sideration of transpiration. To still others, however, it will be a pleasure to find that osmosis is treated as diffusion through a membrane and that it is not limited to the diffusion of water through a semi-permeable membrane, as some American authors are inclined to treat it. The book is divided into three parts—Part I, "General Physiology of the Cell"; Part II, "Metabolism"; and Part III, "Growth, Reproduction and Irritability." That such a division is not entirely satisfactory is shown by the inclusion of transpiration and ascent of sap in Part I, "General Physiology of the Cell," and transport of solutes in Part II, "Metabolism."

A few criticisms selected from many pages may give an impression that much of the book is regarded unfavorably. Such is not the intent, however, as is indicated by the early portion of this review.

The press work and binding are excellent.

WILLIAM J. ROBBINS
NEW YORK BOTANICAL GARDEN

A Bibliography of Eastern Asiatic Botany. By ELMER D. MERRILL and EGBERT H. WALKER. xlii + 719 pp. Jamaica Plain: Arnold Arboretum. 1938. $12.50.

IN every field, good bibliographies are keys to literature that vastly enhance its usefulness. Perhaps the time may come when the best bibliographies will cover the fields where such works are most needed, but up to the present time most bibliographers have chosen their own fields, and each has recorded the literature of the subjects in which he was most deeply interested.

And so it has happened that this fine bibliography, remarkably complete and accurately compiled, deals with the plant life of eastern Asia, with which both authors have long concerned themselves. It may be said in justification of this undertaking that, unless checked by the present unsettled conditions in that part of the world, our knowledge of the Asiatic flora is entering upon an era of great expansion, and the existence of a record such as this of what has already been done may prevent duplication of effort.

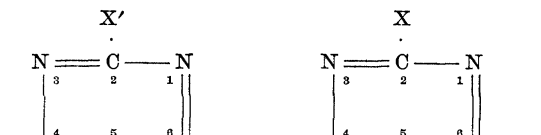
"Eastern Asia," as the term is here used, "comprises China, Japan, Formosa, Korea, Manchuria, Mongolia, Tibet, and eastern and southern Siberia," and works are included relating to the flora of adjacent regions, when these have an important bearing on that of the region mentioned. There are more than 21,000 author-entries, including references to more than 1,200 serials; these have been checked to the original sources whenever possible, and an effort has been made to correct erroneous statements of dates of publication, unless this would involve unwarrantably extensive investigation. The troublesome cases arising from the many authors' names and the titles in Russian, Japanese and Chinese characters have been handled in an eminently satisfactory manner, and there are separate lists of Chinese and Japanese serials and of Chinese and Japanese authors. There are also classified subject-indexes, filling about 125 of the quarto pages. The clerical and typographical errors are remarkably few for a work of this character. In short, the volume is a permanent testimonial to the diligence and scholarship of its authors and will long remain a standard work of bibliographic reference.

JOHN H. BARNHART
NEW YORK BOTANICAL GARDEN

SPECIAL ARTICLES

VITAMIN RESEARCH

A BIOCHEMICAL research program that is receiving attention in the Sterling Chemistry Laboratory at the present time calls for the development of practical methods of synthesizing primary halides of the pyrimidine type, corresponding to the organic structure expressed by formula I. Primary, pyrimidine halides of such constitution are difficult to prepare, and function as necessary intermediates in the synthesis of vitamin principles of the vitamin B_1 type. For example, the recently devised method of synthesizing the anti-neuritic vitamin, *thiamin* (V), is based on the fact that a pyrimidine halide represented by formula III couples



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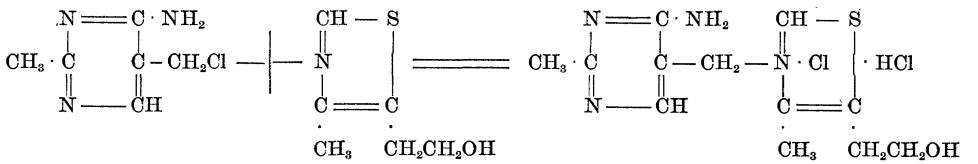
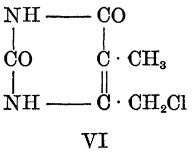
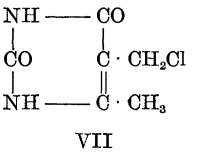


III IV V



VI



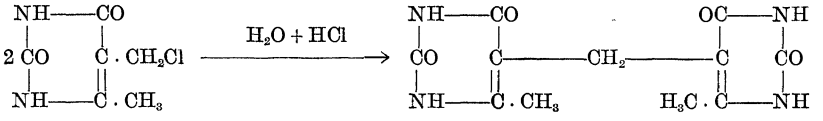
VII

with a specific thiazole (IV) to form the naturally occurring quaternary salt (vitamin B_1) V.[1]

In carrying forward this research program to date our efforts have been confined to the development of new methods of synthesis and to the study of the chemical properties of pyrimidine halides of the uracil type. We now desire to report a recent discovery which reveals a striking difference in chemical behavior between the two isomeric pyrimidine halides expressed by formulas VI and VII. Here we are dealing with primary halide groupings substituted in the 4- and 5-positions, respectively, of the 2,6-dioxy-pyrimidine molecule.

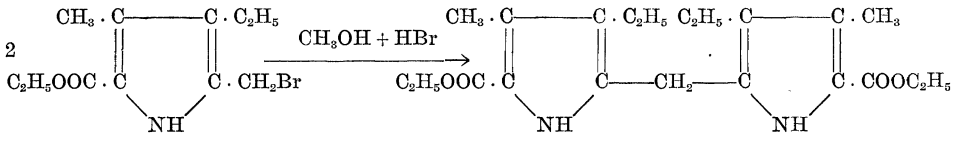
It was the senior author's experience during his earlier researches on the synthesis of simple nucleoside constructions in 1913–1915 that pyrimidine halides of the type VI are extremely stable and are very resistant to hydrolysis. For example, it was shown that both 4-chloromethyluracil and the pyrimidine halide VI can be heated with concentrated hydrochloric acid at 125–130 without alteration.[2] This behavior is in marked contrast to that observed with the halide represented by formula VII.

This pyrimidine VII is very unstable when digested with alcohol or water and can be converted practically quantitatively into the dipyrimidine methane derivative

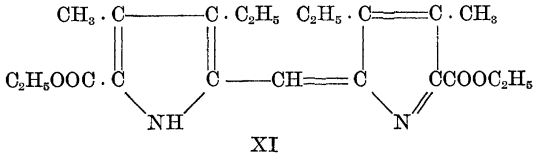


VII VIII

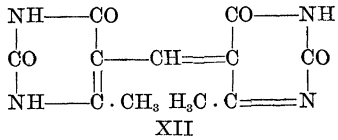
VIII upon treatment with hydrochloric acid. This unexpected change is quite analogous to the well-known pyrrol reaction applied successfully by Professor Hans Fischer and his coworkers in many cases for the preparation of dipyrrol methanes; and which is illustrated by the following reaction employed for the preparation of the dipyrrol methane derivative X.[3] These dipyrrol methane compounds such as X easily undergo oxidation to the corresponding dipyrrol methenes XI.



IX X



XI



XII

Whether our dipyrimidine methane compounds such as VIII may be oxidized to the corresponding unknown dipyrimidine methene derivatives such as XII remains to be determined.

A complete account of the results of this pyrimidine investigation will be presented in future publications from this laboratory.

TREAT B. JOHNSON
MARGARET M. ENDICOTT

YALE UNIVERSITY

THE PREPARATION OF GLUTATHIONE CONTAINING RADIOACTIVE SULFUR

ARTIFICIAL radioactive elements are usually produced as the free isotopes of ordinary elements and may be used in the preparation of compounds suitable for study. The present work was undertaken in order to find a method of obtaining radioactive glutathione to be used later in the study of certain phases of sulfur metabolism in rats. Briefly, this method consisted in growing yeast in a medium containing radioactive sul-

[1] Williams and Cline, *Jour. Am. Chem. Soc.*, 58: 1063, 1504, 1936; 59: 216, 1937; Cline, Williams and Finkelstein, 59: 1052, 1937.

[2] Johnson and Chernoff, *Jour. Am. Chem. Soc.*, 36: 1742, 1914; 35: 585, 1913; *J. Biol. Chem.*, 14: 307, 1913.

[3] Fischer *et. al.*, Ann. 447: 137, 1926; 448: 199, 1926; 459: 85, 1927; 486: 39, 1931; and several other publications.