Reactions of 5α-Hydroxy-steroids: the Mechanism of Backbone Rearrangement in Sulphuric Acid–Acetic Acid–Acetic Anhydride

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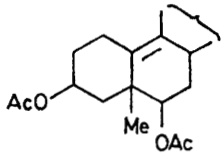
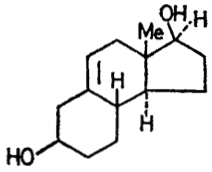
Summary Reaction of 4β-acetoxy-5α-hydroxycholestane (**4**) with D_2SO_4–DOAc–Ac_2O gives the acetoxy-olefins (**5**)—(**7**) with no incorporation of deuterium; these observations exclude the intermediacy of olefin and cyclopropane intermediates in the backbone or partial backbone rearrangement.

THE backbone rearrangement of steroids and triterpenoids with a range of deuteriated acids has generally led to incorporation of deuterium and hence has suggested olefin or cyclopropane intermediates.[1] However, rearrangement of compound (**2**) with DF, followed by treatment with MeOH–KOH has been shown[2] to give compound (**3**) with deuterium incorporation exclusively at C(11). This contrasts with other backbone rearrangements induced by DF and D_2SO_4, in proceeding entirely by a non-stop mechanism, but the influence of the hydroxy-substituent on the five-membered ring is unknown.



(1)



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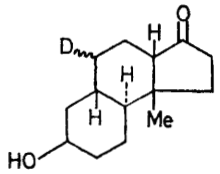

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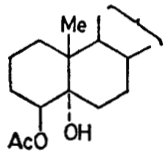

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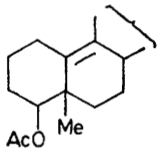

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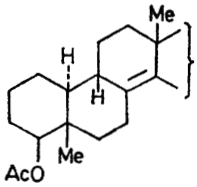
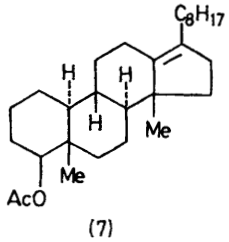


(6)

We now report the study of a steroid system where olefin products of both partial and complete backbone rearrangement can be isolated. Reaction of 4β-acetoxy-5α-hydroxycholestane (**4**) (500 mg) in DOAc–Ac_2O–D_2SO_4 (66 ml; 50 : 16 : 0·005) gives the olefins (**5**)—(**7**), which were isolated by preparative t.l.c. and their identity established by comparison with authentic samples.[3] The deuterium enrichments of the product olefins were determined mass spectrometrically. Within the limits of experimental accuracy (±5%) no deuterium incorporation could be detected in any of the products. Similarly, reaction of 3β,6β-diacetoxy-5α-hydroxycholestane (**8**) with CD_3CO_2D–Ac_2O–D_2SO_4 gives the olefin (**1**) without incorporation of deuterium. These observations contrast with other studies[1] and exclude olefin or cyclopropane intermediates in the backbone and partial backbone



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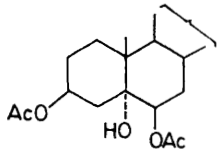

(8)

rearrangement of compounds (**4**) and (**8**). Methyl migration, involving either edge- or corner-protonated cyclopropane intermediates and hydride shifts in the systems examined are therefore more rapid than proton loss to cyclopropane or olefin intermediates.

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[1] J. Barbier, C. Berrier, J. C. Jacquesy, and R. Jacquesy, *Tetrahedron*, 1973, **29**, 1047; Y. Nakatani, G. Ponsinet, G. Wolff, J. L. Zundel, and G. Ourisson, *ibid.*, 1972, **28**, 4249; M. M. Janot, F. Frappier, J. Thierry, G. Lukacs, F. X. Jarreau, and R. Goutarel, *Tetrahedron Letters*, 1972, 3499; R. M. Coates, *ibid.*, 1967, 4143.
[2] J. P. Berthelot and J. Levisalles, *Chem. Comm.*, 1970, 1162.
[3] J. M. Coxon and M. P. Hartshorn, *Tetrahedron Letters*, 1969, 105.