fluxed for 1.5 hours, cooled, filtered, and made acid to congo red with 15% hydrochloric acid. The N-(2-hydroxyethyl)-*p*-aminosalicylic acid was filtered and dried in a vacuum desiccator; yield 0.14 g. (25%); m.p. 126°.

Anal. Calcd. for $C_9H_{11}NO_4$: N, 7.11. Found: N, 6.89.

The filtrate was made alkaline and saturated with carbon dioxide yielding 0.11 g. of methyl N-(2-hydroxyethyl)-*p*-aminosalicylate.

Hydrolysis of methyl *p*-aminosalicylate under identical conditions gave a 61% yield of *p*-aminosalicylic acid.

DEPARTMENT OF CHEMISTRY
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Vanadium Monoboride

A vanadium boride of the composition VB was prepared by simultaneous reduction of V_2O_5 and B_2O_3 with carbon. The reaction was carried out under a protective atmosphere of hydrogen by heating the well mixed and pelleted ingredients in a graphite crucible at 3000°F.

Anal. V, 77.6; B, 16.7; C, 0.07. V/(V + B) ratio found 17.7; calcd., 17.5.

Crystal Structure.—Using X-ray diffraction, the compound was found to be isomorphous with CrB[1]. The X-ray techniques employed were the same as those used by J. T. Norton and co-workers[2].

The VB structure is orthorhombic with four molecules per unit cell. The lattice constants were calculated to be for *a* 3.10 Å., *b* 8.17 Å., *c* 2.98 Å., the calculated density is 5.44 g./cc.

Electrical Resistivity.—65.5 microhm-cm. for a hot pressed piece of 65% of the theoretical density. The resistivity of a dense specimen would probably be between 35 and 40 microhm-cm., making VB a metallic conductor.

Work done under Contract with the Office of Naval Research.

(1) S. J. Sindeband, *Transactions of A.I.M.E.*, 185, 198 (1949).

(2) J. T. Norton, H. Blumenthal and S. J. Sindeband, *ibid.*, **185**, 749 (1949).

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COMMUNICATIONS TO THE EDITOR

THE NATURE OF THE ACTIVE METHYL DONOR FORMED ENZYMATICALLY FROM L-METHIONINE AND ADENOSINETRIPHOSPHATE[1,2]

Sir:

The participation of ATP in the enzymatic transmethylation reaction in which methionine is the methyl donor is well established.[3-5] As has been shown earlier, the role of ATP in such reactions is related to the activation of methionine,[6] as described by equation 1.

L-Methionine + ATP ⟶
Active methionine + orthophosphate (1)

The enzyme catalyzing this reaction has been partially purified, using rabbit liver as its source. The most significant property of active methionine is its ability to function as a methyl donor, even in the absence of ATP. Originally it had been assumed that the role of ATP in the activation reaction was to serve as a source of phosphate bond energy. However, the elucidation of the chemical nature of active methionine which is described below suggests that, regardless of the intermediate steps involved, ATP functions in the activation process in a novel and unexpected way as a donor of its adenosine moiety.

Active methionine, prepared enzymatically, has been purified from the deproteinized reaction mixture by (a) removal of Mg^{++} as Mg pyrophosphate at *p*H 7.0; (b) precipitation of organic and inorganic phosphates with barium and 80% ethanol, *p*H 7.8; (c) paper chromatography with 80% ethanol–5% acetic acid. The location of active methionine on the paper has been greatly facilitated by the observation that when methionine-S^{35} was used for the enzymatic reaction, the intermediate was labeled with S^{35}. Methionine-2-C^{14} also yielded labeled active methionine. After elution from the paper, active methionine exhibited an ultraviolet absorption spectrum nearly identical to that of adenylic acid. On the assumption that the extinction coefficient of active methionine is equal to that of adenylic acid it was found that preparations of active methionine, obtained as above, contained, for each mole of adenine, the equivalent of 0.78 mole of pentose[7] and 0.8 mole of labile methyl groups.[8] Three fragments have been recognized after hydrolysis in 0.5 *N* HCl at 100° for 2 hours. Adenine has been identified conclusively as one of them by chromatography on paper, by ion exchange chromatography on Dowex 1[9] and by oxidation of 2,8-dihydroxyadenine with xanthine oxidase.[10] An amino acid which when chromatographed on paper with different solvents appears to be identical with homoserine is another one of the products of hydrolysis. The nature of a third fragment has not been ascertained as yet; it is a sulfur-

(1) This investigation was aided by grants from the Williams Waterman Fund for the Combat of Dietary Diseases of the Research Corporation of New York and from the American Cancer Society (recommended by the Committee on Growth of the National Research Council).

(2) Adenosinetriphosphate = ATP.

(3) H. Borsook and J. W. Dubnoff, *J. Biol. Chem.*, **171**, 363 (1947).

(4) G. L. Cantoni, *ibid.*, **189**, 203 (1951).

(5) S. Cohen, *ibid.*, **193**, 851 (1951).

(6) G. L. Cantoni, *ibid.*, **189**, 745 (1951); and in "Phosphorus Metabolism," Vol. I, Johns Hopkins Press, Baltimore, Md., 1951, p. 641.

(7) Determined by the Bial-orcinol reaction with heating for 45 minutes at 100°.

(8) The latter were determined enzymatically by guanidoacetate methylpherase, an enzyme catalyzing the reaction

(2) Active methionine + guanidoacetate ⟶ creatine + X

P. J. Vignos, Jr., and G. L. Cantoni, to be published.

(9) W. E. Cohn, *Science*, **109**, 377 (1950).

(10) H. Klenow, *Biochem. J.*, **50**, 404 (1952).