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MASS SPECTROMETRY OF STEROID SYSTEMS. VIII*.
THE DETERMINATION OF THE CONFIGURATION AT C-9 AND C-10 IN Δ^4-3-OXOSTEROID SERIES

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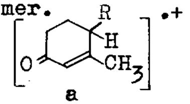
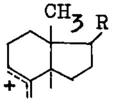
Earlier1/ on the example of the 8β,9α,10β-, 8α,9α,10β- and 8β,9β,10α-isomers of 19-nortestosterone (I) we showed, that the stereochemical differences between the isomers are reflected mainly in the peak intensities of fragments <u>a</u>, <u>b</u> and <u>c</u>, the largest peaks being exhibited by the 8β,9β,10α-isomer.



a

R=H, m/e 110

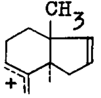
R=CH_3, m/e 124



b

R=OH, m/e 165

R=$COCH_3$, m/e 191



c

m/e 147

It was thought of interest to see whether this regularity would also obtain in the 19-CH_3-steroid series and also to study the effect of the configuration at C-9 on the fragmentation giving the ion <u>a</u>. Testosterone (II),

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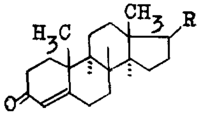
*Part VII: V.I. Zaretskii, N.S. Wulfson, V.G. Zaikin, V.N. Leonov, S.N. Ananchenko, I.V. Torgov, Tetrahedron Letters, 347 (1966).

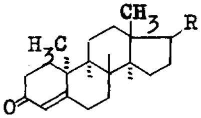
its 10α-isomer (III), corresponding acetates (IV and V) and also progesterone (VI) and its 8β,9β,10α-isomer (VII) were chosen for the study.



II R=OH

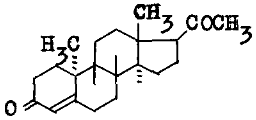
IV R=$OCOCH_3$

VI R=$COCH_3$



III R=OH

V R=$OCOCH_3$



VII

In the spectrum of 8β,9β,10α-isoprogesterone (VII) peak intensity of the ion a (m/e 124) is considerably greater than in that of progesterone (VI) (Fig. 1c,d and Table 1). At the same time a comparison of the mass spectra of testosterone (II) and its 10α-isomer (III) showed that the peak a intensity also sharply increases on passing from the 10β- to 10α-compound (Fig. 1a,b and Table 1). Hence in the Δ^4-3-oxosteroid series degradation of the molecular ion with the formation of type a ions depends mainly on the configuration at C-10 (being facilitated in the case of the α-configuration), whereas the C-9-center (i.e. the mode of B/C-rings junction) has an insignificant influence.

TABLE 1

Abundance of Characteristic Peaks (% from M$^+$) in the Mass Spectra of Δ^4-3-oxosteroids II - VII

m/e	II	III	IV	V	VI	VII	III:II	V:IV	VII:VI
124	130	306	206	386	147	376	2,3	1,9	2,5
147	60	45	173	153	-	-	0,7	0,9	-
191	-	-	-	-	30	65	-	-	2,1

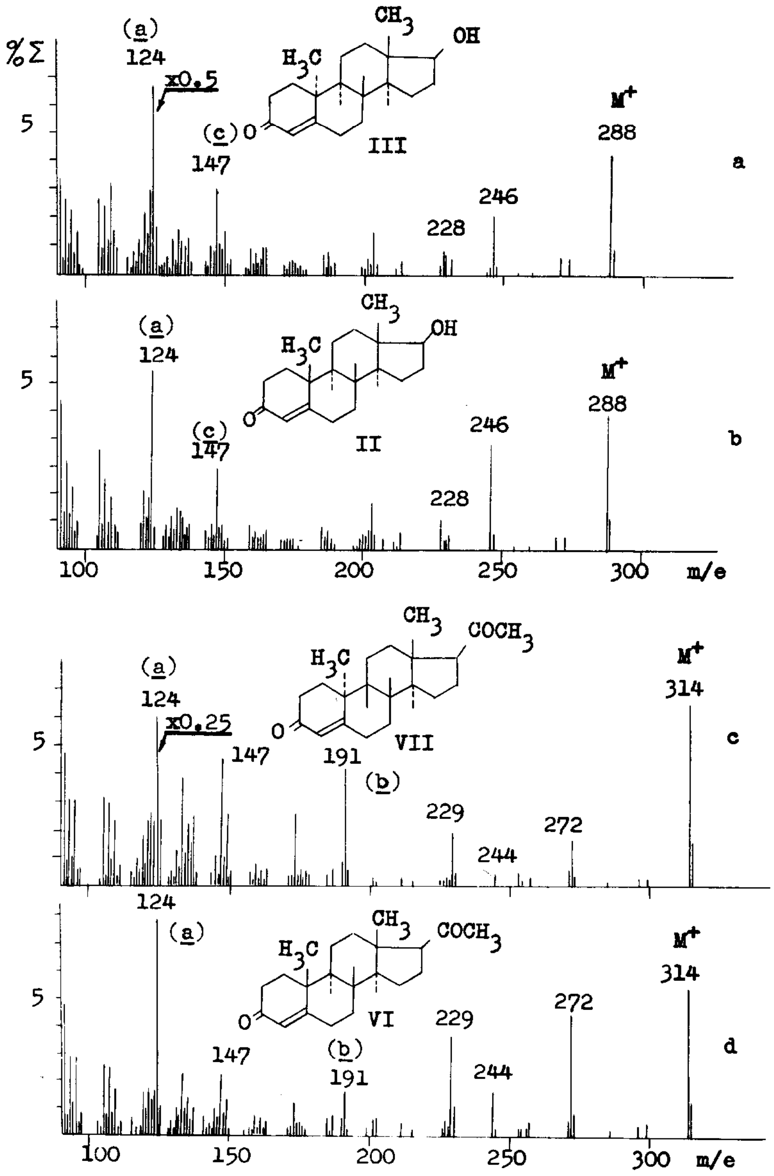


Figure 1a,b,c,d

On the other hand the different modes of fusion of rings B and C in compounds II-VII are reflected mainly in a strong increase in the peaks b (m/e 191) and c (m/e 147) intensities on passing from the trans- to cis-isomer. Indeed, whereas compounds II-V with $8\beta,9\alpha$-configuration show practically the same intensity of the ion c (m/e 147) peak (Fig. 1a,b and Table 1), compound VII ($8\beta,9\beta$-configuration) gives a considerably more intense ion b (m/e 191) peak than does progesterone (VI). A similar regularity has been noted in case of the $8\beta,9\beta$-isomer of I[1]. The more intensive decomposition of the molecular ion of 9-iso-compounds with the formation of the b and c type of ions is due to cis-fusion of the B and C rings in the molecules of these isomers (cf. with spectra of cis-trans-isomers in estrane and D-homoestrane series[1,2]).

These data show that the configuration at C-9 and C-10 in Δ^4-3-oxosteroid series may be unambiguously determinated mass spectrometrically by comparison of relative intensities of the a, b and c peaks.

The mass spectra were taken on the commercial mass spectrometer MX-1303 furnished with a glass system allowing direct sample inlet into the ion source, at temp. 120-130°(±1°) and ionizing energy 70 ev. 10α-Isotestosterone was obtained by hydrolysis[3] of its acetate (V).

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