regular and practical use. "Maury of Virginia, pondering the results of deep-sea soundings, discovered the Atlantic plateau and suggested the Atlantic cable to Cyrus Field." Among the many other Southern scientists mentioned by Professor Johnson are J. Lawrence Smith, John James Audubon, H. W. Ravenel, John W. Mallet, F. P. Venable, Lewis R. Gibbes, Wm. C. Wells, John and Joseph Le Conte. The National Museum Report (Washington, 1897) links Thomas Jefferson with Agassiz as having done so much for science in America, mainly by the immense weight given science by their advocacy.

It seems to me that any unprejudiced person, looking through this book and considering the facts about the South, will agree that Dr. Salant's sweeping statement is unwarranted. Perhaps he was misled by what Dr. Kofoid said in commenting on the *arrangement* of the subject-matter of the book: "Details of evidence of educational interest abound, but a synthesis of accomplishment in the several disciplines is not achieved. There is a noticeable absence of evidence of sustained activity by productive investigators in scientific fields."

For a number of years past I have been trying to accumulate data as to what scientists of the South did to aid the Confederacy in the face of a stringent blockade. The sunken Merrimack was raised and converted into an ironclad, the Virginia. The Charleston submarine, Little David, repeatedly went down with all hands, only to be raised again to damage a Federal ship before her last plunge. The gunpowder made by Colonel Rains was so excellent that what was left after the war was used in the gunnery school at Fortress Monroe and was declared by a British officer to be equal to the best British powder. I will welcome any data showing what scientists did for the Confederacy.

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SCIENTIFIC BOOKS

CRYPTOGAMIC BOTANY

Cryptogamic Botany. By GILBERT M. SMITH. Vol. I, $4.00; Vol. II, $3.00. McGraw-Hill, 1938.

ANY thorough-going review of G. M. Smith's "Cryptogamic Botany" would require that each of the several sections of the two volumes be separately considered by a specialist in the field concerned. With the first volume dealing with algae and fungi and the second with bryophytes and pteridophytes, the author has covered so wide a field that a critical appraisal of all the diverse parts would demand the services of a phycologist, a mycologist, *et al.* It is certain, however, that this work is of major importance in the general field of plant morphology and phylogeny, both because it does cover so extensive a field, because of the scholarly quality and workmanship, and because it represents an attack on general problems in plant science which have received far too little attention. Without attempting to be thorough in any particular field, the present reviewer would like to call attention to certain aspects and implications from the standpoint of a biology teacher.

What is meant by the standpoint of a biology teacher may perhaps deserve some definition. While it is still broadly true, as noted by Thaxter some years back, that most "biologists" are zoologists who teach something about plants in courses and text-books designated as "biological," there are a number of "biologists," like this reviewer, whose antecedents are botanical, and some biology texts which have joint zoological and botanical authorship. Without any definite figures as support, the opinion is ventured that the vast majority of students make their first acquaintance with organized plant and animal science in biology courses and biology texts. Long experience in such courses, with a total approaching fifteen thousand students, makes this reviewer certain that there is such a thing as a "biological" point of view, even if no more is granted to biology courses than the success of a foundling cowbird, that of survival and multiplication.

The term "biology," first used by Lamarck and Treviranus in 1800, was coined to give expression to the idea of the essential unity of plant and animal phenomena, of which these men, whose work was biological in the truest sense, had gained some preliminary appreciation. Verified in the succeeding century, through the cell and protoplasm doctrines, through evolution and genetics, and through the physico-chemical analysis of living things, the implications of the broadest biological point of view are still often misunderstood. Too often, a biology course may mean an introduction to plant structure in terms of possible "dorsi-ventrality," or to plant functioning in terms of an assumed "physiological gradient"—in other words, on the kind of analogical reasoning basis by which Aristotle and Cesalpino interpreted plant structures and activity from their acquaintance with animals. The converse is sometimes true, when terms, exactly applicable only in a restricted botanical sense, like tropism, are applied in the zoological field to a wide diversity of different phenomena, as H. S. Jennings has pointed out.

In a general biological sense, the Smith text is important because it represents one of few attempts

on the part of botanists to place plant classification on a broad phylogenetic basis. When a biology teacher attempts to place before his students, on a comparable basis, pictures of the plant and animal kingdoms and their subdivisions, he finds that zoologists have proceeded much further in dividing the animal kingdom into well-demarked, commonly accepted groups than have the botanists. First of all, he runs across the difference in terminology; the plant kingdom is divided into "divisions"; the animal kingdom into "phyla." "Division" is, of course, orthodox botanical usage, written down in the code of the Fifth International Botanical Congress of 1930, and followed practically exclusively in botanical writings, except by those rare plant biologists, like C. E. Bessey and J. H. Schaffner, who have been interested in delimiting the "phyla" of the plant kingdom.

While, scientifically, this difference in terminology may be considered trivial, the question is raised here whether there may not also be an unsuspected biological significance as well. Is it not a fact that the word "phylum" is much more appropriately applied to the subdivisions of the animal kingdom? That zoologists have really succeeded in recognizing and defining genetically determined phyletic groups, while botanists have been satisfied to go along with such catch-all congeries as "Thallophytes," a group which may be compared in content to the whole animal subkingdom of invertebrates?

That botanists have been slower in analyzing the plant kingdom into natural, more or less coordinate "phyla" has several possible explanations. The problem is vastly more difficult, the basis of subdivision less obvious, requiring biochemical discriminations of pigments, reserve food storage, etc., instead of the more obvious structural features by which animal phyla are separable. Moreover, it seems certain that in plants unicellular types will be found in several well-differentiated phyletic groups, while all one-celled animals are comprised in a single phylum. In the most critically difficult fields, of phycology and mycology, a great amount of pioneer work is still needed; botanists are still concerned with intensive studies, and, so far as fungi are concerned, the emphasis is chiefly economic. Even with the vascular plants, it is only within the past forty years that the anatomical and paleontological groundwork upon which a phyletic grouping may rest, has been accomplished.

"Acceptance of the view that various series of algae are more or less independent of each other means that both the Thallophyta and its subdivision Algae must be abandoned as natural units in classifying plants." From this premise, Professor Smith proceeds to carve nine phyletic groups out of the heterogeneous Thallophyta: Chlorophyta, grass-green algae; Euglenophyta, euglenoids; Pyrrophyta, cryptomonads and dinoflagellates; Chrysophta, the yellow-green algae (diatoms, etc.); Phaeophyta, or brown algae; Cyanophyta, blue-green algae; Rhodophyta, red algae; Myxothallophyta, slime molds; and Eumycetes, or fungi. The subdivision of the true algal groups follows lines which have been more or less anticipated by other writers, like Tilden, and is based upon the biochemical studies of men like Willstätter, etc. It is surprising to find no acceptance of the widely held opinion that the fungi themselves are polyphyletic, and that some fungi have real genetic relationships with certain algal groups. Bacteria are not included in the classification.

With his opinion that the higher vascular plants have been derived from Bryophyta, Dr. Smith recognizes that a majority of botanists will disagree. On the other hand, it is suggested here that while the great majority of general texts in botany are in agreement with Smith in keeping Pteridophyta and Spermatophyta as distinct phyla, the weight of evidence from plant anatomy and morphology and from paleobotany of the last forty years is preponderant for the conclusion expressed by Eames recently ("Vascular Plants. 1936"): "Seed habit can not be used to separate the vascular cryptogams from the phanerogams because of seeds found on the ancient group of fern-like plants." In other words, while the thallophyte miscellany has been long in need of subdivision, two other plant "divisions," Pteriodophyta and Spermatophyta, may just as reasonably be joined to form the Tracheophyta.

Finally, the importance of working toward a natural system of subdividing the plant kingdom is urged upon the authors of botanical texts and also on "botanical biologists." Such a division of Thallophyta as is presented by Smith is a distinct step in advance of present practice. It is not really more difficult to treat of nine phyletic divisions of the plant kingdom than to keep Thallophyta and then discuss its nine subdivisions.

R. C. BENEDICT

BROOKLYN COLLEGE AND
BROOKLYN BOTANIC GARDEN

SOCIETIES AND MEETINGS

THE TENNESSEE ACADEMY OF SCIENCE

THE forty-second meeting of the Tennessee Academy of Science was held at Vanderbilt University on November 25 and 26, 1938. The first general session was on Friday morning from 9 o'clock to noon, President Jesse M. Shaver presiding. Friday afternoon sec-