in crystalline form of a substance (I) active for *Leuconostoc citrovorum*, and the chick; furthermore, it competitively reverses the toxicity of 4-aminopteroylglutamic acid (II) for the mouse.

When pteroylglutamic acid (PGA) or its N^{10}-formyl derivative was reduced catalytically over platinum in formic acid at 0 to 30°, two moles of hydrogen were absorbed. Isolation of the crystalline substance (I) was accomplished by adsorption of impurities on Magnesol at *p*H 7, adsorption of activity on Darco G-60 at *p*H 4, elution, fractional crystallization of the barium salt, and finally chromatographic separation on Magnesol columns. *Anal.* Calcd. for $C_{20}H_{21}N_7O_7Ba\cdot 5H_2O$: C, 34.4; H, 4.47; N, 14.0; Ba, 19.7; CHO, 4.15. Found: C, 34.7; H, 4.31; N, 14.1; Ba, 20.2; CHO, 3.80. Calcd. for $C_{20}H_{23}N_7O_7\cdot 3H_2O$: C, 45.5; H, 5.54; N, 18.6; CHO, 5.50; H_2O, 10.3. Found: C, 45.2; H, 5.67; N, 18.8; CHO, 5.07; H_2O, 11.2. In 0.1 *N* sodium hydroxide solution I (10 mg./l.) exhibited a maximum at 282 mμ (%T = 27.0) and a minimum at 243 mμ (%T = 75.3). Although stable in solution at neutral to mildly alkaline *p*H under aerobic conditions, I rapidly changes at *p*H 2 with loss of activity for *Leuconostoc citrovorum*, but retains PGA-like activity for *Streptococcus faecalis* R and *Lactobacillus casei*. The primary product of anaerobic acid treatment of I appeared to be a labile derivative of tetrahydropteroylglutamic acid.

In microbiological assays of I (barium salt $\cdot 5H_2O$), about 0.15 mγ to 0.20 mγ corresponded to one "unit."[1] Thymidine was not added to the basal culture medium although this addition has been reported to increase the sensitivity of the assay.[4]

In mice I prevented the lethal effects of 4-aminopteroylglutamic acid.[5] Doses were injected three times weekly.[5] With 10 γ of II the average survival time was 6.8 days; with 20 γ, 5.0 days. With 10 γ of II and 15 γ of I injected simultaneously, 9 out of 11 mice survived the 14-day assay period. Average gain was 0.3 g. With 10 γ of II and 30 γ of I, all survived and the gain was 5.3 g.; with 20 γ of II and 30 γ of I, 10 out of 11 survived and the loss was 2.1 g. With 20 γ of II and 60 γ of I all survived and the gain was 4.3 g. The toxic action of 10 γ of II has been shown[6] not to be diminished by 20 γ of PGA.

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(4) Shive, Paper presented at 117th Meeting, American Chemical Society, Houston, Texas, March, 1950.

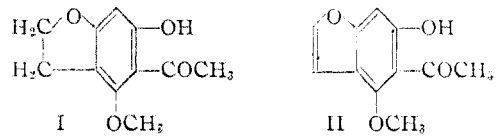
(5) Franklin, *et al.*, *Proc. Soc. Exp. Biol. Med.*, **67**, 398 (1948).

(6) Broquist, *et al.*, *J. Biol. Chem.*, **185**, 399 (1950).

COUMARONE DEHYDROGENATION WITH N-BROMOSUCCINIMIDE

Sir:

In the course of studies on the synthesis of the furochromones khellin, visnagin and related compounds, we have found that the dehydrogenation of certain coumaranes to coumarones, typified by the conversion of dihydrovisnaginone (I) to visnaginone (II), can be carried out by a halogenation-dehydrohalogenation process involving the use of N-bromosuccinimide.



I II

Since Horning and Reisner[1] have recently described unsuccessful attempts to use this reagent for the dehydrogenation of dihydrofurocoumarins, we wish to describe our findings.

The treatment of the acetate of I with N-bromosuccinimide and a trace of benzoyl peroxide in carbon tetrachloride yielded an oily product which when treated successively with dimethylaniline and alcoholic alkali afforded crude visnaginone (II). After purification there was obtained 59% of pure visnaginone, m. p. and mixed m. p. 108–109°. The synthetic material showed the same color reactions (ferric chloride, concentrated sulfuric acid) as the natural substance,[2] and was converted into an acetate, m. p. 63.5–65.5° which did not depress the melting point of a sample of the acetate prepared from natural visnaginone (calcd. for $C_{15}H_{12}O_6$: C, 62.90; H, 4.87; found, C, 63.07; H, 5.12).

This "dehydrogenation" procedure has been applied to some related compounds; the details will be reported in forthcoming papers.

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(1) Horning and Reisner, THIS JOURNAL, **72**, 1514 (1950).

(2) Späth and Gruber, *Ber.*, **74B**, 1492 (1941).

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REARRANGEMENTS INVOLVING 2-THENYLMAGNESIUM CHLORIDE

Sir:

When an ethereal solution of 2-thenyl chloride, at once a β-halo-sulfide and an isolog of benzyl chloride, was passed over amalgamated magnesium turnings in the "cyclic reactor,"[1] the Grignard reagent was obtained in 92% yield; hydrolysis of this solution gave an 86% yield of 2-methylthiophene (b. p. 111–113°). When the

(1) Rowlands, Greenlee and Boord, Abstracts of Papers, American Chemical Society meeting, Philadelphia, April 9 to 13, 1950, p. 8L.