

The spectrum of an aqueous solution of this compound showed: broad band at 2700-2770 Å. ( $E_{1\text{cm}}^{1\%}$  137); 3150 Å. ( $E_{1\text{cm}}^{1\%}$  80); 3525 Å. ( $E_{1\text{cm}}^{1\%}$  150); 4150 Å. ( $E_{1\text{cm}}^{1\%}$  29); 5300 Å. ( $E_{1\text{cm}}^{1\%}$  58). This spectrum is similar to but different from that of vitamin B<sub>12</sub>.<sup>2</sup> In artificial mixtures, the presence of about 10% B<sub>12</sub> in B<sub>12a</sub> is recognizable in the spectrum; about 30% B<sub>12a</sub> in B<sub>12</sub> is not easily discernible.

This new and biologically active crystalline compound is designated vitamin B<sub>12a</sub>.

Vitamin B<sub>12a</sub> shows an activity<sup>1b</sup> of about 5.2 × 10 u./mg. for the growth of *L. lactis* and 1-3 × 10<sup>6</sup> u./mg. for *L. leichmanii*, and about one-half the "animal protein factor" activity<sup>1c</sup> of B<sub>12</sub> in rats<sup>3</sup> and 30 = 15% of B<sub>12</sub> activity<sup>1d</sup> in chicks.<sup>4</sup>

Dr. Randolph West<sup>5</sup> tested 25 μg. of vitamin B<sub>12a</sub> parenterally in a single pernicious anemia patient and observed about 30% of a maximal hematological response.

(2) Brink, Wolf, Kaczka, Rickes, Koniuszy, Wood and Folkers, *THIS JOURNAL*, in press.

(3) Emerson, *Proc. Soc. Exp. Biol. Med.*, in press.

(4) Ott, Rickes and Wood, *J. Biol. Chem.*, **174**, 1047 (1948).

(5) Columbia University, personal communication.

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### THE PROMOTER EFFECT OF PLATINIC CHLORIDE ON RANEY NICKEL

Sir:

In 1936, Lieber and Smith<sup>1</sup> found that small amounts of platonic chloride, added to Raney nickel catalyst just prior to the start of the reduction, produced a marked enhancing effect on the activity of the catalyst. Since this early investigation there has been a marked enhancement in the activity of Raney nickel catalyst itself due to improvements in the procedure for the preparation of the catalyst from the Raney nickel-aluminum alloy<sup>2a</sup> over that of the method<sup>2b</sup> used in (1). Accordingly, it was considered important to investigate the promoter effect on the improved types of Raney nickel, particularly that designated as "W-6".<sup>2a</sup>

Following the procedure of Adkins and Billica,<sup>2a</sup> we have been unable to duplicate the activity reported by them for W-6, but are in agreement that it is the "most active nickel catalyst known".<sup>2a</sup> Comparative hydrogenations were carried out at room temperature under a pressure of 45 p. s. i. in a 250-ml. glass bottle shaken at about 190 oscillations per minute. The reaction mixture (containing 0.05 mole hydrogen acceptor, except where noted) was made up to a volume of 100 ml. with dry ethanol and contained 3 g. of wet W-6 Raney nickel.

(1) E. Lieber and G. B. L. Smith, *THIS JOURNAL*, **58**, 1417 (1936).

(2) (a) H. Adkins and H. R. Billica, *ibid.*, **70**, 695 (1948); (b) H. Adkins and L. W. Covert, *ibid.*, **54**, 4116 (1932).

Using 0.220 millimole of platonic chloride we have found *very marked* promoting actions for the hydrogenation of the nitro-, aldehyde and the nitrile groups, the ketone group being completely poisoned. The promoting action of triethylamine on W-6 alone, for the carbonyl function, as noted by Adkins<sup>2a</sup> was confirmed, but more significantly the combination of triethylamine and platonic chloride *produced promotions far exceeding any activity previously known*, and manifesting itself at *incredibly low concentrations of platonic chloride*. This is illustrated by the following data for the hydrogenation of benzaldehyde to benzyl alcohol

	Time, minutes
W-6 alone	170
W-6 plus 0.220 m.mol PtCl <sub>4</sub>	17
W-6 plus Et <sub>3</sub> N <sup>a</sup>	60
W-6 plus Et <sub>3</sub> N plus 0.220 m.mol PtCl <sub>4</sub>	6 <sup>b</sup>
W-6 plus Et <sub>3</sub> N plus 0.026 m.mol PtCl <sub>4</sub>	7
W-6 plus Et <sub>3</sub> N plus 0.004 m.mol PtCl <sub>4</sub>	13
W-6 plus Et <sub>3</sub> N plus 0.002 m.mol PtCl <sub>4</sub> <sup>c</sup>	29

<sup>a</sup> 2 ml. triethylamine added. <sup>b</sup> Check runs have given low as three to four minutes. <sup>c</sup> Corresponds to 0.4 mg. Pt.

Moreover the combination of triethylamine plus platonic chloride enables the hydrogenation of acetone to proceed rapidly. We have also noted the formation of triethylamine chloroplatinate prior to the start of the reduction and we will investigate the promoter action of aminochloroplatinates as promoters. Further, the combination of triethylamine plus platonic chloride was found to *markedly* promote the hydrogenation of other functional groups as well as the carbonyl group.

Further studies are under way and will be the subject of more complete reports.

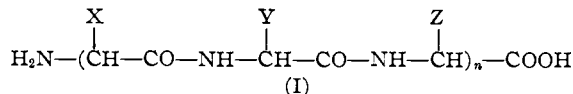
DEPARTMENT OF CHEMISTRY DEWEY ROBERT LEVERING  
ILLINOIS INSTITUTE OF TECHNOLOGY EUGENE LIEBER  
CHICAGO, ILL.

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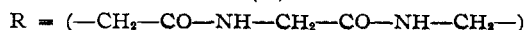
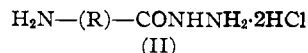
### THE APPLICATION OF THE CURTIUS REACTION TO THE POLYMERIZATION OF TRIGLYCINE

Sir:

In attempts to develop procedures for the preparation of complex peptides of the general structure (I)

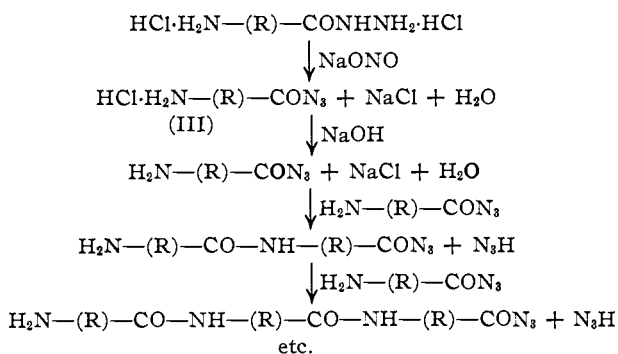


where X, Y, and Z represent side chains found in naturally occurring amino acids, we have as a model experiment investigated the polymerization of a triglycine unit derived from triglycine hydrazide dihydrochloride (II)



(*Anal.* Calcd. for  $C_6H_{15}O_3N_5Cl_2$ : N, 25.37; Cl, 25.68. Found: N, 25.66; Cl, 25.41) and have obtained a product having properties similar to those reported for polyglycines.<sup>1,2,3,4</sup>

Treatment of an aqueous solution of 2 g. of (II) with sodium nitrite followed by the addition of dilute sodium hydroxide resulted in the formation of a precipitate which was washed with water and dried; yield, 0.83 g. (*Anal.* Found: C, 38.89; H, 5.47; N, 23.14). This white powder was insoluble in water and most organic solvents, but dissolved in concentrated hydrochloric acid and in strong alkali. The peptide nature of the compound was demonstrated by hydrolysis of 203 mg. of the substance with concentrated hydrochloric acid followed by benzoylation, yielding 500 mg. of recrystallized hippuric acid, m. p. 186–188° (*Anal.* Calcd. for  $C_9H_9O_3N$ : N, 7.82. Found: N, 8.18). The infrared absorption spectrum<sup>5</sup> further substantiated this conclusion. The formation of polymers by the interaction of (II) with nitrous acid may be considered to occur according to the following scheme, with triglycine azide hydrochloride (III) as an intermediate.



This indicates that under our experimental conditions the rate of reaction of the hydrazide group in (II) with nitrous acid greatly exceeds the rate of deamination of the amino group, leading to the formation of (III) which undergoes polymerization as soon as the amino group is liberated by the addition of alkali.

Although the high insolubility of the product has precluded the determination of its molecular weight, the available evidence indicates strongly that the product represents a polyglycine (or a mixture of polyglycines). The application of this scheme to the polymerization of more complex tripeptides is under investigation.

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(1) Meyer and Co, *Helv. Chim. Acta*, **17**, 1488 (1934).

(2) Pacsu and Wilson, *J. Org. Chem.*, **7**, 117 (1942).

(3) Frankel and Katchalski, *THIS JOURNAL*, **64**, 2268 (1942).

(4) Mellon, Korn and Hoover, *ibid.*, **70**, 3040 (1948).

(5) We are indebted to Dr. Foil A. Miller of the Mellon Institute for the infrared absorption curves, which will be published later.

## MASS SPECTROMETRIC EXAMINATION OF THE ISOMERIZATION OF *n*-PROPYL CHLORIDE

Sir:

The products of the isomerization of *n*-propyl chloride on aluminum chloride in the presence of deuterium chloride have been examined with a mass spectrometer to obtain further information about the mechanism of the rearrangement. If, as frequently postulated,<sup>1</sup> the isomerization occurs by elimination of hydrogen chloride and recombination according to Markownikoff's rule, a reasonable concentration of deuterium would be expected in the isopropyl chloride. Since no deuterium was found in the product, the experiments described here seem to establish the fact that the rearrangement at low temperatures (0°) does not proceed to any appreciable extent by the elimination of hydrogen chloride:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl} \rightleftharpoons \text{CH}_3\text{CH}=\text{CH}_2 + \text{HCl} \rightleftharpoons \text{CH}_3\text{CHCl}-\text{CH}_3$ .

The experiments were carried out in 150-cc. reaction vessels into which about 0.1 g. of aluminum chloride had been sublimed. Mixtures containing 5 cm. each of deuterium chloride or hydrogen chloride and *n*-propyl chloride were allowed to react at 0°. Samples were withdrawn at suitable time intervals for analysis with a Nier type mass spectrometer. Similar experiments were carried out in which propene was allowed to react with hydrogen chloride or deuterium chloride under the same conditions.

The mass spectral data summarized in Table I show that, after one hour at 0° when isomerization was practically complete, no deuterium was found in the isopropyl chloride. Under these same conditions and on the same catalyst deuterium chloride added to propene to give isopropyl chloride containing deuterium (compare masses 64, 66, 79 and 81).

The extent of the isomerization in a given length of time (60 to 70% in five minutes at 0°) was not appreciably changed by the presence of an equal pressure of either hydrogen chloride or deuterium chloride. This is further indication that hydrogen chloride is probably not involved in the rate-controlling process of the isomerization. The hydrochlorination of propene occurred under the same conditions but at an appreciably slower rate (10 to 20% in five minutes at 0°) with some polymerization. With an equal molar mixture of hydrogen chloride and deuterium chloride, the hydrogen chloride added to propene 2.2 times faster than did deuterium chloride.

In view of the result of the above experiments some other mechanism must be involved, possibly the formation of a carbonium ion,<sup>2</sup> or its equivalent, followed by an intramolecular hydride ion shift and recombination with a chloride ion of the catalyst. Additional exchange reactions are being

(1) Thomas, "Anhydrous Aluminum Chloride in Organic Chemistry," Reinhold Publishing Corp., New York, N. Y., 1941.

(2) Hammett, "Physical Organic Chemistry," McGraw-Hill Book Co., New York, N. Y., 1940, p. 320.