was by ill health, of his efforts to obtain definite proofs in his baffling scientific investigations, particularly those pertaining to natural selection and evolution, and of the persistence which eventually led to success. The narratives are enlivened by many amusing episodes and abound in clever and humorous expressions. The story of his ill-fated expedition to the Egyptian Sudan is as thrilling as almost any work of fiction.

As a general rule each chapter concludes with a brief discussion of the sociological aspects of the subject under consideration. The concluding chapters on the real value of science, man versus nature, the vivisection bogey and the philosophy of the booster are sound and forceful. The final comments on religious beliefs are the result of the author's honest conviction, although many will differ from his conclusions.

WESLEY R. COE

## THE ASPERGILLI

*Manual of the Aspergilli.* By CHARLES THOM and KENNETH P. RAPER. 373 pp. Baltimore: Williams and Wilkins. 1945. $7.00.

THIS manual in general follows the plan or system of treatment found in a former work, "The *Aspergilli,*" by Thom and Church. While all the best features of that work have been preserved and added to in this book, it is in no sense merely a second edition or revision. It is an entirely new book written to include new knowledge acquired by the authors and others during the past twenty years. The subject-matter has been treated from a more modern viewpoint without abandoning such principles and conclusions as were strongly supported in the former work, and which have been found to be fundamentally sound.

It is gratifying to see that the authors have continued to maintain that the generic name *Aspergillus* should apply not only to the conidial stage but also to the ascosporic stage. The genus *Aspergillus* is here to stay, regardless of rules of nomenclature. "It is better," the authors say, "to forget *Eurotium* along with technicalities."

In Chapter 3, "Morphology and Description," as in the former work, the characters of the colony are discussed under such headings as (1) color, including the range of color extending through a group, color of conidial wall, chromogenesis or substratum coloration; (2) morphology of the head, foot-cells, stalk, vesicle, sterigmata and conidium formation. These features are more fully discussed and illustrated than formerly, so that a student understands what must first be known in order to identify a species correctly from the conidial stage alone. A comparatively small number of species develop ascocarps. These structures, including the "Hülle cells" and sclerotia, are briefly discussed. Sexual reproduction is strictly on the basis of homothallism. No heterothallic species are known so that variation as it occurs in nature and in culture can not be attributed to +/− relations. A variant is in general applied here to a strain which is not stable. It has arisen through gradual change from a well-defined strain. A mutant, on the other hand, they define as a strain whose source is known and has arisen from sharp breaks in culture. It is a gene mutation, and one which retains its distinguishing features in culture. Examples of natural and induced mutants are cited, though the authors do not pretend to distinguish absolutely an induced mutant from an induced variation.

*Aspergillus* has long been one of the classics for purposes of text-book illustration of the life history of an ascomycete. The authors could have, without detracting from the usefulness of the book, included a more extended discussion of sexual reproduction along with illustrations of cytological features showing nuclear conditions in various structures and nuclear behavior leading up to ascus formation. The importance of heterocaryosis in the fungi is coming to be recognized so that a more extended discussion of this feature along with its many implications as determining colony characteristics would have been welcomed.

Chapter 4 on cultivation and examination has been considerably extended, now covering eighteen pages instead of eight. Nine excellent formulae are now recommended for culturing *Aspergillus.* Only one formula of the four originally suggested is retained. This is Czapek's Solution Agar. The special virtues of each type of medium are indicated. The pros and cons of "single spore" method of culture are interesting and instructive. The method has its place, but it can not be recommended as a way of preserving the whole morphology of a species. Transfer of masses of conidia is the best safeguard for this purpose. To this statement one could agree without giving up the idea that perhaps even then the whole morphology of a species would be difficult to corral in one culture. We are hearing much these days about the best way to maintain cultures of *Penicillium notatum* so as to insure the maximum production of penicillin.

The taxonomy of both of these genera demands the exercise of the most scrupulous care to preserve the purity of cultures. Chapter 5 on this subject has been enlarged to cover this subject more completely. The lyophile form of preservation of cultures for future use is described in some detail, but the authors point out that, while the feasibility of this method has not been fully proved, their results are encouraging. Various common sources of contamination are

again discussed and a good formula for poisoning cotton plugs against mite invasion has been added.

In Part II, the Manual Proper, the principle of bringing closely related forms together in "species groups," formerly strongly advocated because of the extreme variability of the species, has been further extended so that now the authors propose fourteen well-marked species groups. Three separate group keys enable even the non-expert to locate his species in the proper group, and this is about all most of us need. The authors accept only about ninety species, varieties and mutations; of these a dozen or so are mutations or varieties of good species.

Few of us have realized how easily one can locate a species by using a dichotomous diagram (Fig. 20): sterigmata present, absent; conidiophores smooth, rough; sclerotia present, absent; Hülle cells or not; conidiophore walls, smooth, rough. Group keys based (1) primarily on color and (2) on morphology cover the same ground.

Having determined to which of the fourteen species groups one's specimen belongs he turns to the special chapter on that group where additional keys subdivide that group into series. For example, the *A. glaucus* group is made up of nine species series. The *A. repens* series of this group consists of three distinct species. If a mycologist has studied his material properly in culture so that he really knows its morphology and culture characters he will have little trouble in identifying his species.

In the Manual Proper one finds morphological features all well figured. It would be difficult to find anywhere in the whole field of mycology more beautifully drawn figures of ascospores found in their figures 27, 34 and 43 where ascospores are figured from various angles. In addition to the inclusion of many half-tone and black and white illustrations, there are eight plates of photographs in color.

An extensive topical bibliography comprises Chapter 22. Literature on acid, enzyme and fat production, pathogenicity, physiology, pigments, soil tests, variation, growth substances, antibiotics, etc., is brought together topically. Reference to pages in the book where a number of these topics are discussed in the text will be found in the comprehensive index.

The "check list of genera and species" (Chapter 24) forms a very valuable part of the book. Sixteen generic names which have been applied to *Aspergillus* and some 600 species and variety names are covered briefly. Here all forms found in the literature are enumerated and their proper allocation is given in a way that serves as a guide to one who wishes to use the literature in the interpretation of names he finds but are "not known to him in nature, in cultures or in exscitti." The book brings *Aspergillus* up to date. It is one we must all possess, especially if we are interested in either *Aspergillus* or *Penicillium*.

B. O. DODGE

THE NEW YORK BOTANICAL GARDEN

## THE CALENDAR

*Consider the Calendar.* By BHOLA D. PANTH. New York: Bureau of Publications, Teachers College, Columbia University. 1944. $1.25.

USUALLY it is the chapter on "Time and the Calendar" in an astronomical text-book through which a college science student gets his first serious introduction to the problem of chronology and the relation of astronomical events to the clock on the mantelpiece and the calendar on the kitchen door. And most attempts to stimulate the interest of the student in calendar development and the need for calendar reform are distinctly inadequate—the subject of the calendar just seems to most students and laymen to be dull. Brief paragraphs, crammed full of cycles and epochs and eras, necessary in such aforementioned astronomy texts, do not improve the situation.

Therefore, supplementary reading is here especially important, and "Consider the Calendar" is just right for the purpose. It is the right length, too, and the student who reads it will not tend to skip important parts, because he knows its conclusion is on the 121st page. After he gets there, he will probably find himself reading Appendix A about holidays, and perhaps figuring out how to determine the day of the week using Appendix B. His interest will be stimulated enough by Mr. Panth's presentation to make him want to go out and spread his command of the calendar among his fellow students.

In Appendix C, Mr. Panth lists numerous books on the calendar. The trouble with most of them is that they are too specific, too lengthy, too boring, too repetitive—Mr. Panth has digested the salient facts of the problem and included in his well-written pages almost every calendar item of interest to the modern mind, scientific or otherwise.

We are told that the book is the outcome of a fellowship established by Teachers College for the study of the calendar from earliest times to our present day, including arguments for the adoption of a revised calendar more adequate for our daily use. His coverage of these points is in four main parts: the calendar in perspective; basic calendar concepts; basic calendar patterns; proposals and trends in calendar improvement.

Early in the book, Mr. Panth appraises the reader of his forthcoming attitude toward the Gregorian calendar: "It is a lingering medieval instrument operating in a highly advanced and synchronized technological society." Throughout, he never misses a chance to point out the inadequacy of the 28 dif-