foundation is laid for the teaching of the principles and rules.

In the teaching of algebra he would make plain the theory of imaginaries, when the extraction of the square root comes up; and would introduce an exposition of geometric quantity before taking up the equation of the second degree. He predicts that the day when the geometric calculus will be introduced in the regular course of instruction is not far off. In the concluding chapter he deplores the too great centralization of mathematics in Paris to the injury of the rest of France.

In conclusion we recommend the volume to the notice of every live mathematician, and to every one interested in the nature of human knowledge.

ALEXANDER MACFARLANE.

Elements of Comparative Zoology. By J. S. KINGSLEY, S.D., Professor of Zoology in Tufts College. New York, Henry Holt & Co. 1897.

This book of 357 pages embodies an attempt to combine the text-book proper with the laboratory manual in such proportions as to meet the demand of the beginner. It is contended in the preface that "a knowledge of isolated facts, no matter how extensive, is of little value in education, excepting as the powers of observation are trained in ascertaining those facts." In accordance with this idea, the author lays stress upon the more obvious features of the types considered, and seeks to lead the student to an intelligent appreciation of the significance of those features in studies under the title of 'Comparisons.' For example, a bony and a cartilaginous fish are studied separately, and then the facts acquired by the student are correlated by a series of questions which require a careful comparison. In this way twenty-five types are studied and compared, the types representing all the main divisions of the animal kingdom, and being chosen from the most readily accessible materials.

The text of the work is based upon the systematic relations and discusses the orders seriatim.

There is one detail of arrangement, however, which will not appear to everybody to be entirely happy. In the discussion of the fishes the Selachii and Teleosts are treated at some length, and then follows the part bearing upon Pisces. When one comes to the sub-classes he is referred back to Selachii and Teleosts. This may prove somewhat confusing, although the motive is evidently to emphasize the groups of which types have been studied.

There are numerous illustrations and diagrams, the latter in many cases being particularly suggestive.

The part devoted to the laboratory work is arranged in the form of simple directions for dissection and questions to lead the student to as independent a method as possible. The criticism that will be forthcoming will be that the laboratory work is meager—that students, even in the high school, frequently want to know more than the laboratory guide leads them to. This, however, is a minor criticism, since the teacher, if up to the mark, can supplement the work according to his judgment.

The introduction contains suggestions in regard to the carrying on of laboratory work; apparatus, which is reduced to a minimum as to both quantity and simplicity; materials for dissection, and reference books.

The whole is a small, handy volume, neatly bound and well printed on good paper.

F. E. LLOYD.

The Phytogeography of Nebraska. 1. General Survey, by ROSCOE POUND, PhD., Director of the Botanical Survey of Nebraska, and FREDERIC E. CLEMENTS, A.M., Assistant Instructor in Botany in the University of Nebraska. Lincoln, Neb. 1898. 8vo., 329 pp., with four maps. Presented by the authors to the Faculty of the University of Nebraska as a thesis for the degree of Doctor of Philosophy.

From the preface we learn that this work is the result of nearly five years of active study of the floral covering of Nebraska, carried on by the members of the Botanical Seminar in the Botanical Survey of the State. The systematic study of the vegetation of Nebraska was begun by Dr. Bessey in 1884, and has since been carried on by him and his students, all previous collecting having been more or less desultory and unreliable. The Botanical Survey was or-

ganized in 1892, and its work has been directed to the collecting of specimens and observations for a series of reports in which the floral covering of the State should be treated from the phytogeographical standpoint and for a series of monographs of the flora of Nebraska. A beginning has been made by the publication of three parts of the flora of the State, and the present work is the first part of the first series. The authors realize that so much yet remains to be done in many directions that a complete phytogeography of the State will be impossible for many years to come, but the work of the survey has progressed far enough to enable them to present the general facts of its phytogeography in an adequate manner and to deal with details in many of the more important subjects.

The writings of the German phytogeographers have been the chief source of inspiration, especially the Plant Geography of Germany, by Dr. Oscar Drude. It is only in recent years that this subject has become a distinct department of botanical knowledge, and with the exception of certain observations conducted by Professor MacMillan in Minnesota, this is the first attempt to conduct a botanical survey of any State in this manner. It is, therefore, of special interest and deserving of more than passing mention, as even a hasty review of the table of contents will be convincing proof of the broad scope of this work and shows the amount of preliminary preparation which it represents.

In the introduction the authors give a brief outline of the scope of their subject, and state that much of their terminology is new, having been translated from the German or newly coined to meet special necessities. The history of the botanical exploration of Nebraska is briefly given and a list of works consulted fills several pages, including many local lists and contributions to the State flora by Dr. Bessey and his students.

The subject is treated in five chapters, the first dealing with the physiography, geology and meteorology of the State. There is little rock exposed, the soil being of unusual depth, but in the southeastern part of the State the geological formations are Carboniferous, while the rest is Cretaceous and Tertiary. The climate is extremely hot in summer and mild in winter. Meteorological tables are given to show the temperature and rainfall for 1896.

The second chapter deals with statistics of regional limitations, showing that the four regions which occur in the State are the wooded bluff and meadow land region, the prairie region, the sand-hill region and the foot-hill region, and that of all these the proportions occurring in the State are only a small part of the same regions in adjacent States. Tables of species peculiar to each region are given. In the third chapter the different forms of vegetation are considered under the heading of woody plants and herbs, and the various habits and devices of each for protection and reproduction are considered in relation to their place of growth. Size, duration, means of reproduction and dissemination and protective devices are all important factors in the distribution of plants. According to the last report of the Botanical Survey there are 3,196 species in the flora of the State, of which 1,717 are cryptogams, the myxomycetes not being included. The number of trees is 58; shrubs, 33; bushes, 32; climbers, 13. A comparison of the flora of the State shows that 90 per cent. of the plants are herbaceous, there being but little forest. In New Jersey the percentage is 86, in Spain 83, and Germany 89. Herbs are less stable in their distribution than woody plants and their migrations are frequent. The herbacous plants are considered in groups as perennials, biennials, annuals, aquatics, parasites and thallophytes. Of the perennial herbs, those forming rosettes include 27 species, those forming mats 18, succulent plants adapted to high alpine or desert regions number 10 species; creepers and climbers include 35 species; turf-builders include 44 sod grasses and 49 bunch grasses; of plants with perennial rootstocks the number is 472, comprising the largest number of herbaceous plants, not including 37 bulbous or tuberous species and 16 ferns. Of biennial herbs the flora includes 59 species and annuals 197. Water plants are not as common, there being 12 floating plants, 31 submerged and 45 amphibious species in the State, and of parasitic species 14, exclusive of 3 species of saprophytes.

Of the Thallophytes the mosses are few, as only 50 species are known to occur in the State and 16 liverworts; lichens number 157. Of the Fungi, those growing on wood number 266, those on living plants 445, those on decaying matter 75, aquatic parasites on fishes, etc., 18, and on insects 9. The Algæ number 438. The chapter concludes with a discussion of the various biological characters, including protective devices, periods of flowering, seed production and dissemination.

The fourth chapter treats of the relations of the natural group of plants dividing them into six groups according to habitat, and giving tables for each of the natural families showing the numbers of species in each inhabiting the different regions. This represents an immense amount of local work, and it is impossible to give any adequate conception of the careful tabulation which it necessitates. The last chapter treats of the plant formations showing that the floral covering of the earth is not homogeneous, but presents great differences in the kinds and abundance of species as well as variations in the size, habit and habitat of individuals. Such diversities are the direct result of physical and climatic conditions peculiar to more or less restricted areas, hence the vegetation of the earth's surface is arranged into groups of definite constitution and more or less definite limits, known as plant formations. Such formations are invariably complex and more or less difficult to determine, yet they represent a biological community resulting from the forces induced by physiographical and meteorological phenomena, and may be defined as a piece of the floral covering, the extent of which is determined by a characteristic association of vegetable organism forming a stretch of land whose limits are biological and not physiographical, but often having the delimitation of some natural boundary. The topics are treated under the following heads: Forest, Meadow, Prairie, Sand hill, Foot hill, Salt marsh, Water plant, Culture and Waste formations. This chapter constitutes perhaps the most readable portion of the book, summing up the results and effects of all previous observations.

In the appendix certain corrections are made in elevations of various points, and the nomenclature is made to correspond with that of Britton and Brown's illustrated Flora. The four maps show the political boundaries of the State, its topographical characters, the river systems and the natural regions. The index is extensive, including both topics and species.

It will thus be seen that this work indicates the progress of biological studies in recent years, and the long distance from which it is removed from mere lists and catalogues, yet at the same time it emphasizes the importance of thorough systematic and morphological studies, and proves the necessity of broad and correct training in order to be able to accomplish such a task creditably. That this has been so ably done not only reflects credit on its authors, but also on the faculty under whose guidance the work has been accomplished.

ELIZABETH G. BRITTON.

SCIENTIFIC JOURNALS.

The American Naturalist for May opens with a paper on the origin of the mammalia by Professor Henry F. Osborn, presented first at the Toronto meeting of the British Association. The paper especially considers the evidence supporting the hypothesis that the mammals spring from the theriodont reptiles, knowledge of which has been so greatly increased by Professor Seelye's explorations in the Karoo beds of South Africa. The third chapter of the treatise, on the wings of insects, by Professor J. H. Comstock and Mr. J. G. Needham, treats of the Diptera. Mr. O. P. Hay writes on the classification of Amoid and Lepisosteoid fishes.

THE July number of *Appleton's Popular Science Monthly* opens with the first of a series of articles on the evolution of colonies, by Mr. James Collier. Mr. E. J. Prindle contributes an elaborately illustrated article on the methods used by the Weather Bureau in forecasting the weather. Professor S. W. Williston writes on saber-toothed cats. The frontispiece is a Portrait of Maria Agnesi, who was in 1750 nominated professor of mathematics in the University of Bologna.

THE *American Anthropologist* for June contains the following articles: An Ancient Human Effigy Vase from Arizona, by J. Walter