

Considerations for Evaluation of Germicides

By Paul Goedrich*

In 1938 the author reported on new findings concerning the influence of p_H on the action of germicides (1).

On the four main types of antiseptics: the mercurials, the phenols, the halogens and the oxidizers, evidence was presented which shows that a decrease in p_H always results in an increase in germicidal effect, an increase which is independent of the germicidal action of the agent used to lower the p_H . The results obtained by other investigators have confirmed these findings.

As this fact is now very well established, it is apparent that the mere naming of the concentration and the chemical nature of the active principle in the solution of the germicide will not give sufficient information about its performance. So, for instance, from a 5% phenol solution an effect on spore-bearing organisms is not expected, but when its p_H is lowered by the addition of small amounts of HCl, it displays a much better sporicidal action than a 20% formaldehyde solution.

A 7% U. S. P. Tincture of Iodine will not kill the spores of *B. subtilis* in two hours, whereas an acidified solution containing only 5% of iodine showed a killing action within 10 minutes. It was found that the same principle also applies for antiseptics in ointment form. An ointment containing 10% of ammoniated mercury showed a clear zone of 12 mm. on an agar cup plate infected with *Staph. aureus*, whereas the same concentration of this antiseptic in the same medium showed a clear zone of 16 mm. when the p_H was lowered by the addition of a small amount of acid.

But, not only the p_H of a germicide must be considered in the evaluation of its action; also its "affinity" to organic matter like blood, serum, tissue fluid, mucous, etc., plays an important role.

Nye (2) of the Mallory Institute of Pathology demonstrated the fact that the com-

monly used germicides, except iodine, fail to exert a germ-killing effect when tested at body temperature in the presence of 50% horse serum. The application of the results of his findings is significant for the use of antiseptics in deeper wounds or body cavities, where there is always present a large amount of organic matter, which will counteract the effect of the germicide and may render it ineffective. Often we hear, even from very experienced surgeons, that they do not believe in the use of antiseptics and do not use them in their work. In the light of Nye's findings one can understand their position in this regard.

As Nye's results demonstrated the superiority of iodine solutions above other germicides in the presence of heavy organic matter, the author was interested to investigate the cause for this action. It has been previously found by the author that acidified iodine solutions show a higher germicidal effect than ordinary solutions of the same iodine content. As the ordinary iodine solutions have a lower p_H than the other commonly used germicides, the chemical interaction between iodine, serum and acidifying agents was investigated.

It was found that the acidified solutions, when titrated after they had reacted with a definite quantity of serum, retained a much higher amount of available iodine than ordinary iodine solutions of the same iodine content. This reaction seems to be applicable also to solutions of the other halogens, because it was found that when Chlorine Water was acidified and tested in the presence of serum in the same way as the iodine solutions, a similar retention of chlorine occurs.

Various acidifying agents have been used for the reduction of p_H with the same effect. For instance: Diluted Lugol Solutions of about 2% titratable iodine content, acidified with various amounts of HCl, have been tested in comparison with regular Lugol Solutions of the same iodine content in the presence of a definite amount of serum. In the acidified solution free iodine is retained for from 5 minutes to three hours longer, according to the amount of acid used to lower the p_H . Lugol Solutions acidified

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with hydriodic acid or oxalic acid showed a similar effect.

Freshly prepared chlorine solutions in water, acidified with a small amount of diluted sulfuric acid, extended the action of chlorine in the presence of an abundance of serum for a period ten times as long as that observed for unacidified solutions of the same chlorine content. A more detailed report on the effect of low p_H germicides, in the presence of heavy organic matter, will be given in the near future.

REFERENCES

- (1) *JOUR. A. PH. A.*, 27 (1938), 1233.
- (2) *J. Am. Med. Assoc.*, 108 (1937), 280.

Book Reviews

Chemicals of Commerce, by FOSTER DEE SNELL and CORNELIA T. SNELL, viii + 532 pages, 5 $\frac{1}{2}$ x 8 $\frac{1}{2}$. 1939. New York: D. Van Nostrand Co. Price, \$5.00.

In this volume, all chemicals offered on the market in sufficient quantity or usefulness to justify their consideration are discussed. There are short monographs on each chemical giving practical information on its general properties and uses. The monographs on related materials are grouped into chapters. It is believed that the book will serve the pharmacist as a useful source of information which is not available to him in pharmaceutical publications.—A. G. D.

The Story of Vitamin B₁, compiled by C. R. ADDNALL, Merck and Company, Rahway, New Jersey Revised Edition, 1940, 72 pp.

The revised edition of this booklet follows the same arrangement as the first edition (1937) and maintains the same high degree of excellence in telling the story of vitamin B₁. It is well documented with hundreds of references to the original literature, but it is more than a bibliography. It presents in a terse and interesting manner a résumé of the available information concerning the isolation and synthesis of vitamin B₁, its properties and methods of standardization. The chapters relating to the physiological action of thiamin and its role in diet and nutrition have been brought up to date by additional information and literature citations. The chapters on vitamin B₁ in plant growth should be of special interest to biochemists and plant physiologists. The booklet possesses a well-planned and entirely satisfactory index. It is not for sale, but is supplied only to those who have use for the information presented.—J. L. P.

History of Pharmacy—A Guide and Survey, by EDWARD KREMERS, Ph.G., Ph.M., Ph.D., Sc.D., Former Director, of the Course in Pharmacy and Professor of Pharmaceutical Chemistry, University of Wisconsin, author, editor and historian, and GEORGE URDANG, Ph.G., Sc.D., Nat. Honorary Member of the AMERICAN PHARMACEUTICAL ASSOCIATION, Former Editor of the *Pharmazeutische Zeitung*, Former Director of the Society for the History of Pharmacy, Berlin, author and historian. Thirty illustrations. Published by J. B. Lippincott Co., Philadelphia, London, Montreal. Price \$4.50.

The senior author states in the preface that he has desired and had the intention for a number of years to write a history of pharmacy—for pharmacists. He states that well-meaning friends have prodded him on to the task, and he ascribes insufficient time and energy rather than lack of willingness to undertake the work. Evidently the opportunity was presented to him by his co-worker and colleague, Dr. George Urdang, to whom Dr. Kremers gives credit for preparing the plan and continuation of studies. Dr. George Urdang has made the acquaintance of many American pharmacists and has participated in the activities and proceedings of the profession in this country. Before leaving Berlin, he collaborated with Dr. A. Adlung in the publication of a volume of the History of Pharmacy and the German National Pharmaceutical Association. In this connection, the reviewer suggests to the readers the re-reading of the "Introductory Lecture to a Course in the History of Pharmacy" by Dr. Kremers and the discussion following on pages 1270–1279 of the *JOURNAL* of the A. PH. A. for 1933 and a study of the preface to the volume under review.

The contents are divided into four parts in the order of periods and developments to which notes are given in the following: Part I, Early Backgrounds in the Old World; Ancient Civilization and Ages. Part II, The Rise of Professional Pharmacy in Europe; Medical Theories and Materia Medica—the Developments in Italy, France, Germany, England; International Trends. Part III deals with the history of pharmacy in the North American Colonies up to the Revolutionary War and brings out the events of the Young Republic and Pioneer Expansion; Growth of Associations—Local, State, National; History of Legal Regulation; Development of Pharmaceutical Education; Establishment of a Pharmaceutical Literature; Relation of the Pharmacist to Society, etc. Part IV is devoted to a review of the contributions of pharmacists to science and industry. Each chapter contains much that is informative and interesting. In addition, volumes of information are presented bibliographically, which adds greatly to the usefulness of the book to students and teachers and as a historical record. American pharmacists and those of Europe know the senior author, and the co-worker is becoming well and favorably known to American pharmacists, as heretofore stated. It is, therefore, unnecessary to extend the length of this review. Suffice it