compounds, a salt soluble protein and the water soluble precipitating antigen; and fourth, the recombining of these two dissociated compounds to form again a precipitate which is but slightly soluble in physiological salt solution. So far there is no evidence to contradict the conception that this so-called anti-SSS antibody is protein.

The protein so isolated from the antigen-antibody complex was found to have an isoelectric zone between pH 6.8 and 7.4, and to be but slightly soluble in water, readily soluble in neutral salt, completely precipitable with 44 per cent. of saturation with ammonium sulfate and soluble in saturated sodium chloride. In addition, both pepsin and trypsin digest the protein with a resulting loss of immunological characteristics. Although not all immunological tests have been pursued with this dissociated protein, positive reactions were obtained indicating the presence of agglutinins, precipitins, bacteriolysins, opsonins, complement-fixing bodies and protective antibody. Accordingly, our results indicate, in the case of pneumococcus antibody, a confirmation of the unitarian theory, sponsored by Zinsser, that one antibody reacting with a single antigen is responsible for the usual immunological reactions. Whether or not any of the often suggested possibilities with regard to the character of the immunological material called antibody are eventually found to be true, according to our observations the answer to the question raised in the title is that the antibodies found in antipneumococcus horse serum are protein in nature.

LLOYD D. FELTON

STROPHANTHIN. XXIX. THE DEHYDROGENATION OF STROPHANTHIDIN

EARLIER studies of the dehydrogenation of strophanthidin with selenium according to the method of Diels, Gädke and Körding[1] have been reported from this laboratory.[2] In this work a hydrocarbon was isolated which, although bearing strong resemblance to the $C_{18}H_{16}$ hydrocarbon (methylcylopentenophenanthrene) of Diels, Gädke and Körding obtained from cholesteryl chloride, differed from it in a number of respects. Its picrate melted at 138–140° instead of 118°, and it yielded on oxidation with chromic acid a red quinone, which in turn yielded a quinoxaline. The conclusion was reached, therefore, that this substance is probably a dimethylphenanthrene. However, in view of certain observations which will be presented in another connection, we were on the point of extending our study of the dehydrogenation of strophanthidin and its derivatives when the recent work of Tschesche[3] appeared. The latter, among other things, dealt with the dehydrogenation of dianhydrouzarigenin. Tschesche and Knick isolated from the reaction mixture a hydrocarbon which was shown to be identical with the $C_{18}H_{16}$ hydrocarbon obtained from the sterols and the bile acids. On the basis of the similarity in properties of the saturated desoxylactone obtained from one of the hydrogenation products of dianhydrouzarigenin (the so-called α_2-lactone) with octahydrotrianhydroperiplogenin,[4] which we had sent to Tschesche at his request for comparison, he concluded that a direct relationship was therefore established between uzarigenin and the other cardiac aglucones. And since the hydrocarbon $C_{18}H_{16}$ is now regarded as a characteristic dehydrogenation product of the sterol ring system, the conclusion was drawn that the cardiac aglucones are built on the same ring system as the sterols, a possibility which has, of course, been under constant consideration by ourselves and others. However, since discrepancies remained in the rotations and melting points which he reported between his α_2-lactone from uzarigenin and our octahydrotrianhydroperiplogenin (the melting point of which, 176–177°, had remained unchanged after three additional recrystallizations), we believed that confirmation was necessary.

This accordingly precipitated our reinvestigation of the dehydrogenation of strophanthidin with selenium. In our earlier work a procedure had been used which yielded in our preliminary trials the hydrocarbon $C_{18}H_{16}$ from cholesteryl chloride without difficulty. However, in our recent work we departed from this procedure by a strict observation of temperature conditions. The exact details will be described more fully in another place. One hundred fifty gms of strophanthidin gave 72 gms of oil, which distilled up to 275° at 1 mm. Repeated fractionation gave a fraction boiling at 185–195° at 0.2 mm. Crystalline material was obtained from this oil which after purification through the picrate was submitted to extensive fractional crystallization from 95 per cent. alcohol, according to the triangle scheme. One half gm of material melting at 124–125° (cor.) was finally obtained. This substance did not yield a red quinone on oxidation and by conversion into the picrate and trinitrobenzol and trinitrotoluol addition products was shown to be identical with the hydrocarbon $C_{18}H_{16}$ of Diels, Gädke and Körding.

Analysis:		
$C_{18}H_{16}$.	Calculated.	C 93.10, H 6.89.
	Found.	" 93.12, " 7.05.
		" 92.98, " 7.11.

[1] O. Diels, W. Gädke and P. Körding, *Ann. d. Chem.*, 459: 1, 1927.

[2] W. A. Jacobs and E. E. Fleck, SCIENCE, 73: 133, 1931; *Jour. Biol. Chem.*, 97: 57, 1932.

[3] R. Tschesche, *Z. physiol. Chem.*, 222: 50, 1933; R. Tschesche and H. Knick, *Z. physiol. Chem.*, 222: 58, 1933.

[4] W. A. Jacobs and N. M. Bigelow, *Jour. Biol. Chem.*, 101: 700, 1933.

These results therefore confirm the results of Tschesche and Knick obtained with dianhydrouzarigenin. The "dimethylphenanthrene" previously obtained from strophanthidin was apparently the product of too rapid initial heating of the reaction mixture. It is probable that this material consisted of a mixture of the above hydrocarbon $C_{18}H_{16}$ and dimethylphenanthrene. Only the latter yields a characteristic oxidation product with chromic acid.

Since the formation of the hydrocarbon $C_{18}H_{16}$ appears to be a characteristic degradation product of the sterol skeleton and there is no evidence at hand to show that it is the result of extensive rearrangement, the ring system of the cardiac aglucones appears to be built on the same general plan as that of the sterols and the bile acids. This conclusion must, however be substantiated by other means.

Its relationship to the results of other work which has been in progress in our laboratory will be discussed elsewhere. A study of the dehydrogenation of certain derivatives of strophanthidin and the further investigation of the higher melting crystalline dehydrogenation products of strophanthidin itself are in progress.

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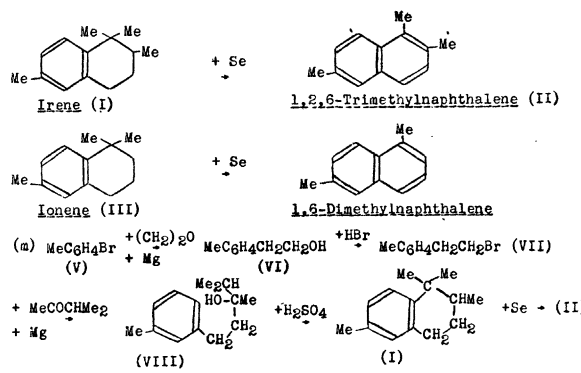
THE SYNTHESIS OF 1, 1, 2, 6-TETRAMETHYLTETRALIN AND THE CONSTITUTION OF IRENE

IN a recent article by Ruzicka, Seidel and Schinz,[1] these skilful investigators deduce for irene, the hydrocarbon obtained by dehydration of the orris perfume irone, the constitution shown in Formula I. One of the strong arguments for the correctness of this deduction is the fact that when irene is heated with selenium, the product is the 1, 2, 6-trimethylnaphthalene (II).

We have already reported[2] from our laboratories the synthesis of the analogously constituted ionene (III), from the violet perfume ionone. As shown by Ruzicka and Rudolph,[3] the action of selenium upon ionene yields 1, 6-dimethylnaphthalene (IV).

We have now succeeded in synthesizing this 1, 1, 2, 6-tetramethyltetralin, by the following steps:

Synthesis of 1,1,2,6-Tetramethyltetralin



m-Bromotoluene (V) was condensed with ethylene oxide and magnesium to the *beta*-(*m*-tolyl) ethyl alcohol (VI), which yielded the corresponding bromide (VII) when treated with HBr. This bromide, subjected to a Grignard reaction with methyl isopropyl ketone, gave the desired tertiary alcohol (VIII). Heated with sulfuric acid, this alcohol lost water, with formation first presumably of the olefin (as we showed in the synthesis of ionene) which then promptly isomerized to the tetramethyltetralin (I). When this synthetic tetralin was heated with selenium, the product was a trimethylnaphthalene identical with the 1, 2, 6-trimethylnaphthalene (II) noted by Ruzicka, Seidel and Schinz.[1]

Our products (B. and A.) compared with theirs (R., S. and S.) as follows:

	R., S. and S.	B. and A.
Irene, b.p. at 10 mm.	119–123°	120–125°
" , $n^{20}D$	1.521	1.511
1, 2, 6-Trimethylnaphthalene picrate, m.p.	122–123°	121–122°
1, 2, 6-Trimethylnaphthalene styphnate, m.p.	150–151°	150°

This synthetic irene is now being studied further, to ascertain whether or not its chemical properties check with those recorded by Ruzicka, Seidel and Schinz for the irene prepared by them from irone.

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[1] Ruzicka, Seidel and Schinz, *Helv. Chim. Acta*, 16: 1143, 1933.

[2] Bogert, SCIENCE, n.s., 76: 1977, 475, Nov. 18, 1932. Full details will appear in the April, 1934, issue of *Jour. Am. Chem. Soc.*

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