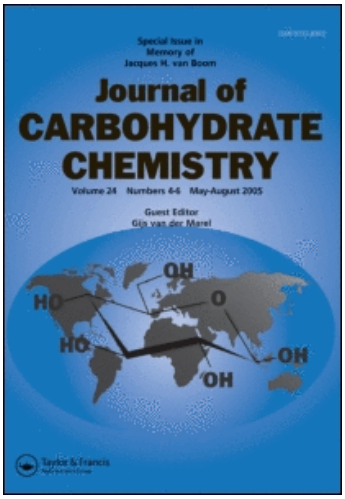

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SYNTHESIS OF 1- AND 3-*C*-(AMINOMETHYL)-1,2,3,4,5-CYCLOHEXANEPENTOLS FROM ( )-*epi*-QUERCITOL[1]

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SYNTHESIS OF 1- AND 3-*C*-(AMINOMETHYL)-1,2,3,4,5-CYCLOHEXANEPENTOLS FROM (+)-*epi*-QUERCITOL[1]

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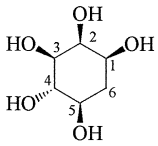
ABSTRACT

Oxidation of three di-*O*-isopropylidene derivatives **2a**—**4a**, newly derived from (+)-*epi*-quercitol (**1**), with acetic anhydride in DMSO gave the corresponding ketones **5**—**7**, which underwent aldol-type condensation with nitromethane under basic conditions to give selectively the protected derivatives **8a**—**10a** of *C*-nitromethyl-1,2,3,4,5-cyclohexanepentols, respectively. On treatment with diazomethane in DMSO, the ketones **6** and **7** gave single spiro epoxides **11** and **12**, the structures of which were confirmed by converting them into new *C*-(azidomethyl)cyclohexanepentols **16** and **17**. The nitro compounds were hydrogenated in the presence of Raney nickel to give the amines isolated as the *N*-acetyl derivatives. Deprotection gave three new 1- and 3-*C*-aminomethyldeoxyinositols **15c**—**17c**. The aminocyclitols obtained and their *N*-acetyl derivatives were assayed for inhibitory activity against examples of glycosidases.

INTRODUCTION

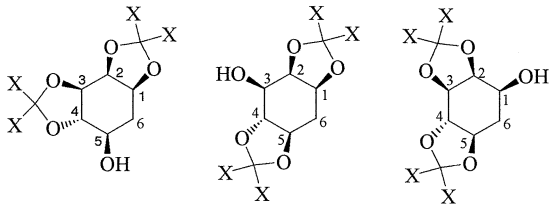
Very recently bioconversion[2] of *myo*-inositol has extensively been investigated to provide several so far inaccessible optically active deoxy derivatives (quercitols) and keto derivatives (dexyinososes) in quantity, which could allow us to apply them as starting materials for development of new biologically active cyclitol derivatives.

In a preceding paper[3] we reported a synthesis of several 1,2- and 2,3-anhydrodeoxyinositols, including a strong α-glucosidase inhibitor 1L-(1,2,4/3,5)-1,2-



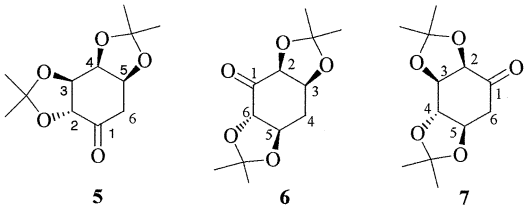
1

(+)-*epi*-Quercitol (1D-1,2,3,5/4-cyclohexanepentol)



2a,b **3a,b** **4a,b**

a: X = CH_3
b: X, X = C_6H_{10}



5 **6** **7**

Scheme 1.

anhydro-1,2,3,4,5-cyclohexanepentol, from (+)-*epi*- (1) and (−)-*vibo*-quercitol, and discussed the structure-activity relationship of inhibitors of this kind. In this paper we describe the use of selective protected inositols to obtain branched chain inositol derivatives with possible biological activity. Thus, the three different di-*O*-isopropylidene derivatives of **1** were first oxidized to afford new versatile deoxyinososе derivatives **5**—**7**, from which three new branched-chain deoxyinositol derivatives of biological interest were obtained through selective base-catalyzed aldol reaction with nitromethane. Alternatively, on treatment with diazomethane the ketones **6** and **7** afforded selectively two spiro epoxides **14** and **15**. Since newly 1-*C*-(aminomethyl)-1,2,3,4,5-cyclohexanepentols were found to be structurally related to the strong α-glucosidase inhibitor valiolamine,[4,5] biological assays for glycosidase inhibition were carried out here.

RESULTS AND DISCUSSION

Reaction of **1** with large excess of 2,2-dimethoxypropane (10 molar equiv) in DMF in the presence of *p*-toluenesulfonic acid for 6 h at room temperature gave,

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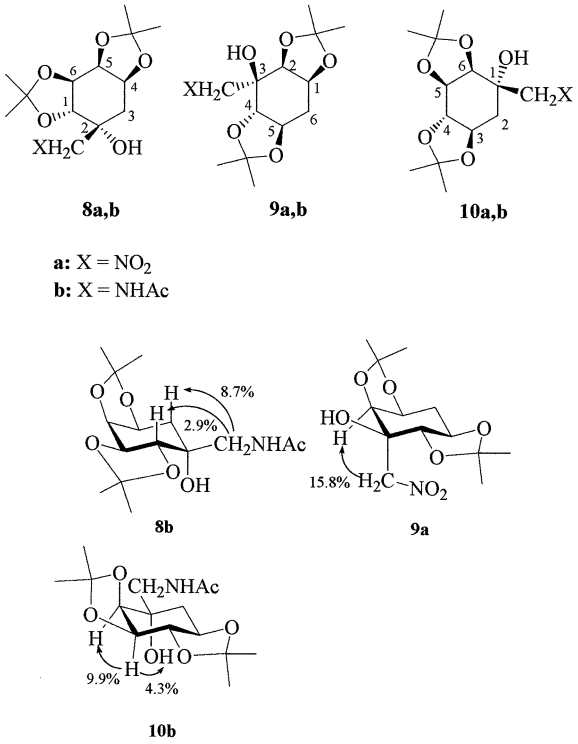
after fractionation over a silica gel column, the 1,2:3,4-, 1,2:4,5-. And 2,3:4,5-di-*O*-isopropylidene derivatives[6] (**2a**, **3a**, and **4a**) in about 22, 22, and 33% isolated yields, respectively, along with a small amount of a mixture of the mono-ketals. Similar isopropylidenation was later much improved by use of 2-methoxypropene (5 molar equiv), which resulted in shortening of the reaction time, complete conversion into the ketals, and easy separation of the products. Alternatively, on similar treatment with 1,1-dimethoxycyclohexane, **1** produced, after chromatography, the respective di-*O*-cyclohexylidene derivatives **2b**, **3b**, and **4b** in a yield of 22, 29, and 24%, respectively, together with a mixture of two mono-ketals. Since the compounds **2b**—**4a** could not be separated as easily as the isopropylidene derivatives **2a**—**4a**, the latter were chosen as the starting compounds for the present study.

Oxidation of **2a**—**4a** with acetic anhydride in DMSO smoothly gave rise to the respective ketones **5**, **6**, and **7** in 91, 70, and 96% yields, respectively. These compounds are shown to exist in keto form and can be expected to be versatile synthetic intermediates for development of a wide variety of deoxyinositol derivatives. Only compound **6** appeared as a somewhat broad-tailing spot on silica-gel TLC analysis.

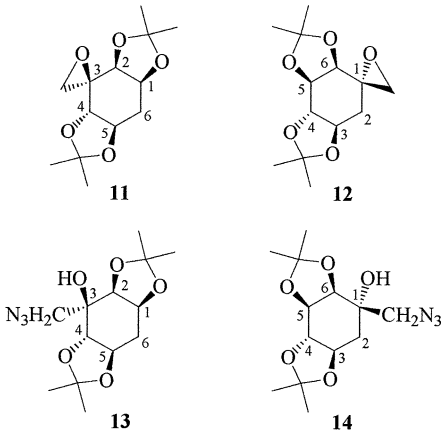
First in an attempt to obtain exo-methylene derivatives, the ketones were subjected to the Wittig reaction with bromotriphenylmethane in the presence of NaHMDS, but this was not successful.



Scheme 2.

Next, a base-catalyzed aldol condensation of **5**—**7** was investigated using an excess of nitromethane. The reaction proceeded selectively to give moderate yields of nitromethyl-branched derivatives **8a**, **9a**, and **10a** as single isomers. The reaction proceeded very slowly, being largely influenced by the kind of base catalyst. Compound **7** readily reacted in the presence of sodium methoxide in MeOH to give condensate **10a**, but difficulties were encountered with **5** and **6**. They only reacted in 1 M aqueous sodium hydroxide solution, giving **8a** and **9a**. Considering the ^{1}H NMR spectral data, the ketones **5**—**7** adopt somewhat distorted chair-conformations related to that of **1**. The selectivity of the aldol reaction seemed to be controlled by the steric hindrance exerted by 1,3-diaxial protons, rather than by the bulky isopropylidene groups which point away from the cyclose carbonyl group. The nitro compounds **8a**—**10a** were readily hydrogenated in ethanol containing acetic anhydride in the presence of Raney nickel catalyst being converted into the respective *N*-acetyl derivatives **8b**—**10b**. Compound **8a**, being contaminated with inseparable unknown side-products, was without isolation converted directly into **8b**. NOE experiments with **8b**, **9a**, and **10b** clearly established the structures as depicted in Scheme 2. A restricted rotation of the amido function was observed in the ^{1}H NMR spectrum for **9b**.

In the next reaction sequence, construction of spiro epoxides was carried out by exposing the ketones **5**—**7** to diazomethane in diethyl ether—DMSO. Two spiro epoxides **11** and **12** were obtained selectively in moderate yields[8] from **6** and **7**. Cleavage of the oxirane ring with an azide ion proceeded smoothly giving rise to the azidomethyl compounds **13** (50%) and **14** (65%), respectively, the structures of which were established on the basis of their ^{1}H NMR spectra, and also by comparison with those of corresponding **9a** and **10a**. The structures of **11** and **12** are shown in Scheme 3. Diazomethane added to the ketones **6** and **7** in a similar fashion as observed in the aldol reaction. Attempts were not made to iso-



Scheme 3.

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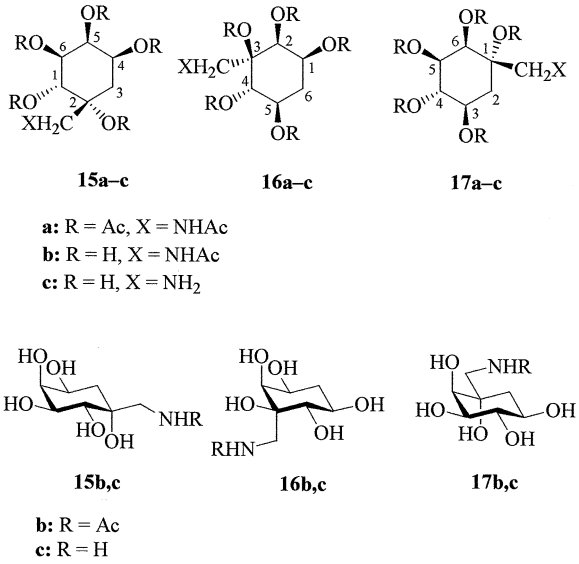

Scheme 4.

late the side-products, including ring-expansion products[9] likely to be formed in these reaction.

De-*O*-isopropylidenation of **8b—10b** with aqueous acetic acid, followed by conventional acetylation with acetic anhydride in pyridine, gave the corresponding hexa-*N*,*O*-acetyl derivatives **15a—17a**, the ^{1}H NMR spectra of which fully supported the assigned structures. In order ton assay the aminocyclitols thus obtained for glycosidase inhibitory activity, compounds **8b—10b** were transformed into their *N*-acetyl derivatives **15b—17b** and the free base **15c—17c**, respectively, in the usual manner.

BIOLOGICAL ASSAY

The *N*-acetyl derivatives and free bases **15b,c—17b,c** were assayed[10] for enzyme inhibitory activity (*I*%) against nine glycohydrolases: α-glucosidase (Baker's yeast), β-glucosidase (almonds), α-mannosidase (Jack beans), α-galactosidase (green coffee), β-galactosidase (bovine kidney), and α-L-fucosidase (bovine kidney), sucrase (rat small intestine),[11] and maltase (rat small intestine).[11] Since, as shown in conformation formulas, **17c** is a β-D-galactopyranose analogue of valiolamine,[4] and **15c** and **16c** are related to α- and β-D-galactopyranose-type cyclohexanepentols, they were expected to have some biological activity.[12] However, among them, only compounds **15b**,**c** showed inhibitory activity, very weak and limited to α-glucosidase and α-mannosidase (I = 20—30%, at 10^{-4} M).

EXPERIMENTAL

General Methods. Melting points: Mel-Temp capillary melting-point apparatus, uncorrected. Specific rotations: Jasco DIP-370 polarimeter, 1-dm cells. IR spectra: Jasco A-202 or FT-IR-200. ^{1}H NMR spectra: Jeol JNM GSX-270 f.t. (270 MHz) and Jeol Lambda-300 (300 MHz); solvent $CDCl_3$ internal standard tetramethylsiliane (TMS), D_2O external acetone. Mass spectra: positive-ion electrospray ionization on a Jasco GC-Mass GC-Mare. TLC: SilicaGel 60 GF (E. Merck, Darmstadt); detection by charring with concd H_2SO_4. Column chromatography: silica gel 60 K070 (Katayama Chemicals, Osaka), Wakogel C-33 (silica gel, 300 Mesh, Wako Chemical, Osaka), and Disogel sp-60 (silica gel, 60 mesh, Daiso, Osaka). Organic solutions, after drying with anhydrous Na_2SO_4, were concentrated $<50°C$ at diminished pressure. After being characterized by spectroscopic methods, the *N*-acetyl derivatives **15b—17b** and the free bases **15c—17c** were subjected directly to biological assay.[10,11]

1,2:3,4-Di-*O*-isopropylidene-(+)-*epi*-quercitol (2a), 1,2:4,5-di-*O*-isopropylidene-(+)-*epi*-quercitol (3a), and 2,3:4,5-di-*O*-isopropylidene-(+)-*epi*-quercitol (4a). a) To a solution of (+)-*epi*-quercitol[13] (**1**, 1.00 g, 6.10 mmol) in DMF (20 mL) were added in turn *p*-toluenesulfonic acid monohydrate (63 mg) and 2,2-dimethoxypropane (10 mL, 82 mmol), and the mixture was stirred for 6 h at room temperature. At that time, TLC showed formation of four components (R_F 0.41; chloroform/MeOH, 5:1; R_F 0.42, 0.45, and 0.51; butanone/toluene, 1:2), which were thought to correspond to one mono and three di-*O*-isopropylidene derivatives, respectively. After neutralization with triethylamine, the reaction mixture was concentrated and the residue was chromatographed on a silica gel column (70 g; acetone/toluene, 1:10) to give **2a** (263 mg, 22%), **3a** (275 mg, 22%), and **4a** (408 mg, 33%) as crystals, together with a homogenous mixture of *ca*. 1:2 mixture of two mono-*O*-isopropylidene derivatives.

b) When compound **1** (1.00 g, 6.10 mmol) was similarly treated with 2-methylpropene (2.93 mL, 30 mmol), the reaction was shown to reach equilibrium within 3 h. Silicagel chromatography of the products gave **2a** (439 mg, 30.4%), **3a** (402 mg, 29.4%), and **4a** (375 mg, 27.4%) as crystals.

2a: mp 124—126°C; $[\alpha]_D^{25}$ +26° (*c* 0.84, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.36, 1.45, 1.47, and 1.57 (4 s, each 3 H, 2 × CMe_2), 2.01 (ddd, $J_{1,6eq}$ = 6.8, $J_{5,6eq}$ = 3.4, J_{6gem} = 15.9 Hz, 1 H, 6eq-H), 2.17 (m, 1 H, 6ax-H), 2.42 (br s, 1 H, OH), 3.38 (dd, $J_{2,3}$ = 3.2, $J_{3,4}$ = 9.8 Hz, 1 H, 3-H), 4.06 (m, 1 H, 5-H), 4.06 (dd, $J_{4,5}$ = 7.3 Hz, 1 H, 4-H), 4.52 (dd, $J_{1,2}$ = 6.6 Hz, 1 H, 1-H), 4.52 (dd, 1 H, 2-H).

Anal. Calcd for $C_{12}H_{20}O_5$ (244.3): C, 59.00; H, 8.25. Found: C, 58.95; H, 8.19.

3a: mp 98—102°C; $[\alpha]_D^{17}$ −27° (*c* 1.0, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.36, 1.43, 1.47, and 1.54 (4 s, each 3 H, 2 × CMe_2), 1.66 (ddd, $J_{1,6ax}$ = 9.5, $J_{5,6ax}$ = 12.7, J_{6gem} = 12.7 Hz, 1 H, 6ax-H), 2.41 (ddd, $J_{1,6eq}$ = 6.8, $J_{5,6eq}$ = 3.7 Hz, 1 H, 6eq-H), 2.50 (br s, 1 H, OH), 3.29 (ddd, $J_{4,5}$ = 9.0 Hz, 1 H, 5-H), 3.77 (dd, $J_{3,4}$

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= 10.5 Hz, 1 H, 4-H), 3.95 (dd, $J_{2,3}$ = 4.2 Hz, 1 H, 3-H), 4.31 (ddd, $J_{1,2}$ = 4.2 Hz, 1 H, 1-H), 4.41 (dd, 1 H, 2-H).

Anal. Calcd for $C_{12}H_{20}O_5$ (244.3): C, 59.00; H, 8.25. Found: C, 58.93; H, 8.36.

4a: mp 116—117°C; $[\alpha]_D^{25}$ −15° (*c* 1.1, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ1.39, 1.40, 1.42, and 1,44 (4 s, each 3 H, 2 × CMe_2), 1.89 (ddd, $J_{1,6eq}$ = 5.6, $J_{5,6eq}$ = 5.4, J_{6gem} = 12.9 Hz, 1 H, 6eq-H), 2.36 (ddd, $J_{1,6x}$ = 6.1, $J_{5,6ax}$ = 6.8 Hz, 1 H, 6ax-H), 2.45 (br s, 1 H, OH), 3.44 (dd, $J_{1,2}$ = 10.0 Hz, 1 H, 1-H), 3.99 (dd, $J_{2,3}$ = 7.6 Hz, 1 h, 2-H), 4.10 (ddd, $J_{4,5}$ = 10.3 Hz, 1 H, 5-H), 4.27 (dd, $J_{3,4}$ = 11.2 Hz, 1 H, 4-H), 4.30 (dd, 1 H, 4-H).

Anal. Calcd for $C_{12}H_{20}O_5$ (244.3): C, 59.00; H, 8.25. Found: C, 58.29; H, 8.21.

1,2:3,4-Di-*O*-cyclohexylidene-(+)-*epi*-quercitol (2b), 1,2:4,5-di-*O*-cyclohexylidene-(+)-*epi*-quercitol (3b), and 2,3:4,5-di-*O*-cyclohexylidene-(+)-*epi*-quercitol (4b). To a solution of (+)-*epi*-quercitol[13] (**1**, 500 mg, 3.05 mmol) in DMF (10 mL) were added dimethoxycyclohexane (5.0 mL, 32.5 mmol) and *p*-toluenesulfonic acid monohydrate (60 mg), and the mixture was stirred for 6 h at room temperature. At that time, TLC revealed formation of one monoketal (R_F 0.47; chloroform/MeOH, 5:1), and three diketals (R_F 0.67, 0.59, and 0.53; butanone/toluene, 1:2). After neutralization with triethylamine, and the mixture was concentrated and the residue was chromatographed on a silica gel column (30 g, ethyl acetate/hexane, 1:5) to give **2b** (205 mg, 24%), **3b** (243 mg, 29%), and **4b** (177 mg, 21%) as crystals. Two monoketals were obtained as homogeneous white solids.

2b: mp 102—104°C; $[\alpha]_D^{22}$ −10° (*c* 1.0, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ?1.44—1.72 (m, 20 H, 6ax-H, 2 × C_6H_{10}), 2.37 (ddd, $J_{1,6eq}$ = 7.1, $J_{5,6eq}$ = 3.7, J_{6gem} = 12.0 Hz, 1 H, 6eq-H), 2.43—2.50 (m, 1 H, OH), 3.20 (ddd, $J_{4,5}$ = 9.0, $J_{5,6ax}$ = 13.2 Hz, 1 H, 5-H), 3.69 (dd, $J_{3,4}$ = 9.0 Hz, 1 H, 4-H), 3.80—3.92 (m, 1 H, 3-H), 4.23 (ddd, $J_{1,2}$ = 4.9, $J_{1,6ax}$ = 13.7 Hz, 1 H, 1-H), 4.34 (dd, $J_{2,3}$ = 4.9 Hz, 1 H, 2-H).

Anal. Calcd for $C_{18}H_{28}O_5$ (324.4): C, 66.64; H, 8.70. Found: C, 66.53; H, 8.65.

3b: mp 115—119°C; $[\alpha]_D^{22}$ +39° (c 1.1, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ1.51—1.77 (m, 20 H, 2 × C_6H_{10}), 1.96 (ddd, $J_{1,6ax}$= 6.8, $J_{5,6ax}$ = 12.7, J_{6gem} = 15.9 Hz, 1 H, 6ax-H), 2.16 (s, 1 H, OH), 3.29 (dd, $J_{2,3}$ = 3.2, $J_{3,4}$ = 9.8 Hz, 1 H, 3-H), 3.91—4.07 (m, 2 H, 4-H, 5-H), 4.45 (ddd, $J_{1,2}$ = 6.8, $J_{1,6eq}$ = 3.4, $J_{1,6ax}$ = 6.8 Hz, 1 H, 1-H), 4.48 (dd, 1 H, 2-H).

Anal. Calcd for $C_{18}H_{28}O_5$ (324.4): C, 66.64; H, 8.70. Found: C, 66.37; H, 8.61.

4b: mp 118—120°C; $[\alpha]_D^{20}$ +0.6° (*c* 1.2, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ1.51—1.80 (m, 20 H, 2 × C_6H_{10}), 1.89 (ddd, $J_{1,6ax}$ = 10.7, $J_{5,6ax}$ = 8.1, J_{6gem} = 13.2 Hz, 1 H, 6ax-H), 2.36 (ddd, $J_{1,6eq}$ = 6.1, $J_{5,6eq}$ = 8.1 Hz, 1 H, 6eq-H), 2.48—2.55 (m, 1 H, OH), 3.44 (ddd, $J_{1,2}$ = 10.0 Hz, 1 H, 1-H), 4.01 (dd, $J_{2,3}$ = 7.1 Hz, 1 H, 2-H), 2.05—4.14 (m, 1 H, 5-H), 4.23—4.32 (m, 2 H, 3-H, 4-H).

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Anal. Calcd for $C_{18}H_{28}O_5$ (324.4): C, 66.64; H, 8.70. Found: C, 66.67; H, 8.68.

(2*R*,3*S*,4*S*,5*S*)-2,3:4,5-Bis(isopropylidenedioxy)-1-cyclohexanone (5). To a solution of **2a** (150 mg, 0.61 mmol) in DMSO (4.5 mL) was added acetic anhydride (4.1 mL) at 10°C, and the mixture was stirred for 6 h at room temperature. TLC showed formation of a single product (R_F 0.71; butanone/toluene, 1:2). After treatment with methanol (4.1 mL), the mixture was concentrated. The residual syrup was diluted with ethyl acetate (30 mL), and the solution was washed thoroughly with water, dried, and concentrated. The residue was chromatographed on a silica gel column (18 g; acetone/toluene, 1:15) to give **5** (135 mg, 91%) as crystals: mp 130—132°C; $[\alpha]_D^{23}$ +56° (*c* 1.0, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ1.41 and 1,55 (2 s, each 3 H) and 1.49 (s, 6 H) (2 × CMe_2), 2.55 (dd, $J_{5,6ax}$ = 3.9, J_{6gem} = 19.5 Hz, 1 H, 6ax-H), 2.85 (dd, $J_{5,6eq}$ = 2.6 Hz, 1 H, 6eq-H), 3.80 (dd, $J_{2,3}$ = 11.2, $J_{3,4}$ = 3.4 Hz, 1 H, 3-H), 4.58 (d, 1 H, 2-H), 4.70 (ddd, $J_{4,5}$ = 7.3 Hz, 1 H, 5-H), 4.77 (dd, 1 H, 4-H).

Anal. Calcd for $C_{12}H_{18}O_5$ (242.3): C, 59.49; H, 7.49. Found: C, 59.49; H, 7.50.

(2*S*,3*S*,5*R*,6*S*)-2,3:5,6-Bis(isopropylidenedioxy)-1-cyclohexanone (6). To a solution of **3a** (800 mg, 3.27 mmol) in DMSO (24 mL) was added acetic anhydride (22 mL) at 10°C, and the mixture was stirred for 5.5 h at room temperature. TLC showed formation of a single product (R_F 0.65; butanone/toluene, 1:2). The mixture was processed as in the preparation of **5**, and the residue was chromatographed on a silica gel column (30 g; acetone/toluene, 1:15) to give **6** (533 mg, 70%) as crystals: mp 93—94°C; $[\alpha]_D^{22}$ −50° (*c* 1.1, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.35, 1.46, 1.50, and 1.58 (4 s, each 3 H, 2 × CMe_2), 2.03 (ddd, $J_{3,4ax}$ = 7.8, $J_{4ax,5}$ = 12.7, J_{4gem} = 12.5 Hz, 1 H, 4ax-H), 2.71 (ddd, $J_{3,4eq}$ = 7.6, $J_{4eq,5}$ = 4.2 Hz, 1 H, 4eq-H), 3.64 (ddd, $J_{5,6}$ = 10.7 Hz, 1 H, 5-H), 4.28 (d, $J_{2,3}$ = 5.1 H, 1 H, 2-H), 4.55 (ddd, 1 H, 3-H), 4.64 (d, 1 H, 6-H).

Anal. Calcd for $C_{12}H_{18}O_5$ (242.3): C, 59.49; H, 7.49. Found: C, 59.51; H, 7.40.

(2*R*,3*R*,4*S*,5*R*)-2,3:4,5-Bis(isopropylidenedioxy)-1-cyclohexanone (7). To a solution of **4a** (1.50 g, 6.14 mmol) in DMSO (45 mL) was added acetic anhydride (41 mL) at 10°C, and the mixture was stirred for 6 h at room temperature. TLC showed formation of a single product (R_F 0.67; butanone/toluene, 1:2). The mixture was processed similarly as in the preparation of **5**. The residue was chromatogeraphed on a silica gel column (30 g; ethyl acetate/hexane, 1:5) to give **7** (1.42 g, 96%) as crystals: mp 129—130°C; $[\alpha]_D^{27}$ −77° (*c* 1.0, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.39, 1.47, 1.49, and 1.51 (4 s, each 3 H, 2 × CMe_2), 2.49 (dd, $J_{5,6ax}$ = 11.0, J_{6gem} = 18.1 Hz, 1 H, 6ax-H), 3.00 (dd, $J_{5,6eq}$ = 7.1 Hz, 1 H, 6eq-H), 3.57 (dd, $J_{3,4}$ = 7.6, $J_{4,5}$ = 10.3 Hz, 1 H, 4-H), 4.13 (ddd, 1 H, 5-H), 4.49 (d, $J_{2,3}$ = 8.5 Hz, 1 H, 2-H), 4.65 (dd, 1 H, 3-H).

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Anal. Calcd for $C_{12}H_{18}O_5$ (242.3): C, 59.49; H, 7.49. Found: C, 59.20; H, 7.43.

3-Deoxy-1,6:4,5-di-*O*-isopropylidene-2-nitromethyl-L-*neo*-inositol (8a) and 2-(Acetamidomethyl)-3-deoxy-1,6:4,5-di-*O*-isopropylidene-L-*neo*-inositol (8b). To a solution of **5** (100 mg, 0.410 mmol) in nitromethane (2 mL) was added aqueous 1 M sodium hydroxide (0.4 mL), and the mixture was stirred for 4 days at room temperature. After neutralization with Amberlite IR-120B (H^+) resin, the mixture was concentrated. The residue was diluted with ethyl acetate, and the solution was washed thoroughly with aqueous sodium chloride, dried, and concentrated. The residue was chromatographed on a silica gel column (14 g; ethyl acetate/hexane, 1:7) to give a mixture of products. The mixture composed of **8a** as a major product was, without further isolation, hydrogenated in ethanol (2 mL) containing acetic anhydride (0.03 mL) in the presence of Raney nickel T-4 for 2 h at room temperature. The catalyst was removed by filtration and the filtrate was concentrated to dryness. The residue was treated with acetic anhydride (0.25 mL) in pyridine (0.5 mL) overnight at room temperature. After treatment with a small amount of methanol, the mixture was concentrated. The residue was chromatographed on a silica gel column (6 g; acetone/toluene, 1:1) to give **8b** (32 mg, 25%) as a syrup: TLC (chloroform/MeOH, 1:1) R_F 0.54; IR (neat) 1650, 1555 (amide) cm^{-1}; $[\alpha]_D^{21}$ −29° (*c* 1.4, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ 1.35, 1.46, 1.47, and 1.56 (4 s, each 3 H, 2 × CMe_2), 1.61 (dd, $J_{3ax,4}$ = 3.7, J_{3gem} = 15.9 Hz, 1 H, 3ax-H), 2.01 (s, 3 H, NAc), 2.19 (dd, $J_{3eq,4}$ = 3.2 Hz, 1 H, 3eq-H), 3.42 (d, $J_{7,NH}$ = 5.6 Hz, 2 H, CH_2NHAc), 3.82 (dd, $J_{1,6}$ = 10.3, $J_{5,6}$ = 3.4 Hz, 1 H, 6-H), 3.94 (d, 1 H, 1-H), 4.52 (ddd, $J_{4,5}$ = 7.3 H, 1 H, 4-H), 4.59 (dd, 1 H, 5-H), 6.13 (br d, 1 H, NH).

Anal. Calcd for $C_{15}H_{25}NO_6$ (315.4): C, 57.13; H, 7.99; N, 4.44. Found: C, 57.06; H, 7.95; N, 4.37.

6-Deoxy-1,2:4,5-di-*O*-isopropylidene-1-nitromethyl-D-*myo*-inositol (9a). A solution of **6** (50 mg, 0.20 mmol) in nitromethane (1 mL) was treated with aqueous 1 M sodium hydroxide (0.4 mL) for 3 days at room temperature. After neutralization, the mixture was processed as in the preparation of **8a**. The product was chromatographed on a silica gel column (8 g; ethyl acetate/hexane, 1:15) to give **9a** (45 mg, 73%) as a syrup: TLC (butanone/toluene, 1:2) R_F 0.71; $[\alpha]_D^{23}$ −5.5° (c 1.4, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ 1.33, 1.41, 1.43, and 1.48 (4 s, each 3 H, 2 × CMe_2), 1.68 (ddd, $J_{1,6ax}$ = 9.5, $J_{5,6ax}$ = 12.9, J_{6gem} = 11.7 Hz, 1 H, 6ax-H), 2.47 (ddd, $J_{1,6eq}$ = 7.1, $J_{5,6eq}$ = 3.7, 1 H, 6eq-H), 3.28 (s, 1 H, OH), 3.55 (d, $J_{4,5}$ = 9.0 Hz, 1 H, 4-H), 3.91 (ddd, 1 H, 5-H), 4.23 (d, $J_{1,2}$ = 4.9 Hz, 1 H, 2-H), 4.42 (dd, 1 H, 1-H), 4.72 and 4.80 (ABq, J_{gem} = 12.6 Hz, CH_2NO_2).

Anal. Calcd for $C_{13}H_{21}NO_7$ (303.3): C, 51.48; H, 6.98; N, 4.62. Found: C, 51.65; H, 7.00; N, 4.69.

1-(Acetamidomethyl)-6-deoxy-1,2:4,5-di-*O*-isopropylidene-D-*myo*-inositol (9b). A solution of **9a** (86 mg, 0.28 mmol) in ethanol (8 mL) containing acetic

anhydride (0.054 mL, 0.57 mmol) was stirred under an atmospheric pressure of hydrogen in the presence of Raney nickel T-4 for 3.5 h at room temperature. The reaction mixture was filtered to remove catalyst and the filtrate was concentrated. The residue was chromatographed on a silica gel column (6.5 g; acetone/toluene, 1:5) to give **9b** (64 mg, 71%) as a syrup: TLC (butanone/toluene, 1:1) R_F 0.49; IR (neat) 1655, 1555 (amide) cm^{-1}; $[\alpha]_D^{22}$ −3.9° (*c* 1.3, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ 1.33, 1.43, 1.46, and 1.48 (4 s, each 3 H, 2 × CMe_2), 1.61 (ddd, $J_{1,6ax}$ = 9.5, $J_{5,6ax}$ = 12.7, J_{6gem} = 11.7 Hz, 1 H, 6ax-H), 2.05 (s, 3 H, NAc), 2.45 (ddd, $J_{1,6eq}$ = 7.1, $J_{5,6eq}$ = 3.8 Hz, 1 H, 6eq-H), 3.53 (d, $J_{4,5}$ = 9.8 Hz, 1 H, 4-H), 3.55 (dd, $J_{7a,NH}$ = 6.8, J_{7gem} = 14.4 Hz, 1 H) and 3.77 (dd, $J_{7b,NH}$ = 5.1 Hz, 1 H) (C*H*$_2$NHAc), 3.91 (ddd, 1 H, 5-H), 4.04 (d, $J_{1,2}$ = 4.9 Hz, 1 H, 2-H), 4.07 (s, 1 H, OH), 4.41 (ddd, 1 H, 1-H), 6.06 (dd, 1 H, NH).

Anal. Calcd for $C_{15}H_{25}NO_6$ (315.4): C, 57.13; H, 7.99; N, 4.44. Found: C, 56.88; H, 7.97; N, 4.33.

2-Deoxy-3,4:5,6-di-*O*-isopropylidene-1-nitromethyl-D-*chiro*-inositol (10a). A solution of **7** (50 mg, 0.20 mmol) in nitromethane (1 mL) was treated with methanolic 1 M sodium methoxide (0.8 mL) for 5 days at room temperature. After neutralization, the mixture was processed as in the preparation of **8a** and the product was chromatographed on a silica gel column (9 g; acetone/toluene, 1:20) to give **10a** (49 mg, 79%) as a syrup: TLC (acetone/toluene, 1:5) R_F = 0.40; $[\alpha]_D^{23}$ +35° (*c* 1.0, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ 1.26 and 1.44 (2 s, each 3 H) and 1.37 (s, 6 H) (2 × CMe_2), 1.68 (dd, $J_{2ax,3}$ = 12.2, J_{2gem} = 12.2 Hz, 1 H, 2ax-H), 2.14 (dd, $J_{2eq,3}$ = 3.4 Hz, 1 H, 2eq-H), 3.42 (dd, $J_{3,4}$ = 9.5, $J_{4,5}$ = 9.3 Hz, 1 H, 4-H), 3.61 (s, 1 H, OH), 3.74 (ddd, 1 H, 3-H), 4.10 (d, $J_{5,6}$ = 5.1 H, 1 H, 6-H), 4.32 (dd, 1 H, 5-H), 4.49 and 4.65 (ABq, J_{gem} = 13.4 Hz, C*H*$_2$NO$_2$).

Anal. Calcd for $C_{13}H_{21}NO_7$ (303.3): C, 51.48; H, 6.98; N, 4.62. Found: C, 51.17; H, 6.91; N, 4.79.

1-(Acetamidomethyl)-2-deoxy-2,3:4,5-di-*O*-isopropylidene-D-*chiro*-inositol (10b). A solution of **10a** (223 mg, 0.73 mmol) in ethanol (20 mL) containing acetic anhydride (0.14 mL, 1.5 mmol) was stirred under an atmospheric pressure of hydrogen in the presence of Raney nickel T-4 for 3.5 h at room temperature. The reaction mixture was filtered to remove the catalyst and the filtrate was concentrated. The residue was chromatograped on a silica gel column (25 g; acetone/toluene, 1:5) to give **10b** (147 mg, 63%) as a syrup: TLC (butanone/toluene, 1:1) R_F 0.28; IR (neat) 1650, 1555 (amide) cm^{-1}; $[\alpha]_D^{22}$ −33° (*c* 1.1, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ 1.39 (s, 6 H), 1.33 and 1.48 (2 s, each 3 H) (2 × CMe_2), 1.45—1.65 (m, 1 H, 2ax-H), 2.00—2.20 (m, 1 H, 2eq-H), 2.04 (s, 3 H, NAc), 3.42 (dd, $J_{3,4}$ = 9.3, $J_{4,5}$ = 9.3 Hz, 1 H, 4-H), 3.30 and 3.65 (2 dd, $J_{7,NH}$ = 14.5, J_{7gem} = 14.5 Hz, each 1 H, C*H*$_2$NHAc), 3.77 (ddd, $J_{2ax,3}$ = 12.0, $J_{2eq,3}$ = 3.7, $J_{3,4}$ = 9.3 Hz, 1 H, 3-H), 4.04 (d, $J_{5,6}$ = 4.6 Hz, 1 H, 6-H), 4.32 (dd, 1 H, 3-H), 5.01 (s, 1 H, OH), 6.05 (br d, 1 H, NH).

Anal. Calcd for $C_{13}H_{21}NO_7$ (303.3): C, 51.48; H, 6.98; N, 4.62. Found: C, 57.15; H, 7.99; N, 4.29.

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3,7-Anhydro-6-deoxy-3-(hydroxymethyl)-1,2:4,5-di-*O*-isopropylidene-D-*myo*-inositol (11). To a solution of **6** (220 mg, 0.90 mmol) in DMSO (2.5 mL) was added dropwise 0.8 M diazomethane etherate, prepared by treatment of 1-methyl-3-nitro-1-nitrosoguanidine with aqueous 40% KOH/diethyl ethyl, at 10°C until the mixture turned yellow. The reaction mixture was stirred for 4 days at room temperature, and then the excess reagent was decomposed with acetic acid. After neutralization with triethylamine, the mixture was dissolved in water (20 mL) and the solution was extracted with diethyl ether (3 × 40 mL). The extracts were concentrated to dryness. TLC showed formation of a single compound (R_F 0.64; acetone/toluene, 1:4). The residue was chromatographed on a silica gel column (20 g; acetone/hexane, 1:30) to give **11** (126 mg, 55%) as a white solid: $[\alpha]_D^{18}$ −31° (*c* 1.2, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.25, 1.34, 1.39, and 1.52 (4 s, each 3 H, 2 × CMe_2), 1.68 (dd, $J_{1,6ax}$ = 3.9, $J_{5,6ax}$ = 12.7, J_{6gem} = 12.0 Hz, 1 H, 6ax-H), 2.54 (ddd, $J_{1,6eq}$ = 7.3, $J_{5,6eq}$ = 3.7 Hz, 1 H, 6eq-H), 2.87 and 3.03 (ABq, J_{gem} = 4.9 Hz, CH_2O), 3.62 (d, $J_{1,2}$ = 5.1 Hz, 1 H, 2-H), 3.69 (ddd, $J_{4,5}$ = 9.5 Hz, 1 H, 5-H), 3.96 (d, 1 H, 4-H), 4.40 (ddd, 1 H, 1-H). HRMS (EI) Calcd for $C_{13}H_{20}O_5$ (M^+): 256.1311. Found: 256.1295.

1,7-Anydro-2-deoxy-1-(hydroxymethyl)-3,4:5,6-di-*O*-isopropylidene-D-*chiro*-inositol (12). To a solution of **7** (250 mg, 1.03 mmol) in DMSO (3.5 mL) was added *ca.* 0.8 M diazomethane etherate at 10°C until the mixture turned yellow. The reaction mixture was processed as in the preparation of **11**. TLC showed formation of a single compound (R_F 0.74; acetone/toluene, 1:4). The product was purified by chromatography on silica gel (20 g; ethyl acetate/toluene, 1:30) to give **12** (109 mg, 41%) as a white solid: $[\alpha]_D^{18}$ −19° (*c* 1.2, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.30, 1.41, 1.42, and 1.51 (4 s, each 3 H, 2 × CMe_2), 1.71 (dd, $J_{2eq,3}$ = 3.9, J_{2gem} = 13.0 Hz, 1 H, 2eq-H), 2.26 (dd, $J_{2ax,3}$ = 12.5 Hz, 1 H, 2ax-H), 2.79 and 2.92 (ABq, J_{gem} = 4.5 Hz, CH_2O), 3.55 (dd, $J_{3,4}$ = 9.2, $J_{4,5}$ = 8.6 Hz, 1 H, 4-H), 3.66 (d, $J_{5,6}$ = 5.9 Hz, 1 H, 6-H), 3.63—3.74 (m, 1 H, 3-H), 4.33 (dd, 1 H, 5-H). HRMS (EI) Calcd for $C_{13}H_{21}N_3O_5$ (M^+): 255.1233. Found: 255.1209.

3-(Azidomethyl)-6-deoxy-1,2:4,5-di-*O*-isopropylidene-D-*myo*-inositol (13). A mixture of **11** (27 mg, 0.10 mmol), sodium azide (27 mg, 0.42 mmol), ammonium chloride (8 mg, 0.15 mmol), and DMF (0.5 mL) was stirred for 22 h at 60°C. At that time, TLC showed formation of a single product (R_F 0.61; acetone/toluene, 1:4). The reaction mixture was concentrated and the residue was dissolved in ethyl acetate (15 mL), and the solution was washed thoroughly with water, dried, and concentrated to dryness. The residue was chromatographed on a silica gel column (3 g; ethyl acetate/hexane, 1:10) to give **13** (24 mg, 76%) as a white solid: $[\alpha]_D^{21}$ +42° (*c* 1.2, $CHCl_3$); ^{1}H NMR (300 MHz, $CDCl_3$) δ 1.36, 1.41, 1.46, and 1.70 (4 s, each 3 H, 2 × CMe_2), 1.64 (dd, $J_{1,6ax}$ = 9.8, $J_{5,6ax}$ = 12.8, J_{6gem} = 13.9 Hz, 1 H, 6ax-H), 2.46 (br s, 1 H, OH), 2.46 (ddd, $J_{1,6eq}$ = 7.0, $J_{5,6eq}$ = 3.7 Hz, 1 H, 6eq-H), 3.53 (d, $J_{4,5}$ = 9.0 Hz, 1 H, 4-H), 3.56 and 3.62 (ABq, J_{gem} = 12.7 Hz, CH_2N_3), 3.87 (dd, 1 H, 5-H), 4.15 (d, $J_{1,2}$ = 4.6 Hz, 1 H, 2-H), 4.42 (ddd, 1 H, 1-H). ERMS (EI) Calcd for $C_{13}H_{21}N_3O_5$ (M^+): 299.1481. Found: 299.1471.

1-(Azidomethyl)-2-deoxy-3,4:5,6-di-*O*-isopropylidene-D-*chiro*-inositol (14). A mixture of **12** (31 mg, 0.12 mmol), sodium azide (39 mg, 0.61 mmol), ammonium chloride (13 mg, 0.24 mmol), and DMF (0.6 mL) was stirred for 3 days at 60°C. At that time, TLC showed formation of a single product (R_F 0.57; acetone/toluene, 1:5). The reaction mixture was processed as in the preparation of **13**, and the residual product was chromatographed on a silica gel column (3 g; ethyl acetate/hexane, 1:15) to give **14** (34 mg, 92%) as a white solid: $[\alpha]_D^{21}$ +2.1° (*c* 1.7, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ1.43 (s, 6 H), and 1.38 and 1.52 (2 s, each 3 H) (2 × CMe_2), 1.67 (dd, $J_{2ax,3}$ = 12.2, J_{2gem} = 12.5 Hz, 1 H, 2ax-H), 2.10 (dd, $J_{2eq,3}$ = 3.4 Hz, 1 H, 2eq-H), 2.47 (s, 1 H, OH), 3.48 (dd, $J_{3,4}$ = 9.5, $J_{4,5}$ = 8.8 Hz, 1 H, 4-H), 3.34 and 3.73 (ABq, J_{gem} = 12.2 Hz, CH_2N_3), 3.73—3.84 (m, 1 H, 3-H), 4.07 (d, $J_{5,6}$ = 4.9 Hz, 1 H, 6-H), 4.35 (dd, 1 H, 5-H). HRMS (EI) *m/z* Calcd for $C_{13}H_{20}N_3O_5$ (M −H): 298.1403; Found: 298.1406.

Hexa-*N*,*O*-acetyl-1-(aminomethyl)-3-deoxy-L-*neo*-inositol (15a). A solution of **8b** (30 mg, 0.095 mmol) in aqueous 80% acetic acid (1.3 mL) was stirred fro 3 h at 50°C, and then concentrated to dryness. The product was treated with acetic anhydride (0.12 mL) and pyridine (0.23 mL) in the presence of DMAP (3 mg) for 3 days at 50°C, and after routine processing the product was chromatographed on a silica gel column (5g; acetone/toluene, 1:5) to give **15a** (30 mg, 71%) as a syrup: TLC (butanone/toluene, 2:1) R_F 0.40: IR (neat) 1750 (CO), 1650, 1555 (amide) cm^{-1}; $[\alpha]_D^{20}$ +33° (*c* 1.5, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ 1.98, 1.99, 2.03, 2.11, 2.16, and 2.17 (6 s, each 3 H, NAc, 5 × OAc), 1.80—2.20 (m, 1 H, 3ax-H), 2.68 (dd, $J_{2,3eq}$ = 4.4, J_{3gem} = 14.4 Hz, 1 H, 3eq-H), 3.53 (dd, $J_{7a,NH}$ = 7.3, J_{7gem} = 14.7 Hz, 1 H) and 4.05 (dd, $J_{7b,NH}$ = 5.9 Hz, 1 H) (CH_2NHAc), 5.02 (ddd, $J_{3ax,4}$ = 12.5, $J_{3eq,4}$ = 4.4, $J_{4,5}$ = 2.7 Hz, 1 H, 4-H), 5.24—5.35 (m, 2 H, 1-H, 6-H), 5.57—5.35 (m, 1 H, 5-H), 6.43 (dd, 1 H, NH).

Anal. Calcd for $C_{19}H_{27}NO_{11}$ (445.4): C, 51.23; H, 6.11; N, 3.14. Found: C, 51.47; H, 6.22; N, 3.01.

Hexa-*N*,*O*-acetyl-3-(aminomethyl)-6-deoxy-D-*myo*-inositol (16a). A solution of **9b** (59 mg, 0.20 mmol) in aqueous 80% acetic acid (1.8 mL) was stirred for 2 h at 50°C, and then concentrated to dryness. The residue was acetylated in the preparation of **15a**, and the product was chromatographed on a silica gel column (8 g; acetone/toluene, 1:5) to give **16a** (55 mg, 66%) as a syrup: TLC (butanone/toluene, 2:1) R_F 0.59; IR (neat) 1750 (CO), 1680, 1520 (amide) cm^{-1}; $[\alpha]_D^{22}$ −52° (*c* 0.92, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ 1.85—2.23 (m, 2 H, 6,6-H_2), 1.90, 1.97, 2.04, 2.09, 2.14, and 2.23 (6 s, each 3 H, NAc, 5 × OAc), 3.16 (dd, $J_{7a,NH}$ = 2.4, J_{7gem} = 15.6 Hz, 1 H) and 4.26 (dd, $J_{7b,NH}$ = 10.3 HZ, 1 H) (CH_2NHAc), 5.05 (ddd, $J_{1,2}$ = 2.1, $J_{1,6ax}$ = 12.7, $J_{1,6eq}$ = 4.9 Hz, 1 H, 1-H), 5.18 (ddd, $J_{4,5}$ = 9.9, $J_{5,6ax}$ = 11.7, $J_{5,6eq}$ = 5.4 Hz, 1 H, 5-H), 5.44 (d, 1 H, 4-H), 5.82 (d, 1 H, 2-H), 6.67 (dd, 1 H, NH).

Anal. Calcd for $C_{19}H_{27}NO_{11}$ (445.4): C, 51.23; H, 6.11; N, 3.14. Found: C, 51.73; H, 6.12; N, 3.09.

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Hexa-[cf'1]*N*,*O*-acetyl-1-(aminomethyl)-2-deoxy-D-*chiro*-inositol (17a). A solution of **10b** (29 mg, 0.095 mmol) in aqueous 80% acetic acid (0.9 mL) was stirred for 3 h at 50°C, and then concentrated to dryness. The residue was acetylated as in the preparaion of **15a**, and the product was chromatographed on a silica gel column (4.5 g; acetone/hexane, 1:3) to give **17a** (36 mg, 85%) as a syrup: TLC (butanone/toluene, 2:1) R_F 0.40; IR (neat) 1750 (CO), 1650, 1555 (amide) cm^{-1}; $[\alpha]_D^{22}$ +14° (*c* 1.1, $CHCl_3$); ^1H NMR (300 MHz, $CDCl_3$) δ 1.83—2.00 (m, 1 H, 2ax-H), 1.56, 1.88, 1.91, 2.10, and 2.12 (6 s, each 3 H, NAc, 5 × OAc), 2.61 (dd, $J_{2eq,3}$ = 4.8, J_{2gem} = 13.9 Hz, 1 H, 2eq-H), 3.62—3.68 (m, 2 H, C*H*$_2$NHAc), 5.00 (ddd, $J_{2ax,3}$ = 12.0, $J_{3,4}$ = 10.0 Hz, 1 H, 3-H), 5.09 (dd, $J_{4,5}$ = 10.0, $J_{5,6}$ = 3.2 Hz, 1 H, 5-H), 5.31 (dd, 1 H, 4-H), 5.49 (d, 1 H, 6-H), 6.15 (dd, $J_{7a,NH}$ = 6.0, $J_{7b,NH}$ = 6.4 Hz, 1 H, NH). HRMS (EI) m/z Calcd for $C_{18}H_{23}NO_{11}$ (M $-CH_3$, $-H$): 429.1270; Found 429.1269.

2-(Acetamidomethyl)-3-deoxy-L-*neo*-inositol (15b). A solution of **8b** (25 mg, 0.080 mmol) in aqueous 80% acetic acid (0.75 mL) was stirred for 2 h at 50°C, and then concentrated to give **15b** (17 mg, 89%) as a white solid: TLC (1-butanol/acetic acid/H_2O, 3:1:1) R_F 0.35; IR (neat) 3410 (OH), 1655, 1565 (amide) cm^{-1}; $[\alpha]_D^{21}$ +41° (*c* 0.54, H_2O); ^1H NMR (300 MHz, D_2O) δ 1.52—1.68 (m, 2 H, 3,3-H_2), 1.87 (s, 3 H, Ac), 3.13 and 3.20 (ABq, J_{gem} = 14.3 Hz, C*H*$_2$NHAc), 3.39 (d, $J_{1,6}$ = 10.0 Hz, 1 H, 2-H), 3.57 (dd, $J_{5,6}$ = 3.0 Hz, 1 H, 6-H), 3.79 (ddd, $J_{3ax,4}$ = 8.6, $J_{3eq,4}$ = 8.3, $J_{4,5}$ = 2.7 Hz, 1 H, 4-H), 3.88 (dd, 1 H, 5-H).

3-(Acetamidomethyl)-6-deoxy-D-*myo*-inositol (16b). A solution of **9b** (18 mg, 0.058 mmol) in aqueous acetic acid 80% acetic acid (0.55 mL) was stirred for 1.5 h at 50°C, and then concentrated. The residue was chromatographed on a silica gel column (Disogel sp-60: 0.2 g; chloroform/MeOH, 3:1) to give **16b** (12 mg, 88%) as a white solid: TLC (1-butanol/acetic acid/H_2O, 3:1:1) R_F 0.37; IR (neat) 3380 (OH), 1635, 1560 (amide) cm^{-1}; $[\alpha]_D^{21}$ +22° (*c* 0.32, H_2O); ^1H NMR (300 MHz, D_2O) δ 1.54 (ddd, $J_{1,6ax}$ = 12.1, $J_{5,6ax}$ = 11.7, J_{6gem} = 12.0 Hz, 1 H, 6ax-H), 1.81—1.88 (m, 1 H, 6eq-H), 1.89 (s, 3 H, Ac), 3.30 and 3.42 (ABq, J_{gem} = 14.4 Hz, C*H*$_2$NHAc), 3.28 (d, $J_{4,5}$ = 4.9 Hz, 1 H, 4-H), 3.50 (d, $J_{1,2}$ = 3.2 Hz, 1 H, 2-H), 3.60 (ddd, $J_{5,6eq}$ = 4.9 Hz, 1 H, 5-H), 3.86 (ddd, 1 H, 3-H).

1-(Acetamidomethyl)-2-deoxy-D-*chiro*-inositol (17b). A solution of **10b** (21 mg, 0.065 mmol) in aqueous 80% acetic acid (0.62 mL) was stirred for 2 h at 50°C, and then concentrated. The residue was chromatographed on a silica gel column (Disogel sp-60: 0.2 g; chloroform/MeOH, 3:1) to give **17b** (14 mg, 90%) as a white solid: TLC (1-butanol/acetic acid/H_2O, 3:1:1) R_F 0.37; IR (neat) 3370 (OH), 1625, 1590 (amide) cm^{-1}; $[\alpha]_D^{21}$ +18° (*c* 0.47, H_2O): ^1H NMR (300 MHz, D_2O) δ 1.48 (dd, $J_{2ax,3}$ = 11.7, J_{2gem} = 13.6 Hz, 1 H, 2ax-H), 1.67 (dd, $J_{2eq,3}$ = 4.9 Hz, 1 H, 2eq-H), 1.88 (s, 3 H, Ac), 3.07 and 3.26 (ABq, J_{gem} = 13.8 Hz, C*H*$_2$NHAc), 3.36 (dd, $J_{3,4}$ = 9.3, $J_{4,5}$ = 9.8 Hz, 1 H, 4-H), 3.47—3.57 (m, 2 H, 3-H, 6-H), 3.59 (dd, $J_{5,6}$ = 3.4 Hz, 1 H, 5-H).

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2-(Aminomethyl)-3-deoxy-D-*neo*-inositol (15c). A solution of **8b** (36 mg, 0.11 mmol) and 2 M hydrochloric acid (1 mL) was stirred for 5 h at 80°C, and then concentrated. The product was chromatographed on a column of Dowex 50W 2 (H^+) resin (1 mL) with 1% aqueous ammonia to give **15c** (22 mg, ~100%) as a white powder: TLC (1-butanol/acetic acid/H_2O, 4:1:1, twice development) R_F 0.35; IR (neat) 3400 (OH), 1580 (amine) cm^{-1}; $[\alpha]_D^{20}$ +39° (*c* 0.55, H_2O); ^1H NMR (300 MHz, D_2O) δ 1.52—1.68 (m, 2 H, 3,3-H_2), 2.55 and 2.72 (ABq, J_{gem} = 13.6 Hz, CH_2NHAc), 3.43 (dd, $J_{1,6}$ = 13.4, $J_{5,6}$ = 9.8 Hz, 1 H, 6-H), 3.58 (dd, $J_{4,5}$ = 2.7 Hz, 1 H, 5-H), 3.82 (ddd, $J_{3ax,4}$ = 13.9, $J_{3eq,4}$ = 5.4 Hz, 1 H, 4-H), 3.87—3.92 (m, 1 H, 1-H).

3-(Aminomethyl)-6-deoxy-D-*myo*-inositol (16c). A solution of **9b** (30 mg, 0.094 mmol) and 2 M hydrochloric acid (1 mL) was stirred for 3 h at 80°C, and then concentrated. The product was chromatographed on a column of Dowex 50W 2 (H^+) resin (1 mL) with 1% aqueous ammonia to give **16c** (15 mg, 85%) as a white powder: TLC (1-butanol/acetic acid/H_2O, 4:1:1, twice development) R_F 0.34; IR (neat) 3350 (OH), 1580 (amine) cm^{-1}; $[\alpha]_D^{20}$ +1.8° (*c* 0.56, H_2O); ^1H NMR (300 MHz, D_2O) δ 1.54 (ddd, $J_{1,6ax}$ = 11.7, $J_{5,6ax}$ = 11.7, J_{6gem} = 12.2 Hz, 1 H, 6ax-H), 1.85 (ddd, $J_{1,6eq}$ = 5.4, $J_{5,6eq}$ = 4.6 Hz, 1 H, 6eq-H), 2.74 and 2.81 (ABq, J_{gem} = 13.9 Hz, CH_2NHAc), 3.28 (d, $J_{4,5}$ = 9.3 Hz, 1 H, 4-H), 3.52—3.67 (m, 2 H, 2-H, 5-H), 3.88 (ddd, $J_{1,2}$ = 2.9 Hz, 1 H, 1-H).

1-(Aminomethyl)-2-deoxy-D-*chiro*-inositol (17c). A solution of 10b (19 mg, 0.061 mmol) and 2 M hydrochloric acid (1 mL) was stirred for 9 h at 80°C, and then concentrated. The product was chromatographed on a column of Dowex 50W 2 (H+) resin (1 mL) with 1% aqueous ammonia to give 17c (12 mg, ~100%) as a white powder: TLC (1-butanol/acetic acid/H_2O, 4:1:1, twice development) R_F 0.25; IR (neat) 3350 (OH), 1575 (amine) cm^{-1}; $[\alpha]_D^{20}$ +7.1° (*c* 0.65, H_2O); ^1H NMR (300 MHz, D_2O) δ 1.44 (dd, $J_{2ax,3}$ = 11.7, J_{2gem} = 13.6 Hz, 1 H, 2ax-H), 1.71 (dd, $J_{2eq,3}$ = 4.2 Hz, 1 H, 2eq-H), 2.56 and 2.67 (ABq, J_{gem} = 13.8 Hz, CH_2NHAc), 3.37 (dd, $J_{3,4}$ = 9.3, $J_{4,5}$ = 9.3 Hz, 1 H, 4-H), 3.88 (m, 3 H, 3-H, 5-H, 6-H).

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