apparatus equipped with a water trap. After removal of the water which had formed, the remainder of the benzene was distilled off and the residual oil poured into 500 ml. of ice-water and stirred vigorously. The crude solid (13.9 g., 53%, m. p. 74–77°), was recrystallized from *n*-hexane and then melted at 76–77°. Criegee and Stanger,[4] who prepared this substance from cyclohexene oxide and trichloroacetic acid, reported a melting point of 76–77°.

trans-1,2-**Cyclohexanediol Trichloroacetate** *p*-**Toluenesulfonate.** (a) **Trichloroacetylation of the Mono-***p*-**toluenesulfonate.**—*trans*-1,2-Cyclohexanediol *p*-toluenesulfonate (8.1 g., 0.03 mole) prepared in 84% yield (m. p. 97°) by a modification of the method of Criegee and Stanger[4] or Winstein, Hess and Buckles[5] and pyridine (5 ml., 0.06 mole) were mixed and the trichloroacetyl chloride[3] (3.4 ml., 0.03 mole) added slowly without cooling. The reaction mixture crystallized on standing overnight, and after 200 ml. of water had been stirred in, the crystalline suspension was refrigerated. The crude solid was removed, washed with water, and dried in air (10 g., 80%, m. p. 98–102°). It was recrystallized three times from absolute alcohol and once from *n*-hexane and then melted at 104.0–104.5°.

Anal. Calcd. for $C_{15}H_{17}O_5Cl_3S$: C, 43.27; H, 4.09; Cl, 25.70; S, 7.69. Found: C, 43.29; H, 4.08; Cl, 25.60; S, 7.79.

(b) **Tosylation of the Mono-trichloroacetate.**—*trans*-1,2-Cyclohexanediol trichloroacetate (15.7 g., 0.06 mole) and *p*-toluenesulfonyl chloride (11.4 g., 0.06 mole) were dissolved by warming with pyridine (19.3 ml., 0.24 mole) to 55°. After maintaining the mixture at this temperature for a few minutes, it was allowed to cool to room temperature and remain overnight. The solidified mixture was then stirred with cold water (500 ml.) and the residual solid removed, washed with water and dried in air (23.9 g., 96%, m. p. 103–104°). It was recrystallized from *n*-hexane (22.1 g., yield 89%) and then melted at 105°. The melting point of a mixture of the products from part (a) and part (b) was not lower than that of either product melted separately.

The reaction of this compound (0.1 *M*) with sodium acetate (0.1 *M*) in glacial acetic acid at 91° was followed by the method of Winstein and co-workers[1] and gave a first order reaction rate constant of approximately 6.7 ($k \times 10^4$ in hour^{-1}). The reaction products were not isolated.

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(4) Criegee and Stanger, *Ber.*, **69B**, 2753 (1936).

(5) Winstein, Hess and Buckles, THIS JOURNAL, **64**, 2798 (1942).

COMMUNICATIONS TO THE EDITOR

ACTIVATION OF THIONASE BY FOLIC ACID[1]

Sir:

It has been found that preparations of thionase (the enzyme responsible for the cleavage of cystathionine and cysteine[2]) may be inactivated by dialysis against dilute acetate buffer (0.01 *M*, *p*H 4.0). The activity of the enzyme was restored by the addition of folic acid. Adenylic acid, adenosinetriphosphate, diphosphopyridine nucleotide, vitamin B_{12} or aureomycin did not reactivate the inactive material.

A solution of enzyme in saline had an activity toward L-allocystathionine such that 1.2 mg. of homocysteine was produced from 4.4 mg. of substrate in 30 min. by 1 ml. of enzyme. This solution was dialyzed for 48 hr. against the acetate buffer. The material that precipitated was redissolved in the original volume of saline and was found to be without activity. Fifty γ folic acid per ml. of digest (total volume 10 ml., 0.02 *M* histidine buffer, *p*H 7.3) was added and the activity was found to be restored to the extent that 0.7 mg. of homocysteine was produced. The relationship of activity to concentration of folic acid was reasonably linear up to concentrations of folic acid of the order of 150 γ per ml.; at this level an activity of 1.0 mg. of homocysteine was found. Similar activations with other substrates and other methods of analyses were observed.

These results are difficult to interpret since the levels of folic acid required for reactivation are of a different order of magnitude than any possible concentration in the enzyme. The purified enzyme was found to have, aside from the protein component, peaks of absorption near 245, 285 and 350 mμ. These peaks disappeared during the dialysis. However, if it were assumed that certain of these peaks were due to a derivative of folic acid, less than 0.5 γ per ml. of digest was present in the fully-active preparation. Studies as to the nature of the activation by folic acid and the possibility of more active derivatives of folic acid are in progress.

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(1) These studies were supported by grants from the U. S. Public Health Service.

(2) F. Binkley and D. Okeson, *J. Biol. Chem.*, **182**, 273 (1950).

THE ISOLATION OF A NEW THYMINE PENTOSIDE FROM SPONGES[1]

Sir:

When certain air-dried sponges, particularly those of the genus *Cryptotethia*, are extracted in a Soxhlet apparatus with acetone, a nicely crystal-

(1) Contributions to the Study of Marine Products. XXVIII.