The results are summarized in Table I and compared with the quantities of free purines and pyrimidines found in acid hydrolysates of nucleic acids (*Procedure 3*).[4] It will be seen that the nucleotide analyses presented here contribute to a more complete understanding of ribonucleic acid composition, mainly with respect to uridylic acid which has proved relatively resistant to formic acid hydrolysis.[4] They also reveal remarkable differences between ribonucleic acids from different sources.

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RECEIVED MARCH 17, 1949

REARRANGEMENT OF 2-BROMOBICYCLO[2,2,2]OCTANE WITH SILVER BROMIDE

Sir:

We have found that the brominative decarboxylation[1] of a suspension of the silver salt of bicyclo[2,2,2]octane-2-carboxylic acid[2] (I) affords 2-bromobicyclo[1,2,3]octane (II), m. p. 39–41°. The structure of II is tentatively assigned on the grounds (a) that reduction with sodium and alcohol gives bicyclo[1,2,3]octane (III) [*Anal.* Calcd. for C_8H_{14}: C, 87.19; H, 12.81. Found: C, 86.88; H, 13.14], m. p. 139.5–141°, reported 133°[3,4] and 141°[5] and (b) that aqueous alcoholic alkali gives an alcohol, m. p. 183–184°, which is apparently identical with the bicyclo[1,2,3]octane-2-ol, m. p. 183°, of Alder and Windemuth[5] by virtue of the similarity of the phenylurethan [*Anal.* Calcd. for $C_{15}H_{19}O_2N$: C, 73.44; H, 7.81; N, 5.71. Found: C, 73.62; H, 7.74; N, 5.64], m. p. 128–129.5°, reported[5] 130° and the hydrogen phthalate [*Anal.* Calcd. for $C_{16}H_{18}O_4$: C, 70.05; H, 6.61. Found: C, 70.11; H, 6.74], m. p. 118–119°, reported[5] 116–117°.

This rearrangement, the first example of the conversion of the bicyclo[2,2,2]octane system to the bicyclo[1,2,3]octane system,[6] has prompted examination of the effect of silver bromide on the potentially initial product, 2-bromobicyclo[2,2,2]-octane (IV). Unrearranged IV [*Anal.* Calcd. for $C_8H_{13}Br$: C, 50.81; H, 6.93; Br, 42.26. Found: C, 50.90; H, 6.89; Br, 42.13], m. p. 64–65.5°, is prepared from bicyclo[2,2,2]octene[2] by the addition of hydrogen bromide in ether,[7] and can be reduced to bicyclo[2,2,2]octane (V), m. p. 169.5–170.5°. On treatment in carbon tetrachloride either with silver bromide or with silver acetate and bromine but not with bromine alone, IV is converted in good yield to II (identified by reduction to III).

The silver bromide-catalyzed rearrangement affords strong experimental support to the hypothesis that silver bromide is a Lewis acid of sufficient strength to weaken *observably* the carbon–bromine bond of an alkyl bromide. Limiting the establishment of a mechanism for the brominative decarboxylation is the corollary hypothesis that the alkyl bromide actually *isolated*, having been subject to alteration by silver bromide, is not necessarily identical with the bromide produced initially in the decarboxylation. Consequently, the rearrangement observed in the decarboxylation of I may not, in the absence of further experimentation, form the basis for a mechanistic hypothesis. Similarly no mechanistic significance is attributable to the optical inactivity of the 3-bromoheptane isolated from the brominative decarboxylation of optically active silver heptane-3-carboxylate,[8] in the absence of observations on the optical stability of 3-bromoheptane in the presence of silver bromide.

(1) *Cf.* Kleinberg, *Chem. Rev.*, **40**, 381 (1947).
(2) Seka and Tramposch, *Ber.*, **75**, 1379 (1942).
(3) Komppa, *et al.*, *Ann.*, **521**, 242 (1936).
(4) Barrett and Linstead, *J. Chem. Soc.*, 611 (1936).
(5) Alder and Windemuth, *Ber.*, **71**, 2404 (1938).
(6) The driving force is plausibly derived from the relief of Pitzer strain [Beckett, Pitzer and Spitzer, THIS JOURNAL, **69**, 2488 (1947)].
(7) Following Meerwein and von Emster, *Ber.*, **55**, 2500 (1922).
(8) Arnold and Morgan, THIS JOURNAL, **70**, 4248 (1948).

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RECEIVED MARCH 5, 1949

VITAMIN B_{12}. V. IDENTIFICATION OF CRYSTALLINE VITAMIN B_{12a}

Sir:

Catalytic reaction of vitamin B_{12} with hydrogen has yielded a crystalline product which shows high hematopoietic activity in pernicious anemia, although it is somewhat less active than vitamin B_{12}.

To a solution of 26.3 mg. of vitamin B_{12} in 15 ml. of water, 78 mg. of platinum oxide catalyst was added and the mixture was shaken with hydrogen at atmospheric pressure for twenty hours. During reaction, the red color changed to dark brown, but on contact with air the red color returned indicating changes in the cobalt ion. The filtrate from the catalyst was evaporated *in vacuo* at 25°. The residue was dissolved in 1 ml. of water and 6 ml. of acetone was added. After several hours, 1–2 mg. of precipitate formed and was removed. Acetone (2 ml.) was added again and, after standing, 4–5 mg. of precipitate was removed. Acetone (2 ml.) was added, and dark-red crystals formed during twenty-four hours; yield, 12 mg. Further addition of acetone yielded more crystalline material.

After two recrystallizations from water by the addition of acetone, the red crystals showed refractive indices[1a] of α, 1.580; β, 1.640; and γ, 1.654. The cobalt (4.58%) and phosphorus (2.43%) content reveal that the B_{12} molecule is not grossly altered.

(1) Courtesy of (a) Dr. Charles Rosenblum; (b) Mr. David Hendlin; (c) Dr. Gladys Emerson; (d) Dr. Walther Ott.

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

This new and biologically active crystalline compound is designated vitamin B_{12a}.

Vitamin B_{12a} shows an activity[1b] of about 5.2×10 u./mg. for the growth of *L. lactis* and $1–3 \times 10^6$ u./mg. for *L. leichmanii*, and about one-half the "animal protein factor" activity[1c] of B_{12} in rats[3] and 30 ± 15% of B_{12} activity[1d] in chicks.[4]

Dr. Randolph West[5] tested 25 μg. of vitamin B_{12a} 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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RECEIVED MARCH 21, 1949

THE PROMOTER EFFECT OF PLATINIC CHLORIDE ON RANEY NICKEL

Sir:

In 1936, Lieber and Smith[1] found that small amounts of platinic 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[2a] over that of the method[2b] 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".[2a]

Following the procedure of Adkins and Billica,[2a] 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".[2a] 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 platinic 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[2a] was confirmed, but more significantly the combination of triethylamine and platinic chloride *produced promotions far exceeding any activity previously known*, and manifesting itself at *incredibly low concentrations of platinic 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 $PtCl_4$	17
W-6 plus Et_3N[a]	60
W-6 plus Et_3N plus 0.220 m.mol $PtCl_4$	6[b]
W-6 plus Et_3N plus 0.026 m.mol $PtCl_4$	7
W-6 plus Et_3N plus 0.004 m.mol $PtCl_4$	13
W-6 plus Et_3N plus 0.002 m.mol $PtCl_4$[c]	29

[a] 2 ml. triethylamine added. [b] Check runs have given low as three to four minutes. [c] Corresponds to 0.4 mg. Pt.

Moreover the combination of triethylamine plus platinic 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 platinic 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.

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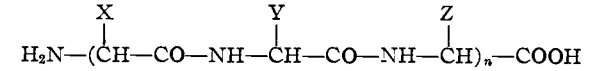
RECEIVED FEBRUARY 25, 1949

THE APPLICATION OF THE CURTIUS REACTION TO THE POLYMERIZATION OF TRIGLYCINE

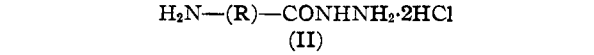
Sir:

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



(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)



(II)

R = (—CH_2—CO—NH—CH_2—CO—NH—CH_2—)