gewonnenen Dihydro-γ-fagarins. Reduziert man nun das Aldehyd (VIII) aus Nor-orixin in Alkohol mit $NaBH_4$, so erhält man einen Alkoholkörper (X), $C_{18}H_{13}O_5N$, als Nadeln vom Schmp. 200~202° (Ber.: C, 59.31; H, 4.98; N, 5.32. Gef.: C, 59.49; H, 5.54; N, 5.55. IR: ν_{max}^{KBr} 3480 cm^{-1} (OH)), aus dem durch Einwirkung von Diazomethan N-Methylkörper (XI) als Prismen vom Schmp. 145.5° gebildet wird. Diese Substanz ist gleich derjenigen, die sich bildet, wenn man ein durch katalytische Reduktion von Kokusagin bei Gegenwart von Pd-Kohle gewonnenes Dihydrokokusagin (XII), $C_{13}H_{11}O_4N$, als Tafeln vom Schmp. 165~166°, mit CH_3J methyliert, das erhaltene Jodmethylat (XIII) mit verd. Alkali erwärmt und den labilen Ring aufsprengt. Beide Alkoholkörper wurden durch Mischprobe identifiziert.

Den Herren Prof. T. Ohta, Prof. S. Ohki, und Dr. S. Hara danke ich verbindlichst für ihre wertvollen Ratschläge, Frl. K. Narahashi und Y. Tomikawa für ihre experimentelle Hilfe, Frl. Y. Baba, K. Okabe, Dr. S. Baba und Dr. S. Sakai für die Mikroanalyse bzw. für die Messung des IR-Spektrens. Für die Herstellung von Extrakten danke ich aufrichtig Herrn Z. Fujinaga in der Fujinaga Pharmazeutischen Gesellschaft.

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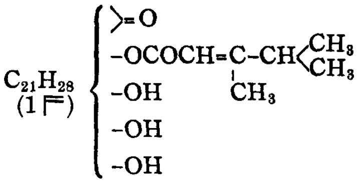
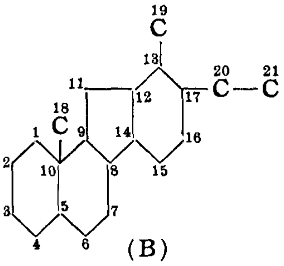
On the Structure of Cynanchogenin*[1]

Cynanchogenin (I), $C_{28}H_{42}O_6$, was isolated from the glycoside of *Cynanchum caudatum* MAX. and recent experiments suggested the partial structure[1] (A).



$$C_{21}H_{28}\ (1\models)\left\{\begin{array}{l} >\!=\!O \\ -OCOCH\!=\!\underset{\displaystyle CH_3}{\underset{|}{C}}\!-\!CH\!<\!\begin{array}{l}CH_3\\CH_3\end{array} \\ -OH \\ -OH \\ -OH \end{array}\right.$$

(A)



(B)

On the other hand, it was suggested in a previous communication,[2] that desacylcynanchogenin (II), $C_{21}H_{32}O_5$, has C-nor-D-homopregnane skeleton (B) from the result of selenium-dehydrogenation. The CO-stretching absorption at 1678 cm^{-1} in its infrared spectrum, corresponding to the open-chain ketone, and its positive iodoform reaction suggest the presence of an acetyl group CH_3CO-, i.e. 20-one. From the analogy of steroids to modified steroids, it seems probable that a hydroxyl group is present at 3-position, where the sugar moiety might be bonded. (II) consumed two moles of

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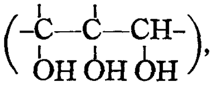
*[1] This work was reported at the 4th Hokkaido Local Meeting of the Pharmaceutical Society of Japan, September 26, 1959.

[1] Unpublished work.

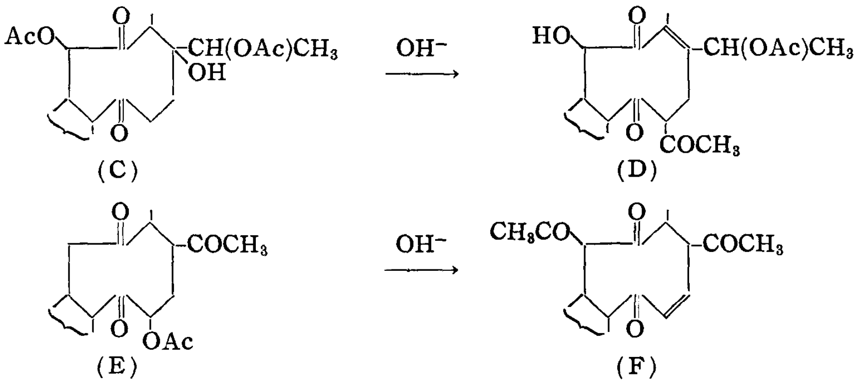
[2] This Bulletin, 7, 749(1959). In this communication, the molecular formula of desacylcynanchogenin was erroneously given as $C_{21}H_{32}O_6$.

$Pb(OAc)_4$ rapidly at room temperature to give a compound (III) of m.p. 172~175°, $C_{21}H_{30}O_6$ (*Anal.* Calcd.: C, 66.64; H, 7.99. Found: C, 66.33; H, 8.33), which reduces Tollen's reagent and tetrazolium strongly, implying the formation of an aldehyde group. This compound is soluble in cold NaOH solution, but is not an enol type, because it has no characteristic UV maximum or color reaction. Its IR absorptions are at 1700 (20-one), 1713 (-CHO), and 1735 cm^{-1}, and the two separated sharp maxima at 3560 and 3400 cm^{-1} show that at least two hydroxyl groups are present in (III).

By consuming one mole of $Pb(OAc)_4$, desacylcynanchogenin diacetate (IV) readily afforded a compound (V) of m.p. 148~152°, $C_{25}H_{34}O_7$ (*Anal.* Calcd.: C, 67.24; H, 7.68. Found: C, 67.15; H, 7.72), which also reduces Tollen's reagent and tetrazolium in alkaline solution, suggesting that it has an α-ketol acetate. It has no O-H absorption in its IR spectrum. Oxidation of (IV) with chromium trioxide yielded a compound which was proved to be identical with (V), so the product (V) was derived from the oxidative cleavage of a vicinal tertiary diol group.

These observations on (V) and those on (III) might be interpreted in the term of the partial structure  $\left(-\overset{|}{\underset{OH}{C}}-\overset{|}{\underset{OH}{C}}-\underset{OH}{CH}-\right)$, but as (II) has only five oxygens, the fact that two hydroxyl groups are present in (V) is quite inconsistent with this structure. To explain this difficulty, a lactol structure, i.e. pseudo acid, was assumed, in which the carboxyl group derived from the middle $-\overset{|}{\underset{|}{C}}-OH$ forms a six-membered lactol (1735 cm^{-1}) with one of the three carbonyl groups to produce a new hydroxyl group (such a hydroxyl group usually has ν_{O-H} at 3400 cm^{-1}). This assumption is in good agreement with the above results.

Compound (V) is neither carboxylic acid nor enol type, but it changes into the enol compound (VI) with dil. NaOH solution rapidly in the cold. The compound (VI) has not been purified as yet. It shows a strong violet coloration with ferric chloride and UV absorption maxima at 231 and 290 mμ in EtOH, and at 231 and 309 mμ (with increasing intensity) in alkaline solution, which imply that the group responsible for 231 mμ band has no relation with the enol part. The change very similar to this has been recently reported by Cornforth[3] on the $Pb(OAc)_4$ oxidation product of sarcostin triacetate. In this case, the UV maxima were at 241 and 291 mμ, and this compound also resisted purification. He attributed this characteristic change to the rearrangement of an O-acetyl group to a C-acetyl group favored by a 9-membered ring formation, and dehydration (C→D).[3]



If this assumption could be adopted in the present case, the change from (V) to (VI) would be formulated as (E) to (F).

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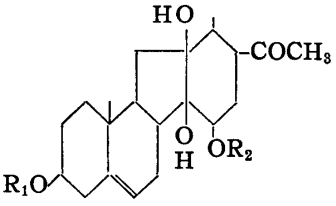
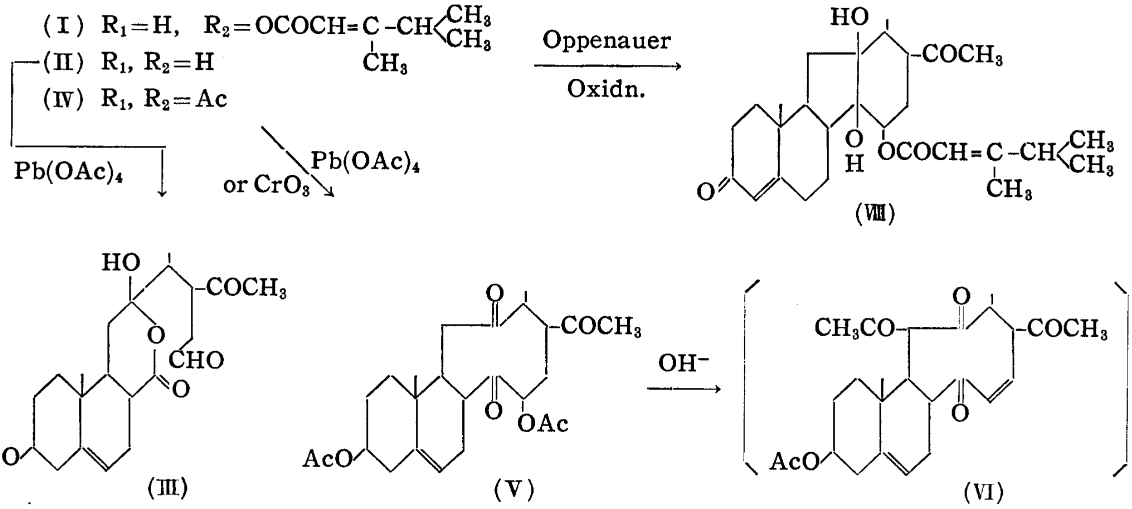
[3] J. W. Cornforth: Chem. & Ind. (London), **1959**, 602.

The nature of the double bond in desacylcynanchogenin was characterized as follows: (II) suffered hydrogenation over PtO_2 in AcOH to afford a ketone-free tetrahydro compound (VII) of m.p. 222~226°, $C_{21}H_{36}O_5$ (*Anal.* Calcd.: C, 68.44; H, 9.85. Found: C, 68.34, H, 9.57) which lacks $\delta_{>C-CH-}$ 800 cm^{-1} seen in the original compound. The Oppenauer oxidation of (I) gave a compound (VIII) of m.p. 224~225°, which seems to be 4-en-3-one compound from its UV and IR spectra. This result was also expected from the lack of conjugation in (III) and (V).

Combination of the above evidences leads to the structure (G)-(II) for desacylcynanchogenin (II), and the fact that cynanchogenin (I) gave a monoacetate and consumed one mole of $Pb(OAc)_4$ limits the ester linkage in (I) to 15-OH. Thus the total structure of cynanchogenin would be represented as (G)-(I).



(G)



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