paleobotany, ornithology, plant nutrition and other scientific areas. A minority of the chapters in this volume summarize the character and achievements of whole fields of science.

As to the merits of the varied technical presentations, the present reviewer is not competent to judge. As to the papers which are broad in scope, he finds them excellent examples of popular exposition, notably Professor Aitken's paper on astronomy, "Driving Back the Dark"; Professor Putnam's essay on a Sierran landscape; the study of longevity of bacteria in old soil and mud bricks by the late Dean Lipman; and Professor Chaney's "Trees and History."

Citizens of California are entitled to pride in this anniversary record of scientific work at the university which they have so generously supported. Other general readers will find the volume one of rewarding value if they approach it aware of its actual contents, ready to skip judiciously, but braced also to read with care material which is significant and illuminating.

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MEDICAL EDUCATION

Medical Education in the United States Before the Civil War. By WILLIAM FREDERICK NORWOOD. xvi + 487 pp. Philadelphia: University of Pennsylvania Press. 1944. $6.00.

IN the preparation of this history of medical education in the United States before the Civil War, the author undertook a very difficult and arduous task involving the location and study of many documents in widely separated areas.

He has made available in a single volume rather detailed factual data in regard to the medical schools established during the period covered. Much of the material included has until now been relatively inaccessible in the libraries of the country.

The first few chapters are devoted to a consideration of the status of medical practise and the initiation of medical education during the Colonial period. There follows by states and districts a description of the development of the individual medical schools and their history up to the time of the Civil War. The last few chapters deal with various general aspects of the development of the American system of medical education during the period covered.

Although a consideration of the schools on a geographic basis, following in a general way the settlement of the country, is probably the logical method of presentation, it is somewhat difficult in certain instances to follow the historic sequence. The lack of stability of most of the schools and the frequent movement of faculty members from place to place tends to be confusing to the reader. However, it should be pointed out that it is the events themselves rather than the author's presentation that is confusing.

The author is undoubtedly correct in stating that extension of the scope of the study to include developments in the field of medical education after the Civil War "would make of the book too bulky a tome." However, this volume in itself offers little opportunity for correlation with the present and stimulates the hope that it may be supplemented by a history of medical education subsequent to the events so ably recorded by Dr. Norwood.

The bibliography and the index of personal names are in themselves a valuable contribution to the literature on the history of medical education. The activities of many physicians, whose biographies have never been recorded, can be traced through the index of personal names.

In this and other respects the book will prove to be of great value for reference and will be frequently used by those interested in the period covered by it.

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STARCH

Chemistry and Industry of Starch, Starch Sugars and Related Compounds. By RALPH W. KERR. 472 pp. Argo, Ill.: Academic Press, Inc. 1944. $8.50.

WITH the assistance of fourteen co-authors, Dr. Kerr has prepared a very readable text dealing with the art, science and technology of the starch industry. The book is quite comprehensive in its citations to current literature, although the treatment is of necessity brief. The interweaving of scientific information with description of the art and technology has been very well done. Some of the reports of practices in the American industry can be found in no other text.

The subject-matter has been conveniently and somewhat arbitrarily distributed under five major headings: "Occurrence," "Preparation," "Properties," "Reactions" and "Uses." The section on "Properties" suffers as a result of this organization. Much of the material which could be treated in this section has been discussed under other headings; *e.g.,* viscosity and gel properties are discussed as control methods under "Preparation"; hydrogen bonding, as an interpretation of chemical characteristics under "Reactions." The section on "Properties," however, serves the worthwhile purpose of focussing attention on the separation and properties of starch fractions, particularly amylose. Considerable practical information, unavailable elsewhere in organized form, is to be found under the heading of "Uses."

In general the book is free of typographical errors. The shift in style and the repetition often characteristic of books by co-authors have been fairly well elim-

inated. An exception to this is the conflict in the views on dextrinization expressed in Chapters XII and XIII. In some of the treatment of the more controversial subject-matter, the vague speculation and non-conclusive experimental detail characteristic of older texts still persist. These deviations from the clear description of industrial operations and concise presentation of certain phases of the scientific literature detract from the general objectivity of the book.

The book is timely and a contribution to both the scientific and the technological literature.

R. M. HIXON

REPORTS

THE BOTANICAL WORK OF THE CINCHONA MISSIONS IN SOUTH AMERICA

WHEN the Japanese invaded the Dutch East Indies in the late winter of 1942, our primary source of quinine was suddenly and unexpectedly cut off. Since our stock piles of this essential drug were inadequate for the urgent needs of a long war, the critical problem was placed in the hands of the Board of Economic Warfare (now the Office of Foreign Economic Administration). Negotiations were gotten under way almost at once with the several Andean republics which a century earlier had produced the world's quinine supply. Although the cinchona agreements consisted essentially of our guarantee to buy all bark above a certain minimum alkaloid content, to furnish technical aid to the bark harvesters and dealers and to establish a plantation program, in exchange for sole buying privileges, such negotiations are traditionally slow, and it was October, 1942, before the first field party was able to leave Washington.

Dr. F. R. Fosberg and myself, the first two botanists of the cinchona program, arranged to stop off in Guatemala in order to study briefly the cinchona plantations there before starting our search for wild species in Colombia. Our first surveys were in the Santander provinces of northern Colombia, in the Eastern Andes near Pamplona, since small lots of bark from this region were already appearing on the market. In the months which followed we laboriously studied the forests of the three ranges of the Colombian Andes and came to know in a general way the basic distribution of cinchona species there. *Cinchona pubescens,* an inferior species, was found to occur throughout all three ranges, although it is relatively richer in alkaloids in the eastern range. *Cinchona officinalis,* which usually produces bark of high quality, occurs in Colombia only in the eastern range. This range was found to possess still another source of quinine, quite unsuspected when our work was originally planned. In December, 1942, it had been my good luck to run into large stands of a race of *Remijia pedunculata* on the west slopes of the Eastern Andes north of Bucaramanga. We were astonished to find that the bark of this non-cinchona gave up to 3 per cent. of quinine sulfate with very little admixture of other alkaloids. This same species extends along the eastern foothills of the Colombian Andes from Florencia to Villavicencio, near the type locality where its alkaloid production is very low. The low percentage of quinine may be due to the very sterile, sandy soil, since the high-quality variety grows on deep rich clay in Santander. Another piece of good fortune not foreseen in our original plans was the rediscovery of *Cinchona pitayensis* in the Central Andes, in Cauca province, both by Dr. Fosberg and myself. This little known species had been supposed to be a botanical rarity with very limited geographical distribution. Nevertheless, it turned out not only to be relatively abundant in southern Colombia, but also to be the species richest in alkaloids, with an average of 3 per cent. of quinine sulfate and 5 to 6 per cent. of total crystallizable alkaloids.

In July, 1943, I went to Ecuador to inaugurate exploratory work in the northern provinces, where no cinchona species had ever been collected. My first expedition had as its aim the discovery of *C. pitayensis,* unreported in Ecuador, and in August, 1943, the first-known Ecuadorian stands of this high-quality species were found on the west slope of the Western Andes in the province of Carchi. It occurs in a zone between altitudes of 8,500 and 10,000 feet, and had been overlooked previously because of the tradition in Ecuador that the best races of cinchona occur between 3,000 and 5,000 feet. Explorations were continued and during the next twelve months the belt of *C. pitayensis* was followed southward through the provinces of Carchi, Imbabura, Pichincha and León, more than a hundred miles and well into the southern hemisphere. *Cinchona officinalis,* on the other hand, which had been known previously only in Loja and Azuay provinces of southernmost Ecuador, was followed northward to the Colombian frontier. *Cinchona pubescens* was found to occur throughout the Ecuadorian Andes, and although its bark is generally low in alkaloids, especially quinine, it occasionally produces local races which are surprisingly rich. Several other species were found in the course of survey work, but are of more botanical interest than economic importance. The importance of botanical surveys was demonstrated early in our program, as can be seen from the foregoing, but it was only during the winter of 1943–1944, a full year later, that the Colombian and Ecuadorian cinchona