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Note

The synthesis of a derivative of L-decilonitrose (2,3,6-trideoxy-3-*C*-methyl-3-nitro-L-*ribo*-hexose)*

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L-Decilonitrose[2] (**1**, 2,3,6-trideoxy-3-*C*-methyl-3-nitro-L-*ribo*-hexose) is the latest methyl-branched nitro sugar to be found as an antibiotic component. Other members of this novel group of sugars are L-evernitrose[3] (**2**, from the everninomicins[4]), D-rubranitrose[5] (**3**, from rubradirin[6]), and D-kijanose[7] or D-tetronitrose[8] (**4**, from kijanimicin[7,9] and tetrocarcins A and B[10]). Syntheses of **2**[11,12], **3**[1,13], and a derivative of **4**[8,14] have been reported.

Decilonitrose (**1**) is a component of the new anthracycline antibiotics decilorubicin[15] and arugomycin[16] produced by *Streptomyces virginiae* MF-266-g4 and *Strept. violochromogenes* 1098-AV2, respectively. Methanolysis of decilorubicin yielded methyl β-L-decilonitropyranoside[2] (**5**) among the sugar components. The structure **5** was indicated initially by spectroscopic evidence and was confirmed subsequently by synthesis[2]. We have recently used methyl 3-acetamido-2,3,6-trideoxy-3-*C*-methyl-α-L-*ribo*-hexopyranoside (**6**) in syntheses of **7**[17], a derivative of 3-amino-2,3,6-trideoxy-3-*C*-methyl-L-*xylo*-hexose (the methyl-branched amino sugar[18] of antibiotic A35512B[19]), and L-rubranitrose[13] (the enantiomer of **3**). Interchange of the acetamido group at the tertiary centre of **6**[17] with a nitro group would transform **6** into methyl α-L-decilonitropyranoside (**9**), thus providing a useful, alternative route to a derivative of **1**. This was accomplished by *N*-deacetylation of **6** with calcium in liquid ammonia[20], and oxidation of the resulting amine **8** with *m*-chloroperoxybenzoic acid in boiling dichloromethane. Methyl α-L-decilonitropyranoside (**9**) was obtained crystalline in 31% yield from **6**. As in the synthesis of the β-anomer **5**[2], the oxidation step was less efficient than usual for this type of amine.

Such nitro sugars as **9** would be susceptible to base-catalysed epimerisation at C-3 and/or C-4 *via* a retro-Henry reaction and recyclisation. Although potassium

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[*] Branched-chain Sugars, Part XIX. For Part XVIII, see ref. 1.

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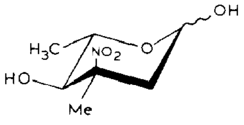

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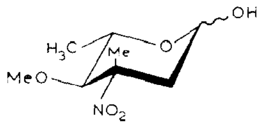

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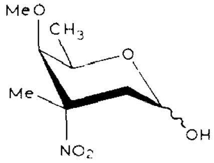

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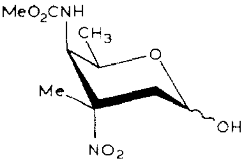

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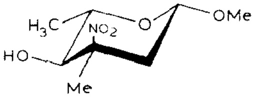

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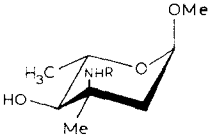
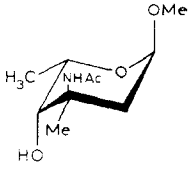


6 R = Ac
8 R = H



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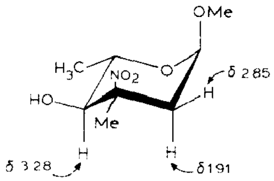

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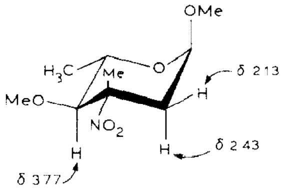

10

fluoride, a potential base[21], was used in excess during processing of the reaction mixture containing **9**, this seemed an acceptable risk in view of the virtual insolubility of potassium fluoride in the reaction medium. Nevertheless, we sought assurance for the L-*ribo* configuration of **9** from p.m.r. spectroscopy (see Experimental for details). The diaxial arrangement of H-4 and H-5 in **9** is guaranteed by the strong coupling ($J_{4,5}$ 9 Hz) observed between these protons. It is a characteristic feature that axial protons (H-2*a* and H-4) vicinal to equatorial 3-nitro groups in L-*arabino* analogues, such as **10**, are so deshielded that the H-2*a* signals resonate downfield from that of H-2*e*[11]. Comparison of the chemical shifts of these protons for **9**, **10**[11] (see formulae), and **5**[2] {δ 2.74 (H-2*e*), 1.77 (H-2*a*), and ~3.20 (H-4)} leaves no doubt that the 3-nitro group of **9** is disposed axially.

EXPERIMENTAL

General methods. — T.l.c. was performed on Kieselgel G, and detection was effected with 1% sulphuric acid. I.r. spectra were recorded for Nujol mulls with a Perkin–Elmer Model 298 spectrometer, and ^{1}H-n.m.r. spectra were recorded for solutions in deuteriochloroform (internal Me$_4$Si) by the Edinburgh University WH-360 NMR service. Optical rotations were measured with a Perkin–Elmer 141 automatic polarimeter, using 1-dm tubes. Melting points are uncorrected.

*Methyl 2,3,6-trideoxy-3-*C*-methyl-3-nitro-α-*L-ribo*-hexopyranoside (methyl α-*

L-*decilonitropyranoside*, **9**). — A solution of **6**[17] (0.22 g, 1 mmol) in 1,2-dimethoxyethane (10 mL) containing ethanol (0.2 mL) was added to refluxing liquid ammonia (80 mL), followed by calcium (0.298 g, 7.4 mg atom). The resulting solution was stirred under reflux for 4 h, and the excess of the reagent was then destroyed by the dropwise addition of ethanol. Chloroform (70 mL) was added to the stirred mixture followed, after 30 min, by water (4 mL). The excess of ammonia was allowed to evaporate, and the resulting mixture was stirred for a further 30 min, during which time a white precipitate was deposited. Solids were filtered off, and the filtrate was dried ($MgSO_4$) and concentrated under reduced pressure to give an oily residue (0.17 g) containing the amine **8**; t.l.c. (1:1 dichloromethane–acetone) revealed the absence of **6** and the presence of several minor impurities.

A solution of the foregoing oil (0.17 g) in dichloromethane (5 mL) was added to a boiling solution of *m*-chloroperoxybenzoic acid (85%; 1.27 g, 6.25 mmol) in dichloromethane (18 mL) during 15 min. The mixture was then boiled under reflux for a further 40 min, cooled, and stirred with activated potassium fluoride[22] (0.7 g, 12 mmol) at room temperature for 1 h to precipitate the excess of the oxidant and the acidic by-products. Solids were filtered off and washed with dichloromethane, and the filtrate and washings were concentrated under reduced pressure. Chromatography of the residue on silica gel (elution with 10:1 dichloromethane–acetone) gave **9** (64 mg, 31% from **6**), m.p. 101.5–103° (from hexane), $[\alpha]_D$ −172 ±3° (*c* 0.25, chloroform); ν_{max} 3500 (OH) and 1540 cm^{-1} (NO_2) (Found: C, 46.6; H, 7.3; N, 6.9. $C_8H_{15}NO_5$ calc.: C, 46.8; H, 7.4; N, 6.8%). ^{1}H-N.m.r. data: δ 4.60 (d, 1 H, H-1), 4.11 (dq, 1 H, $J_{4,5}$ 9.0, $J_{5,6}$ 6.25 Hz, H-5), ~3.28 (d, 1 H, H-4), 3.24 (s, 3 H, OMe), 2.85 (dd, 1 H, J_{gem} 15.1, $J_{1,2e}$ 1.2 Hz, H-2*e*), 1.91 (dd, 1 H, $J_{1,2a}$ 3.7 Hz, H-2*a*), 1.68 (s, 3 H, Me-3), and 1.34 (d, 3 H, Me-5); the assignments were confirmed by decoupling experiments.

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