de Candolle and Boussingault, who were the most important of the early workers in the physiology of plants, and, in addition, Tull, Duhamel, Home, Thaer, Chaptal, Schübler and Sprengel, who were the leaders in the application to the problems of agriculture of the observations and speculations of these other investigators.

The book contains seven chapters in which the men chiefly responsible for the progress of agricultural chemistry are treated in historical order beginning with an entertaining and highly informative account of the theoretical views and accomplishments of the Greeks and Romans. This is followed by a discussion of representatives of the sixteenth and seventeenth century alchemical and iatrochemical schools of thought, and by successive chapters on the workers of the period of the early Royal Society, of the early and the late phlogiston period, of the period of the chemical revolution that began with Lavoisier, and by a final one upon more recent investigators up to the time of Liebig. It is within this framework that the author describes the conditions which led to the application to agricultural science of modern scientific views, a result for which Liebig was in many ways primarily responsible through the publication in 1840 of his celebrated book, "Organic Chemistry and Its Applications to Agriculture and Physiology."

Nothing so comprehensive and at the same time so detailed has, to the knowledge of the reviewer, been attempted and so satisfactorily accomplished. Although the book is far indeed from being light reading, it is invariably interesting and stimulating; the product of a ripe scholarship and of an amazing breadth of knowledge and experience, it fills a place in the history of chemical science that has hitherto been only superficially if at all dealt with. It will doubtless become required reading in all courses that attempt to describe this field.

The text contains biographical sketches which are illustrated by comprehensive quotations from the writings of the investigators discussed, and illuminated by clear descriptions of the fundamental experiments upon which their most important contributions were based. The numerous figures include reproductions of the title pages of many of the classical publications in chemistry and in agriculture, as well as illustrations of apparatus or experiments taken from the originals. Each of the sections contains a selection of references to the titles of the more important books and papers of the subject as well as to other biographical and historical material concerning him or his work. The book ends with an appendix which gives an outline of sources in the history of agricultural chemistry from the time of Liebig to the present. For this period there is a wealth of material available in any library; what Dr. Browne has accomplished is to make the earlier and rarer material available in brief and attractive form by publishing what is in effect an abstract of a lifetime of reading and research into the background of his field of special interest.

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THE IMPROVEMENT OF LIVESTOCK

Livestock Improvement. By J. E. NICHOLS. 208 pp. Illustrated. Edinburgh: Oliver and Boyd, Ltd. 1944. Price 10/6.

THE excellent little volume is a valuable addition to the literature on animal breeding. The author has brought together a wealth of material, drawn from a broad experience and extensive travel. The presentation of the genetic background for problems of animal breeding is sound and clear. The author may have gone a little too far in his emphasis of the influence of the environment, but this emphasis does have the merit of counteracting the tendency of some texts on breeding to ignore entirely this factor. Much consideration was properly given to the problem of acquiring adequate standards for measuring genotypic differences among animals. This text is not designed for the novice, since there has been no avoidance of technical terms or some of the involved phases of selection. Certain topics such as crossbreeding have been dealt with somewhat arbitrarily, but this may be expected in a text so limited in scope.

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REPORTS

CONFERENCE ON SCIENCE EDUCATION FOR NATIONAL SECURITY

A CONFERENCE on "Science Education for National Security," held at the Engineers Club in Philadelphia on Friday, March 30, 1945, was attended by 50 representatives of science, industry and labor.

The leading speaker at the meeting was Dr. Marion H. Trytten, director of scientific personnel of the National Research Council, who reported on pending and proposed legislation designed to alleviate the alarming scarcity of highly trained scientific workers and on other steps being taken to improve the situation. Dr. Trytten predicted that the termination of hostilities would bring little relief because demand

for scientific personnel will continue to outstrip the supply. Military research will continue and universities must enlarge their faculties to fill the gap in training caused by the wartime lag; they are witnessing the beginning of an influx of foreign students. The demand by foreign countries for scientific and technical personnel is expected to be very great.

Despairing of bringing about a reversal of the administrative policy that has been responsible for the excessive drafting of irreplaceable personnel, leaders of science are turning their effort to legislative methods, Dr. Trytten reports. While most of the damage has already been done it is imperative that training in the physical sciences particularly be resumed immediately. Legislation in preparation would select 20,000 men a year for such training.

Dr. Reuben T. Shaw, chairman of the National Science Teachers Association's Committee on Public Relations, presided at the meeting. Dr. Philip G. Johnson, president of the association, described science education's job as two-fold: to supplant widespread scientific illiteracy with a basic scientific culture and to train technical workers for science and industry. He suggested that industrial advertisers who have been saluting the role of the teacher in education should call attention to the special importance of the science teacher.

Dr. Ivor Griffith, president, and Dr. Rachel Anderson, vice-president, of the Middle States Science Teachers Association, were among the speakers. Dr. Griffith, who also is president of the Philadelphia College of Pharmacy and Science, paid special tribute to the pharmaceutical industry for pre-war research that made possible the remarkable wartime developments in medicine, and for that industry's generous and timely support of science education.

The spokesman for industry was E. C. Fuller, president of the Curtis Publishing Company and former president of the National Association of Manufacturers. Mr. Fuller reported on surveys made by the NAM which clearly showed industry's large stake in better education. He cited the particular need for a public with an understanding of scientific principles.

Joseph F. Burke, educational director of the American Federation of Labor, spoke of labor's strong support for better educational opportunities. Also present was W. B. Woodward, Jr., of the Brotherhood of Locomotive Firemen and Enginemen.

Dr. Homer C. Will, president of the Pennsylvania Academy of Science; Dr. Bradford Willard, president-elect, and several members of the executive committee attended the meeting as well as Dr. Walter S. Lapp, president of the Philadelphia Science Teachers Association, and members of its executive committee.

Dr. William A. Feirer, vice-president of Sharpe and Dohme; Franklyn Waltman, public relations director of the Sun Oil Company; Roy Stryker, George Freyermuth and Barry Meglaughlin, of the Standard Oil Company of New Jersey; J. A. Lorimer and H. J. Druequer, of the Standard Oil Company of Pennsylvania, and H. R. Clark and A. F. Natters, of the Radio Corporation of America; James K. Hunt, public relations director of E. I. du Pont de Nemours and Company; and P. L. Schauble, vice-president (public relations) of the Bell Telephone Company of Pennsylvania, and W. M. Welch also were present.

Dr. Irving P. Reimann, director of the Lankenau Hospital Research Institute, represented the American Medical Association and spoke of the critical need for more science in the secondary school in the interest of public health. The American Legion was represented by Dr. Charles E. Sohl, the American Chemical Society by Dr. F. T. Tyson, Sigma Xi by Dr. James A. Harrison, the Physics Club of Philadelphia by Dr. M. R. Wehr, and various engineering societies by Dean J. H. Billings, of the Drexel Institute of Technology, Philip H. Spear and F. V. Westermaier.

SPECIAL ARTICLES

IN VITRO EVIDENCE OF REGENERATION OF ACTIVE PENICILLIN FROM PENICILLIN ESTERS

INDIRECT evidence for the existence of bacteriostatically inactive penicillin esters and their ability to hydrolyze to yield bacteriostatically active penicillin has been presented by Meyer, Hobby and coworkers.[1, 2] Their esters were prepared by the reaction of a diazoalkane with the acid form of penicillin in chloroform. Evidence for the regeneration of bacteriostatically active penicillin from the esters was deduced from experiments *in vivo*. These showed that mice inoculated with lethal doses of a hemolytic streptococcus were protected by oral or subcutaneous administration of solutions of the ethyl or n-butyl esters.

Direct evidence has been found which shows that penicillin esters may be converted to active penicillin *in vitro*.

The methyl ester of penicillin was prepared by addition of diazomethane[3] to 250 ml of an amyl acetate solution of the free acid of penicillin which assayed initially 5,990 International Units per ml. After re-

[1] K. Meyer, G. L. Hobby and E. Chaffee, SCIENCE, 97: 205–206, 1943.

[2] K. Meyer, G. L. Hobby and M. M. Dawson, *Proc. Soc. Exp. Biol. and Med.*, 53: 100–104, 1943.