 4.4, 1.6 Hz, 2′-H), 7.85 (1 H, d, *J* 8.8 Hz, 6″-H), 8.61 (1 H, dd, *J* 8.8, 2.6 Hz, 5″-H), 8.62 (1 H, s, 5-H), and 8.80 (1 H, d, *J* 2.6 Hz, 3″-H) (Found: C, 44.7; H, 3.25; N, 13.15. $C_{20}H_{19}N_5O_{13}$ requires C, 44.69; H, 3.54; N, 13.04%).

4-*Nitro*-3(5)-(2,3,5-*tri*-O-*acetyl*-β-D-*xylofuranosyl*)*pyrazole* (**17**).—A solution of compound (**16**) (2.3 g) in methanol (15 ml) containing sodium methoxide [from sodium (0.4 g)] was left to stand at room temperature for 0.5 h. The solvent was evaporated and to the residue was added pyridine (10 ml) and acetic anhydride (5 ml). The mixture was left to stand overnight, poured onto ice, partitioned between water and dichloromethane, and the dried organic layer was evaporated. The residue was chromatographed on silica gel, eluting firstly with light petroleum–ether (10:1) to remove dinitroanisole, and then with ether to yield the *pyrazole* (**17**) (1.37 g, 86%) as a colourless oil, $[\alpha]_D$ + 84.2° (*c* 0.92 in $CHCl_3$); $\nu_{max.}$(film) 3 260 (NH), 1 750 (CO), 1 510, and 1 375 cm^{-1} (CNO_2); δ_H (200 MHz; $CDCl_3$) 1.92, 2.13, and 2.15 (each 3 H, s, COMe), 4.16 (1 H, dd, *J* 15, 8 Hz, 5′-H_a), 4.59 (2 H, m, 4′-H, 5′-H_b), 5.32 (1 H, dd, *J* 3, 1.2 Hz, 3′-H), 5.45 (1 H, t, *J* 2.2 Hz, 2′-H), 5.57 (1 H, d, *J* 2.2 Hz, 1′-H), and 8.15 (1 H, s, 5-H) (Found: M^+ + 1, 372.1039. $C_{14}H_{18}N_3O_9$ requires *M* + 1, 372.1043).

1,4-*Dinitro*-3-(2,3,5-*tri*-O-*acetyl*-β-D-*xylofuranosyl*)*pyrazole* (**18**).—A stirred solution of compound (**17**) (1.3 g) and ammonium nitrate (0.3 g) in trifluoroacetic acid (10 ml) was cooled in ice and trifluoroacetic anhydride (1.6 ml) was added dropwise. The solution was allowed to warm to room temperature, stirred for a further 0.5 h, then poured into ice–water and the mixture extracted immediately with dichloromethane. The dried organic extracts were evaporated and the residue chromatographed on silica gel eluting with light petroleum–ether (1:4) to give the *N-nitropyrazole* (**18**) (1.24 g, 85%) as a colourless oil, $[\alpha]_D$ −10.2° (*c* 3.14 in $CHCl_3$); ν_{max}(film) 1 750 (CO), 1 650 and 1 285 (NNO_2), and 1 525 and 1 280 cm^{-1} (CNO_2); δ_H (200 MHz; $CDCl_3$) 2.05 (3 H, s, Me), 2.09 (6 H, s, 2 × Me), 4.26 (2 H, m, 5′-H), 4.48 (1 H, m, 4′-H), 5.36 (1 H, dd, *J* 1.65, 4.1 Hz, 3′-H), 5.42 (1 H, d, *J* 3.7 Hz, 1′-H), 5.50 (1 H, dd, *J* 3.7, 1.65 Hz, 2′-H), and 9.05 (1 H, s, 5-H) (Found: M^+ + 1, 417.0891. $C_{14}H_{17}N_4O_{11}$ requires *M* + 1, 417.0893).

3(5)-*Cyano*-4-*nitro*-5(3)-(2,3,5-*tri*-O-*acetyl*-β-D-*xylofuranosyl*)*pyrazole* (**19**).—To a solution of potassium cyanide (1.5 g) in water (10 ml) and ethanol (10 ml), was added dropwise over a period of 5 min, a solution of the *N*-nitropyrazole (**18**) (1.2 g) in ethyl acetate (10 ml) and ethanol (10 ml). The resulting solution was left for a further 5 min, then neutralised with aqueous acetic acid (2M). To the neutral solution was added water (100 ml) and ethyl acetate (50 ml). The organic layer was separated and the aqueous layer repeatedly extracted with ethyl acetate until no product remained in the aqueous layer (by t.l.c.). The combined organic layers were dried, evaporated to dryness, and the resultant pale yellow oil was chromatographed on silica, eluting with light petroleum–ether (1:3) to give the *nitrocyano pyrazole* (**19**) (0.89 g, 78%) as a colourless oil, $[\alpha]_D$ +100.7° (*c* 1.39 in $CHCl_3$); $\nu_{max.}$(film) 3 200 (NH), 2 255 (CN), 1 750 (CO), and 1 520 and 1 370 cm^{-1} (CNO_2); δ_H (200 MHz; $CDCl_3$) 1.94, 2.17, and 2.18 (each 3 H, s, COMe), 4.12 (1 H, m, 5′-H_a), 4.66 (2 H, m, 4′-H, 5′-H_b), 5.33 (1 H, dd, *J* 3.0, 1.3 Hz, 3′-H), 5.44 (1 H, t, *J* 1.7 Hz, 2′-H), and 5.56 (1 H, d, *J* 1.7 Hz, 1′-H) (Found: M^+ + 1, 397.096 ± 0.004. $C_{15}H_{17}N_4O_9$ requires *M* + 1, 397.0995).

3-*Amino*-3(5)-*cyano*-5(3)-(2,3,5-*tri*-O-*acetyl*-β-D-*xylofuranosyl*)*pyrazole* (**20**).—A solution of the nitro compound (**19**) (0.85 g) in ethanol (30 ml) and acetic acid (0.1 ml) was hydrogenated using 10% palladium-on-charcoal as catalyst. The mixture was filtered through Celite, which was washed well with ethyl acetate. Evaporation and chromatography of the residue on silica, eluting with light petroleum–ether (1:3) gave the *amine* (**20**) (0.495 g, 63%), as a white solid, m.p. 84—86 °C, $[\alpha]_D$ −15.6° (*c* 0.27 in $CHCl_3$); $\nu_{max.}$(KBr) 3 220 (NH), 2 210 (C≡N), and 1 760 cm^{-1} (CO); δ_H (200 MHz; $CDCl_3$) 1.96, 2.13, and 2.18 (each 3 H, s, COMe), 3.93 (2 H, s, NH_2), 4.30 (1 H, dd, *J* 15, 8 Hz, 5′-H_a), 4.53 (2 H, m, 4′-H, 5′-H_b), 5.30 (2 H, m, 2′-H, 3′-H), and 5.36 (1 H, d, *J* 3.8 Hz, 1′-H) (Found: M^+, 366.118. $C_{15}H_{18}N_4O_7$ requires 366.1175).

7-*Amino*-3-(β-D-*xylofuranosyl*)*pyrazolo*[4,3-d]*pyrimidine* (**3**) (*Xyloformycin*).—A solution of aminopyrazole (**20**) (0.15 g) and formamidine acetate (0.5 g) in ethanol (20 ml) was heated under reflux for 2 h. Removal of the solvent and chromatography of the resultant pale yellow solid on silica gel eluting with ether–ethyl acetate (9:1) gave tri-*O*-acetylxyloformycin (**21**), which was dissolved in methanol (3 ml) containing sodium methoxide [from sodium (0.25 g)]. After 0.5 h, the solvent was evaporated, and the residue, in water (1 ml) was applied to a column of Dowex 50-X8 (H^+). The column was washed with water, and subsequent elution with dilute aqueous ammonia gave after evaporation a pale yellow solid. This was recrystallised from water to give *xyloformycin* (**3**) (0.079 g, 72%), as white crystals, m.p. 138—140 °C, $[\alpha]_D$ −97.8° (*c* 0.23 in water); $\nu_{max.}$(KBr) 3 400 (NH), 3 200 (OH), 1 655, and 1 560 cm^{-1}; δ_H (200 MHz; D_2O) 3.2—3.8 (3 H, m, 4′-H, 5′-H_2), 4.10 (1 H, m, 3′-H), 4.73 (1 H, m, 2′-H), 4.83 (1 H, br s, 1′-H), and 7.88 (1 H, s, 5-H); $\lambda_{max.}$(EtOH) 294 nm (ε 7 320); $\lambda_{max.}$ (in alkali) 303 (6 070) and 232 nm (12 950); $\lambda_{max.}$ (in acid) 296 (7 280) and 236 nm (6 030); *m/z* 267 (M^+, 7%), 192 (7), 178 (40), 164 [(Heterocycle + 30)$^+$, 100] (Found: M^+ 267.0974. $C_{10}H_{13}N_5O_4$ requires *M*, 267.0968).

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