university efficiency which can not be measured by any mechanical tests, but which has its root in the personality of the professors.—*The New York Evening Post.*

SCIENTIFIC BOOKS

A Directory of American Museums. Compiled by Paul Marshall Rea. Being No. 1, Volume X., Bulletin of the Buffalo Society of Natural Sciences. 8vo, pp. 360. Buffalo, N. Y. 1910.

The object of this directory is to give, as far as possible, a complete list of the museums of America, using the word in its broad sense, with information as to their purposes, character and extent of their collections, mode of support, manner of administration, staff and publications, with a brief sketch of the history of each institution. It is arranged alphabetically by states and cities, and, with the index, comprises 360 pages, 313 being devoted to the museums of the United States. The collections are listed mainly under certain specified headings; anthropology, art, botany, geology, paleontology, zoology, and the approximate number of specimens on exhibition and in the study series is stated. Great pains have been taken to have this information as exact as possible, and it will be found that in many cases there is a very considerable reduction in the size of collections from that noted in the list prepared by F. J. H. Merrill and that in a few instances there is stated to be "no museum," where one was said to exist in 1903.

The data given, checked by the character of the financial support, and a knowledge of the staff, will furnish a pretty good idea of the size and importance of the institutions noted.

The preparation of the work was authorized in 1908 at the second meeting of the Association of American Museums and the arduous duty of gathering the information and making it ready for publication was performed by Paul M. Rea, secretary of the association. The cost of issuing the work, which has been considerable, was generously borne by the Buffalo Society of Natural Sciences. It was hoped to have had the directory issued as a memorial of the Buffalo meeting of the association, but owing to inevitable delays in securing needed information it did not appear until late in 1910.

As the only directory of American museums previously issued is that prepared by F. J. H. Merrill and published in 1903, by the education department, state of New York, this volume is very welcome. We should have been glad of a brief summary, giving the number of museums in the United States, their total annual expenditure and the number of their staff, but this may well be left for some one interested in the study of statistics.

In conclusion it may be said that if, as Dr. Goode considered, the museum is the most advanced of institutions for the education of the public the United States stands well to the fore.

F. A. Lucas

Studies on the Structure and Affinities of Cretaceous Plants. By Marie C. Stopes and K. Fujii. Phil. Trans. Roy. Soc., London, Series B, Vol. 201, 1910, pp. 1–90, pls. 1–9.

A glance at the above somewhat impressive title might lead one to presume that we have to do with a paper of broad, possibly world-wide, scope, and it is not until we reach page 4 that we learn incidentally that it deals exclusively with material from Hokkaido, northern Japan. Here the authors have been exceedingly fortunate in securing nodules—presumably silicified—in which are preserved fragments of vegetation which indicate the presence of a varied and interesting flora, and suggest, in the manner of occurrence, the English Carboniferous nodules which have yielded such splendid results to Williamson, Scott and others. It is much to be regretted, however, that the present paper does not give more explicit information regarding the geological position of the material, the only data on this point consisting of the following statement: "In nearly every case there are parts of shells of Ammonites in the nodules. These have been described by Yabe, and there is no doubt, as a consequence, that the plants are of Cretaceous age." That the description of the

Ammonites by Yabe necessarily proves the Cretaceous age of the plants may, or may not, be true, but it can hardly be accepted as very definite information in itself, since Ammonites had their origin in the Triassic. Even if they are located in the Cretaceous or "Upper Cretaceous" it is not sufficiently close to permit of comparison with horizons of definite stratigraphic positions in the Cretaceous of other parts of the world. But this study avowedly was made, not from the standpoint of geological paleobotany, but from the professedly higher plane of histology, and as such it must be judged.

Those paleobotanists who, although perhaps not entirely without knowledge or appreciation of the value of structure, have made widest use of the impressions of plants, have had held before them the dictum that structure is the only road that leads to permanent accomplishment—a sort of Nirvana, as it were, which few could hope to attain. It was therefore with particular pleasure that we turned to the present paper in the hope that we should find an exposition of paleobotany founded on the solid basis of internal structure. The reviewer confesses to a feeling of disappointment.

Of the eighteen new genera and species, which range from fungi to angiosperms, it appears that hardly any is of absolutely definite position and affinity. Thus, of the fungus (*Pterosphæria*) our authors say, "the lack of characteristic spore-bearing fructifications makes its exact location impossible." Of the two forms described as ferns, the first (*Schizæopteris*) is thought to belong to the Schizæaceæ, but its affinity is uncertain, while the other (*Fasciostelopteris*) is balanced between the Cyatheaceæ, Marattiaceæ and Dicksoniaceæ, and the conclusion is reached it "may therefore for the present be provisionally included in the Dicksoniaceæ." *Niponophyllum cordaitiforme* is a leaf, and here now is the opportunity to see what can be done with internal structure as compared with an impression. After meandering through the better part of five quarto pages in seeking affinities balanced between Araucarineæ, Podocarpineæ, various genera of cycads, as well as *Cordaites,* we have the following: "Was the plant to which our leaf belonged a primitive type of cycad, or perchance a belated, small-leaved *Cordaites* surviving in this island of the orient, just as the truly archaic *Ginkgo* survived to the present geological epoch?" Since *Cordaites* had its maximum development in the Carboniferous and did not, so far as we definitely know, survive beyond the close of the Paleozoic, this discovery is of interest—if true! Their new species of *Cedroxylon* might belong, they state, either to this genus or to *Cupressinoxylon,* while the "new" coniferous genera *Yezonia* and *Cryptomeriopsis* have recently been reviewed at length by Professor Jeffrey.[1] The Anglo-Japanese authors state of their *Yezonia:* "It is impossible to find any family among gymnosperms with which we can satisfactorily include this plant," but Jeffrey shows conclusively that it is the same as *Brachyphyllum* from the Cretaceous of Staten Island, adding "if all the points of agreement between the description of the supposed new genus *Yezonia* . . . and the account of the anatomy and habit of *Brachyphyllum,* given in the present article and in the large memoir of Dr. Hollick and the present author were italicized, it would be necessary to italicize the whole description"! Their *Cryptomeriopsis* is shown by Jeffrey to be merely the old *Geinitzia* (*Sequoia*) *Reichenbachi,* that has been known from impressions since 1842.

The several angiosperms described are, if possible, in an even more unsatisfactory state as regards definiteness, and the authors acknowledge that "from the anatomy of stem and rootlets alone it is a matter of extreme difficulty and some uncertainty to determine the affinity of an angiosperm." Thus of their *Jugloxylon* they "lay no particular stress on the systematic position that the name suggests." *Populocaulis* agrees with *Populus* "more closely than with any other," while *Fagoxylon* has "general affinities with the whole Cupuliferæ," which is certainly sufficient leeway. The only angiospermic fructifi-

[1] *Annals of Botany,* Vol. 24, 1910, p. 767.

cation that came to light our authors had some difficulty in placing, finding it hard to decide whether it belonged to the dicotyledons or monocotyledons, but as a final conclusion they say: "On the whole, judging from its detailed structure and general appearance, we incline to place the flower in the Liliaceæ." Is it to be presumed that such adumbrations as the above add much to the evolutionary history of the Liliaceæ, or of the monocotyledons in general?

It is not necessary to further mention the technical portion of the paper, and it only remains to call attention to some of the nomenclatorial anomalies. All the genera and species published as new to science in the present paper were printed a year earlier in the *Geological Magazine,* London, N. S., Vol. 6, 1909, pp. 557–559, but without characterization. They are all again listed on page 1 of the paper under review, some of them incidentally mentioned at various places in the introduction, each again appearing at the head of the section of the text in which it is described, while at the end of the description there is a formal generic and specific characterization where each is called "gen. nov.," or "sp. nov." The question arises as to how these shall be cited. To give *Cryptomeriopsis* as a concrete example: Shall we quote page 1 of this paper, where it is first printed; page 3, where it is mentioned and partially described; page 52, where it stands at the head of the description; or page 57, where the genus and species are formally dedicated?

The reviewer does not wish to be understood as in any way underestimating the value of histology in establishing a firm basis on which to work out the developmental history of plants, but if the study of the internal structure of fossil plants, as contrasted with the study of plant impressions, is to be given proper weight it must be subject to the same scrutiny. If the study of the intimate anatomy of fossil plants leads only to indefiniteness and inconclusion, it is not entitled to greater weight than attaches to the study of the impressions of plants.

F. H. KNOWLTON

SOME RECENT ADVANCES IN FLUORESCENCE AND PHOSPHORESCENCE[1]

AFTER an opening period of great activity, which began with Becquerel, Herschel and Stokes and included the important work of Lommel, Wiedemann and Schmidt and of numerous other physicists, there was a long time of comparative quiescence during which *luminescence,* to use the word proposed by E. Wiedemann, was a neglected branch of optics. Quite recently there has been renewed activity in this field and it is of some aspects of this newer work that I shall try to give a brief account. No approach to a complete summary can be made in a single paper and I shall deal chiefly with certain investigations which are particularly suggestive of the beginnings of correlation in this involved and obscure portion of the science of radiation.

The Relations of Phosphorescence to Fluorescence.—The common view that phosphorescence is simply what remains of fluorescence after the cessation of excitation would seem to need essential modification according to the latest paper of Lenard,[2] who, after extending his observations to some fifty phosphorescent compounds, made by the addition of a trace of some metallic salt to a sulphide of strontium, barium or calcium and certain heat treatment with a flux, considers that it is necessary to distinguish two phenomena, the one temporary, which ceases almost instantly after the end of excitation (*Momentan-process*), and the phenomenon of long-time phosphorescence (*Dauer-process*). The distinction is three fold: The momentary process may be produced independently of the other (1) by very brief excitation; (2) it may be excited by the use of portions of the ultra-violet spectrum which are incapable of producing long time phosphorescence or (3) at temperatures above or below the range within which long-time phospho-

[1] Abstract of a paper presented before Section B at the Minneapolis meeting of the American Association for the Advancement of Science.

[2] Lenard, *Annalen der Physik* (4), Vol. XXXI., p. 641, 1910.