of reactions yielded spirostan-3β-ol-11-one acetate (11-ketotigogenin acetate), m.p. 224–229°; α_D −39.4° ($CHCl_3$); found: C, 73.60; H, 9.08. Pyrolysis of the keto genin, oxidation of the pseudogenin and alkaline treatment of the latter provided Δ^{16}-*allo*pregnene-3β-ol-11,20-dione acetate, m.p. 183–185°; α_D +64.5° ($CHCl_3$); $\lambda_{max.}$ 234.5 mμ, E_m 9050 (alcohol); found: C, 73.93; H, 8.83. By hydrogenation of the latter, *allo*pregnane-3β-ol-11,20-dione acetate (m.p. 141–143° (VIII); α_D +88° ($CHCl_3$); found: C, 73.79; H, 8.90) was obtained which was identical with the product obtained by the Barbier-Wieland degradation of VII.

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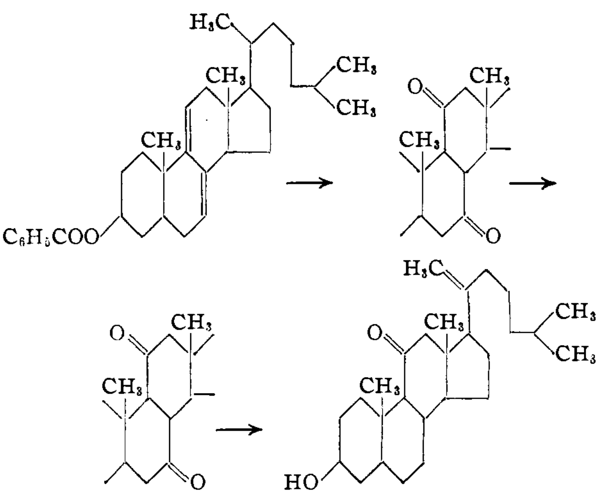
11-KETOLITHOCHOLIC ACID AND 11-KETOCHOLESTANOL FROM THE $\Delta^{7,9(11)}$-DIENES

Sir:

A practical route from cholic acid to methyl 3α,-7α-diacetoxy-12-keto-$\Delta^{9(11)}$-cholenate and methyl 12-keto-$\Delta^{7,9(11)}$-lithocholadienate has been reported.[1] Dr. S. Rajagopalan found that both esters are converted in good yield by Wolff–Kishner reduction into $\Delta^{7,9(11)}$-lithocholadienic acid (m.p. 201°, dec., $[\alpha]_D$ +121° Di; methyl ester, m.p. 120°, $[\alpha]_D^{22}$ +119° Di, $\lambda_{max.}^{EtOH}$ 244.5 mμ (log ϵ 4.2)), which forms a methyl ester acetate m.p. 149–150°, $[\alpha]_D$ +123° Di, $\lambda_{max.}^{EtOH}$ 244.5 (log ϵ 4.2) ($C_{27}H_{40}O_4$: C, 75.67; H, 9.64; found: C, 75.56; H, 9.63). We have now found that oxidation of this ester acetate with sodium dichromate dihydrate in acetic acid yields methyl 3α-acetoxy-7,8-oxido-$\Delta^{9(11)}$-cholenate (m.p. 185°, $[\alpha]_D$ +22° Di; $C_{27}H_{40}O_5$: C, 72.94; H, 9.07; found, C, 73.24; H, 9.29) and methyl 3α-acetoxy-7,11-diketo-Δ^8-cholenate (m.p. 115°, $[\alpha]_D$ +36° Di, $\lambda_{max.}^{EtOH}$ 271 mμ, log ϵ 3.85; $C_{27}H_{38}O_6$: C, 70.72; H, 8.35; found: C, 70.65; H, 8.38). The unsaturated oxide, formed also by perbenzoic acid oxidation, was isomerized by zinc and acetic acid, aqueous dioxane at 160°, or methanolic potassium hydroxide (re-esterification) to methyl 3α-acetoxy-7-keto-Δ^8-cholenate (m.p. 182.5° $[\alpha]_D$ −15° Di, $\lambda_{max.}^{EtOH}$ 254 mμ, log ϵ 4.04; found: C, 72.88; H, 9.13). Reduction of the unsaturated diketone with zinc and acetic acid afforded methyl 3α-acetoxy-7,11-diketocholenate (m.p. 162°, $[\alpha]_D$ +25° Di, $C_{27}H_{40}O_6$: C, 70.40; H, 8.75; found: C, 70.28; H, 8.94), which on Wolff–Kishner reduction followed by esterification, acetylation, and chromatography gave both methyl lithocholate acetate (m.p. 134°, $[\alpha]_D$ +44° An, no depression with authentic sample[2]) and methyl 3α-acetoxy-11-ketocholanate[3] (m.p. 131°, $[\alpha]_D$ +67° An, $C_{27}H_{42}O_5$: C, 72.61; H 9.48; found: C, 72.60, H, 9.69, no depression with authentic sample.

Δ^7-Cholestenol (m.p. 123–125°), available from cholesterol by Raney-nickel hydrogenation of the 7-dehydro derivative, was converted by dehydrogenation with mercuric acetate and benzoylation into $\Delta^{7,(911)}$-cholestadienyl benzoate, m.p. 134°, $[\alpha]_D$ +32° Di, $\lambda_{max.}^{EtOH}$ 243 mμ (log ϵ 4.0) (free alcohol), $C_{34}H_{48}O_2$: C, 83.55; H, 9.90; found: C, 83.81; H, 10.05). Oxidation of this diene with sodium dichromate in acetic acid-benzene at 25° yielded, after chromatography, Δ^8-cholestene-3β-ol-7,11-dione-3-benzoate (m.p. 150°, $[\alpha]_D$ about +6° Di, $\lambda_{max.}^{EtOH}$ 268 mμ, log ϵ 3.8, $\lambda_{max.}^{Chf}$ 5.95 μ, $C_{34}H_{46}O_4$: C, 78.72; H, 8.94; found: C, 78.77; H, 9.19); a second oxidation product is formed but has not been fully characterized. Reduction of the enedione with zinc dust and acetic acid gave cholestane-3β-ol-7,11-dione-3-benzoate, m.p. 200°, $[\alpha]_D$ +3° Di, $C_{34}H_{48}O_4$: C, 78.42; H, 9.29; found: C, 78.37; H, 9.71. Alternately, the total product from oxidation of the diene benzoate (8 g.) was reduced with zinc dust and acetic acid. Chromatography of the mixture yielded the saturated diketone benzoate (m.p. 200°), some of the stenyl benzoate (m.p. 142°, $[\alpha]_D$ −10° Di), and 7-keto-Δ^8-cholestenyl benzoate (m.p. 150°, $[\alpha]_D$ −13° Di, $\lambda_{max.}^{EtOH}$ 252 mμ, log ϵ 3.8, $C_{34}H_{48}O_3$: C, 80.90; H, 9.58; $\lambda_{max.}^{CHCl_3}$ 5.95μ; found: C, 81.02; H, 9.87). Wolff–Kishner reduction of the saturated diketone gave a cholestanolone, m.p. 151°, $[\alpha]_D$ +49° Di, $\lambda_{max.}^{Chf}$ 5.89 μ; $C_{27}H_{46}O_2$: C, 80.54; H, 11.52; found: C, 80.66; H, 11.49. That cholesterol has been converted into the 11-keto stanol is evidenced by analogy to the synthesis in the bile acid series, by the presence of a carbonyl group (infrared) resistant to Wolff–Kishner reduction, and the M_D increment of +96° for the carbonyl group, as compared with known values (+79°, mean of 5 examples, +60 to +96°.[4]



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[1] L. F. Fieser, S. Rajagopalan, M. Tishler and E. Wilson, THIS JOURNAL, in press.

[2] Comparison sample: L. F. Fieser and S. Rajagopalan, THIS JOURNAL, **72**, 5530 (1950).

[3] Comparison sample: R. B. Turner, V. R. Mattox, L. L. Engel, B. F. McKenzie and E. C. Kendall, *J. Biol. Chem.*, **166**, 345 (1946).

[4] D. H. R. Barton and W. Klyne, *Chemistry and Industry*, **26**, 757 (1948).