CCCXCIX.—*Conversion of 2 : 3 : 4-Triacetyl α-Methylglucoside into 3 : 4 : 6-Triacetyl 2-Methyl α-Methylglucoside.*

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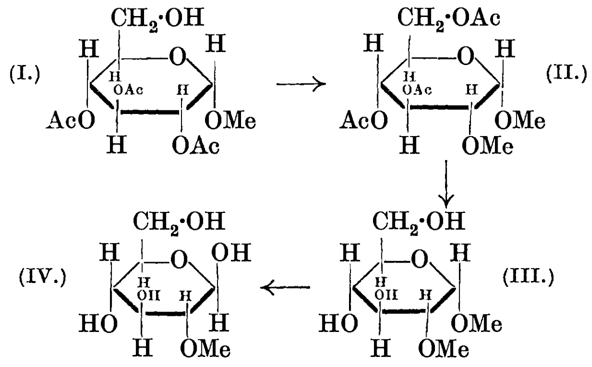
In an earlier paper (Haworth, Hirst, and Teece, J., 1930, 1405) we have shown that 1 : 2 : 3 : 4-tetra-acetyl glucose gives rise to 2 : 3 : 4 : 6-tetra-acetyl β-methylglucoside by the migration of an acetyl group from position 1 to position 6. We now record a similar phenomenon in the case of 2 : 3 : 4-triacetyl α-methylglucoside (Helferich, Bredereck, and Schneidmüller, *Annalen*, 1927, **458**, 111). With this substance (I) there is no possibility of a transference of an acetyl group from the reducing position, but it is noteworthy that methylation with Purdie's reagents introduces a methyl group, in a yield of about 30%, at position 2, accompanied by the transference of the 2-acetyl residue to position 6. The crystalline product, 3 : 4 : 6-*triacetyl* 2-*methyl* α-*methylglucoside* (II), gives rise on deacetylation to crystalline 2-*methyl* α-*methylglucoside* (III), and on hydrolysis to 2-methyl glucose (IV), which, as the crystalline β-form, was found to be identical with the 2-methyl glucose described by Hickinbottom (J., 1928, 3140) and Brigl and Schinle (*Ber.*, 1929, **62**, 1716; 1930, **63**, 2887). According to the work of the latter authors 2-methyl glucose passes to phenylglucosazone by loss of the methyl group. This is the case, but the yield is poor and the glucosazone is accompanied by the hydrazone of 2-methyl glucose.



It is evident that little credence can be attached to methods of this kind which are intended to prove the orientation of a free hydroxyl in a group partly acetylated hexose. On the other hand it is on record (Helferich and Günther, *Ber.*, 1931, **64**, 1276) that the corresponding 2 : 3 : 4-tribenzoyl methylglucoside passes on methylation and subsequent hydrolysis to the expected 6-methyl glucose, a result which seems to indicate that benzoyl groups have not the capacity of free migration which is associated with the acetyl groups in the compounds we have studied. The mechanism of the above migrations has been referred to in the earlier paper by Haworth, Hirst, and Teece (*loc. cit.*).

EXPERIMENTAL.

Methylation of 2 : 3 : 4-*Triacetyl* α-*Methylglucoside.*—α-Methylglucoside was converted by Helferich, Klein, and Schäfer's method (*Ber.*, 1926, **59**, 81) into 6-trityl 2 : 3 : 4-triacetyl α-methylglucoside, which had m. p. 136°, $[\alpha]_D^{20^\circ}$ + 137° in pyridine (*c*, 1·66) in agreement with the constants recorded by Helferich and Becker (*Annalen*, 1924, **440**, 9). Removal of the trityl group by hydrogen bromide in acetic acid gave 2 : 3 : 4-triacetyl α-methylglucoside, m. p. 111°, $[\alpha]^{20^\circ}$ + 147° in chloroform (*c*, 1·2) (Found : CH_3·CO, 40·3. Calc. for $C_{13}H_{20}O_9$: CH_3·CO, 40·3%). The properties of the material used in the following experiments conformed exactly with those ascribed to 2 : 3 : 4-triacetyl α-methylglucoside by Helferich, Bredereck, and Schneidmüller (*loc. cit.*). Methylation was effected by heating the substance (4 g.) in boiling methyl iodide (10 c.c.) for 8 hours with silver oxide (20 g.). The product (3·9 g.) was extracted by chloroform and, on removal of the solvent, was obtained as a glass which crystallised partly when triturated with alcohol. The solid portion (1·3 g.) was recrystallised from alcohol, giving 3 : 4 : 6-*triacetyl* 2-*methyl* α-*methylglucoside* as colourless needles, m. p. 120°, $[\alpha]_D^{20^\circ}$ + 145° in chloroform (*c*, 0·9) (Found : C, 50·3; H, 6·8; OMe, 18·4. $C_{14}H_{22}O_9$ requires C, 50·3; H, 6·6; OMe, 18·6%). The liquid portion of the methylated product gave a high methoxyl value (OMe, 23%) and had lost part of its acetyl content during the methylation.

2-*Methyl* α-*Methylglucoside.*—3 : 4 : 6-Triacetyl 2-methyl α-methylglucoside (0·9 g.) was de-acetylated by methyl-alcoholic ammonia (100 c.c. saturated at 0°). After 5½ hours at room temperature the methyl alcohol and ammonia were removed by distillation under diminished pressure, leaving a white solid, which was dissolved in boiling ethyl acetate (18 c.c.). On cooling, 2-*methyl* α-*methylglucoside* separated as colourless prisms, m. p. 147—148°, $[\alpha]_D^{19^\circ}$ + 155° in water (*c*, 0·7) (Found : C, 46·5; H, 8·0; OMe, 29·7. $C_8H_{16}O_6$ requires C, 46·1; H, 7·8; OMe, 29·8%).

2-Methyl α-methylglucoside was hydrolysed by 7% aqueous hydrochloric acid in about 17 hours at 90—95°. The reaction was followed polarimetrically. $[\alpha]_D^{20^\circ}$ + 156° (initial value); 148° (40 mins.); 132° (2 hrs.); 100° (4½ hrs.); 91° (5½ hrs.); 76° (8 hrs.); 72° (10½ hrs.); 68° (13 hrs.); 65° (17 hrs., constant value). The solution was neutralised with silver carbonate and evaporated to dryness under diminished pressure, giving a syrup which partly crystallised. The solid was recrystallised from methyl alcohol, giving 2-methyl β-glucose (yield, 60%), m. p. 157—159°, $[\alpha]_D^{20^\circ}$ + 16° in water (3 mins. after dissolution; *c*, 0·64); 20° (4 mins.); 24° (10 mins.); 27° (15 mins.); 41° (45 mins.); 52° (75 mins.); 56° (105 mins.); 59·5° (135 mins.); 64° (230 mins.); 66° (6 hrs., constant value). From these figures the initial value $[\alpha]_D^{20^\circ}$ + 12° was found by extrapolation (Found : C, 43·1; H, 7·5; OMe, 16·2. Calc. for $C_7H_{14}O_6$: C, 43·3; H, 7·3; OMe, 16·0%).

2-Methyl glucose readily gave the phenylhydrazone, m. p. 174—175°, when treated at 15° with phenylhydrazine and glacial acetic acid in concentrated aqueous solution (Hickinbottom, *loc. cit.*; Brigl and Schinle, *loc. cit.*) (Found : C, 55·0; H, 7·3; N, 9·7; OMe, 10·9. Calc. for $C_{13}H_{20}O_5N_2$: C, 54·9; H, 7·1; N, 9·9; OMe, 10·9%). When heated with phenylhydrazine hydrochloride and sodium acetate in aqueous solution it gave glucosazone, m. p. 206°, in poor yield. The loss of a methoxyl group during this transformation was confirmed by analysis, the osazone being found to have a negligible methoxyl content. The properties of the methyl glucose now described are therefore in complete agreement with those of the crystalline 2-methyl glucose prepared by Brigl and Schinle (*Ber.*, 1930, **63**, 2887).

For comparison a specimen of 2-methyl glucose was prepared from 3 : 4 : 6-triacetyl 2-methyl β-methylglucoside (Hickinbottom, *loc. cit.*; compare Brigl, *Z. physiol. Chem.*, 1922, **122**, 257). The 2-methyl glucose so obtained had m. p. 157—158°, alone or when mixed with the material described above, and readily yielded the phenylhydrazone, m. p. 174—175°. A mixed m. p. determination with the above phenylhydrazone showed no depression.

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