graphs show, also, that much further south, at In Salah and beyond, over half way to Timbuctu, there is a similar condition of affairs. It is probable, however, that the vegetation of the mesa-like areas, the *reg* or the *hamada,* may be barren in the extreme south, since even at Ghardaia there is very little vegetation on such areas. The mid-Saharan country is of the greatest interest botanically since there the Mediterranean element is almost wholly lacking, and the influence of the countries to the south of the desert begins to be felt. We shall await with much expectancy the promised detailed account of this remarkable journey.

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DESERT LABORATORY

BOTANICAL NOTES

SUPPLEMENT TO ENGLER AND PRANTL'S ALGAE

THE volume of the "Pflanzenfamilien" containing the Algae (I., abt. 2) was completed fourteen years ago (1897), while most of the parts of which it was composed appeared several years earlier. In 1909 two supplementary Lieferungen were issued by Wille, in 1910 two more were issued by Wille, Kjellman and Svedelius, while two more were issued in 1911 by Svedelius. These have now been brought together by the Leipzig publisher, Wilhelm Engelmann, under the subtitle of "Nachtraege zum I Teil, 2, Abteilung." It covers the period from 1890 to 1910, and so brings the treatment of the Algae down to date.

The first thing one notices is the considerable modification of the schematic chart of the relationship of the families of the green algae. The five groups (classes) are developed from the Flagellata, the Protococcales being the primitive class with *Volvocaceae* as the lowest family. From the latter came the Conjugatae as a side line ending blindly. Above *Volvocaceae* are placed *Tetrasporaceae* which lead by one line through *Protococcaceae* to *Hydrogastraceae* and *Valoniaceae,* and by the other to *Ulvaceae.* The family *Valoniaceae* is regarded as the lowest of the class Siphonocladales, which culminates in *Dasycladaceae* and *Sphaeropleaceae.* From *Valoniaceae* a line reaches *Bryopsidaceae* in Siphonales, culminating in *Vaucheriaceae.* The *Ulvaceae* are the lowest of the Chaetophorales, which pass by several lines to *Chroolepidiaceae, Coleochaetaceae* and *Oedogoniaceae* at the summits of as many genetic lines. A significant thing in the treatment of these families of green algae is the association of five families of colorless plants as "Nebenformen" related to *Volvocaceae, Pleurococcaceae, Protococcaceae, Oocystaceae,* and *Oedogoniaceae,* thus adding another step to the movement for the obliteration of the distinction between algae and fungi, and their assembling into new groups on morphological characters.

In passing it may be noted that *Pleurococcaceae* are separated from *Protococcaceae* by the absence of zoospores in the former and their presence in the latter, contrary to some recent algologists. Nor has the author been stampeded into dividing *Hydrogastraceae* and in his system *Protosiphon* and *Botrydium* lie peacefully side by side as related genera in the same family. *Characeae* are still so placed as to immediately follow Siphonales, and by this one is reminded of Wille's suggestion of their relationship in his earlier treatment. The revision of the Phaeophyceae was partly made by Kjellman, and on his death it was continued by Svedelius. It thus happens that some of the families are the joint work of the two authors, while in other cases Svedelius alone did all of the work, as in *Sphacelariaceae, Laminariaceae* and *Fucaceae.* The revision of the Rhodophyceae also is the work of Svedelius. Here the treatment is necessarily the same as that of Schmitz and Hauptfleisch fourteen to fifteen years earlier. However in the difficult family of the *Corallinaceae* the genera of the earlier treatment are freely broken up into smaller ones in accordance with the trend of recent opinion, resulting in the recognition of twenty-four genera instead of nine, with a considerable shifting of their places in the family.

NOTES

WITHIN the past two years Dr. W. C. Coker has rendered a distinct service to botany by the publication of two historical papers in the *Journal of the Elisha Mitchell Scientific Society,* the first (April, 1910) entitled "A Visit to the Grave of Thomas Walter" and the second (July, 1911) "The Garden of Andre Michaux." Walter's grave is now in the midst of a dense forest growth in southern South Carolina, not far from the swamps of the Santee River, although when he was buried his grave was made in what had been his botanical garden. The flat stone over the grave tells us that he died "in the beginning of the year 1788." No traces of the garden remain. An old oak at the head of the stone is now heavily draped with *Tillandsia.* Here he lies alone in the dense wild shade of his forest-covered garden.

Michaux's garden was about ten miles from Charleston, but like that of Walters has become overgrown with a heavy forest growth of mostly native species, but undoubtedly some of the trees date from Michaux's time, and were probably planted by him.

THE same writer's report on "Science Teaching in North Carolina" (*N. C. High School Bull.,* July, 1911) contains some good suggestions in spite of the statement that the committee "has been unable to arrive at any general agreement" as to what the science work should be. However they agreed in one most important conclusion, namely, that where single courses in science are offered they "should include the most important facts and principles" of the sciences concerned, and this is commended especially for "students whose instruction is concluded with the high school."

IN the paper on "The Wilting Coefficient for Different Plants and its Indirect Determination" (U. S. Dept. Agric. Bureau of Plant Industry, Bull. 230) L. J. Briggs and H. L. Shantz attempt "to determine the extent of the variation exhibited by different plants with respect to the minimum point to which they can reduce the moisture content of the soil before permanent wilting occurs," with the result that they conclude that the differences "are so small as to be of little practical utility from the standpoint of drought resistance." There is, however, a "great range in the wilting coefficient due to soil texture." The bulletin can not easily be summarized, and must be read by every botanist who is interested in physiological problems. The apparatus used is very ingeniously devised.

ALLIED to the foregoing is E. N. Transeau's paper on "Apparatus for the Study of Comparative Transpiration" in the July, 1911, number of the *Botanical Gazette,* in which he describes new forms of chronograph, weight droppers and irrigators, which he has devised and found useful.

Two recent ecological papers by R. M. Harper may be listed here, namely, "The River-bank Vegetation of the Lower Appalachicola, and a New Principle Illustrated Thereby" (*Torreya,* No. 11, 1911) and "The Relation of Climax Vegetation to Islands and Peninsulas" (*Bull. Torrey Bot. Club,* Dec., 1911).

AMONG recent economic papers are "The Propagation of Guayule by Seed," by Dr. J. E. Kirkwood (*Am. Review of Tropical Agriculture,* Vol. I.); "The Artificial Ripening of Persimmons," by Professor F. E. Lloyd (Proc. Ala. State Hort. Society, 1911); "American Medicinal Leaves and Herbs," by Alice Henkel (U. S. Dept. Agric. Bureau of Plant Industry, Bull. 219). The last named should interest the students in our schools of pharmacy.

THE "Annual Report of the Director of Forestry of the Philippine Islands" for the year ending June 30, 1911, contains much interesting matter for the botanist and general reader as well as for the professional forester. It is evident that there are serious forestry problems on the Islands not wholly unlike those that confront us in the United States, for the reckless destroyer is there just as he is here.

"The Forests of Oregon" (Bull. I., Oregon State Board of Forestry, 1911), by Professor G. W. Peavy, and the "First Annual Report of the State Forester" of Oregon (1912), by F. A. Elliott, indicate the state of mind of the people of the northwest in regard to the conservation of their forests.

One of the best of recent publications on trees is "New England Trees in Winter," by Professors Blakeslee and Jarvis, of the Storrs Agricultural Experiment Station (Bull. 69, 1911). After a helpful introduction, by means of keys the student is led to the principal genera, where further keys lead him to the species, and last to full descriptions accompanied by excellently selected photographs (in "half tone"). We do not recall any better treatment of our trees than is to be found in this publication, nor anything approaching it in other station bulletins. The authors are to be congratulated upon the quality of the matter which they have presented, and the Station upon its wisdom in giving it publication.

Here may well be mentioned favorably E. R. Jackson's "Forestry in Nature Study" (U. S. Dept. Agric. Farmers' Bulletin, 468), which should be found in every public school in the country. Mr. Lamb's "Key to Common Kinds of Trees" (p. 38) should prove helpful to many teachers who have somewhat hazy ideas as to the identity of the trees about them.

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SPECIAL ARTICLES

THE ACCUMULATION OF OIL AND GAS IN SANDSTONE

Let two plates of glass be slightly inclined to each other and touching along one edge. Place by means of a pipette some petroleum and water between the plates. By manipulation of the plates, cause a bubble of air and oil to be enclosed within the water. It will be noticed that while the oil surrounds the air, much more than half of the oil will lie toward the thinner end of the combined bubble. This would, of course, naturally follow, since liquids are subject to capillarity and gases not.

Let us now consider the newly formed strata of marine or lagoon shales and sandstones, which are potentially petroliferous. All the interstices will at first be filled with water. Assuming now that the petroleum and natural gas arise from chemical changes in included organic substances, principally in the shale, we have the following sequence of events. The gas that originates finds itself forced by the greater hold that the water has for the fine interstices to take a position in the largest near interstice. If this is more globular than tubular or flat, a bubble of gas will be thus imprisoned, otherwise it will move along till it reaches the largest lacuna. In other words, much of the gas will leave finer grained rocks for the coarser, and so produce an accumulation of gas in sandstone reservoirs. Gas then is the first constituent to be forced into these reservoirs.

But further, although petroleum has a lower capillarity constant, it has an extraordinary capacity of spreading along a surface between water and a gas. This is shown by the way oil will surround a bubble of air in water between two plates of glass. Therefore, in the movement of the gas bubble from the place of origin to the reservoir, each will carry with it a pellicle of oil, and thus accomplish an accompanying movement of oil from the place of origin to the reservoir.

I regret that I have not the facilities to demonstrate experimentally these principles, since they would be easily put to the test, given the required apparatus.

As to their practical bearings,

(*a*) Since the shale can contribute to a neighboring sandstone reservoir, contiguous bodies of organic shale and limestones would be considered favorable circumstances, rather than negligible as held by I. C. White, who finds the origin of the oil and gas within the sandstone.

(*b*) A reservoir may be expected to receive its oil and gas from shale above as well as below.

(*c*) A sandstone embedded within shales that seem to have very little oil in them may