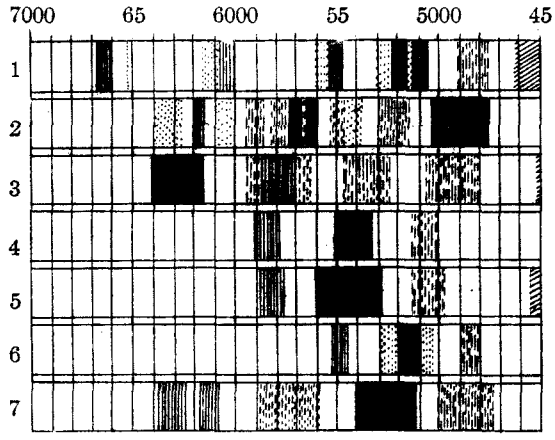
The reaction mixture was then subjected to vacuum distillation to remove the methanol and the aldehyde; the oily residue was taken up in warm pyridine, transferred into ether and the ether solution was fractionated with hydrochloric acid. The results are indicated in a somewhat abbreviated form in the chart of the absorption spectra.



Absorption spectra.

(1) Porphyrin from reaction I (pyrrole + acetaldehyde) in ether. (2) Porphyrin from reaction II (pyrrole + formaldehyde) in ether. (3) Porphyrin from reaction I in 0.05% hydrochloric acid. (4) Porphyrin from reaction II in 3.0% hydrochloric acid. (5) Copper complex salt of porphyrin from reaction I in ether. (6) Copper complex salt of porphyrin from reaction II in ether. (7) 3% hydrochloric acid fraction from the reaction pyrrole + furfuraldehyde in ether.

The main fraction in case I enters 0.5% hydrochloric acid and has a hydrochloric acid number of 0.075. The main fraction in case II enters 3% hydrochloric acid, its hydrochloric acid number is 3.3. The porphyrin from I crystallized in rhomb-shaped crystals, the one from II in platelets. The corresponding copper complex salts and hemins were prepared.

The yield increased upon addition of pyridine to the original solution, or when suitable agents (*e. g.*, $CaCO_3$ + MgO, $PbCrO_4$) were added; the resulting porphyrins were different from the ones mentioned above when the reaction was performed in presence of PbO_2.

Further studies are in progress to secure information on the structure of the porphyrins formed, and to determine the applicability of the reaction to other aldehydes; a comprehensive report of the research will soon be published. From theoretical considerations and in the light of numerous porphyrin syntheses by H. Fischer [*Ann.* since 1926; H. Fischer and H. Orth, "Die Chemie des Pyrrols," Leipzig, 1934 and 1935], the main porphyrin formed from acetaldehyde and pyrrole seems to be $\alpha,\beta,\gamma,\delta$-tetramethylporphin. The reaction between formaldehyde and pyrrole apparently leads to porphin, the as yet hypothetical tetracyclic parent ring system of the porphyrins, and hence, also the fundamental structure in the physiologically important pigments, hemin and chlorophyll.

C. F. KETTERING FOUNDATION FOR THE STUDY OF CHLOROPHYLL AND PHOTOSYNTHESIS
ANTIOCH COLLEGE
YELLOW SPRINGS, OHIO
PAUL ROTHEMUND

RECEIVED AUGUST 23, 1935

CONTRIBUTION TO THE KNOWLEDGE OF THE TESTICULAR HORMONE

Sir:

The communication of E. S. Wallis and E. Fernholz [THIS JOURNAL, **57**, 1511 (1935), received July 15] occasions the present note. In an article accepted on June 1 and published in the number of *Helv. Chim. Acta* [**18**, 986 (1935)] which appeared on July 1, we described the preparation of androstene-3,17-dione (I) and suggested the probability that the testicular hormone (not then isolated) is identical either with this diketone or with androstene-3-one-17-ol (II).

At our request, Dr. E. Tschopp in Basel began the investigation of this hypothesis by submitting (I) to the usual tests on capons and castrated rats. The details of his study, which were communicated to the League of Nations committee in London (July 15–17), will be published elsewhere; they are summarized in the table.

Substance investigated	Capon unit	Seminal vesicle wt. in mg. after 20 days[a] 50 γ daily	100 γ daily	200 γ daily
(I) Androstene-3,17-dione	100 γ	25	51	285
(III) Androstane-3,17-dione	100 γ	16	27	51
(IV) Androstane-3,17-diol	15 γ	14	25	40
(V) Androsterone	60 γ	11	14	17

[a] The control animals had a seminal vesicle weight of about 6 mg.

Compared in terms of capon units, (I) is five times as effective on seminal vesicle growth as (V), on the basis of the 50 γ daily dose; on the basis of the 200 γ daily dose, however, (I) is 25 times as effective as (V). The corresponding activity ratios for (IV) and (I) are 1:12 and 1:50, respectively.

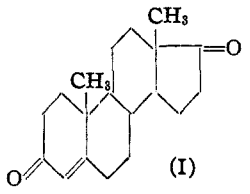
This constituted the first description of the physiological activity of a substance of known

constitution which exhibits the relationship between rat-tests and capon-test potency characteristic of testicular extracts. The natural expectation that this observation would prove significant in the elucidation of the constitution of the testicular hormone was fulfilled with surprising promptitude.

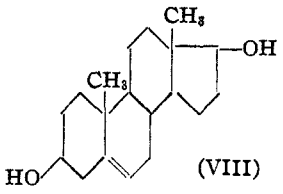
Laqueur, *et al.* [*Z. physiol. Chem.*, **233**, 281 (1935), appearing on June 7] described the isolation of a testicular hormone of unknown constitution (m. p. 154°), with a capon activity of about 10 γ, which was called testosterone (VI). Although (VI) showed the characteristic difference in capon-test and rat-test effectiveness, the published figures do not permit a rigorous comparison with (I).

At London, Laqueur expressed the opinion, based on chemical evidence, that (VI) is an isoandrosterone. The physiological activity of (I) suggested further investigation of (VI) and we have recently learned by private communication from Prof. Laqueur that (VI) yields (I) upon oxidation. Therefore it appears highly probable that formula (II) is that of testosterone (VI).

In pursuance of the program outlined in our paper (*loc. cit.*) we reduced androstene-3-ol-17-one (VII) with sodium and alcohol to androstene-3,17-diol (VIII), m. p. 175–178° corr. Utilizing the greater reactivity of the 3-substituent we partially oxidized the dibromide of (VIII) to produce (II) upon subsequent debromination. We also partially saponified the diacetate of (VIII) to produce the 17-monoacetate, which, upon oxidation of its dibromide and debromination, should yield the acetate of (II).



(I)



(VIII)

Further details will be published elsewhere, and we hope that the previous announcement of our research program (*loc. cit.*), together with the work initiated before the isolation of testosterone, may serve as a reservation of this project.

Footnote (Sept. 7).—At the time this note was written the author was unaware that testosterone (androstene-3-one-17-ol) had already been synthesized in his laboratory in Zürich by his assistants. The substance was made by partially saponifying the unsaturated diol diacetate and oxidation of the monoacetate dibromide.

GEORGE HERBERT JONES LABORATORY L. RUZICKA
UNIVERSITY OF CHICAGO
CHICAGO, ILLINOIS

RECEIVED AUGUST 20, 1935

EXPERIMENTS ON THE CONSTITUTION AND PREPARATION OF THE TESTICULAR HORMONE

Sir:

In the preceding Communication of L. Ruzicka it is evident from the dates given that the publication of his experiments on the preparation of androstendione-3,17 antedates the publication of our experiments on the preparation of this same compound. However, we would like to state that the particular issue of the *Helv. Chim. Acta* to which reference is made was not received in our library until August 8, three days after the publication of our experiments, and that a sample of dehydroandrosterone prepared by our method (received by THIS JOURNAL, June 4) was sent to Professor Butenandt on May 20. We were unaware, therefore, of Professor Ruzicka's experiments, and our suggestion as to the constitution of the testicular hormone and our experiments on its preparation were made independently. At the time of the appearance of his article in the *Helv. Chim. Acta* we were engaged in the preparation of 17-hydroxy-androsten-one-3, and we had succeeded in preparing androstendiol (m. p. 175°), and its diacetate (m. p. 159°) by the reduction of our synthetically prepared dehydroandrosterone when the above Communication reached us. In view of Professor Ruzicka's Communication, and of his request that this project be reserved we are discontinuing our work in this particular direction.

FRICK CHEMICAL LABORATORY EVERETT S. WALLIS
PRINCETON UNIVERSITY E. FERNHOLZ
PRINCETON, N. J.

RECEIVED SEPTEMBER 23, 1935

THE PREPARATION OF β-CHLOROVINYLARSINE SULFIDE

Sir:

β-Chlorovinylarsine sulfide was first described by Lewis and Stiegler [THIS JOURNAL, **47**, 2546 (1925)] as a clear, amber-colored plastic mass insoluble in the usual solvents other than carbon disulfide and possessing an extraordinarily irritating and noxious odor.

We have succeeded in obtaining this substance, β-chlorovinylarsine sulfide, in a crystalline condition by the following procedure. Hydrogen sulfide was conducted for two hours through a solution of 45 g. of β-chlorovinyldichloroarsine (b. p. 78° at 12 mm.) in 50 cc. of alcohol. The solution became noticeably warmer and a yellow