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Note

A stereospecific synthesis of vinelose

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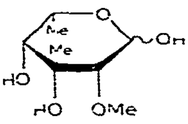
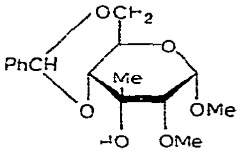
Two similar syntheses of vinelose[1] (**1**, 6-deoxy-3-*C*-methyl-2-*O*-methyl-L-talose), a component of the first branched-chain-sugar nucleotide to be discovered, have been reported[2]. We now report an easy synthesis of **1** in five steps from known[3] methyl 4,6-*O*-benzylidene-3-*C*-methyl-2-*O*-methyl-α-D-allopyranoside (**2**).



1



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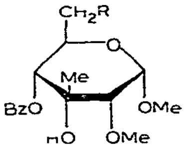
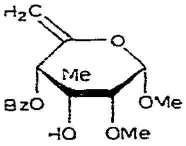


3 R = Br
6 R = H



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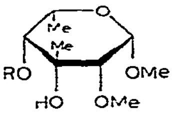

5 R = Bz
7 R = H

Treatment of **2** with 1.1 equiv. of *N*-bromosuccinimide in carbon tetrachloride afforded methyl 4-*O*-benzoyl-6-bromo-6-deoxy-3-*C*-methyl-2-*O*-methyl-α-D-allopyranoside (**3**, 98%). Dehydrobromination[4,5] of **3** in the presence of silver fluoride gave crystalline methyl 4-*O*-benzoyl-6-deoxy-3-*C*-methyl-2-*O*-methyl-α-D-*ribo*-hex-5-enopyranoside (**4**, 77%).

Hydrogenation of **4** in the presence of palladised charcoal afforded a mixture of **5** (85%) and **6** (15%), which could be easily separated by chromatography. When the hydrogenation was performed in the presence of Raney nickel **5** was obtained exclusively, and characterised[5] by its strongly deshielded ^{13}C-resonance for C-5 and the H-4 resonance (δ 5.95, bs). Compound **5** has the correct stereochemistry for transformation into vinelose (**1**). Thus, saponification of the benzoate group of **5** afforded **7** (96%) which, on acid hydrolysis gave **1** (71%), which was indistinguishable from naturally occurring vinelose.

EXPERIMENTAL

General. — Solutions were concentrated under diminished pressure. Organic solvents were dried with anhydrous sodium sulphate. Optical rotations were measured on solutions in $CHCl_3$ at room temperature. ^{1}H-N.m.r. spectra were recorded for solutions in $CDCl_3$ (internal Me_4Si) with a Varian T-60 spectrometer, and ^{13}C-n.m.r. spectra with a Bruker HX-90 F.T. spectrometer. Chromatography was performed on Silica Gel G (Merck). Melting points are uncorrected.

Methyl 4-O-benzoyl-6-bromo-6-deoxy-3-C-methyl-2-O-methyl-α-D-allopyranoside (**3**). — To a solution of methyl 4,6-*O*-benzylidene-3-*C*-methyl-2-*O*-methyl-α-D-allopyranoside (**2**, 9 g) in carbon tetrachloride (300 ml) were added *N*-bromosuccinimide (6 g, 1.1 equiv.) and barium carbonate (9 g). The mixture was boiled under reflux for 3 h, and then cooled, filtered, diluted with water, and extracted with dichloromethane. Concentration of the extract yielded **3** (11.4 g, 98%) which, after crystallisation from ether, had m.p. 139–141°, $[\alpha]_D$ +85°. ^{1}H-N.m.r. data: δ 8.06 and 7.50 (m, 5 H), 5.03 (d, 1 H, $J_{4,5}$ 10 Hz, H-4), 4.30 (m, H-5), 3.66 (bs, OH), 3.55 and 3.53 (2 s, 2 OMe), 3.53 (m, H-6,6′), 3.23 (d, $J_{1,2}$ 3 Hz, H-2), and 1.26 (s, Me-3).

Anal. Calc. for $C_{16}H_{21}BrO_6$: C, 49.37; H, 5.44; Br, 20.53. Found: C, 49.54; H, 5.60; Br, 20.33.

*Methyl 4-O-benzoyl-6-deoxy-3-C-methyl-2-O-methyl-α-D-*ribo*-hex-5-enopyranoside* (**4**). — To a solution of **3** (5 g) in pyridine (150 ml) was added silver fluoride (5 g). The mixture was stirred in the dark for 5 h and then diluted with dichloromethane (150 ml), filtered through Kieselguhr, and concentrated, to give **4** (3.65 g, 77%). Crystallisation from ethyl acetate–hexane gave material having m.p. 112–113°, $[\alpha]_D$ +126°. ^{1}H-N.m.r. data: δ 8.17 and 7.53 (2 m, 5 H), 5.43 (d, 1 H, $J_{4,6}$ 2 Hz, H-4), 5.07 (d, 1 H, $J_{1,2}$ 4 Hz, H-1), 4.77 (dd, 2 H, $J_{6,6}$ 9, $J_{6,4}$ = $J_{6',4}$ = 2 Hz, H-6,6′), 3.63 (s, OH), 3.52 (s, 6 H, 2 Me), 3.36 (d, 1 H, $J_{1,2}$ 4 Hz, H-2), and 1.31 (s, 3 H, Me-3). ^{13}C-N.m.r. data: δ 98.8 (C-1), 80.0 (C-2), 74.7 (C-3), 73.2 (C-4), 150.4 (C-5), 99.5 (C-6), 56.2 (OMe-1), 59.3 (OMe-2), and 21.0 (C-Me).

Anal. Calc. for $C_{16}H_{20}O_6$: C, 62.33; H, 6.54. Found: C, 62.53; H, 6.58.

Methyl 4-O-benzoyl-6-deoxy-3-C-methyl-2-O-methyl-β-L-talo- (**5**) *and -α-D-allo-pyranoside* (**6**). — (*a*) To a solution of **4** (500 mg) in methanol (100 ml) was added 10% palladium-on-carbon (150 mg), and the mixture was hydrogenated at normal pressure overnight, filtered through Kieslguhr, and concentrated. A solution of the residue in dichloromethane was washed with water and concentrated, and the syrupy product (380 mg, 75%) was chromatographed to give the major product **5** as a syrup (240 mg), $[\alpha]_D$ 0° ^{1}H-N m r data. δ 8 16 and 7 46 (2 m, 5 H), 4.95 (bs, 1 H, H-4), 4 55 (bs, 1 H, H-1), 3 60 (m, 1 H, H-5), 3 66 and 3 56 (2s, 6 H, 2 OMe), 3 13 (s, 1 H, H-2), 1 86 (bs, OH), 1 40 (s, Me-3), and 1 26 (d, $J_{5\,6}$ 7 Hz, Me-5) ^{13}C-N m r data δ 101 9 (C-1), 76 5 (C-2), 70 9 (C-3), 85 0 (C-4), 70 4 (C-5), 16 8 (C-6), 57 2 (MeO-1), 62 8 (MeO-2), and 21 9 (C-Me) + benzoate carbons

Anal Calc for $C_{16}H_{22}O_6$ C, 61 92, H, 7 14 Found C, 61 65, H, 7 00

The minor product **6** had m p 113–115°, $[\alpha]_D$ +101° ^{1}H-N m r data δ 7 90 and 7 33 (2 m, 5 H). 4 87 (d, 1 H. $J_{1\,2}$ 4 Hz, H-1), 4 76 (d 1 H, $J_{4\,5}$ 10 Hz, H-4), 4 16 (m, H-5), 3 76 (bs, OH), 3 43 and 3.40 (2 s, 2 OMe), 3 13 (d, 1 H. $J_{1\,2}$ 4 Hz. H-2), 1 23 (s, Me-3), and 1 20 (d, $J_{5\,6}$ 6 Hz, Me-5)

Anal. Found C, 61 70, H, 7 06

(*b*) To a solution of **4** (1 g) in ethanol (200 ml) was added freshly prepared Raney nickel (3 g), and the mixture was hydrogenated overnight and extracted as in (*a*) The product (0 93 g, 92%) consisted exclusively of **5**

*Methyl 6-deoxy-3-C-methyl-2-O-methyl-β-*L*-talopyranoside* (**7**) — A solution of **5** (1 3 g) in methanolic 0 1M sodium methoxide (100 ml) was stored at room temperature for 3 h. neutralised with Amberlite IR-50 (H^+) resin. and concentrated, to give syrupy **7** (0 9 g, 96%), $[\alpha]_D$ +86° ^{1}H-N m r data δ 4 33 (s, 1 H, H-1), 3 48 and 3 41 (2 s, 2 OMe), 3 08 (s, 1 H. H-2), 1 18 (s, Me-3), and 1 31 (d, $J_{5\,6}$ 6 Hz, Me-5)

Anal Calc for $C_9H_{18}O_5$ C, 52 41, H, 8 80 Found C, 52 21, H, 8 61

*6-Deoxy-3-C-methyl-2-O-methyl-*L*-talose* (*vinelose*, **1**) — To a solution of **7** (30 mg) in tetrahydrofuran (0 3 ml) was added 2M hydrochloric acid (1 ml), and the mixture was boiled under reflux for 3 h, neutralised ($BaCO_3$), filtered through Kieselguhr, and concentrated, to give **1** (20 mg, 71%), $[\alpha]_D$ +17° (lit ^{2} $[\alpha]_D^{24}$ +14°), which was indistinguishable from the naturally occurring substance on the basis of i r and mass spectra

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