the Cornell light shine farther still Mrs. Comstock now issues this monumental handbook, which is so full of meat for nature-study teachers that it almost requires both hands to lift it. A thousand clay-coated pages are too many and too heavy for one volume. The book is already being brought out in two-volume form, animal study filling one volume, and plant and earth and sky study making up the second.

There is an amazing amount of information, very well digested and arranged, about animal and plant life and earth and sky, in the book. It is an encyclopedia for the nature-study teacher, and it is at the same time a manual of nature-study practise. It contains the facts and, also, precise directions for using them in the most approved way; most approved, that is, by the actual experience, during the last fifteen years, of Mrs. Comstock, her associates, and the many teachers who have been under her eyes in New York.

The book is prepared, confessedly, to meet the general condition of untrainedness in nature study on the part of school teachers. This lack of training includes a lack of knowledge of nature, and hence a lack of knowing what there is to see. Mrs. Comstock's book has for each of its subjects, a "teacher's story" which tells facts, and then a "lesson," based on these facts, for the teacher to use with the children. The lesson includes a "leading thought" which determines the special observations called for, a note on the special "methods" to use for the particular lesson, and then a set of "observations" put in question form. In each lesson, too, there are book references for the teacher to make use of, if desired, and usually a bit of quoted verse or prose from some writer who has, of his own initiative had a lesson in seeing, enjoying and loving nature, from the special subject in hand. There are, too, hosts of pictures, most of them very attractive ones made from photographs of live plants and animals, and there is a detailed table of contents, extensive list of books for reference, and a full index. The book is altogether practically made.

Where nature study has weakened Mrs. Comstock's "Handbook" should help it; where it has not yet taken root at all, the "Handbook" should go far toward giving it a beginning. For teachers and parents it should be *the* book of American nature study.

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## Jongman's Palaeobotanisch Literatur[1]

The third volume of Jongman's paleobotanical year-book has just been received in this country. It covers the years 1910 and 1911 and includes such titles as were omitted in the enumeration for 1908 and 1909. The arrangement is the same as in the two previous volumes, that is to say, the book is divided into two parts. The first part is a bibliography arranged chronologically by authors, each author's contributions being numbered, starting with number one for the first contribution in 1908 or subsequently. The second part, comprising pages 41 to 569, consists of a complete analysis of the literature listed in Part 1, and like it arranged alphabetically.

The real usefulness of a work of this kind depends entirely upon the skill and thoroughness with which the literature is digested, and in this respect Jongman's work seems to the writer to be of a much higher grade than that of comparable bibliographic undertakings. All old as well as new species discussed during the year are included, as well as all geological horizons, anatomical, morphological and phylogenetic contributions; all living species with which fossil species are compared, as well as purely botanical studies of such living forms as promise to shed light on fossil forms.

The work in short is exceedingly useful and botanists and paleobotanists are under a heavy debt of gratitude for the manner in which Dr. Jongman carries through this exceedingly laborious task. It is to be hoped that it will furnish the inspiration to some one to undertake a similar work for paleozoology.

[1] "Die Palaeobotanisch Literatur," Dritter Band, Die Erscheinungen der Jahre 1910 und 1911 und Nachträge für 1909, Fischer, Jena, 1913, 570 pages.

It is proposed to issue this paleobotanical volume each year. This laudable intention in a measure depends upon the acquisition of a regular subscription list and it is to be hoped that individual botanists and geologists as well as institutions will make the absurdly small expenditure that will insure the permanence and prompt appearance of this work.

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*The Aborigines of Minnesota.* A Report based on the Collection of JACOB V. BROWER and on the Field Surveys and Notes of ALFRED J. HILL and THEODORE H. LEWIS. Collated, augmented and described by N. H. WINCHELL. Published by the Minnesota Historical Society. Illustrated by 36 half-tone page plates, 26 folded inserts and 642 figures inserted in the text. St. Paul, Minn., The Pioneer Company. 1911. Pp. xiv + 761.

This profusely illustrated monograph contains a mass of useful archeological and ethnological information, much of which is a monument to the scientific activities of the late Jacob V. Brower. Pages 1–579 treat of the Dakota, with some notes on the related Winnebago, etc.; pages 580–731 of the Ojibwa; while in appendices (pp. 732–743) are given Brebeuf's account of the solemn feast of the dead, from the *Jesuit Relations,* an account of the battle of Pokegama, from SCIENCE of 1886, a part of the *Walum Olum,* a tradition of the Delaware Indians, etc. A good index adds to the value of the book. Besides historical and geographical information, data as to treaties, and a detailed record and description (occupying pages 77–379) of earthworks in Minnesota, there are sections on the habitations, implements and instruments, manufactured articles, ornaments, food, pipes and smoking—also matter relating to death and burial, dances and "medicine," traditions, myths, etc., pictographs. A good deal of bibliographical material is included—on pages 25–62 is an annotated list of old maps of the Minnesota country, on pages 575–579 a partial bibliography of the Dakota, and on pages 707–731 (two columns to the page) a valuable list of Ojibwa personal names.

In connection with the discussion of the "pre-Indian inhabitants of Minnesota" (pp. 1–23) one should read the recent studies of the antiquity of man in North and South America by Dr. A. Hrdlička, and remember also that no convincing evidence of the existence of "*pre-Indian* inhabitants" of the new world has as yet been produced, either for Minnesota or for any other region of this continent. Nor can one rightfully speak of "the Eskimo quartz-workers of Minnesota" (p. 18). That the Algonkian stock preceded the Siouan in the occupation of Minnesota (p. 76) is an opinion here associated with the belief that "the Algonquian area in Colorado, shown on Powell's map of linguistic stocks, is perhaps a very ancient home of that stock," but this view is hardly to be approved. The Catawban area on the Atlantic (Carolinian) seaboard is taken as the "post-Glacial starting-point of the Siouan stock."

The recognition of "pre-Dakotan" mound-builders in Minnesota must be considered doubtful, but it is quite right to state (p. 408) that "there has been found in Minnesota nothing that would warrant the assignment of the mounds and effigies to any people enjoying superior culture or higher intellectual rank than the Indians who inhabited the state at the coming of the whites." Moreover, "in Minnesota there has not yet been discovered any evidence that the earthworks were designed for sacrificial purposes, nor for any religious ceremonies, nor primarily for points of observation," and, with the exception of the effigies, "there is nothing symbolic in their shapes or in their distribution."

Among the pictographs figured are a number from sandstone caves in Houston and Winona counties. The pictographs, attributable to the Dakota rather than to other Indian peoples, "belong in one grand category" and exhibit "a uniformity of style which points to but one people." The chief Algonkian inhabitants of Minnesota were the Ojibwa, but, according to the authors (p. 581),

there were pre-Ojibwa Algonkians in this region—probably the Cheyenne. Altogether, there is much good information and not a little speculation of a somewhat doubtful character in this volume. Some of the material deserves to be gone over again and made more of.

Alexander F. Chamberlain
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## *SPECIAL ARTICLES*

### THE NATURE OF THE SUBSTANCES WHICH CAUSE THE BIOELECTRICAL POTENTIAL DIFFERENCES

In previous papers[1] we have shown that the potential differences at the junction of the *intact* surfaces of plants and aqueous salt solutions exhibit sharply defined and reversible changes with the change in the concentration of the salt solution. The sense of these changes is such that we can speak of a reversibility for kations and the order of magnitude corresponds nearly with that calculated by Nernst's formula. A similar change was observed on the *injured* surface of certain plants and on animal organs.

We found, moreover, that the potential difference becomes smaller if we substitute an equimolecular acid solution for the salt solution, and we pointed out that this difference is of the order of magnitude of the so-called current of injury found in living organs. Finally we observed that the bioelectrical potential difference approaches a limit for increasing concentrations of the salt solution.

These characteristics are so definite that we undertook an investigation of the nature of the substances which are responsible for the potential differences at the junction of living organs and aqueous solutions. It was first ascertained that solid proteins, like gelatine or coagulated white of egg, show none of the potential differences characteristic for living organs. These characteristics were shown, however, by certain fatty compounds, like phosphatides (lecithin and kephalin), oleic, stearic and palmitic acids, and to a lesser degree by triolein. For technical reasons it was necessary to dissolve these substances in guaiacol or kresol.[2]

At the junction of a soluble lecithin solution and aqueous solutions were found the same changes in E.M.F. with the change in the concentration of the salt solution as we had previously found at the junction of a living organ (*e. g.*, the leaf of *Ficus elasticus*) and the aqueous solution, and moreover we noticed also the characteristic acid effect. In order to show to what extent the electromotive behavior of a lecithin solution resembles that of

| Salt Solution | 10 Per Cent. Lecithin in m-kresol E.M.F. | Difference. | Leaf of *Ficus elasticus* E.M.F. | Difference |
|---|---|---|---|---|
| *m*/10 KCl | + .050 volt | | | |
| *m*/1250 KCl | .141 volt | .023 volt | .099 volt | .031 volt |
| *m*/250 KCl | .118 volt | .034 volt | .068 volt | .002 volt |
| *m*/50 KCl | .084 volt | .035 volt | .036 volt | .024 volt |
| *m*/10 KCl | .049 volt | .031 volt | .012 volt | |
| *m* KCl | .018 volt | | | |
| *m*/10 NaCl | .064 volt | | | |
| *m*/1250 NaCl | .150 volt | .022 volt | .141 volt | .038 volt |
| *m*/250 NaCl | .128 volt | .030 volt | .103 volt | .036 volt |
| *m*/50 NaCl | .098 volt | .037 volt | .067 volt | .034 volt |
| *m*/10 NaCl | .061 volt | .031 volt | .043 volt | |
| *m*/2 NaCl | .030 volt | | | |
| | *10 per cent. lecithin in guaiacol.* | | | |
| *m*/10 KCl | + .042 volt | .042 volt | | |
| *m*/10 HCl | ± .000 volt | | | |

[1] Science, XXXIV., 884, 1911; XXXV., 970, 1912. *Biochem. Ztschr.*, 41: 1, 1912; 44: 303, 1912.

[2] Beutner, *Jour. Amer. Chemical Society*, 35: 344, 1913.