A Backbone Rearrangement in A,19-Bisnor-steroids

By J. BASCOUL and A. CRASTES DE PAULET*

(*Groupe de Recherches sur la Biochimie des Stéroïdes U.58—I.N.S.E.R.M., Institut de Biologie, Boulevard Henri IV, 34 Montpellier, France*)

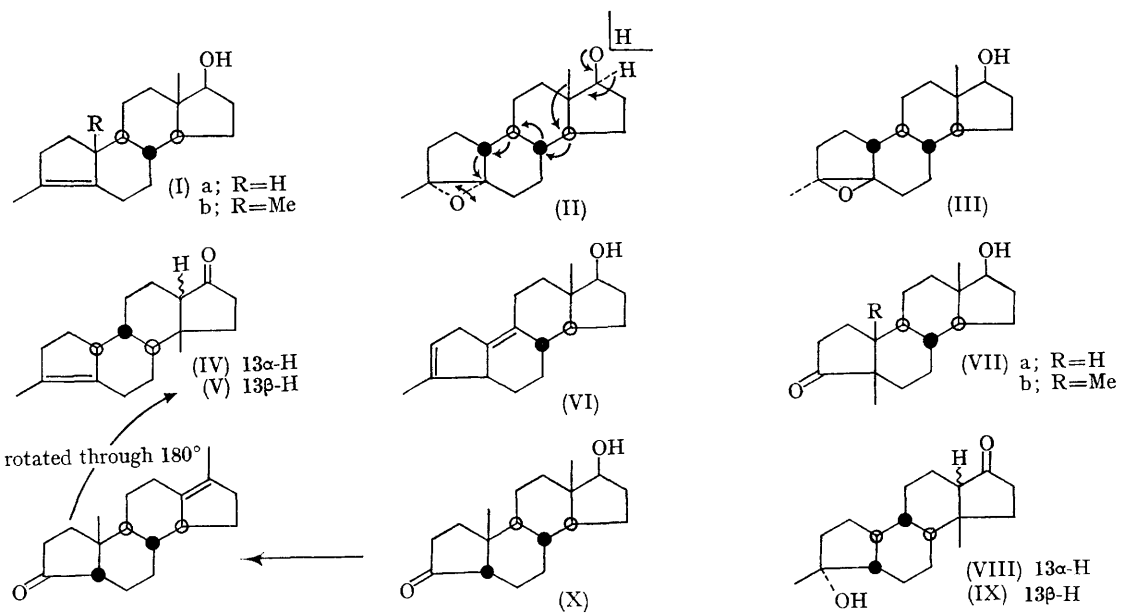
THE mixture of epoxides (II) and (III) of the A,19-bisnor-androstane series has been obtained from the unsaturated compound (Ia). The more abundant isomer (II), m.p. 127—128°, $[\alpha]_D^{20}$ + 25° ($CHCl_3$), on cleavage with BF_3,Et_2O, gives a mixture of several components, which separates into three groups of very different R_F upon t.l.c. on silica gel.

The first group contains two isomeric ketones, (IV) and (V), as shown by g.l.c. Under the conditions used, only one of the ketones can be isolated, 17-methyl-3-oxo-A,18-bisnor-5β-androst-13(17)-ene, (V), m.p. 149—150°, $[\alpha]_D^{20}$ + 102° ($CHCl_3$); ν_{CO} 1740 cm.$^{-1}$ (CS_2). This compound was prepared by solvolysis of the toluene-*p*-sulphonate of 17β-hydroxy-3-oxo-A-nor-5β-androstane (X).

From the second group was isolated the heteroannular diene (VI), m.p. 70—72°, $[\alpha]_D^{20}$ ± 0° ($CHCl_3$) λ_{max} 238, 247, 258 nm. (cyclohexane); no vinylic proton (n.m.r., 49, 102 c./sec.). A compound containing two nonconjugated double bonds was detected in the same group, though we have not been able to isolate it.

The third group contains the transposed ketone (VIIa), m.p. 203—205°, $[\alpha]_D^{20}$ + 120° ($CHCl_3$), ν_{CO} (KBr) 1725 cm.$^{-1}$; circular dichroism Δε + 0·65; n.m.r. 46, 59 c./sec. This group also contains the isomeric ketones (VIII) and (IX) in small amounts. Treatment of the mixture with Ac_2O–AcOH leads to the ketones found in the first group described above.

The ketones (IV), (V), (VIII), and (IX) result from a backbone rearrangement. This type of rearrangement does not occur when compound (Ib) is subjected to the same sequence of reactions; only one transposition product is observed, namely the ketone (VIIb).[1]



It is thus apparent that the backbone rearrangement is dependent upon the propensity of the substituents for intramolecular migration. In the case described here, just as in other series such as friedelane,[2] cholestane,[3] and androstane,[4,5] the rearrangement implies the inversion of the asymmetric centres at the ring junctions. It also implies a 1,2-transposition of the substituents at these centres of asymmetry and a modification of the groups attached to the terminal rings.

The backbone rearrangement observed in A,19-bisnor-steroids is probably not altogether concerted; indeed, it leads to unsaturated intermediates, particularly the diene (VI). As mentioned by other workers,[4] the 17-ketones do not arise as a result of enolisation at C-13(17), since the ketone with 13α-configuration is one of the kinetic reaction products. The proton removed is presumably the one from the 17-hydroxy-group.

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[1] A. Crastes de Paulet and J. Bascoul, *Bull. Soc. chim. France*, 1962, 401.
[2] J. L. Courtney, R. M. Gascoigne, and A. Z. Szumer, *J. Chem. Soc.*, 1958, 881.
[3] J. W. Blunt, S. M. Coxon, M. P. Hartshorn, and D. N. Kirk, *Tetrahedron*, 1967, **23**, 1811, and previous papers.
[4] J. C. Jacquesy, J. Levisalles, and J. Wagnon, *Chem. Comm.*, 1967, 25.
[5] M. Fétizon and P. Foy, *Chem. Comm.*, 1967, 1005.