The Allyl Group for Protection in Carbohydrate Chemistry. Part 18.[1] Allyl and Benzyl Ethers of *myo*-Inositol. Intermediates for the Synthesis of *myo*-Inositol Trisphosphates

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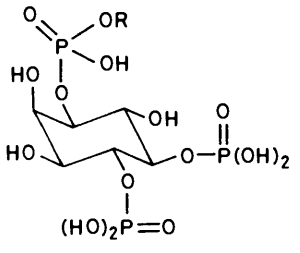
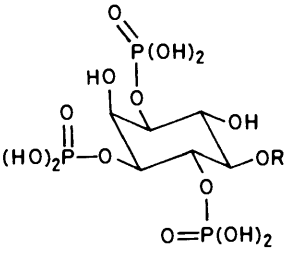
Racemic 1,2:4,5-di-*O*-isopropylidene-*myo*-inositol was converted into racemic 1,2,4-tri-*O*-benzyl-*myo*-inositol, 1,2,4-tri-*O*-*p*-methoxybenzyl-*myo*-inositol and 2,4,5-tri-*O*-benzyl-*myo*-inositol using allyl groups for 'temporary' protection. The benzyl ethers are required as intermediates for the synthesis of the 'second messenger,' inositol 1,4,5-trisphosphate and its metabolite, inositol 1,3,4-trisphosphate. 1,2,3,4-Tetra-*O*-benzyl-*myo*-inositol, and its two monoallyl and monoprop-1-enyl ethers, were also prepared as model compounds for phosphorylation studies of the vicinal 5,6-diol system which occurs in 1,2,4-tri-*O*-benzyl-*myo*-inositol.

D-*myo*-Inositol 1,4,5-trisphosphate (**1**)† is released from the membrane lipid phosphatidylinositol 4,5-bisphosphate (**2**) on receptor-mediated enzymic hydrolysis and acts as a 'second messenger' by mobilising intracellular calcium ions.[2,3] *myo*-Inositol 1,3,4-trisphosphate (**3**) is also found in stimulated cells[3,4] and is thought[5] to arise from (**1**) by phosphorylation to the tetrakisphosphate (**4**) followed by dephosphorylation at the 5-position.



(**1**) R = H
(**2**) R = CH_2-4-C(-OCOR')(CH_2OCOR')

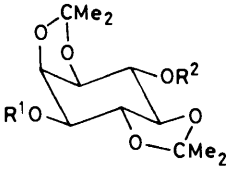


(**3**) R = H
(**4**) R = P(O)(OH)$_2$

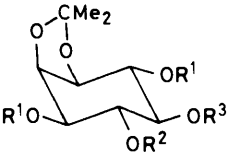
Suitably protected derivatives of *myo*-inositol were required for synthetic studies on these phosphates and we describe here[6] the synthesis of the racemic tri-*O*-benzyl ethers (**38**) and (**45**), as intermediates for the syntheses of compounds (**1**) and (**3**) respectively, as well as the tri-*O*-*p*-methoxybenzyl ether (**40**) required as an intermediate for the preparation of a 'caged' derivative of the phosphate (**1**) where the removal of the benzyl protecting groups by hydrogenolysis would be incompatible with the phosphate protection in the 'caged' derivative. Compound (**40**) would also be useful for the synthesis of lipid (**2**) containing unsaturated fatty acids. The tetra-*O*-benzyl ether (**51**) was also prepared as a model compound for the investigation of methods of phosphorylation of the vicinal 4,5-diol system of the *myo*-inositol derivatives (**38**) and (**40**). The monoallyl derivatives (**53**) and (**54**) and the monoprop-1-enyl derivatives (**59**) and (**61**) of the tetrabenzyl ether (**51**) were also prepared.

Results

(±)-1,2:4,5-Di-*O*-isopropylidene-*myo*-inositol (**5**)[7] was converted[7] into the dibenzyl ether (**6**). Partial hydrolysis of compound (**6**) removed preferentially the *trans* (diequatorial) isopropylidene group to give the crystalline diol (**18**) which was converted into the diallyl ether (**19**). Acidic hydrolysis of the



(**5**) $R^1 = R^2 = H$
(**6**) $R^1 = R^2 = CH_2Ph$
(**7**) $R^1 = CH_2Ph$, $R^2 = H$
(**8**) $R^1 = H$, $R^2 = CH_2Ph$
(**9**) $R^1 = R^2 = CH_2CH{=}CH_2$
(**10**) $R^1 = CH_2CH{=}CH_2$, $R^2 = H$
(**11**) $R^1 = H$, $R^2 = CH_2CH{=}CH_2$
(**12**) $R^1 = CH_2CH{=}CH_2$, $R^2 = Me$
(**13**) $R^1 = R^2 = CH_2C_6H_4OMe$-*p*
(**14**) $R^1 = CH_2C_6H_4OMe$-*p*, $R^2 = H$
(**15**) $R^1 = CH_2C_6H_4OMe$-*p*, $R^2 = CH_2Ph$
(**16**) $R^1 = CH_2C_6H_4OMe$-*p*, $R^2 = Me$
(**17**) $R^1 = CH_2C_6H_4OMe$-*p*, $R^2 = CH_2CH{=}CH_2$



(**18**) $R^1 = CH_2Ph$, $R^2 = R^3 = H$
(**19**) $R^1 = CH_2Ph$, $R^2 = R^3 = CH_2CH{=}CH_2$
(**20**) $R^1 = CH_2CH{=}CH_2$, $R^2 = R^3 = H$
(**21**) $R^1 = CH_2CH{=}CH_2$, $R^2 = R^3 = CH_2Ph$
(**22**) $R^1 = CH_2CH{=}CH_2$, $R^2 = H$; $R^3 = CH_2Ph$
(**23**) $R^1 = CH_2CH{=}CH_2$, $R^2 = CH_2Ph$, $R^3 = H$
(**24**) $R^1 = R^3 = CH_2CH{=}CH_2$, $R^2 = CH_2Ph$
(**25**) $R^1 = CH_2C_6H_4OMe$-*p*, $R^2 = R^3 = H$
(**26**) $R^1 = CH_2C_6H_4OMe$-*p*, $R^2 = R^3 = CH_2CH{=}CH_2$

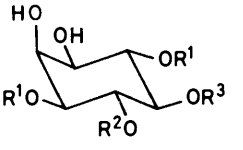
† Formulae (**1**)—(**4**) show the absolute configurations of the compounds described in the text. *Although the depictions* of formulae (**5**)—(**62**) specify an absolute configuration for these compounds it should be noted that the text refers only to racemates of these compounds. See reference 21 for an excellent discussion of the stereochemistry of *myo*-inositol derivatives and the problems of nomenclature.

ether (**19**) gave the diol (**27**) and this was treated with dibutyltin oxide in toluene to give the dibutylstannylene derivative[8] which was treated with allyl bromide to give the tri-*O*-allyl derivative (**33**). Benzylation of (**33**) gave the crystalline derivative (**34**). Removal of the allyl groups from (**34**), by the action of potassium t-butoxide in dimethyl sulphoxide and subsequent dilute acidic hydrolysis[9] or by the action of palladium-on-charcoal in the presence of acid,[10] gave crystalline (±)-1,2,4-tri-*O*-benzyl-*myo*-inositol (**38**) which was converted into the crystalline acetate (**39**). Compound (**38**) also gave a crystalline isopropylidene derivative (**42**) which was converted into the methyl ether (**43**). Acidic hydrolysis of compound (**43**) gave the diol (**50**) which after catalytic hydrogenolysis of the benzyl ethers gave the known[11,12] 1-*O*-methyl-*myo*-inositol thus proving the substitution pattern of compound (**38**).

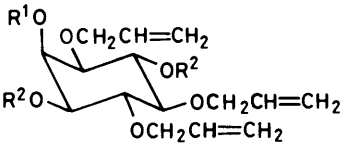
Compounds (**34**) and (**38**) were also prepared by a different route starting from 3,6-di-*O*-allyl-1,2:4,5-di-*O*-isopropylidene-*myo*-inositol (**9**). Partial hydrolysis of compound (**9**) removed preferentially the diequatorial isopropylidene group to give the crystalline diol (**20**). Reaction of the diol (**20**) with one equivalent of benzyl bromide and sodium hydride in *N*,*N*-dimethylformamide gave a mixture of approximately equal proportions of the dibenzyl ether (**21**) and the two monobenzyl ethers (**22**) and (**23**) which were well separated on t.l.c. and which were readily isolated by silica gel chromatography. Acidic hydrolysis of the isopropylidene derivatives (**21**)—(**23**) gave the crystalline diol (**28**) and the crystalline triols (**29**) and (**30**) respectively. Removal of the allyl groups from compounds (**29**) and (**30**) by the action[10] of palladium-on-charcoal gave the known 5-*O*-benzyl-*myo*-inositol[13] from (**29**) and 4-*O*-benzyl-*myo*-inositol[13,14] from (**30**). Allylation of the alcohol (**23**) gave (**24**) which on acidic hydrolysis gave the diol (**31**) and this on benzylation gave (**34**) identical with the material prepared as described above.

For the preparation of the 1,2,4-tri-*O*-*p*-methoxybenzyl-*myo*-inositol (**40**), the diol (**5**) was converted into the crystalline ether (**13**) and this on partial hydrolysis gave the diol (**25**) which was converted into the allyl ether (**26**). Hydrolysis of compound (**26**) gave the diol (**32**) which was converted into the crystalline allyl derivative (**35**) by reaction of the dibutylstannylene derivative with allyl bromide in *N*,*N*-dimethylformamide. The alcohol (**35**) was characterised by conversion into the crystalline methyl ether (**36**). The allyl groups were removed from (**36**) by isomerisation and subsequent dilute acidic hydrolysis to give the triol (**41**). Further acidic hydrolysis of (**41**) removed the *p*-methoxybenzyl groups, which have been shown[15] to be very acid labile, to give the known[11] 2-*O*-methyl-*myo*-inositol.

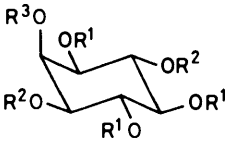
The alcohol (**35**) was converted into the tri-*p*-methoxybenzyl ether (**37**) and the allyl groups were removed by isomerisation followed by dilute acidic hydrolysis to give the required crystalline triol (**40**). The allyl groups could also be removed from compound (**37**) by the action[10] of Pd–C in acidic aqueous ethanol but the yields were lower due to the acid lability[15] of the *p*-methoxybenzyl groups.

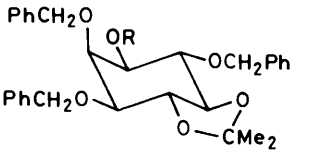


(**27**) $R^1 = CH_2Ph$, $R^2 = R^3 = CH_2CH{=}CH_2$
(**28**) $R^1 = CH_2CH{=}CH_2$, $R^2 = R^3 = CH_2Ph$
(**29**) $R^1 = CH_2CH{=}CH_2$, $R^2 = H$, $R^3 = CH_2Ph$
(**30**) $R^1 = CH_2CH{=}CH_2$, $R^2 = CH_2Ph$, $R^3 = H$
(**31**) $R^1 = R^3 = CH_2CH{=}CH_2$, $R^2 = CH_2Ph$
(**32**) $R^1 = CH_2C_6H_4OMe\text{-}p$, $R^2 = R^3 = CH_2CH{=}CH_2$



(**33**) $R^1 = H$, $R^2 = CH_2Ph$
(**34**) $R^1 = R^2 = CH_2Ph$
(**35**) $R^1 = H$, $R^2 = CH_2C_6H_4OMe\text{-}p$
(**36**) $R^1 = Me$, $R^2 = CH_2C_6H_4OMe\text{-}p$
(**37**) $R^1 = R^2 = CH_2C_6H_4OMe\text{-}p$

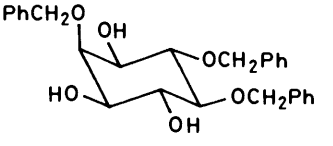




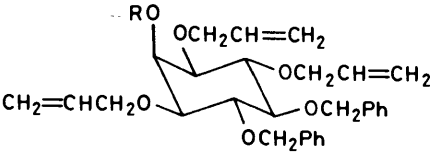
(**38**) $R^1 = H$, $R^2 = R^3 = CH_2Ph$
(**39**) $R^1 = Ac$, $R^2 = R^3 = CH_2Ph$
(**40**) $R^1 = H$, $R^2 = R^3 = CH_2C_6H_4OMe\text{-}p$
(**41**) $R^1 = H$, $R^2 = CH_2C_6H_4OMe\text{-}p$, $R^3 = Me$

(**42**) R = H
(**43**) R = Me
(**44**) R = CH_2Ph

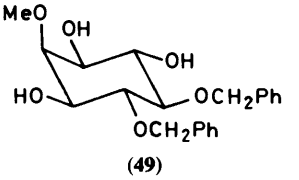
For the synthesis of the 2,4,5-tri-*O*-benzyl-*myo*-inositol (**45**), required for the preparation of the 1,3,4-trisphosphate (**3**), the diol (**20**) was converted into the benzyl ether (**21**) which was hydrolysed to the diol (**28**). Allylation of the dibutylstannylene derivative of (**28**) gave the crystalline tri-*O*-allyl derivative (**46**). For characterisation, compound (**46**) was converted into the methyl ether (**47**) and removal of the allyl groups gave the crystalline derivative (**49**) which on hydrogenolysis gave the known[11] 2-*O*-methyl-*myo*-inositol. Benzylation of the alcohol (**46**) gave (**48**) and removal of the allyl groups gave crystalline 2,4,5-tri-*O*-benzyl-*myo*-inositol (**45**).



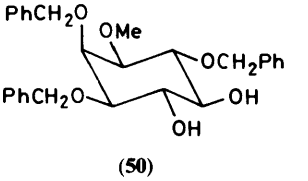
(**45**)



(**46**) R = H
(**47**) R = Me
(**48**) R = CH_2Ph

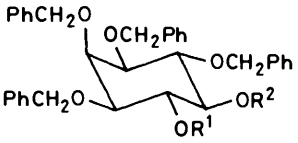


(**49**)



(**50**)

For the synthesis of 1,2,3,4-tetra-*O*-benzyl-*myo*-inositol (**51**), required for phosphorylation studies, the diol (**27**) was benzylated to give compound (**52**) and the allyl groups were removed by isomerisation with potassium t-butoxide in dimethyl sulphoxide and subsequent acidic hydrolysis. The diol (**51**) was best purified by conversion into the crystalline acetate (**57**) since the diol holds solvent tenaciously. The diol (**51**) also gave a crystalline isopropylidene derivative (**44**).



(51) $R^1 = R^2 = H$
(52) $R^1 = R^2 = CH_2CH{=}CH_2$
(53) $R^1 = CH_2CH{=}CH_2$, $R^2 = H$
(54) $R^1 = H$, $R^2 = CH_2CH{=}CH_2$
(55) $R^1 = CH_2CH{=}CH_2$, $R^2 = Me$
(56) $R^1 = H$, $R^2 = Me$
(57) $R^1 = R^2 = Ac$
(58) $R^1 = CH{=}CHMe$, $R^2 = Me$
(59) $R^1 = CH{=}CHMe$, $R^2 = H$
(60) $R^1 = CH{=}CHMe$, $R^2 = CH_2CH{=}CH_2$
(61) $R^1 = H$, $R^2 = CH{=}CHMe$
(62) $R^1 = CH_2CH{=}CH_2$, $R^2 = CH{=}CHMe$

Removal of the allyl groups from the di-*O*-allyl ether (**52**) by Pd–C was slow and led to the accumulation of the monoallyl derivatives (**53**) and (**54**). One of these isomers, 6-*O*-allyl-1,2,3,4-tetra-*O*-benzyl-*myo*-inositol (**53**) crystallised readily after separation of the monoallyl fraction by chromatography and its structure was established by conversion into the methyl ether (**55**). Removal of the allyl group from (**55**) gave the alcohol (**56**) and hydrogenolysis of the benzyl groups and subsequent acetylation gave the known[16] 5-*O*-methyl-*myo*-inositol penta-acetate.

Isomerisation of the allyl group in (**53**) gave the crystalline prop-1-enyl ether (**59**) which was allylated to give compound (**60**). Dilute acidic hydrolysis of (**60**) gave crystalline 5-*O*-allyl-1,2,3,4-tetra-O-benzyl-*myo*-inositol (**54**) and this was converted into the crystalline prop-1-enyl ether (**61**). Although the monoallyl ethers (**53**) and (**54**) were not resolved by t.l.c., the corresponding prop-1-enyl ethers (**59**) and (**61**) were well separated. Further samples of the monoallyl derivatives (**53**) and (**54**) were obtained from the mother liquors of the monoallyl fraction by isomerisation of the contents [predominantly (**54**) as observed by t.l.c. of the isomerised mixture] to the prop-1-enyl ethers (**59**) and (**61**) and separation of these by chromatography. Allylation of these gave (**60**) and (**62**) respectively and subsequent acidic hydrolysis of the prop-1-enyl groups gave the monoallyl derivatives (**54**) and (**53**) respectively.

Partial alkylation of the diol (**5**) allowed the preferential isolation by crystallisation of the 3-*O*-alkyl-1,2:4,5-di-*O*-isopropylidene-*myo*-inositols (**7**), (**10**), and (**14**). Thus, partial benzylation of compound (**5**) gave readily crystalline 3-*O*-benzyl-1,2:4,5-di-*O*-isopropylidene-*myo*-inositol (**7**) which gave the known[13,17] 1-*O*-benzyl-*myo*-inositol on acidic hydrolysis. The isomer (**8**) of compound (**7**) was prepared as described below for comparison.

Partial *p*-methoxybenzylation of (**5**) gave the readily crystalline 3-*O*-*p*-methoxybenzyl-1,2:4,5-di-*O*-isopropylidene-*myo*-inositol (**14**). For characterisation the alcohol (**14**) was converted into the crystalline methyl ether (**16**) and this was readily converted by acidic hydrolysis into 4-*O*-methyl-*myo*-inositol which gave the known[18] crystalline penta-acetate. Benzylation of compound (**14**) gave (**15**) and removal of the *p*-methoxybenzyl group by the action[19] of dichlorodicyanoquinone gave 6-*O*-benzyl-1,2:4,5-di-O-isopropylidene-*myo*-inositol (**8**). Similarly, allylation of the alcohol (**14**) gave the allyl ether (**17**) and removal of the *p*-methoxybenzyl group gave 6-*O*-allyl-1,2:4,5-di-O-isopropylidene-*myo*-inositol (**11**).

Partial allylation of the diol (**5**) gave readily crystalline 3-*O*-allyl-1,2:4,5-di-O-isopropylidene-*myo*-inositol (**10**). For proof of structure this was converted into the methyl ether (**12**) which gave 4-*O*-methyl-*myo*-inositol on deacetonation and deallylation. The monoallyl derivatives (**10**) and (**11**) had similar melting points but could be readily distinguished by the melting points of their acetates.

Experimental

All of the *myo*-inositol derivatives described are racemic. T.l.c. was carried out on microscope slides coated with silica gel G. Solvents were evaporated under reduced pressure. The light petroleum used had b.p. 40—60 °C unless otherwise stated.

3,6-*Di*-O-*benzyl*-1,2-O-*isopropylidene*-myo-*inositol* (**18**).—A solution of 3,6-di-*O*-benzyl-1,2:4,5-di-*O*-isopropylidene-*myo*-inositol (**6**)[7] (54 g) and toluene-*p*-sulphonic acid monohydrate (4 g) in acetone (800 ml) and water (20 ml) was kept at 20 °C for 45 min after which time t.l.c. [chloroform–ethyl acetate (1:1)] showed a major product (R_F 0.5) together with starting material (R_F 0.9) and 1,4-di-*O*-benzyl-*myo*-inositol[7] (R_F 0.1). Triethylamine (16 ml) and a solution of sodium hydrogen carbonate (4.5 g) in water (20 ml) was added and the solvents were evaporated off. The residue was extracted with dichloromethane and filtered. Most of the 1,4-di-*O*-benzyl-*myo*-inositol was insoluble in the dichloromethane and remained on the funnel with the inorganic material and was recovered (8 g) by washing the solid with water. The dichloromethane extract was evaporated and the residue was triturated with ether (800 ml) and filtered. Evaporation of the ether solution gave predominantly starting material (12 g) and the ether-insoluble material was predominantly compound (**18**) (27 g, 55%) but still containing small amounts of starting material and 1,4-di-*O*-benzyl-*myo*-inositol. For characterisation a portion was chromatographed on silica gel [chloroform–ethyl acetate (1:1)] to give the *diol* (**18**), m.p. 161—163 °C (from ethyl acetate) (Found: C, 69.2; H, 7.2. $C_{23}H_{28}O_6$ requires C, 69.0; H, 7.1%).

5,6-*Di*-O-*allyl*-1,4-*di*-O-*benzyl*-myo-*inositol* (**27**).—The crude isopropylidene derivative (**18**) (20 g) [containing traces of compound (**6**) and 1,4-di-*O*-benzyl-*myo*-inositol] was treated with an excess of allyl bromide and sodium hydride in *N,N*-dimethylformamide at 20 °C and the product isolated in the usual way[20] to give the crude allyl ether (**19**). This was taken up in methanol (675 ml) and 1M-hydrochloric acid (75 ml) and the solution was heated under reflux for 30 min. Sodium hydrogen carbonate (10 g) was added to the cooled solution, the solvents were evaporated off, and the product was extracted from the residue with ether. Recrystallisation from ethyl acetate–light petroleum (b.p. 60—80 °C) gave the *diol* (**27**) (16 g, 73%), m.p. 107—108 °C (Found: C, 70.6; H, 7.4. $C_{26}H_{32}O_6$ requires C, 70.9; H, 7.3%).

1,4,5-*Tri*-O-*allyl*-2,3,6-*tri*-O-*benzyl*-myo-*inositol* (**34**).—(*a*) A mixture of the diol (**27**) (25 g), dibutyltin oxide (15 g), and dry benzene (200 ml) was heated under reflux for 2 h with a Dean and Stark apparatus to collect the water liberated. The benzene was evaporated off and dry *N,N*-dimethylformamide (120 ml) and allyl bromide (8 ml) were added to the residue. The mixture was kept at 50 °C for 48 h after which time t.l.c. [ether–light petroleum (2:1)] showed conversion of the diol (**27**) (R_F 0.2) into a major product (R_F 0.75) together with traces of other products. The solution was cooled, diluted with water and the products extracted with ether. Chromatography on silica gel gave the alcohol (**33**) (20 g, 73%) as a syrup. This was treated with an excess of benzyl bromide and sodium hydride in *N,N*-dimethylformamide and the product isolated in the usual way and chromatographed on silica gel to give the *benzyl ether* (**34**) as a syrup which crystallised, m.p. 53—55 °C (from light petroleum) (Found: C, 75.5; H, 7.2. $C_{36}H_{42}O_6$ requires C, 75.8; H, 7.4%).

(*b*) The alcohol (**23**) (see below) was treated with an excess of

allyl bromide and sodium hydride in *N,N*-dimethylformamide and the product (**24**) was isolated in the usual way. A solution of the isopropylidene derivative (**24**) in 1M-hydrochloric acid–methanol (1:9) was heated under reflux for 30 min. Sodium hydrogen carbonate (5 g) was added to the cooled solution and the solvents were evaporated off. The residue was extracted with ether to give the diol (**31**) as a syrup which was treated with an excess of benzyl bromide and sodium hydride in *N,N*-dimethylformamide and the product isolated in the usual way to give the tri-*O*-benzyl ether (**34**) identical with the material described in (*a*).

1,2,4-*Tri*-O-*benzyl*-myo-*inositol* (**38**).—(*a*) A mixture of the tri-*O*-benzyl ether (**34**) (8 g), toluene-*p*-sulphonic acid monohydrate (800 mg), ethanol (190 ml), water (10 ml), and palladium-on-charcoal (1 g; 10% Fluka) was heated under reflux with stirring and the course of the reaction was followed by t.l.c. (ether). After 4 h most of the starting material (R_F 0.9) was converted into a major product (R_F 0.6) and traces of slower products (from debenzylation) and traces of faster products (from incomplete deallylation). Sodium hydrogen carbonate (500 mg) was added to the cooled solution and the solvents were evaporated off and the residue was extracted with dichloromethane. The crude product was chromatographed on silica gel and elution with ether–light petroleum (4:1) gave the *triol* (**38**) (5.5 g, 87%), m.p. 116—118 °C [from ethyl acetate–light petroleum (b.p. 60—80 °C)] (Found: C, 72.3; H, 6.8. $C_{27}H_{30}O_6$ requires C, 72.0; H, 6.7%) which gave an *acetate* (**39**), m.p. 123—125 °C (Found: C, 68.4; H, 6.3. $C_{33}H_{36}O_9$ requires C, 68.7; H, 6.3%).

(*b*) A mixture of the tri-*O*-allyl ether (**34**) (1 g) and potassium t-butoxide (1 g) in dry dimethyl sulphoxide (20 ml) was kept at 50 °C for 6 h after which time t.l.c. [ether–light petroleum (1:4)] showed complete conversion of compound (**34**) (R_F 0.6) into a major product (R_F 0.8) and traces of other products. The solution was diluted with water and the product was extracted with ether and treated with 1M-hydrochloric acid–acetone (1:9) (25 ml) at reflux for 30 min. Sodium hydrogen carbonate (500 mg) was added and the solvents were evaporated off. The product was extracted from the residue with ether and chromatographed on silica gel (ether) to give the triol (**38**) (500 mg, 63%) identical with the material described in (*a*).

1,2,4-*Tri*-O-*benzyl*-5,6-O-*isopropylidene*-myo-*inositol* (**42**).—A solution of the triol (**38**) (500 mg) and toluene-*p*-sulphonic acid monohydrate (50 mg) in dry acetone (20 ml) and 2,2-dimethoxypropane (5 ml) was kept at 20 °C for 2 h after which time t.l.c. [ether–light petroleum (1:1)] showed almost complete conversion of compound (**38**) (R_F 0.1) into a product (R_F 0.7). Triethylamine (0.5 ml) and sodium hydrogen carbonate (500 mg) were added and the solvents were evaporated off. The product was extracted from the residue with ether and chromatographed on silica gel [ether–light petroleum (1:1)] to give the *isopropylidene derivative* (**42**) (450 mg, 82%) as a syrup which slowly crystallised, m.p. 75—77 °C (Found: C, 73.0; H, 7.0. $C_{30}H_{34}O_6$ requires C, 73.4; H, 7.0%). This was methylated with methyl iodide and sodium hydride in *N,N*-dimethylformamide and the product (**43**) isolated in the usual way. Compound (**43**) was treated with 1M-hydrochloric acid–methanol (1:5; 20 ml) at reflux for 30 min, the solvents were evaporated off and the product (**50**) was hydrogenolysed over Pd–C in ethanol at 20 °C for 12 h. The catalyst was filtered off and washed with water and evaporation of the filtrate gave 1-*O*-methyl-*myo*-inositol, m.p. 202—204 °C (from ethanol) (lit.,[11] 199—200 °C; lit.,[12] 200—201 °C) which gave a penta-acetate, m.p. 154—156 °C (from ethanol) (lit.,[11] 152—153 °C; lit.,[12] 154—154.5 °C).

3,6-*Di*-O-*allyl*-1,2:4,5-*di*-O-*isopropylidene*-myo-*inositol* (**9**).—1,2:4,5-Di-*O*-isopropylidene-*myo*-inositol (**5**)[7] (11 g) was added slowly to a mixture of sodium hydride (8 g), allyl bromide (11 ml) and dry *N,N*-dimethylformamide (300 ml) and the mixture was stirred at 20 °C for 3 h after which time t.l.c. showed that the reaction was complete. Methanol was added to destroy the excess of sodium hydride and the solution was diluted with water and the product was extracted with ether. Recrystallisation from light petroleum (b.p. 60—80 °C) gave the *di*-O-*allyl ether* (**9**) (11.5 g, 80%), m.p. 85—87 °C (Found: C, 63.4; H, 8.3. $C_{18}H_{28}O_6$ requires C, 63.5; H, 8.3%).

3,6-*Di*-O-*allyl*-1,2-O-*isopropylidene*-myo-*inositol* (**20**).—A solution of the di-*O*-allyl ether (**9**) (11 g) and toluene-*p*-sulphonic acid monohydrate (1.1 g) in acetone (240 ml) and water (6 ml) was kept at 20 °C for 1 h after which time t.l.c. (ether) showed a major product (R_F 0.3), starting material (R_F 0.95) and 1,4-di-*O*-allyl-*myo*-inositol (R_F 0.05). Triethylamine (5 ml) and sodium hydrogen carbonate (5 g) were added and the solvents were evaporated off. Water (50 ml) was added to the residue and the mixture was extracted with dichloromethane. The extract, containing only starting material (**9**) and the major product, was evaporated and the product crystallised from ethyl acetate–light petroleum (b.p. 60—80 °C) to give the *diol* (**20**) (6 g, 62%), m.p. 130—132 °C (Found: C, 60.2; H, 8.0. $C_{15}H_{24}O_6$ requires C, 60.0; H, 8.05%).

1,4-*Di*-O-*allyl*-5,6-*di*-O-*benzyl*-myo-*inositol* (**28**).—The diol (**20**) was treated with an excess of benzyl bromide and sodium hydride in *N,N*-dimethylformamide and the product isolated in the usual way to give the dibenzyl ether (**21**) as a syrup. This was treated with 1M-hydrochloric acid–methanol (1:9) at reflux for 30 min and the product isolated in the usual way. Recrystallisation from light petroleum (b.p. 60—80 °C) gave the *diol* (**28**), m.p. 78—80 °C (Found: C, 70.6; H, 7.3. $C_{26}H_{32}O_6$ requires C, 70.9; H, 7.3%).

1,4-*Di*-O-*allyl*-5-O-*benzyl*-myo-*inositol* (**29**) and 1,4-*di*-O-*allyl*-6-O-*benzyl*-myo-*inositol* (**30**).—3,6-Di-*O*-allyl-1,2-*O*-isopropylidene-*myo*-inositol (**20**) (3.6 g, 12.2 mmol) and sodium hydride (880 mg, 36.5 mmol) were stirred in dry *N,N*-dimethylformamide (70 ml) and benzyl bromide (1.75 ml; 14.6 mmol) was added dropwise at 20 °C. After 1 h, t.l.c. [ether–light petroleum (1:1)] showed a trace of starting material (R_F 0.05), the dibenzyl ether (**21**) (R_F 0.9) and the two monobenzyl ethers (**23**) (R_F 0.7) and (**22**) (R_F 0.5). Compounds (**21**), (**23**), and (**22**) were present in approximately equal proportions. Methanol was added to destroy the excess of sodium hydride and then water was added and the products were extracted with ether and chromotographed on silica gel. Elution with ether–light petroleum (1:2) gave the dibenzyl ether (**21**) (1.65 g) followed by the fast moving *monobenzyl ether* (**23**) (R_F 0.7; 1.5 g) which was obtained as an oil (Found: C, 67.6; H, 7.6. $C_{22}H_{30}O_6$ requires C, 67.7; H, 7.7%). Further elution with ether–light petroleum (1:1) gave the slow moving *monobenzyl ether* (**22**) (R_F 0.5; 1.1 g) as an oil (Found: C, 67.3; H, 7.6%).

Hydrolysis of the fast isomer (**23**) with 1M-hydrochloric acid–methanol (1:9) at reflux for 30 min and recrystallisation of the product from ethyl acetate–light petroleum (b.p. 60—80 °C) gave the *triol* (**30**), m.p. 107—109 °C (Found: C, 64.8; H, 7.4. $C_{19}H_{26}O_6$ requires C, 65.1; H, 7.5%). A mixture of compound (**30**) (400 mg), toluene-*p*-sulphonic acid (150 mg), Pd–C (10% Fluka; 200 mg), ethanol (20 ml), and water (10 ml) was heated under reflux for 3 h. The solution was cooled and filtered, the catalyst washed with hot ethanol and the filtrate evaporated. Trituration of the residue with ethanol gave a crystalline product which was separated and recrystallised from ethanol to give 4-*O*-benzyl-*myo*-inositol (250 mg, 81%), m.p. 165—168 °C

(lit.,[13] 165—167 °C; lit.,[14] 169—170 °C) which on acetylation gave 1,2,3,5,6-*penta*-O-*acetyl*-4-O-*benzyl*-myo-*inositol*, m.p. 162—164 °C (Found: C, 57.1; H, 5.7. $C_{23}H_{28}O_{11}$ requires C, 57.5; H, 5.9%).

Acidic hydrolysis of the slow isomer (**22**), as described above for the fast isomer, and recrystallisation of the product from ethyl acetate–light petroleum (b.p. 60—80 °C) gave the *triol* (**29**), m.p. 162—164 °C (Found: C, 64.9; H, 7.4. $C_{19}H_{26}O_6$ requires C, 65.1; H, 7.5%). Deallylation of the triol (**29**) as described above for compound (**30**) gave 5-*O*-benzyl-*myo*-inositol, m.p. 280—283 °C (decomp.) (from aqueous ethanol) (lit.,[13] 281—283 °C).

1,2:4,5-*Di*-O-*isopropylidene*-3,6-*di*-O-p-*methoxybenzyl*-myo-*inositol* (**13**).—The diol (**5**)[7] was treated with an excess of *p*-methoxybenzyl chloride (Aldrich) and sodium hydride in *N,N*-dimethylformamide at 20 °C and the product isolated in the usual way and recrystallised from ethyl acetate–light petroleum (b.p. 60—80 °C) to give the *ether* (**13**), m.p. 130—131 °C (Found: C, 67.6; H, 7.5. $C_{28}H_{36}O_8$ requires C, 67.2; H, 7.25%).

1,2-O-*Isopropylidene*-3,6-*di*-O-p-*methoxybenzyl*-myo-*inositol* (**25**).—A solution of the ether (**13**) (21.3 g) and toluene-*p*-sulphonic acid monohydrate (1.7 g) in acetone (350 ml) and water (9 ml) was kept at 20 °C for 1 h after which time t.l.c. [dichloromethane–ethyl acetate (1:1)] showed a major product (R_F 0.6), some starting material (R_F 0.95), and some 1,4-di-*O*-*p*-methoxybenzyl-*myo*-inositol (R_F 0.1). Triethylamine (7 ml) and a solution of sodium hydrogen carbonate (2.3 g) in water (10 ml) was added and the solvents were evaporated off. The residue was extracted with dichloromethane and the product was chromatographed on silica gel [dichloromethane–ethyl acetate (3:1)] to give the *diol* (**25**) (11 g, 56%), m.p. 129—130 °C [from ethyl acetate–light petroleum (b.p. 60—80 °C)] (Found: C, 65.5; H, 7.0. $C_{25}H_{32}O_8$ requires C, 65.2; H, 7.0%).

5,6-*Di*-O-*allyl*-1,4-*di*-O-p-*methoxybenzyl*-myo-*inositol* (**32**).—The diol (**25**) was treated with an excess of allyl bromide and sodium hydride in *N,N*-dimethylformamide at 20 °C and the product isolated in the usual way to give the diallyl ether (**26**) as a syrup which was hydrolysed in 1M-hydrochloric acid–methanol (1:9) at 50 °C. The reaction was carefully followed by t.l.c. [ether–dichloromethane (7:2)] since prolonged reaction led to hydrolysis[15] of the *p*-methoxybenzyl groups. After 30 min, most of the starting material (R_F 0.9) was converted into a major product (R_F 0.4). An excess of sodium hydrogen carbonate was added and the solvents were evaporated off. The product was extracted from the residue with dichloromethane and recrystallised from ethyl acetate–light petroleum (b.p. 60—80 °C) to give the *diol* (**32**), m.p. 109—110 °C (Found: C, 67.3; H, 7.0. $C_{28}H_{36}O_8$ requires C, 67.2; H, 7.25%).

1,4,5-*Tri*-O-*allyl*-3,6-*di*-O-p-*methoxybenzyl*-myo-*inositol* (**35**).—The diol (**32**) (10 g) was converted into the dibutylstannylene derivative and this was treated with allyl bromide as described above under the preparation of compound (**34**). T.l.c. (ether) showed conversion of the diol (**32**) (R_F 0.5) into a major product (R_F 0.8) which was separated by chromatography on silica gel [ether–light petroleum (1:1)] and recrystallised from ethyl acetate–light petroleum (b.p. 60—80 °C) to give the *alcohol* (**35**) (7.5 g, 69%), m.p. 76—77 °C (Found: C, 69.2; H, 7.3. $C_{31}H_{40}O_8$ requires C, 68.9; H, 7.5%). Methylation of the alcohol (**35**) with methyl iodide and sodium hydride in *N,N*-dimethylformamide gave the *methyl ether* (**36**), m.p. 78—79 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 69.6; H, 7.6. $C_{32}H_{42}O_8$ requires C, 69.3; H, 7.6%). The methyl ether (**36**) was treated with a solution of potassium t-butoxide in dry dimethyl sulphoxide at 50 °C for 20 h after which time t.l.c. [ether–light petroleum (1:1)] showed the conversion of (**36**) (R_F 0.3) into a major product (R_F 0.5). This was isolated by dilution with water and ether extraction and was hydrolysed with 1M-hydrochloric acid–acetone (1:9) at 50 °C for 15 min after which time t.l.c. (ether) showed conversion of the starting material (R_F 0.9) into a major product (R_F 0.1) together with small amounts of less polar materials. An excess of sodium hydrogen carbonate was added and the solvents were evaporated off. The product was extracted from the residue with dichloromethane and crystallised from ethyl acetate–light petroleum (b.p. 60—80 °C) to give the *triol* (**41**), m.p. 159—160 °C (Found: C, 63.3; H, 6.6. $C_{23}H_{30}O_8$ requires C, 63.6; H, 7.0%). Compound (**41**) was heated under reflux in 1M-hydrochloric acid–ethanol (1:2) for 3 h after which time t.l.c. [chloroform–methanol (9:1)] showed the absence of compound (**41**) (R_F 0.7) and presence of a major product (R_F 0) together with *p*-methoxybenzyl alcohol (R_F 0.9). The solvents were evaporated off and the residue was diluted with water and extracted with ether to remove the *p*-methoxybenzyl alcohol. Evaporation of the aqueous layer gave 2-*O*-methyl-*myo*-inositol, m.p. 213—214 °C (from aqueous ethanol) (lit.,[11] 212 °C) which gave a penta-acetate, m.p. 235—236 °C (from ethanol) (lit.,[11] 235—236 °C).

1,4,5-*Tri*-O-*allyl*-2,3,6-*tri*-O-p-*methoxybenzyl*-myo-*inositol* (**37**).—The alcohol (**35**) was treated with an excess of *p*-methoxybenzyl chloride and sodium hydride in *N,N*-dimethylformamide at 20 °C and the product isolated in the usual way to give the *tri*-O-p-*methoxybenzyl ether* (**37**), m.p. 73—74 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 71.0; H, 7.3. $C_{39}H_{48}O_9$ requires C, 70.9; H, 7.3%).

1,2,4-*Tri*-O-p-*methoxybenzyl*-myo-*inositol* (**40**).—The tri-*O*-*p*-methoxybenzyl ether (**37**) (10 g) and potassium t-butoxide (10 g) in dry dimethyl sulphoxide (100 ml) was kept at 50 °C for 24 h. The solution was diluted with water and the product extracted with ether and kept with acetone (135 ml) and 1M-hydrochloric acid (15 ml) at 50 °C for 30 min after which time t.l.c. [ether–dichloromethane (1:1)] showed conversion of the starting material (R_F 0.9) into a major product (R_F 0.2). Sodium hydrogen carbonate (1.5 g) was added and the solvents were evaporated off and the product was extracted from the residue with dichloromethane. Evaporation of the solvent gave a crystalline product (7 g, 85%). For analysis a portion was chromatographed on silica gel [ether–dichloromethane (1:2)] to give the *triol* (**40**), m.p. 137—139 °C [from ethyl acetate–light petroleum (b.p. 60—80 °C)] (Found: C, 66.5; H, 6.65. $C_{30}H_{36}O_9$ requires C, 66.65; H, 6.7%).

1,3,6-*Tri*-O-*allyl*-4,5-*di*-O-*benzyl*-myo-*inositol* (**46**).—The diol (**28**) was converted into the dibutylstannylene derivative and this was treated with allyl bromide as described above under the preparation of compound (**34**). After chromatography on silica gel, the product crystallised and was recrystallised from light petroleum (b.p. 60—80 °C) to give the *alcohol* (**46**), m.p. 60—62 °C (Found: C, 72.8; H, 7.5. $C_{29}H_{36}O_6$ requires C, 72.5; H, 7.55%). A portion of compound (**46**) was treated with methyl iodide and sodium hydride in *N,N*-dimethylformamide to give the methyl ether (**47**). The allyl groups were removed from compound (**47**) by the action of Pd–C in acidic aqueous ethanol as described above for the deallylation of compound (**30**) to give the *triol* (**49**), m.p. 217—219 °C (from ethanol) (Found: C, 67.6; H, 7.2. $C_{21}H_{26}O_6$ requires C, 67.4; H, 7.0%). The triol (**49**) was hydrogenolysed over Pd–C in methanol–water (9:1) at 20 °C for 15 h and the product was recrystallised from ethanol to give 2-*O*-methyl-*myo*-inositol, m.p. 215—218 °C (lit.,[11] 212 °C) which gave a penta-acetate, m.p. 236 °C (from ethanol) (lit.,[11] 235—236 °C).

2,4,5-*Tri*-O-*benzyl*-myo-*inositol* (**45**).—1,3,6-Tri-*O*-allyl-4,5-di-*O*-benzyl-*myo*-inositol (**46**) was treated with an excess of benzyl bromide and sodium hydride in *N*,*N*-dimethylformamide and the product (**48**) isolated in the usual way. A mixture of the tri-*O*-allyl ether (**48**) (1.3 g), toluene-*p*-sulphonic acid (80 mg), Pd–C (10% Fluka; 100 mg), ethanol (19 ml) and water (1 ml) was heated under reflux for 4 h after which time t.l.c. [ether–light petroleum (1:1)] showed conversion of compound (**48**) (R_F 0.95) into a major product (R_F 0.25) together with traces of other products. Sodium hydrogen carbonate (500 mg) was added to the cooled solution and the solvents were evaporated off. The product (1.1 g) was extracted from the residue with dichloromethane and chromatographed on silica gel to give the *triol* (**45**) (740 mg, 72%), m.p. 135—137 °C [from ethyl acetate–light petroleum (b.p. 60—80 °C)] (Found: C, 71.8; H, 6.7. $C_{27}H_{30}O_6$ requires C, 72.0; H, 6.7%).

5,6-*Di*-O-*allyl*-1,2,3,4-*tetra*-O-*benzyl*-myo-*inositol* (**52**).—The diol (**27**) was treated with an excess of benzyl bromide and sodium hydride in *N*,*N*-dimethylformamide and the product isolated in the usual way to give the *tetrabenzyl ether* (**52**), m.p. 52—54 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 71.1; H, 7.0. $C_{40}H_{44}O_6$ requires C, 77.4; H, 7.1%).

5,6-*Di*-O-*acetyl*-1,2,3,4-*tetra*-O-*benzyl*-myo-*inositol* (**57**).—A solution of the di-*O*-allyl ether (**52**) (10 g) and potassium t-butoxide (5 g) in dry dimethyl sulphoxide (50 ml) was kept at 50 °C for 10 h after which time t.l.c. [ether–light petroleum (1:2)] showed conversion of the starting material (R_F 0.7) into a product (R_F 0.85). The solution was diluted with water and the product (10 g) was extracted with ether and treated with 1M-hydrochloric acid–methanol (1:9; 50 ml) at reflux for 30 min. Sodium hydrogen carbonate (1 g) was added and the solvents were evaporated off. The crude product was acetylated in acetic anhydride–pyridine in the usual way to give the *acetate* (**57**) (9 g, 89%), m.p. 132—134 °C [from ethyl acetate–light petroleum (b.p. 60—80 °C)] (Found: C, 73.4; H, 6.6. $C_{38}H_{40}O_8$ requires C, 73.1; H, 6.45%). Hydrolysis of the acetate (**57**) with sodium hydroxide in methanol gave the diol (**51**), m.p. 87—89 °C (from ether). Treatment of the diol (**51**) with 2,2-dimethoxypropane in acetone containing toluene-*p*-sulphonic acid and chromatography of the product on alumina (ether) gave the *isopropylidene derivative* (**44**), m.p. 92—94 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 76.4; H, 6.8. $C_{37}H_{40}O_6$ requires C, 76.5; H, 6.9%).

6-O-*Allyl*-1,2,3,4-*tetra*-O-*benzyl*-myo-*inositol* (**53**).—A mixture of the di-*O*-allyl ether (**52**) (4 g), toluene-*p*-sulphonic acid (300 mg) and Pd–C (10% Fluka; 300 mg) in ethanol (69 ml) and water (6 ml) was heated under reflux for 6 h after which time t.l.c. [ether–light petroleum (2:1)] showed partial conversion of compound (**52**) (R_F 0.8) into monoallyl derivatives (R_F 0.6) and the diol (**51**) (R_F 0.45). Sodium hydrogen carbonate (1 g) was added and the solvents were evaporated off. The products were extracted from the residue with dichloromethane and chromatographed on silica gel to give the monoallyl fraction (1.2 g). Crystallisation from light petroleum (b.p. 60—80 °C) gave the *alcohol* (**53**) (300 mg), m.p. 123—125 °C (Found: C, 76.7; H, 7.0. $C_{37}H_{40}O_6$ requires C, 76.5; H, 6.9%). The alcohol (**53**) was converted into the *methyl ether* (**55**) in the usual way, m.p. 87—89 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 76.7; H, 6.8. $C_{38}H_{42}O_6$ requires C, 76.7; H, 7.1%). Isomerisation of the allyl group in compound (**55**) with potassium t-butoxide in dimethyl sulphoxide in the usual way gave the *prop*-1-*enyl ether* (**58**), m.p. 99—101 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 76.6; H, 7.1. $C_{38}H_{42}O_6$ requires C, 76.7; H, 7.1%). The prop-1-enyl group was removed from compound (**58**) by acid hydrolysis in the usual way to give the *alcohol* (**56**), m.p. 86—88 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 75.4; H, 6.9. $C_{35}H_{38}O_6$ requires C, 75.8; H, 6.9%). The alcohol (**56**) was hydrogenolysed over Pd–C in glacial acetic acid and the product acetylated to give 1,2,3,4,6-penta-*O*-acetyl-5-*O*-methyl-*myo*-inositol, m.p. 200—201 °C (from ethanol) (lit.,[16] 202 °C).

Isomerisation of the monoallyl fraction (900 mg) remaining in the mother liquors from the crystallisation of compound (**53**), as described below for the preparation of compound (**59**) gave a mixture of the prop-1-enyl ethers (**59**) and (**61**) in which the latter predominated. Although t.l.c. [ether–light petroleum (1:1)] did not separate the allyl ethers (**53**) and (**54**) (R_F 0.6), the prop-1-enyl ethers (**59**) (R_F 0.8) and (**61**) (R_F 0.65) were well separated (see below for the characterisation of the compounds) and were readily separated by chromatography on silica gel [ether–light petroleum (1:2) followed by (1:1)] to give (**59**) (160 mg) and (**61**) (630 mg). Allylation of compound (**59**) gave the allyl ether (**60**) (R_F 0.95) and allylation of compound (**61**) gave (**62**) (R_F 0.85). The prop-1-enyl ethers were hydrolysed with dilute acid in the usual way to give the allyl ether (**54**) [from (**60**)] and the allyl ether (**53**) [from (**62**)] identical with the materials described elsewhere in this paper.

1,2,3,4-*Tetra*-O-*benzyl*-6-O-*prop*-1-*enyl*-myo-*inositol* (**59**).—The allyl ether (**53**) was treated with potassium t-butoxide in dimethyl sulphoxide at 50 °C for 30 min after which time t.l.c. [ether–light petroleum (1:1)] showed complete conversion of the allyl ether (**53**) (R_F 0.6) into a product (R_F 0.8). The product was isolated in the usual way to give the *prop*-1-*enyl ether* (**59**), m.p. 142—143 °C [from ether–light petroleum (1:1)] (Found: C, 76.3; H, 6.8. $C_{37}H_{40}O_6$ requires C, 76.5; H, 6.9%).

5-O-*Allyl*-1,2,3,4-*tetra*-O-*benzyl*-myo-*inositol* (**54**).—The prop-1-enyl ether (**59**) was treated with an excess of allyl bromide and sodium hydride in *N*,*N*-dimethylformamide and the product isolated in the usual way to give the allyl ether (**60**) as a syrup. This was treated with 1M-hydrochloric acid–acetone (1:9) at reflux for 15 min and the product isolated in the usual way to give the *allyl ether* (**54**), m.p. 78—80 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 76.2; H, 6.8. $C_{37}H_{40}O_6$ requires C, 76.5; H, 6.9%).

1,2,3,4-*Tetra*-O-*benzyl*-5-O-*prop*-1-*enyl*-myo-*inositol* (**61**).—The allyl ether (**54**) was isomerised as described for the preparation of compound (**59**). T.l.c. [ether–light petroleum (1:1)] showed conversion of the allyl ether (**54**) (R_F 0.6) into a product (R_F 0.65) which was isolated in the usual way to give the *prop*-1-*enyl ether* (**61**), m.p. 95—96 °C (from light petroleum) (Found: C, 76.2; H, 6.8. $C_{37}H_{40}O_6$ requires C, 76.5; H, 6.9%).

3-O-*Benzyl*-1,2:4,5-*di*-O-*isopropylidene*-myo-*inositol* (**7**).—The diol (**5**)[7] was treated with one equivalent of benzyl bromide and excess sodium hydride in *N*,*N*-dimethylformamide for 2 h at 20 °C. T.l.c. [ether–light petroleum (1:1)] then showed a mixture of the dibenzyl ether (**6**)[7] (R_F 0.8) and the monobenzyl ethers (**7**) and (**8**) (R_F 0.2). [Subsequent preparation of compound (**8**) (see below) showed that the monobenzyl ethers were not separated by t.l.c.]. The products were isolated in the usual way and chromatographed on silica gel to give the monobenzyl ether fraction. Crystallisation from ethyl acetate–light petroleum (b.p. 60—80 °C) gave the *benzyl ether* (**7**), m.p. 167—169 °C (Found: C, 65.0; H, 7.5. $C_{19}H_{26}O_6$ requires C, 65.1; H, 7.5%). A solution of compound (**7**) in acetic acid–water (4:1) was heated at 100 °C for 1 h and the solvents were evaporated to give 1-*O*-benzyl-*myo*-inositol, m.p. 207—209 °C (from ethanol) (lit.,[17] 206—208 °C; lit.,[13] 203—205 °C).

1,2:4,5-*Di*-O-*isopropylidene*-3-O-p-*methoxybenzyl*-myo-*inositol* (**14**).—Partial *p*-methoxybenzylation of the diol (**5**), as

described in the partial benzylation for the preparation of compound (**7**), gave a mixture of the mono-*p*-methoxybenzyl ethers (R_F 0.7) and compound (**13**) (R_F 0.9) as observed by t.l.c. [chloroform–ethyl acetate (1:1)]. The monoether fraction was separated by chromatography on silica gel and crystallisation from ethyl acetate–light petroleum (b.p. 60—80 °C) gave the p-*methoxybenzyl ether* (**14**), m.p. 158—160 °C (Found: C, 63.3; H, 7.7. $C_{20}H_{28}O_7$ requires C, 63.1; H, 7.4%). Methylation of compound (**14**) gave the *methyl ether* (**16**), m.p. 117—119 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 63.8; H, 7.5. $C_{21}H_{30}O_7$ requires C, 63.9; H, 7.7%). Compound (**16**) was heated under reflux in 1M-hydrochloric acid–ethanol (1:2) for 3 h and the solvents were evaporated to give 4-*O*-methyl-*myo*-inositol which gave a crystalline penta-acetate, m.p. 130—132 °C (from aqueous ethanol) (lit.,[18] 129—130 °C).

6-O-*Benzyl*-1,2:4,5-*di*-O-*isopropylidene*-myo-*inositol* (**8**).—Benzylation of the *p*-methoxybenzyl ether (**14**) with benzyl bromide and sodium hydride in *N*,*N*-dimethylformamide gave 6-O-*benzyl*-1,2:4,5-di-O-*isopropylidene*-3-O-p-*methoxybenzyl*-myo-*inositol* (**15**), m.p. 111—113 °C (from light petroleum) (Found: C, 68.9; H, 7.2. $C_{27}H_{34}O_7$ requires C, 68.9; H, 7.3%). Dichlorodicyanoquinone (500 mg) was added to a solution of compound (**15**) (500 mg) in dichloromethane (15 ml) containing water (1 ml). After 1 h at 20 °C, t.l.c. [chloroform–acetone (1:1)] showed complete conversion of compound (**15**) (R_F 0.95) into a product (R_F 0.75). The mixture was filtered and the filtrate washed with aqueous sodium metabisulphite and aqueous sodium hydrogen carbonate and dried (K_2CO_3). Chromatography of the product on silica gel [chloroform–ethyl acetate (1:1)] removed the *p*-methoxybenzaldehyde and gave the pure *benzyl ether* (**8**), m.p. 135—137 °C [from ethyl acetate–light petroleum (b.p. 60—80 °C)] (Found: C, 65.0; H, 7.3. $C_{19}H_{26}O_6$ requires C, 65.1; H, 7.5%).

3-O-*Allyl*-1,2:4,5-*di*-O-*isopropylidene*-myo-*inositol* (**10**).—The diol (**5**)[7] (1 g) was treated with one equivalent of allyl bromide and excess sodium hydride in *N*,*N*-dimethylformamide for 2 h at 20 °C. Methanol was added to destroy the excess of sodium hydride and the solution was diluted with water. Extraction of the aqueous solution with light petroleum removed the diallyl ether (**9**) and further extraction with ether gave the monoallyl ethers (**10**) and (**11**) (700 mg). Crystallisation of the monoallyl fraction from light petroleum (b.p. 60—80 °C) gave the *allyl ether* (**10**) (350 mg), m.p. 127—129 °C (Found: C, 60.0; H, 7.9. $C_{15}H_{24}O_6$ requires C, 60.0; H, 8.1%) which gave an *acetate*, m.p. 153—155 °C [from light petroleum (b.p. 60—80 °C)]. Methylation of the alcohol (**10**) gave the *methyl ether* (**12**), m.p. 81—83 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 61.2; H, 8.35. $C_{16}H_{26}O_6$ requires C, 61.1; H, 8.3%). The methyl ether (**12**) was heated under reflux in glacial acetic acid–water (4:1) for 1 h and the solvents evaporated to give 1-O-*allyl*-4-O-*methyl*-myo-*inositol*, m.p. 170—172 °C (from ethanol) (Found: C, 51.3; H, 7.8. $C_{10}H_{18}O_6$ requires C, 51.3; H, 7.75%). This compound (400 mg), Pd–C (10% Fluka; 300 mg), ethanol (45 ml), and 0.5M-hydrochloric acid (4 ml) were heated under reflux for 6 h. The mixture was filtered and the solvents were evaporated off to give 4-*O*-methyl-*myo*-inositol which was converted into the penta-acetate, m.p. 130—132 °C (from aqueous ethanol) (lit.,[18] 129—130 °C).

6-O-*Allyl*-1,2:4,5-*di*-O-*isopropylidene*-myo-*inositol* (**11**).—Allylation of the *p*-methoxybenzyl ether (**14**) gave 6-O-*allyl*-1,2:4,5-*di*-O-*isopropylidene*-3-O-p-*methoxybenzyl*-myo-*inositol* (**17**), m.p. 98—99 °C [from light petroleum (b.p. 60—80 °C)] (Found: C, 65.8; H, 7.6. $C_{23}H_{32}O_7$ requires C, 65.7; H, 7.7%). Compound (**17**) was treated with 2,6-dichloro-3,5-dicyano-*p*-benzoquinone as described under the preparation of compound (**8**) to give the *allyl ether* (**11**), m.p. 130—131 °C [from light petroleum (b.p. 60—80 °C)–ethyl acetate (10:1)] (Found: C, 59.8; H, 7.8. $C_{15}H_{24}O_6$ requires C, 60.0; H, 8.1%) which gave an *acetate*, m.p. 125—126 °C [from light petroleum (b.p. 60—80 °C)].

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