

ried through the remaining steps, which consisted first in lengthening the acetic acid chain to a propionic acid chain through the Arndt-Eistert reaction. The dimethyl ester of the *trans*-7-methoxy-1-propionic acid-2-methyl-2-carboxytetrahydrophenanthrene (m. p. 101–102°) was cyclized by sodium and the product was converted to *d,l*-equilenin by the usual hydrolysis and decarboxylation, including the hydrolysis of the methoxy group. The synthetic equilenin crystallized from benzene in thin colorless plates which melted at 265–267° (natural equilenin, 258°) to a red liquid. The structure of the synthetic equilenin was established definitely by its conversion to 3',3'-dimethyl-7-methoxy-1,2-cyclopenteno-phenanthrene, identical with the compound obtained from natural equilenin by the procedure of Cohen, Cook and Hewett [*J. Chem. Soc.*, 445 (1935)], the method employed by these investigators to establish the structure of equilenin. The synthetic equilenin was resolved by converting it to its *l*-menthoxyacetic ester, from which was isolated the ester which proved to be identical (mixed melting point) with the *l*-menthoxyacetic ester (m. p. 172–174°) of natural equilenin.

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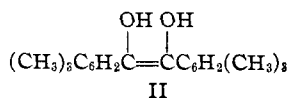
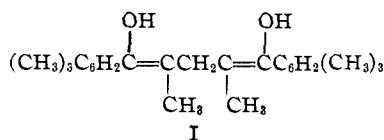
W. E. BACHMANN
WAYNE COLE
A. L. WILDS

RECEIVED MARCH 28, 1939

1,2-DIARYLACETYLENE GLYCOLS. A NEW TYPE OF ENE-DIOL

Sir:

The isolation of the dienol I in solid form¹ suggested that an ene-diol such as 1,2-dimesitylacetylene glycol (II), being more highly conjugated,



might possess still greater stability. This has proved to be true. The ene-diol is formed by the action of the binary mixture, Mg + MgI₂,² on dimesityl diketone or 2,4,6-trimethylbenzoyl chloride.

(1) Fuson, Ross and McKeever, *THIS JOURNAL*, **61**, 414 (1939).
(2) Gomberg and Bachmann, *ibid.*, **49**, 236 (1927).

The ene-diol is a white solid (plates) which melts at 144–145° in a nitrogen-filled sealed tube.

Anal. Calcd. for C₂₀H₂₄O₂: C, 81.04; H, 8.16. Found: C, 81.02; H, 8.01.

It can be kept indefinitely in an atmosphere of dry nitrogen but when exposed to air autoxidizes rapidly even in the solid state, giving the corresponding benzil. The ene-diol rearranges to 2,4,6,2',4',6'-hexamethylbenzoin under the influence of hydrochloric acid or piperidine. It reduces Tollens' reagent as well as cupric acetate solution at 0°. It is immediately oxidized by sodium 2,6-dichlorobenzeneoneindophenol. The isomeric benzoin does not react with Tollens' reagent or cupric acetate solution in the cold nor with the indophenol even when heated.

2,4,6-Triethylbenzoyl chloride gives a similar but even more stable ene-diol when treated with the binary mixture.

These ene-diols are unique in that in them the ene-diol grouping is not conjugated with a carbonyl group.³ However, it is conjugated with two aromatic nuclei. This consideration suggested that the remarkable stability of the new ene-diols might be shared by their vinyls derived from ketones of the types RCO(CH=CH)_nCOR and RCO(C₆H₄)_nCOR. Evidence of this already has been brought forward by Lutz and Reveley,⁴ who report the existence in solution of an ene-diol obtained by the reduction of 1,2-di-(2,4,6-trimethylbenzoyl)-ethylene.

A detailed report of our work will be presented in the near future.

(3) See Barnes and Green, *ibid.*, **60**, 1549 (1938).

(4) Paper presented at the Baltimore meeting of the American Chemical Society, April 4, 1939.

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REYNOLD C. FUSON
JOSEPH CORSE

RECEIVED MARCH 23, 1939

PANTOTHENIC ACID AND THE FILTRATE (CHICK ANTI-DERMATITIS) FACTOR

Sir:

An extensive series of investigations on pantothenic acid, a factor stimulating the growth of yeast, has been conducted by Williams and co-workers, culminating in the preparation and elementary analysis of the calcium salt.¹ Properties so far described for the filtrate² (chick anti-derma-

(1) Williams, Weinstock, Rohrmann, Truesdail and Meyer, *THIS JOURNAL*, **61**, 454 (1939).

(2) (a) Lepkovsky and Jukes, *J. Biol. Chem.*, **114**, 109 (1936); (b) Jukes, *ibid.*, **117**, 11 (1937); (c) Woolley, Waisman, Mickelsen and Elvehjem, *ibid.*, **125**, 715 (1938).

titis) factor are in agreement with the properties of pantothenic acid.¹

A sample of calcium pantothenate was kindly furnished by Dr. R. J. Williams. Day-old chicks were placed on a normal diet for eight days, following which they were fed a heated diet^{2b} for ten days, at the end of which time incipient symptoms of dermatitis were apparent. The birds were then divided into groups and fed the supplements indicated in the table. Five chicks were used in each group.

TABLE I

Group	Supplement to 100 g. of heated diet	Av. weight (g.) of chicks at		No. of birds showing symptoms of dermatitis at 25 days
		18 days	25 days	
1	None	76	83	5
2	1.5 mg. Ca pantothenate prepn.	75	85	4
3	10 mg. Ca pantothenate prepn.	77	112	0
4	3 cc. rice bran extract (positive control diet)	75	110	0

The calcium pantothenate preparation was markedly active at the 10-mg. level. Since the rice bran extract furnished about 28 "units"^{2b} of filtrate (chick anti-dermatitis) factor per cc., a minimal activity of approximately 8400 "units" per gram was indicated for the calcium pantothenate preparation. Dr. Williams stated that the preparation contained about 1600 "pantothenic acid units" per gram, measured by yeast growth stimulation, fresh liver containing about 0.6 "unit" per gram. Previous experiments in this Laboratory have indicated fresh liver to contain about 3 "filtrate-factor units" per gram. Thus a ratio of approximately 5:1 exists between the yeast pantothenic acid "unit"¹ and the chick "filtrate-factor" unit^{2b} both in the case of the calcium pantothenate preparation and in the case of fresh liver.

Addendum.—After the preparation of this communication a copy of a manuscript by Woolley, Waisman and Elvehjem³ reporting that "the chick anti-dermatitis factor appears to be very similar in properties to pantothenic acid" was received in this division.

DIVISION OF POULTRY HUSBANDRY THOMAS H. JUKES
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DAVIS, CALIFORNIA

RECEIVED MARCH 20, 1939

(3) Woolley, Waisman and Elvehjem, *THIS JOURNAL*, **61**, 977 (1939).

POLAROGRAPHIC CURRENT-VOLTAGE CURVES WITH DROPPING AMALGAM ELECTRODES

Sir:

The writer has discovered that it is possible, by means of the polarographic technique,^{1,2} to obtain anodic current-voltage curves with dropping amalgam electrodes whose characteristics are very similar to the ordinary c. v. (current-voltage) curves obtained with the dropping mercury electrode. As far as the writer is aware, current-voltage curves with dropping amalgam electrodes heretofore have not been described in the literature.

Typical c. v. curves of a very dilute cadmium amalgam, obtained with a polarograph,^{1,2} are shown in Figs. 1 and 2. The curve in Fig. 1 was obtained with an approximately 0.01% cadmium

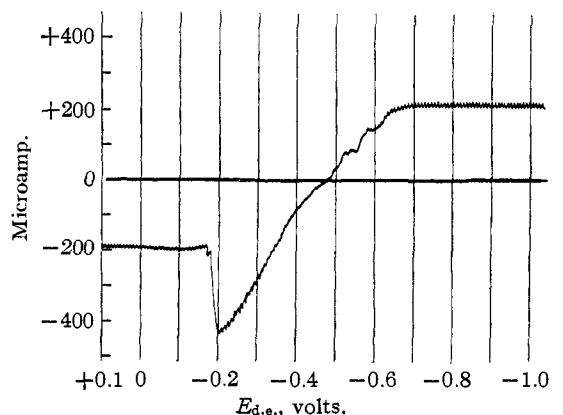


Fig. 1.—Current-voltage curve with dropping cadmium amalgam electrode.

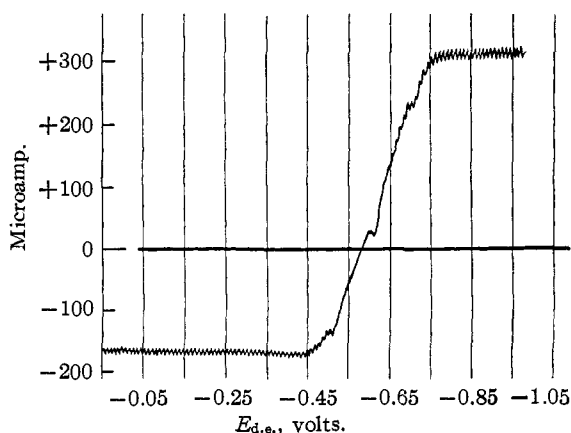


Fig. 2.—Elimination of the anodic maximum of cadmium amalgam by sodium methyl red.

(1) J. Heyrovsky, "Polarographie," in W. Bottger's "Die physikalischen Methoden der chemischen Analyse," Akad. Verlagsgesellschaft, Leipzig, 1936, Vol. II, pp. 260-322.

(2) I. M. Kolthoff and J. J. Lingane, *Chem. Rev.*, **24**, 1 (1939).