
 COMMUNICATIONS TO THE EDITOR

 THE PRESENCE OF AN INSECTICIDAL PRINCIPLE
 IN THE BARK OF SOUTHERN PRICKLY ASH

Sir:

Incidental to the preparation of asarinin, which, like sesamin, increases the insecticidal effect of pyrethrum solutions,^{1,2} the observation was made that a petroleum ether extract of the bark of southern prickly ash (*Zanthoxylum clava-herculis* L.) contained, besides asarinin, a substance highly toxic to houseflies.

The insecticidal material can be extracted from the hydrocarbon solution with 90% acetic acid, leaving most of the inert and highly colored constituents. Most of the acetic acid solvent is then removed by distillation under reduced pressure, and the remainder, together with water-soluble substances, is eliminated by washing the ethereal solution of the extractives. Further purification can be attained by hot extraction of the concentrate with ligroin and removal of the solvent.

By these steps a light-colored, semi-solid product is obtained which in its toxic action on flies is apparently similar to pyrethrum. The best material so far obtained is undoubtedly a complex mixture, from which we hope to isolate the specific constituent.

(1) Haller, McGovran, Goodhue and Sullivan, *THIS JOURNAL*, in press.

(2) Haller, LaForge and Sullivan, *ibid.*, in press.

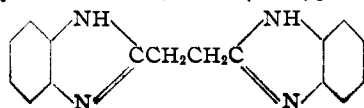
U. S. DEPARTMENT OF AGRICULTURE F. B. LAFORGE
 BUREAU OF ENTOMOLOGY H. L. HALLER
 AND PLANT QUARANTINE W. N. SULLIVAN
 BELTSVILLE, MD.

RECEIVED OCTOBER 24, 1941

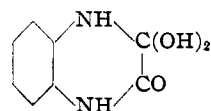
BIS-BENZIMIDAZOLES

Sir:

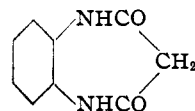
Shriner and Upson [*THIS JOURNAL*, 63, 2277 (1941)] describe the formation of *bis*-benzimidazoles by the condensation of *o*-phenylenediamine (2 moles) with dibasic acids (1 mole) in the presence of hot dilute hydrochloric acid, and, in particular, refer to the *bis*-benzimidazole obtained by the use of succinic acid. This compound was described by the writer as α,β -dibenziminazolyliethane in 1928 and was prepared by a similar method [*J. Chem. Soc.*, 2393 (1928)]



Shriner and Upson also refer to the condensation of *o*-phenylenediamine with oxalic and malonic acids, respectively, and confirm the present writer's observation that the former gives 2,3-dihydroxyquinoxaline which was obtained by him as a "hydrate" probably of the structure



The product obtained by Shriner and Upson by the use of malonic acid and described by them as a compound different from any previously prepared and given the formula $C_9H_8O_2N_2$ is almost certainly the same as that prepared by the present writer by the same method and shown by him to be *o*-phenylenemalonamide (Phillips, *loc. cit.*, 2394, 2398)



This compound was also described by Meyer and his co-workers in a paper also cited by Shriner and Upson [*Ann.*, 347, 17 (1906)].

RESEARCH LABORATORIES
 MESSRS. MAY & BAKER LTD.
 DAGENHAM, ESSEX
 ENGLAND

M. A. PHILLIPS

RECEIVED OCTOBER 25, 1941

BIS-BENZIMIDAZOLES

Sir:

A careful reading of our note [*THIS JOURNAL*, 63, 2277 (1941)] will show that the previous work of Meyer and of Phillips was cited and the references given. Succinic acid was merely one of nine dibasic acids used and was included in order to have the complete series of compounds and to obtain its decomposition point since previous workers merely stated it melted above 300°. Specific credit to Phillips was cited for the formation of 2,3-dihydroxyquinoxaline. Reference to *o*-phenylenemalonamide is given in the third sentence of the note (it is a cyclic diamide). Whether our product (d. 345-349°) is identical with the above can only be determined by experiment. The reaction leading to the high melting insoluble product involves two bifunctional molecules

which may produce either the seven-membered cyclic diamide or a polyamide. No molecular weight for the cyclic diamide was reported and attempts to obtain values on our compound have failed because of its insolubility.

UNIVERSITY OF ILLINOIS
URBANA, ILLINOIS

R. L. SHRINER
R. W. UPSON

RECEIVED NOVEMBER 24, 1941

ON THE STRUCTURE OF BIOTIN

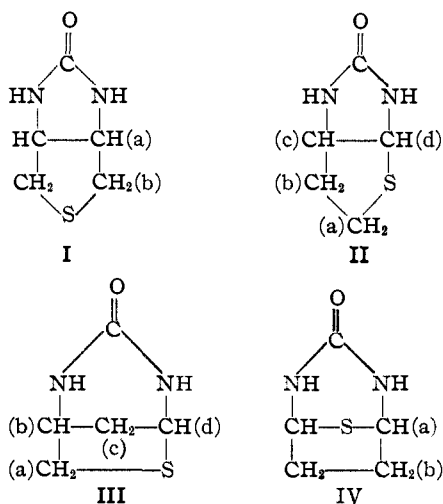
Sirs:

In a previous communication¹ we reported the isolation of adipic acid from the oxidation of the diaminocarboxylic acid derived from biotin; this finding greatly reduced the number of possible structures ascribable to biotin. Further restriction would result if it were possible to demonstrate that one of the carboxyl groups of the adipic acid was the original carboxyl group of biotin. We now wish to report evidence indicating this to be the case.

A Curtius degradation of biotin methyl ester was carried out. Biotin hydrazide (m. p. 238–240°), $C_{10}H_{18}O_2N_4S$ (calcd.: C, 46.50; H, 7.02; N, 21.69. Found: C, 46.82; H, 7.09; N, 21.88), through the azide yielded the corresponding ethyl urethan (m. p. 188–190°), $C_{12}H_{21}O_3N_3S$ (calcd.: C, 50.14; H, 7.37; N, 14.62. Found: C, 50.53; H, 7.64; N, 14.19). Hydrolysis of the urethan with barium hydroxide at 140° opened the urea ring and cleaved the urethan group to yield the triamine, $C_8H_{19}N_3S$, which was characterized as the tribenzoyl derivative (m. p. 194–195°), $C_{29}H_{31}O_3N_3S$, (calcd.: N, 8.37. Found: N, 8.01). The original carboxyl group was thus lost. Oxidation of the triamine under the conditions employed for the degradation of the diaminocarboxylic acid¹ was carried out and no adipic acid was isolated. The oxidation of the triamine was carried out on extremely small amounts of material. However, if adipic acid had been formed in yields comparable to that in the oxidation of the diaminocarboxylic acid we are confident that it should have been possible to isolate it.

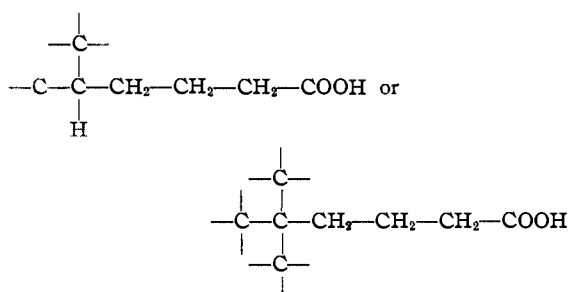
The most logical interpretation of these data is that biotin contains the side chain, $CH_2CH_2CH_2CH_2COOH$, attached to one of the ring carbons. On this basis, and eliminating consideration of 4-membered rings, we are led to the structures indicated below with the side chain replacing the

hydrogen atom at one of the positions indicated by a, b, c, or d.



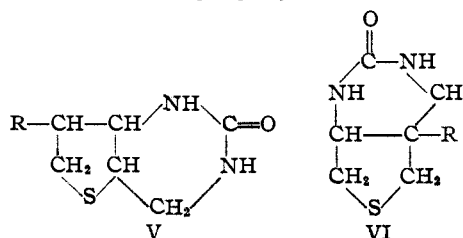
We feel that the remarkable stability of the diaminocarboxylic acid toward hydrolytic agents renders unlikely structures II, III, and IV, with both sulfur and nitrogen attached to a single carbon atom. Structure Ia or Ib would therefore seem most likely.

On the other hand, should the adipic acid arise from the decarboxylation of a malonic or an α -substituted β -keto acid arising during the oxidation, then biotin could contain the structural element



On this basis structures V, VI, and VII would therefore be possible (eliminating structures with sulfur and nitrogen on the same carbon atom for the reasons mentioned above).

$R = CH_2CH_2CH_2COOH$



(1) K. Hofmann, D. B. Melville and V. du Vigneaud, *THIS JOURNAL*, **68**, 3237 (1941).