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A NEW SYNTHETIC METHOD OF NITRO SUGARS

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Recently, the first member of nitro sugars has been encountered in Nature, i.e. evernitrose[1)], obtained as a hydrolytic fragment from everninomicin antibiotics. It has been found in our laboratory[2)], on the other hand, that some purine and pyrimidine bases can be introduced with surprising ease in the C-2 position of 3-deoxy-3-nitroglucopyranosides to afford a new type of nucleosides in excellent yields. These findings urged us to reexamine synthetic methods of nitro sugars not only in a pyranose series but in a furanose one. Up to the present, nitroalkane, inorganic nitrite and dinitrogen tetraoxide have been used as a vehicle for introducing the nitro group into sugars and cyclitols[3)]. In this paper, we wish to present the fourth route to nitro sugars, which consists of the DMSO oxidation of a hydroxyl group of sugars, followed by treatment with hydroxylamine, and then the oxidation of the resulting oxime by trifluoroperacetic acid, used by Emmons and Pagano[4)] for the preparation of aliphatic nitro compounds.

Treatment of 5-O-benzoyl-1,2-O-isopropylidene-3-oximino-α-D-*erythro*-pentofuranose (**1**) (5.0 g), $C_{15}H_{17}NO_6$[5)], m.p. 127-128°C and $[\alpha]_D^{20}$ +193° (c 1, $CHCl_3$), derived from 5-O-benzoyl-1,2-O-isopropylidene-α-D-*erythro*-pentos-3-ulofuranose[6)] in a 92 % yield, with a mixture of trifluoroacetic anhydride (5.84 ml) and 90 % hydrogen peroxide (0.92 ml) in acetonitrile (8.3 ml) in the presence of disodium hydrogen phosphate (13 g) and urea (0.34 g) at 60°C for 1 hr gave a

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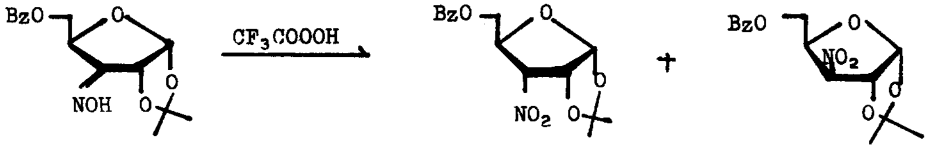
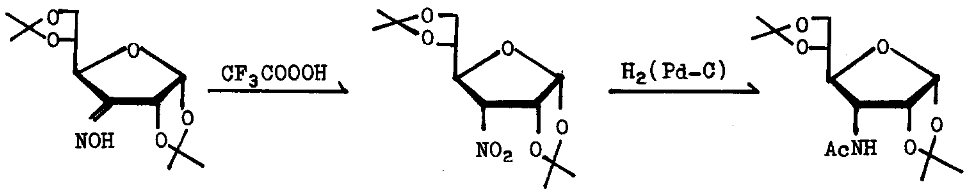
mixture of 3-nitro-D-ribo- and D-xylofuranose derivative (2 and 3, respectively) over 90 % yield, with a ratio of 2:1 on the basis of NMR spectra. Only the *xylo*-isomer 3 was isolated as a crystalline form from ethanol: $C_{15}H_{17}NO_7$ 5),



1 2 3

m.p. 84-86°C, $(\alpha)_D^{20}$ +9.7° (c 1, $CHCl_3$), R_f 7) 0.83, IR (KBr) $\nu_{as}NO_2$ 1550 cm^{-1}. On evaporation of the mother liquor was remained a sirupy material, almost consisted of the *ribo*-isomer 2 but inevitably contaminated with 3. All attempts to separate 2 in a pure form were unsuccessful even if a silica gel column chromatography was used with several solvent systems. The structure of 3 was deduced from its NMR spectrum (Fig. 1): The values of the coupling constants of the ring protons, $J_{2,3}$ ~0 and $J_{3,4}$ ~5.0 Hz, indicate proton H^3 to be orientated in *trans* to H^2 but in *cis* to H^4 on the furanose ring, so that 3 has a *xylo*-configuration 8).

Similarly, 1,2;5,6-di-O-isopropylidene-3-oximino-α-D-*ribo*-hexofuranose (4) 9) was oxidized below 5°C to afford in 75 % yield 3-deoxy-1,2;5,6-di-O-isopropylidene-3-nitro-α-D-allofuranose (5), $C_{12}H_{19}NO_7$ 5), m.p. 112-113°C, $(\alpha)_D^{20}$ +106° (c 1, $CHCl_3$), IR (KBr) $\nu_{as}NO_2$ 1565 cm^{-1}. The *allo*-configuration



4 5 6

Fig.1

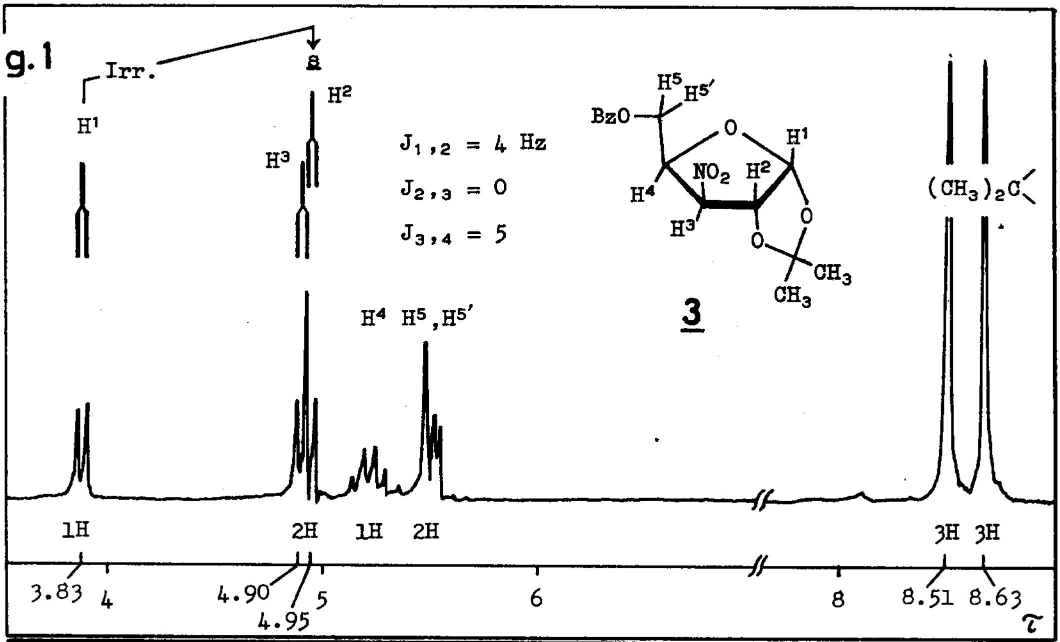
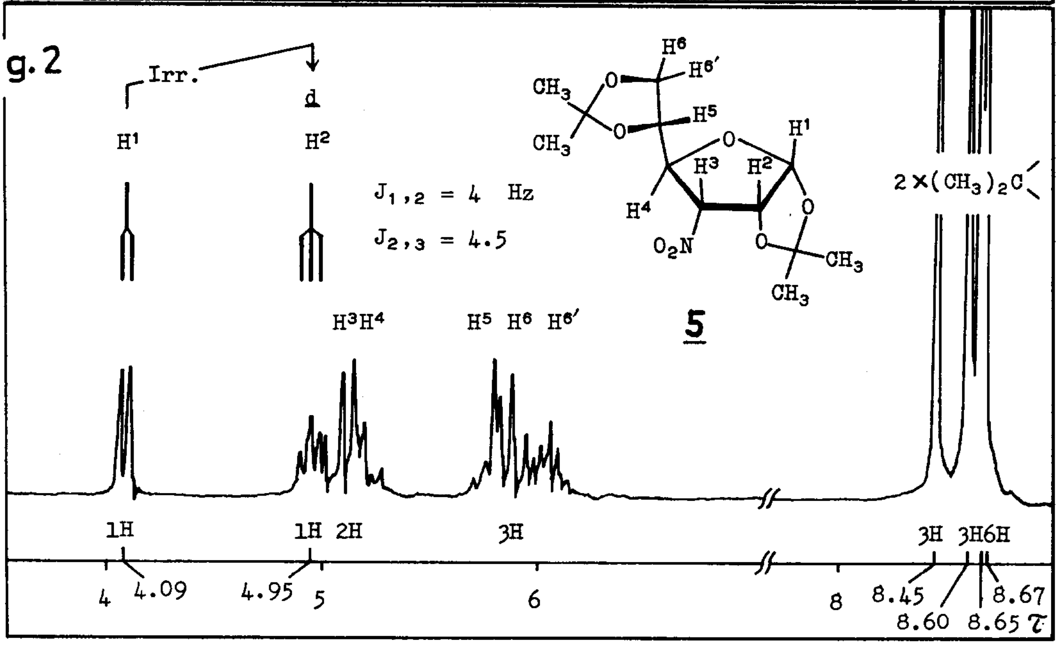


Fig.2



100 MHz NMR spectra of 5-O-benzoyl-3-deoxy-1,2-O-isopropylidene-3-nitro-α-D-xylofuranose (3) [Fig.1] and 3-deoxy-1,2;5,6-di-O-isopropylidene-3-nitro-α-D-allofuranose (5) [Fig.2] in $CDCl_3$ with a TMS internal standard.

of 4 was assigned on the basis of coupling constant, $J_{2,3}$ ∼4.5 Hz, and of a chemical identification: Compound 4 was hydrogenated and then N-acetylated to give 3-acetamido-3-deoxy-1,2;5,6-di-O-isopropylidene-α-D-allofuranose (6), which was identified by comparison of an authentic sample¹⁰⁾.

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