fellow-workers and produced a work which will always remain the standard source of information on the subject of which it treats—the birds of the coast region of South Carolina, their relative abundance and manner of occurrence at the date of its publication.

J. A. A.

BOTANICAL NOTES

BOOKS ON MOSSES

TEN years ago Dr. A. J. Grout brought out a little book with the title "Mosses with a Hand Lens," which was intended to "give by drawings and descriptions the information necessary to enable any one interested to become acquainted with the more common mosses with the least possible outlay of time, patience and money."

Five years later, encouraged by the reception accorded his venture the author brought out a second, greatly enlarged edition, in which he included the liverworts also. That these little books have been most useful needs no proof here. They have made it possible for many a student to study mosses in field and forest as he studied ferns and flowering plants. Some one should give us similar books on the fungi (and lichens) and the freshwater algæ, and for seaside dwellers the seaweeds might well receive a similar treatment.

In the optimistic mood which the success of his little moss book induced, Dr. Grout projected a larger work which he began publishing in German fashion in successive "parts," under the title "Mosses with Hand Lens and Microscope." The first of these parts appeared in 1903; the second in 1904, the third in 1906, the fourth in 1908, and the fifth (concluding) in 1910. We have now the complete work, making a large octavo volume of 416 pages, including 89 full-page plates, and 220 text figures. Many of these are from *Bryologia Europaea,* and Sullivant's *Icones Muscorum.* There is no attempt to include all the mosses of the region (northeastern United States) but the author has made a judicious selection, for which his long experience as a teacher as well as a bryologist has well fitted him. The keys to the genera and species, together with the carefully drawn descriptions, make it rather easy for the pupil to find the name of any ordinary moss.

The book closes with a key to sterile specimens, and a good index. A good glossary (illustrated) is given in the introductory part of the work (pp. 37–44).

The author is to be congratulated upon the completion of this notable book, and students of the mosses will be glad to know that he offers it now as a bound book. (New Brighton, N. Y.)

THE GRAY CENTENARY

THE Botanical Seminar of the University of Nebraska will celebrate the one hundredth anniversary of the birth of Dr. Asa Gray on Friday, November 18, 1910. At a general convocation to be held at eight o'clock in the evening of the above day in the botanical lecture room in Nebraska Hall, the following papers will be read:

"Gray's Writings to be found in the Botanical Library," Professor E. R. Walker.

"Gray's Manuals and Floras," Professor G. H. Coons.

"Gray's Text-books," Professor R. J. Pool.

"Gray's Influence as a Teacher," Professor E. M. Wilcox.

"Reminiscences and Letters," Professor C. E. Bessey.

The above papers will be assembled by the "Lord Warden" and printed as a publication of the seminar.

THE NUMBER OF KNOWN SPECIES OF PLANTS

IN some work upon which I have been engaged recently it became necessary to bring together in compact form what is known as to the number of kinds (species) of plants with which botanists have enough acquaintance to permit of their systematic arrangement and enumeration. The result is that roughly speaking we may say that there are now known about 210,000 species, distributed as follows:

Myxophyceae (Blue Greens)	2,020
Protophyceae (Simple Algae)	1,100
Zygophyceae (Conjugate Algae)	7,000
Siphonophyceae (Tube Algae)	1,100
Phaeophyceae (Brown Algae)	1,030

Carpophyceae (Higher Algae)	3,210
Carpomyceteae (Higher Fungi)	63,700
Bryophyta (Mossworts)	16,600
Pteridophyta (Ferns)	2,500
Calamophyta (Calamites)	20
Lepidophyta (Lycopods)	900
Cycadophyta (Cycads)	140
Strobilophyta (Conifers)	450
Anthophyta (Flowering Plants)	110,000

About eighteen years ago Saccardo made some rather careful estimates of the numbers of species of plants, and a translation of his paper made by Dr. Roscoe Pound was published in the *American Naturalist* for February, 1894. In that paper Saccardo makes a number of very interesting and ingenious calculations and estimates and reaches the conclusion that at that time there were known nearly 174,000 species of plants, distributed as follows:

Algae	12,178
Fungi (including Lichens)	45,203
Liverworts and Mosses	7,650
Equis, Marsil, Lucopod	565
Ferns	2,819
Phanerogams	105,231
	173,706

Upon these figures he then estimates that "the flora of the world when it is completely enough known will consist of at least 385,000 species, that is 250,000 fungi, and 135,000 species of the other groups." Adding 15,000 as the probable number of new species that it may reasonably be presumed will be found outside of the fungi, and we have 400,000 as the grand total of plant species in the world. These he estimates may require 150 years of work by botanists, in other words "our remote grandchildren" may be confronted by this vast array of species.

In his paper Saccardo contrasts these later numbers with earlier ones, as follows: Theophrastus, about 2,200 years ago, knew about 500 species of plants; Dioscorides 1,900 years ago knew 600 species; Bauhin 260 years ago knew 5,266; Linné 150 years ago knew about 8,551; DeCandolle (in 1819) reckoned about 30,000 phanerogams alone, and this was increased by Lindley (in 1845) to nearly 80,000 and by Duchartre (in 1885) to 100,000; the latter at the same time estimated the cryptogams at 25,000.

How to Teach Botany

That there is need of improvement in our teaching of botany scarcely needs arguing, especially when we consider the teaching in the high schools of the country at large. In fact when we think of the thousands of young people who yearly enter the classes in general botany in the colleges and universities, and then consider the annual hunt by heads of botanical departments for men (or women) who are prepared to fill even minor places as teachers or investigators, we are sometimes tempted to question whether any of us know how to teach our science aright. Upon the latter point the writer would like to take part in a serious Seminar Conference in Minneapolis during the meeting of the American Association for the Advancement of Science, and he here suggests to the officers of Section G that they make provision for such a seminar on one of the evenings at some convenient place. So, leaving the question of the apparent inefficiency of college and university teaching, every teacher who has had to evaluate and build upon the botany of the high schools realizes very fully that there is very much poor teaching of the subject which makes it in every way fruitless. Too often after a half year or a year spent in the study the pupil has acquired neither culture nor training therefrom; instead, he has a mass of unrelated and rather dimly outlined botanical facts whose incoherency and vagueness preclude any mental training, and whose lack of relation to the daily life of the community makes impossible the suggestion that they may contribute to the general education, that is the culture, of the pupil.

Now it is to remedy this state of things in botanical pedagogy that Professor Ganong, well known as a most successful teacher, has brought out a new and enlarged edition of his "Teaching Botanist" (Macmillan) a book of somewhat more than four hundred pages. In these he discusses "The Place of the Sciences in Education, and of Botany among the

Sciences," "What Botany is of Most Educational Worth?" "The Training and Traits of the Good Botanical Teacher," "The Methods and Marks of Good Botanical Teaching," "Drawing and Description," "Botanical Laboratories and their Equipment," "Botanical Collections and other Illustrations," "Botanical Books and their Use," etc., and then takes up *seriatim* particular directions for teaching those parts of the science that he considers it possible to teach in the high schools. The book closes with reprints of two committee reports, viz.: Report of the Committee of Education of the Botanical Society of America, and the Report of the Committee of the Association of Colleges and Secondary Schools of the North Central States.

It is impossible to point out here all the good things this book contains. Each chapter might be quoted here entire with profit for the teacher-reader, but perhaps one of the most helpful is that on botanical books, with its many titles and very discriminating notes. The teacher who will carefully read this chapter will be in no danger of wasting money on poor books, or those not applicable to the particular conditions of his school.

In the second part of the book the prevailing idea that the seed is a good starting point is adopted. The writer of this notice does not have that veneration for seeds which so many of his colleagues have, and does not feel it incumbent upon him to regard seeds as having prior or paramount rights in the botanical laboratory or lecture room. Of course the well worn pedagogical axiom that in our teaching "we must proceed from the known to the unknown," is brought out to show that this old-time sequence is the truly orthodox one. But in fact how much that is of any scientific value whatever does the high school pupil know about a seed, one of the most complex of all plant structures? It would be difficult indeed to light upon anything anywhere in the whole plant kingdom that the pupil knows less about. And yet we ask the pupil to start with this complex thing, and make out a good deal of its structure, giving names to this and that part, of whose real nature and significance he can have no conception until he has studied some of the plants from which seed-bearing plants have been evolved. So, the writer has no use for the sequence here recommended, but he cheerfully testifies to the excellence of the presentation of the structure of seeds, their morphology, ecology, germination, etc., from the standpoint taken in this book. Professor Ganong's laboratory directions are admirable, and no doubt the pupils that are brought up this way will learn accurately a great many things that many teachers think should enter into high school botany. After thus ranging the structure of the higher plants, in accordance with the axiom quoted above, there is a brief chapter of twenty-five pages given to the Natural History and Classification of the Groups of Plants. This is where the writer would start his high school pupils, beginning with simple, one-celled plants and taking in succession higher and more complex forms until the flowering plants were reached, quite as Professor Ganong suggests in this part of his book. Then, and not until then, could the pupil have some ideas as to what flowers, and fruits and seeds are structurally and morphologically.

So the writer would reverse the order, beginning with page 386 and then after covering the subject as far as page 411, he would go back to pages 257–385 and take up much what is outlined there. In his opinion, which is confirmed by a good many years of experience with classes of beginners, and observation of high school pupils in botany, such a sequence is better for the pupil, and less likely to lead to confusion; and he so advises all teachers in high schools within his "sphere of influence."

And now, after saying all this about the mere matter of sequence, the writer here gives it as his opinion that Professor Ganong has made a most valuable addition to the literature of botanical pedagogy, and his book ought to be read by every school teacher, and while we are at it we might as well include college and university teachers also.

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