7a-KETO-B-HOMOTESTOSTERONE AND 7a-KETO-B-HOMOEPITESTOSTERONE*

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Synthesis of 7a-keto-B-homotestosterone (*IX*) and its 17α-isomer *XIV* from 3β-acetoxy-17β(or α)-benzoyloxyandrost-5-en-7-one (*I* or *X*) is described. The key reaction is the enlargement of the ring B in reaction with diazomethane in the presence of aluminium chloride.

Recently, great attention has been paid to epitestosterone (17α-hydroxyandrost-4-en-3-one) whose antiandrogen activity represents a certain therapeutical potential[1 – 5]. Within the framework of our structure–antiandrogen activity studies we recently prepared B-nor-epitestosterone[6]. In the present paper we describe the results of attempts to prepare 7a-oxo-B-homoepitestosterone (*XIV*). At the same time, we also prepared 7a-oxo-B-homotestosterone (*IX*) for comparison of biological activities.

We first tried to homologize ring B in the accessible starting compound *I* (3β-acetoxy-17β-benzoyloxyandrost-5-en-7-one) (ref.[7]) using a method[8] based on the acid-catalyzed dehydration of compounds of the type *IV* and *V*. These compounds were prepared as follows. The 7-oxo group in compound *I* was reduced with tri-*tert*-butoxylithium aluminium hydride under formation of two compounds: the lipophilic 7β-alcohol *II* (68%) and the more polar 7α-alcohol *III* (23%). The configuration at carbon 7 in both isomers was assigned by NMR spectroscopy according to the multiplicity of signals of protons in position 7 and according to chemical shift of the singlet of H-19.

The double bond in both the alcohols *II* and *III* was subjected to Simmons–Smith reaction[9], in both cases giving rise to a single adduct. The products of the Simmons–Smith reaction were assigned configuration on the basis of experience[10 – 15] that the steric position of hydroxyl group determines the approach of reagent to the reactant. Thus, alcohol *II* is converted into adduct *IV* and alcohol *III* into adduct *V* (Scheme 1).

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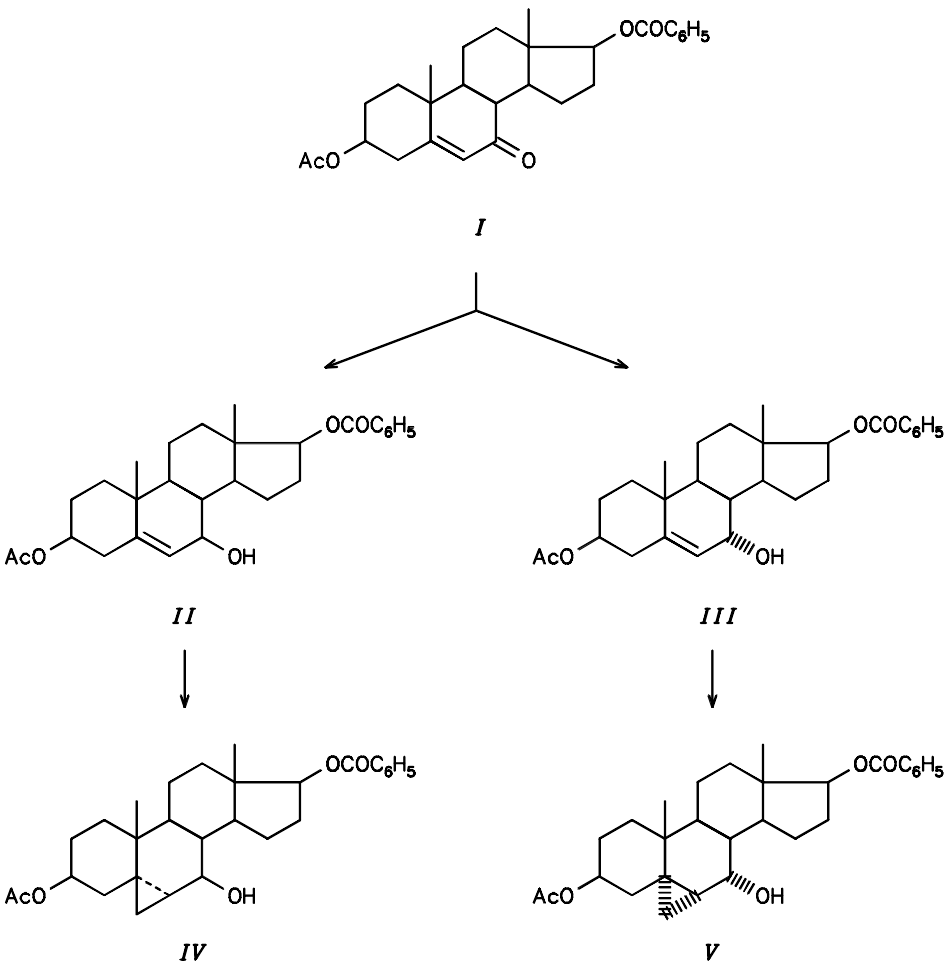


SCHEME 1

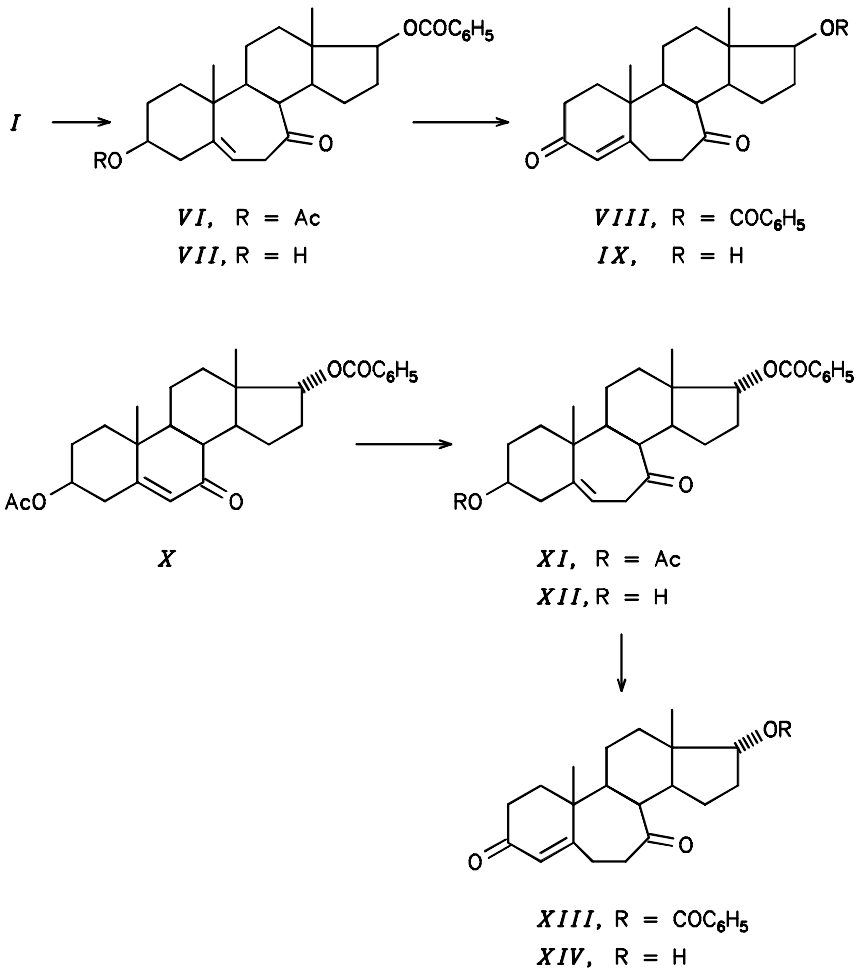
This assignment was proved by the NMR spectra of both compounds. As seen from Table I, the 5α,6α-cyclopropane ring in 3β-acetoxy-17β-benzoyloxy-5,7β-cyclo-B-homo-5β-androstan-7aα-ol (*V*) shifts the H-19 signal downfield whereas the cyclopropane ring of opposite configuration in 5,7α-cyclo-B-homo-5α-androstane adduct *IV* has no effect in this respect. In the adduct *V*, the H-19 protons are located outside the cone whose axis goes through the center of the 5α,7α-cyclopropane ring and is perpendicular to its plane; such protons are shifted downfield. On the other hand, in the adduct *IV*, which contains 5β,7β-cyclopropane ring, the H-19 protons lay more or less on the surface of the cone and thus are not affected by the cyclopropane ring. At the same time, this consideration proves that the configuration of hydroxyl groups in the hydride reduction products (*II* and *III*) has been determined correctly.

We tried acid-catalyzed cleavage of the cyclopropane ring in adducts *IV* and *V* to obtain B-homo compounds, similarly as described in the literature[8]. However, there was no cleavage of the cyclopropane ring in either isomer and after prolonged treatment with acid the only reaction observed was the beginning hydrolysis of the 3β-acetoxy group.

An alternative method of homologization of the ring B consisted in reaction of the conjugated ketone with diazomethane in the presence of aluminium chloride. We made use of the same starting material, 3β-acetoxy-17β-benzoyloxyandrost-5-en-7-one (*I*). Reaction of this compound with diazomethane in the presence of aluminium chloride afforded a mixture which, after column chromatography on silica gel, gave 3β-acetoxy-17β-benzoyloxy-B-homoandrost-5-en-7a-one (*VI*). The insertion of the CH_2 group into the molecule was confirmed by mass (*m*/*z* 464, M^+) as well as IR spectroscopy (the 7-keto group absorbs in the region of unconjugated ketones at 1 718 cm^{-1}). And since the 7-keto group absorbs in the region of unconjugated ketones, the carbonyl functionality must be in position 7a. Selective hydrolysis of the 3β-acetoxy group in compound *VI* with hydrochloric acid in methanol gave 3β-hydroxy derivative *VII* which was converted by Oppenauer oxidation into the conjugated ketone *VIII*. Subsequent removal of the 17-benzoyl group by alkaline hydrolysis afforded the desired 7a-keto-B-homotestosterone (*IX*) (Scheme 2).

TABLE I
Chemical shift values (ppm) for proton-19 signals

Compound	H-19
3β-Acetoxy-5,7α-cyclo-B-homo-5α-cholestan-7aβ-ol (ref.[15])	0.89
3β-Acetoxy-5,7β-cyclo-B-homo-5β-cholestan-7aα-ol (ref.[15])	1.09
3β-Acetoxy-17β-benzoyloxy-5,7α-cyclo-B-homo-5α-androstan-7aβ-ol (*IV*)	0.92
3β-Acetoxy-17β-benzoyloxy-5,7β-cyclo-B-homo-5β-androstan-7aα-ol (*V*)	1.12


I
OCOC6H5
RO
O
OR
O
O
VI, R = Ac
VII, R = H
VIII, R = COC6H5
IX, R = H
OCOC6H5
AcO
O
OCOC6H5
RO
O
X
XI, R = Ac
XII, R = H
OR
O
O
XIII, R = COC6H5
XIV, R = H

SCHEME 2

Using a similar procedure, we prepared the 17α-isomer *XIV*: the starting known 3β-acetoxy-17α-benzoyloxyandrost-5-en-7-one (*X*, ref.[6]) was converted into the B-homo derivative *XI* again by treatment with diazomethane in the presence of aluminium chloride. Subsequent selective removal of the acetoxy group, Oppenauer oxidation and alkaline saponification of the benzoyloxy group afforded compounds *XII*, *XIII* and 17α-hydroxy-B-homoandrost-4-ene-3,7a-dione (*XIV*), respectively.

The biological activities of the compounds obtained will be published elsewhere.

EXPERIMENTAL

The melting points were determined on a Kofler block and are uncorrected. Infrared spectra were recorded on a Perkin–Elmer PE 580 spectrometer in tetrachloromethane (unless stated otherwise), wavenumbers are given in cm^{-1}. Proton NMR spectra were taken in deuteriochloroform on a Varian XL-200 (FT mode, 200 MHz) instrument with tetramethylsilane as internal reference. Chemical shifts are given in ppm (δ-scale), coupling constants (*J*) and multiplet half-widths ($W_{1/2}$) in Hz. The data were interpreted as the first-order spectra. Mass spectra were obtained with a ZAB-EG spectrometer at 70 eV. The identity of the samples prepared was checked by mixture melting points, thin-layer chromatography (TLC), IR and proton NMR spectra. Preparative TLC was carried out on 200 × 200 mm plates coated with 0.7 mm thick layer of silica gel Woelm DC. The "usual work-up" of a solution denotes washing with water, 5% aqueous potassium hydrogen carbonate, water, drying over sodium sulfate, filtering and evaporation of the solvent to dryness in vacuo. The light petroleum used was a fraction boiling at 40 – 62 °C.

3β-Acetoxy-17β-benzoyloxyandrost-5-en-7β-ol (*II*)

Tri-*tert*-butoxylithium aluminium hydride (1.40 g, 5.5 mmol) was added to a solution of 3β-acetoxy-17β-benzoyloxyandrost-5-en-7-one (0.70 g, 1.56 mmol) in tetrahydrofuran (20 ml). The reaction mixture was set aside at room temperature for 2 h, poured into water, extracted with ether and worked up in the usual manner. The obtained mixture of two products was column chromatographed on silica gel (250 g) in chloroform–ether–light petroleum (1 : 1 : 1). The product-containing fractions afforded 480 mg (68%) of the lipophilic product *II*, m.p. 131 – 134 °C (methanol) with change of crystal modification at 60 – 70 °C. ^{1}H NMR spectrum: 0.97 s, 3 H (3 × H-18); 1.09 s, 3 H (3 × H-19); 2.04 s, 3 H (acetate); 3.92 d, 1 H (H-7α, J = 8); 4.63 m, 1 H (H-3α, $W_{1/2}$ = 21); 4.86 m, 1 H (H-17α, $W_{1/2}$ = 16); 5.53 bs, 1 H (H-6, $W_{1/2}$ = 5); 7.30 – 7.64 m, 3 H and 8.00 – 8.11 m, 2 H (C_6H_5CO–). IR spectrum: 3 603 (hydroxyl); 1 750 sh, 1 732, 1 244 (acetate); 1 720, 1 277 (benzoate); 1 675 (C=C); 1 603, 1 585 (aromate). For $C_{28}H_{36}O_5$ (452.6) calculated: 74.30% C, 8.02% H; found: 74.01% C, 8.19% H.

3β-Acetoxy-17β-benzoyloxyandrost-5-en-7α-ol (*III*)

Further elution in the chromatography in the preceding preparation of compound *II* afforded 162 mg (23%) of compound *III* as an oil. ^{1}H NMR spectrum: 0.96 s, 3 H (3 × H-18); 1.04 s, 3 H (3 × H-19); 2.04 s, 3 H (acetate); 3.88 m, 1 H (H-7β, $W_{1/2}$ = 9); 4.64 m, 1 H (H-3α, $W_{1/2}$ = 18); 4.91 m, 1 H (H-17α, $W_{1/2}$ = 15); 5.66 d, 1 H (H-6, J = 5.5 Hz); 7.35 – 7.65 m, 3 H and 7.98 – 8.11 m, 2 H (C_6H_5CO–). IR spectrum: 3 616 (hydroxyl); 1 733, 1 243 (acetate); 1 720, 1 275 (benzoate). For $C_{28}H_{36}O_5$ (452.6) calculated: 74.30% C, 8.02% H; found: 73.89% C, 8.21% H.

3β-Acetoxy-17β-benzoyloxy-5,7α-cyclo-B-homo-5α-androstan-7aβ-ol (*IV*)

Zn–Cu couple (0.7%) was prepared by adding zinc dust (2.6 g) to a solution of cupric acetate monohydrate (60 mg) in acetic acid (2.5 ml) at 50 – 60 °C and shaking until the solution became colourless. Fresh acetic acid (2.5 ml) was added and the sedimented zinc was decanted with eight portions (2.5 ml each) of anhydrous ether. Ether (10 ml) and methylene iodide (2.3 ml, 29.6 mmol) were added and the mixture was refluxed under nitrogen for 2 h. A solution of 7β-alcohol *II* (410 mg, 0.91 mmol) in anhydrous ether (20 ml) was added and the mixture was refluxed for further 4 h under nitrogen. After cooling, the mixture was poured into water, the product was taken up in ether and the ethereal phase was washed successively with water, 5% hydrochloric acid, water, 10% sodium hydrogen carbonate, 10% sodium thiosulfate and water, dried and the solvent was evaporated. The residue was purified by chromatography on a column of silica gel in light petroleum–ether (7 : 3); yield 185 mg (44%) of adduct *IV*. ^{1}H NMR spectrum: 0.12 dd, 1 H (J = 2, J' = 4) and 0.50 t, 1 H (J = 4) (2 × cyclopropane proton); 0.91 and 0.92 2 × s, 2 × 3 H (3 × H-18 and 3 × H-19); 2.02 s, 3 H (acetate); 3.71 dd, 1 H (H-7, J = 5, J' = 7); 4.79 dd, 1 H (H-17α, J = 6, J' = 8); 4.91 m, 1 H (H-3α, $W_{1/2}$ = 13); 7.35 – 7.62 m, 3 H and 7.97 – 8.09 m, 2 H (C_6H_5CO–). IR spectrum: 3 603 (hydroxyl); 1 736, 1 246 (acetate); 1 721, 1 275 (benzoate). For $C_{29}H_{38}O_5$ (466.6) calculated: 74.65% C, 8.21% H; found: 73.97% C, 8.02% H.

3β-Acetoxy-17β-benzoyloxy-5,7β-cyclo-B-homo-5β-androstan-7aα-ol (*V*)

Zn–Cu couple (0.7%) was prepared by adding zinc dust (0.7 g) to a solution of cupric acetate monohydrate (15 mg) in acetic acid (0.7 ml) at 50 – 60 °C and shaking until the solution became colourless. Fresh acetic acid (0.7 ml) was added and the sedimented zinc was decanted with eight portions (1 ml each) of anhydrous ether. Ether (3 ml) and methylene iodide (0.6 ml, 7.4 mmol) were added and the mixture was refluxed under nitrogen for 2 h. A solution of 7α-alcohol *III* (108 mg, 0.24 mmol) in anhydrous ether (5 ml) was added and the mixture was refluxed for further 4 h under nitrogen. After cooling, the mixture was poured into water, the product was taken up in ether and the ethereal phase was washed successively with water, 5% hydrochloric acid, water, 10% sodium hydrogen carbonate, 10% sodium thiosulfate and water, dried and the solvent was evaporated. The residue was purified by chromatography on a column of silica gel in light petroleum–ether (7 : 3); yield 45 mg (43%) of adduct *V*, m.p. 158 – 163 °C (ethanol). ^{1}H NMR spectrum: 0.23 m, 1 H ($W_{1/2}$ = 4) (cyclopropane proton); 0.88 s, 3 H (3 × H-18); 1.12 s, 3 H (3 × H-19); 2.01 s, 3 H (acetate); 4.16 m, 1 H (H-7β, $W_{1/2}$ = 12); 4.85 m, 2 H (H-17α and H-3α, $W_{1/2}$ = 14); 7.36 – 7.63 m, 3 H and 7.97 – 8.07 m, 2 H (C_6H_5CO–). IR spectrum: 3 619 (hydroxyl); 1 732, 1 244 (acetate); 1 720, 1 275 (benzoate). For $C_{29}H_{38}O_5$ (466.6) calculated: 74.65% C, 8.21% H; found: 73.30% C, 8.19% H.

3β-Acetoxy-17β-benzoyloxy-B-homoandrost-5-en-7a-one (*VI*)

A solution of diazomethane (420 mg, 10.0 mmol) in ether (16.2 ml) was added to a solution of 3β-acetoxy-17β-benzoyloxyandrost-5-en-7-one (ref.[7]) (*I*; 450 mg, 1.0 mmol) in anhydrous ether (50 ml). Aluminium chloride (25 mg) was added, followed after 2 min by another 25 mg portion. Finally, after further 5 min, the last portion (50 mg) of aluminium chloride was added. During the reaction the yellow colour of the solution rapidly disappeared under formation of a milky solution. After standing for 10 min at room temperature, the reaction mixture was poured into water, extracted in ether and worked up as usual, affording 490 mg of a residue which contained no starting compound *I* but, beside further products, contained a compound of slightly higher R_F (in light petroleum–acetone 6 : 1) than *I*. The residue was chromatographed on a column of silica gel (200 g) in light petroleum–acetone (12 : 1). Fractions of R_F almost identical with that of the starting compound *I*

were worked up and the obtained product (172 mg, 37%) was crystallized from ethanol to give 95 mg (21%) of the homo derivative *VI*, m.p. 153 – 154 °C (methanol). ^{1}H NMR spectrum: 0.96 s, 3 H (3 × H-18); 1.09 s, 3 H (3 × H-19); 2.03 s, 3 H (acetate); 4.61 m, 1 H (H-3α); 4.83 dd, 1 H (H-17α, J = 9, J' = 7.5); 5.16 m, 1 H (H-6, $W_{1/2}$ = 5); 7.36 – 7.64 m, 2 H and 7.97 – 8.09 m, 3 H (C_6H_5CO–). IR spectrum: 1 733, 1 245 (acetate); 1 718 (seven-membered ring ketone); 1 718, 1 274 (benzoate); 1 642 (C=C). Mass spectrum, *m/z*: 464 (M^+), 404 (M – CH_3COOH), 282 (M – CH_3COOH – C_6H_5COOH). For $C_{29}H_{36}O_5$ (464.6) calculated: 74.97% C, 7.81% H; found: 75.06% C, 7.83% H.

17β-Benzoyloxy-3β-hydroxy-B-homoandrost-5-en-7a-one (*VII*)

A solution of acetate *VI* (131 mg, 0.28 mmol) in methanol (25 ml) was mixed with 37% hydrochloric acid (0.7 ml). After standing at room temperature for 4 h, the solvent was evaporated to dryness in vacuo. The residue was mixed with benzene (100 ml) and ethanol (100 ml) and the mixture was again evaporated to dryness. The residue was subjected to preparative chromatography on two plates of silica gel in chloroform–ether (1 : 1) and the obtained material (72 mg) was crystallized from ethanol to give 25 mg (21%) of compound *VII*, m.p. 245 – 246 °C (subl. 220 °C). ^{1}H NMR spectrum: 1.00 s and 1.03 s, 2 × 3 H (3 × H-18 and 3 × H-19); 2.45 – 2.68 m, 2 H (H-4); 3.54 m, 1 H (H-3α, $W_{1/2}$ = 22); 3.66 d, 1 H (H-7, J = 11); 4.94 m, 1 H (H-17α, $W_{1/2}$ = 15); 5.44 d, 1 H (H-6, J = 9); 7.64 – 7.39 m, 3 H and 7.99 – 8.13 m, 2 H (C_6H_5CO–). IR spectrum: 3 622 (hydroxyl); 1 718, 1 274 (benzoate). For $C_{27}H_{34}O_4$ (422.6) calculated: 76.74% C, 8.11% H; found: 76.30% C, 8.19% H.

17β-Benzoyloxy-B-homoandrost-4-ene-3,7a-dione (*VIII*)

A part of the solvent (3 ml) was distilled from a solution of 3β-alcohol *VII* (130 mg, 0.31 mmol) in toluene (15 ml). Cyclohexanone (2 ml, 19.3 mmol) was added and another part of the distillate (2.5 ml) was collected. After addition of aluminium isopropoxide (140 mg, 0.70 mmol), the mixture was boiled so as to collect about 6 ml of the distillate during 45 min. The mixture was cooled, poured into water, extracted with ether and worked up in the usual manner. The obtained material was chromatographed on a column of silica gel (100 g), elution successively with light petroleum–ether in the ratios 9 : 1, 5 : 1, 2 : 1, and chloroform–ether–methanol (10 : 10 : 1). The obtained oil (155 mg) was purified by preparative thin-layer chromatography on 4 plates of silica gel in light petroleum–ether (2 : 3) to give 121 mg (78%) of product *VIII*, m.p. 214 – 216 °C (aqueous ethanol). ^{1}H NMR spectrum: 0.98 s, 3 H (3 × H-18); 1.26 s, 3 H (3 × H-19); 4.91 dd, 1 H (H-17α, J = 9.0, J' = 7.5); 5.76 s, 1 H (H-4); 7.35 – 7.65 m, 3 H and 7.98 – 8.10 m, 2 H (C_6H_5CO–). IR spectrum (KBr): 1 716, 1 275 (benzoate); 1 713 shoulder (seven-membered ring ketone); 1 674, 1 610 (C=C–C=O). For $C_{27}H_{32}O_4$ (420.5) calculated: 77.11% C, 7.67% H; found: 76.91% C, 7.52% H.

17β-Hydroxy-B-homoandrost-4-ene-3,7a-dione (*IX*)

Potassium hydroxide (300 mg, 5.4 mmol) was added to a solution of benzoate *VIII* (110 mg, 0.26 mmol) in methanol (5.4 mmol). After standing at room temperature for 5 h, the mixture was poured in water and the product was extracted in chloroform. The solvent was evaporated and the residue (91 mg) was purified by chromatography on four plates of silica gel; elution with chloroform–ether (1 : 1). Yield 36 mg (43%) of non-crystalline product *IX*. ^{1}H NMR spectrum: 0.79 s, 3 H (3 × H-18); 1.25 s, 3 H (3 × H-19); 3.63 – 3.72 m, 1 H (H-17α); 5.72 s, 1 H (H-4). IR spectrum: 3 628 (hydroxyl); 3 018 (=C–H); 1 711 (seven-membered ring ketone); 1 676, 1 620, 1 558 (C=C–C=O). For $C_{20}H_{28}O_3$ (316.4) calculated: 75.92% C, 8.92% H; found: 75.59% C, 8.71% H.

3β-Acetoxy-17α-benzoyloxy-B-homoandrost-5-en-7a-one (*XI*)

Diazomethane (420 mg, 10.0 mmol) in ether (16.2 ml) was added to a solution of 3β-acetoxy-17α-benzoyloxyandrost-5-en-7-one (ref.[6]) (*X*; 450 mg, 1.0 mmol) in anhydrous ether (100 ml). Aluminium chloride (50 mg) was added, followed after 2 min by a second portion (25 mg), and after further 5 min by the last portion (50 mg) of aluminium chloride. During the reaction the yellow colour of the solution rapidly disappeared under formation of a milky solution. After standing at room temperature for further 10 min, the reaction mixture was poured into water, the product extracted with ether and worked up in the usual manner. The obtained material was chromatographed on a column of silica gel (200 g); gradient elution with light petroleum–ether (9 : 1 to 7 : 1). Processing of fractions of R_F slightly higher than that of the starting compound *X* afforded 207 mg (45%) of non-crystalline product *XI*. ^{1}H NMR spectrum: 0.91 s, 3 H (3 × H-18); 1.03 s, 3 H (3 × H-19); 2.03 s, 3 H (acetate); 4.58 m, 1 H (H-3α, $W_{1/2}$ = 21); 5.11 d, 1 H (H-17β, J = 6); 5.46 dd, 1 H (H-6, J = 10, J' = 1.5); 7.38 – 7.65 m, 2 H and 7.96 – 8.10 m, 3 H (C_6H_5CO–). Mass spectrum, *m*/*z*: 404 (M – CH_3COOH), 282 (404 – C_6H_5COOH). For $C_{29}H_{36}O_5$ (464.6) calculated: 74.97% C, 7.81% H; found: 75.02% C, 7.99% H.

17α-Benzoyloxy-3β-hydroxy-B-homoandrost-5-en-7a-one (*XII*)

A solution of acetate *XI* (464 mg, 1.0 mmol) in methanol (40 ml) was mixed with 37% hydrochloric acid (2.0 ml). After standing at room temperature for 4 h, the mixture was concentrated, the residue poured into water and the product extracted in ether and worked up as usual. The product was purified by chromatography on a column of silica gel (50 g) in light petroleum–ether (1 : 1); yield 318 mg (75%). Crystallization from ethanol gave 161 mg (38%) of compound *XII*, m.p. 130 – 132 °C. ^{1}H NMR spectrum: 0.91 s, 3 H (3 × H-18); 1.01 s, 3 H (3 × H-19); 3.57 m, 1 H (H-3α, $W_{1/2}$ = 22); 3.71 d, 1 H (H-7, J = 11); 5.11 d, 1 H (H-17β, J = 6); 5.44 d, 1 H (H-6, J = 9); 7.38 – 7.57 m, 3 H and 7.97 – 8.09 m, 2 H (C_6H_5CO–). IR spectrum: 3 619 (hydroxyl); 1 717, 1 274 (benzoate); 1 701 shoulder (seven-membered ring ketone); 1 637 (C=C). For $C_{27}H_{34}O_4$ (422.6) calculated: 76.74% C, 8.11% H; found: 76.52% C, 8.00% H.

17α-Benzoyloxy-B-homoandrost-4-ene-3,7a-dione (*XIII*)

A part of the solvent (9 ml) was distilled from a solution of 3β-alcohol *XII* (400 mg, 0.95 mmol) in toluene (45 ml). Cyclohexanone (6.0 ml, 57.9 mmol) was added and another part of the distillate (7.5 ml) was collected. After addition of aluminium isopropoxide (400 mg, 1.99 mmol), the mixture was boiled so as to collect about 18 ml of the distillate during 30 min. The mixture was cooled, poured into water, extracted with ether and worked up in the usual manner. The obtained material was chromatographed on a column of silica gel (400 g), elution successively with light petroleum–ether in the ratios 9 : 1, 5 : 1, 2 : 1, and 1 : 1. The obtained oil (292 mg, 73%) was purified by crystallization from tetrachloromethane to give 201 mg (51%) of product *XIII*, m.p. 221 – 223 °C (sublimed from 205 °C). ^{1}H NMR spectrum: 0.88 s, 3 H (3 × H-18); 1.25 s, 3 H (3 × H-19); 5.10 d, 1 H (H-17β, J = 6); 5.75 s, 1 H (H-4); 7.39 – 7.67 m, 3 H and 7.99 – 8.14 m, 2 H (C_6H_5CO–). IR spectrum (KBr): 1 716, 1 274 (benzoate); 1 716 (seven-membered ring ketone); 1 681, 1 612 (C=C–C=O). For $C_{27}H_{32}O_4$ (420.5) calculated: 77.11% C, 7.67% H; found: 76.83% C, 7.43% H.

17α-Hydroxy-B-homoandrost-4-ene-3,7a-dione (*XIV*)

Potassium hydroxide (100 mg, 1.8 mmol) was added to a solution of benzoate *XIII* (105 mg, 0.25 mmol) in methanol (10 ml). After standing at room temperature for 18 h, the mixture was poured into water, the product was extracted with chloroform and worked up in the usual manner.

The obtained material (100 mg) was purified by chromatography on four plates of silica gel; elution with chloroform–ether–2-propanol (2 : 1 : 0.2). Crystallization of the residue (32 mg) from tetrachloromethane afforded 14 mg (18%) of product *XIV*, m.p. 136 – 139 °C (change of crystal modification at 60 – 70 °C. ^{1}H NMR spectrum: 0.72 s, 3 H (3 × H-18); 1.21 s, 3 H (3 × H-19); 2.76 d, 1 H (H-17β, J = 5.5); 5.75 s, 1 H (H-4). IR spectrum: 3 627, 3 620, 1 066 (hydroxyl); 3 026 (double bond); 1 711 (seven-membered ring ketone); 1 678, 1 664, 1 611 (C=C–C=O). Mass spectrum (FAB), *m*/*z*: 317 (M + 1), 299 (317 – H_2O), 284 (299 – CH_3). For $C_{20}H_{28}O_3$ (316.4) calculated: 75.92% C, 8.92% H; found: 76.03% C, 8.91% H.

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