corona show from three to four solar diameters extension for the longest streamers. The equatorial 'wings' as they recede from the sun, are finally lost in an illuminated sky, without any indication of having actually come to an end.

No attempt to carefully examine the plates taken for intra-mercurial planets has yet been possible. It is, however, as has been remarked, doubtful if very faint objects will be found, in consideration of the considerable sky illumination during totality. However, Pleione in the Pleiades, (a star of the 6.3 magnitude) is plainly seen on one of the plates and some smaller ones are discernible.

On the whole, the expedition may be considered as promising to be very satisfactory to one and all of whom I desire to express my obligations.

S. P. Langley.

Smithsonian Institution,
Washington, D. C., June 9, 1900.

Scientific Books.

Text-Book of Paleontology. By Karl A. von Zittel. Translated and edited by Charles R. Eastman. English edition, revised and enlarged by the Author and Editor, in collaboration with C. E. Beecher, J. M. Clarke, W. H. Dall, G. J. Hinde, A. Hyatt, J. S. Kingsley, H. A. Pilsbry, C. Schuchert, S. H. Scudder, W. P. Sladen, E. O. Ulrich, C. Wachsmuth. London and New York, Macmillan & Co. 1900. Vol. I. 8vo. Pp. x + 706. 1476 woodcuts.

This volume is the result of an interesting experiment. To take an epitome of a science,

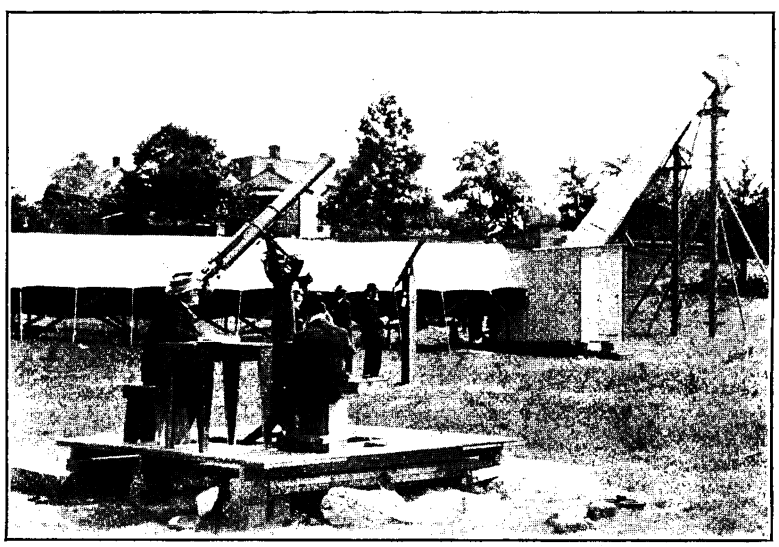

Fig. 4. Dark room and tubes of 135 foot and 38-foot telescopes. 5-inch equatorial in foreground, Professor Langley observing.

in its results, and that it was so, is largely owing not only to the efficient care of Mr. Abbot, but to the many gentlemen who have assisted me with the loan of valuable apparatus, with counsel, with voluntary service, and with painstaking observation, impressed with the individuality of an eminent investigator, who is if anything even more eminent as a teacher, a clear synopsis drawn up on an harmonious plan, distinguished by both breadth of outlook and a restraining common sense, and then to entrust the several chapters of this work to men who are essentially special-

ists and enthusiasts, many of them without notable experience as teachers, and to permit them to correct, revise, or even rewrite as each thinks fit: the very boldness of the attempt deserves success. But when the original author is representative of the somewhat conservative European school of thought, and his revisers are for the most part leading exponents of revolutionary American ideas, then who can wonder if the result is curious rather than satisfactory? Professor von Zittel would be the last person to claim infallibility, and it is not surprising that the enormous mass of detail condensed into his 'Grundzüge der Palæontologie' should contain some removable errors. Dr. Eastman might with advantage have done one of two things. He might have given us a translation of the 'Grundzüge' with these errors corrected by his corps of specialists; or he might have sketched out the plan of a new work, in which the phylogenetic and morphogenetic principles of Professors Hyatt, Beecher and others should have had free play. But what we have here is neither one thing nor the other. The mistakes of the original are in very many cases still uncorrected, often added to in somewhat inexplicable fashion (as when Wachsmuth alters the correct '*Holocrinus* W. u. Spr.' to the incorrect '*Holocrinus*, Jaekel'); on the other hand, the opinions of the Munich professors, which after all are entitled to some respect, have as often as not been brushed aside, and some new and untried scheme of classification put in their place. The unity of the work, as the author's own preface points out, has been destroyed, and the student is presented on the supposed authority of Zittel with views opposed not merely to those of that eminent paleontologist, but often to one another. The climax is reached when most of the genera referred on pp. 102 et sq., to the Chætetidæ and Fistuliporidæ, families of Anthozoa, are repeated under Bryozoa as Cerioporidæ (p. 266), Fistuliporidæ (p. 269), Monticuliporidæ (p. 272), Heterotrypidæ (p. 373), Calloporidæ (p. 274), and Batostomellidæ (p. 277). We are left wondering what is to become of *Chætetes* (which no doubt is a coral) and *Labechia* (which is probably a Stromatoporoid). In this way the elementary student is fogged, while the more advanced student is uncertain on whose authority doubtful or novel statements are made. And possibly some may think that the advertisement of this book as a 'Text-book of Paleontology by Karl A. von Zittel' is an unwarrantable use of a famous name and an abuse of the professor's well-known kindness.

After this protest it is pleasant to be able to express gratitude for much of the fare with which the enterprise of Dr. Eastman and Messrs. Macmillan has provided us; and more particularly are thanks due to the many specialists who have undertaken a difficult and ungrateful task.

English speaking readers should be glad to have Professor von Zittel's admirable Introduction in more accessible form. The translation is flowing without being much too free; but the statement (on p. 8) that "many fossil crinoids before maturity resemble the living genus *Antedon*" is not the same as "many fossil crinoids may be compared with the young stages of the living genus *Antedon*." To say that the application of the term 'fossil' to any organic remains is determined solely by 'the geological age of the formation in which they occur,' is unnecessarily to exaggerate a restriction which Professor von Zittel has already made too strong. An explorer in a new country finds a cliff containing shells or bones; these eventually prove to be of identical species with animals now living in the neighborhood, and it is inferred that the rock has been formed and elevated within the historic period. The observation is a geological observation, and the argument is precisely the same as it would have been had the organisms proved of Cretaceous age. Why should the remains be called fossils in one case and not in the other? The true criterion seems to be that 'fossils' have been buried by natural causes. Thus one emphasizes that uniformity of geological operations which Professor Zittel's qualification tends to obscure.

The chronological table would have been of more service to those for whom the translation is intended, had the gallicised terms of the last column been replaced, so far as possible, by American equivalents. It is hard to see the point of 'Danian Series (Danien), Senonian Series (Senonien)' and so on.

The chapters on Protozoa and Cœlenterata,

the latter including Sponges, show little alteration, which is just as well. Additional references to writings on Protozoa are given on p. 36, but among them is no mention of C. D. Sherborn's 'Bibliography of the Foraminifera.' On p. 82, Professor von Zittel has himself added a summary of Dr. Ogilvie-Gordon's classification of Anthozoa, but without expressing any opinion as to its value.

The account of the Crinoidea, good as it was in the 'Grundzüge,' has been greatly improved, presumably by Wachsmuth, who also made valuable additions giving the latest views of Wachsmuth and Springer. This should be most useful to those unable to see the splendid monograph by those authors. The same learned writer also revised the accounts of the Cystoidea and Blastoidea. It is the more unfortunate that so authoritative a piece of work should be marred by several slips. Fig. 237, *A*, *a* is not a 'posterior view' of *Pisocrinus*, but is from the right side, as also is *B*, *a*. The stem of *Herpetocrinus* is anything but 'sharply pentagonal' in section (p. 153). *Achradocrinus* appears in two families (pp. 155, 158); the former position, in the Gasterocomidæ, is probably the correct one. The calyx of Apiocrinidæ is not 'unsymmetrical' (p. 167). 'Jaekel regards the centrodorsal (of *Tetracrinus*) as representing the anchylosed basals, notwithstanding the absence of axial canals,' should read: 'because of the presence of axial canals.' Fig. 296, '*Caryocrinus*' should be *Caryocystis*. *Camarocrinus* *Lobolithus* and *Lichenocrinus* are without doubt the roots of Pelmatozoa and not cystid calyces, as on p. 183. The anus of *Anomalocystis* is unknown; the account of it on p. 186 is therefore incorrect. The analysis of a Blastoid theca (Fig. 312) is oriented in a very puzzling manner; the uppermost radial is the right anterior, the lowest deltoid is the left posterior, the lower deltoid on the right is therefore the posterior and ought to show a notch or hole for the anus. These little slips are just the things that worry an earnest student.

Mr. W. P. Sladen has not taken advantage of the opportunities offered by a revision of the Asteroidea and Ophiuroidea, while in the Echinoidea he has not advanced beyond the classification of Duncan in his Linnean Society paper with its pre-Linnean nomenclature. The account of the sea-urchins is, however, clear and comprehensive, and additional references to publications are given. Among these the reference to Keyes, *Proc. Iowa Acad. Sci.*, Vol. II., will not be of much use to students on this side of the water, if I may judge by my own fruitless attemps to see that paper.

A little more exactitude has been introduced by Dr. G. J. Hinde into the chapter on those troublesome fossils assigned to worms of one sort or another. One looks in vain, however, for any pronouncement on the perplexing *Platysolenites* of the Cambrian. Its associate, *Volborthella*, is placed among the Cephalopoda, a position that will need some defending.

The account of the Bryozoa has been expanded from 9 to 34 pages by Mr. E. O. Ulrich, and many illustrations have been added. This careful piece of revision is most welcome.

Recent work on the Brachiopoda is summarized by Mr. C. Schuchert, who has contrived to classify all the genera on the basis given by Beecher. Modification in details will doubtless be required, but Mr. Schuchert works on advanced lines, and his attempt must prove of the greatest service to the many workers who are attempting to apply modern ideas to the vast hordes of fossil brachiopods.

In entrusting the Pelecypoda to Dr. W. H. Dall and the rest of the Mollusca, with exception of the Cephalopodes to Mr. H. A. Pilsbry, Dr. Eastman has been well advised. There are no higher authorities on those groups. Dr. Dall's contribution is an adaptation of his memoir published by the Wagner Free Institute of Philadelphia in 1895. The main divisions, based largely on the characters of the hinge, may commend themselves to those who deal mainly with the fossil shells, while Dr. Dall has evaded the objections that have been raised to some of the minor groupings—Palæoconcha, Schizodonta and the like—by stating that these terms are retained 'merely as convenient descriptive appellations, and are in nowise to be regarded as possessing systematic values.' Though further investigation both of adult morphology and of ontogeny is sure to modify the phylogenetic bases on which the ultimate classification must rest, yet this careful synopsis

will prove of distinct value for reference. Neither Dr. Dall nor Mr. Pilsbry departs so far from accepted ideas that his scheme cannot easily be used by those accustomed to the views of other teachers. In this connection, however, one point may puzzle the inquirer, and that is the attachment of the names of the present writers to family names that were well known almost before those gentlemen were born. What for instance is the meaning of 'Chitonidæ, Pilsbry'; 'Arcidæ, Dall,' or 'Anatinidæ, Dall'? It must be recognized by this time that scarcely any family is regarded by each fresh systematist in the precise sense of the first founder; and if Lamarck, Gray and the rest are quoted in some cases, why not in others? No attempt to attribute authority to family names can attain absolute justice, and the simplest solution is to omit the names of authorities altogether. But if Mr. Pilsbry, for example, claims to have modified the conception of Chitonidæ, it would be well to give the date of the publication in which it was done, so that we may know precisely what value to attach to the collocation 'Chitonidæ, Pilsbry.' Fortunately there do not appear to be any new generic names in these chapters: *Prolucina*, Dall, is unfamiliar certainly, but had it really been new, so careful a worker as Dr. Dall would have indicated the fact.

It is deeply to be regretted that the above commendatory remarks cannot be extended to the section on Tetrabranchiate Cephalopoda. Professor Hyatt has devoted his high abilities to the study of those animals with such enthusiasm and success, that his account was eagerly expected. It is a disappointment. What we are given is little better than a preliminary notice of 'an exhaustive monograph,' which will doubtless have great value when it appears; but the present abstract is of slight use to the beginner and incomprehensible even to the specialist. One can sympathize with a man of peculiar knowledge and original ideas, called upon suddenly to edit an account with which he is in total disagreement; but Professor Hyatt has attempted too much for the allotted space. Dr. Eastman, as editor, should have refused these crowds of new and undefined genera, thus making room for clearer elucidation of the principles on which the new classification was erected. He should also have eliminated the numerous inconsistencies that disfigure the work. They are of many kinds: family names sometimes have an author's name added, sometimes not; a species is often ascribed to two different authors, there are three instances on pp. 588–9; the legends to figures do not always agree with the text; the genders of adjectives do not always agree with their substantives; there is also a confusion, which might easily have been avoided, between the 'siphon (funnel)' and 'siphuncle' of Professor Verrill, and the 'siphonal funnels,' 'siphuncle' and 'siphon' of Professor Hyatt. The retention of Tetrabranchiata as a subclass to include both Nautiloidea and Ammonoidea is perhaps not due to Professor Hyatt; it involves certain statements concerning extinct forms, and especially concerning Ammonoidea, that are absolutely unwarranted by evidence.

It is not clear who is responsible for the changes in the account of the Dibranchiate Cephalopods. But it is clear that the homologies of the cuttle-bone are not yet appreciated. When they are, we shall no longer see *Belemnosis*, *Beloptera* and *Spirula*, in one suborder, and *Belosepia* and *Sepia* in another.

The recasting of the section on Trilobites by Professor Beecher, and that on Merostomata by Dr. J. M. Clarke, the latter incorporating the results of Holm, Laurie and others, will prove most useful. There are also other changes of value under the head Crustacea, due to Professor J. S. Kingsley, Dr. J. M. Clarke and Mr. E. O. Ulrich. But while we would gladly leave the precise classificatory relationships of Trilobita and Merostomata still unsettled, we should like to see the discovery of *Pollicipes* and *Scalpellum* in the Silurian of Gotland recognized by some text-book before another eight years have passed.

The defects in form and arrangement shown by this volume must be a source of regret to all who believe that a good book covering the whole field of systematic zoology cannot nowadays be written without the co-operation of specialists. To attain success, an editor is required honey-tongued enough to get all he wants out of his helpers, strong enough to sub-

ordinate them to the scheme of the book, and with grasp enough to weld their contributions into a consistent whole. With the experience he has now acquired, and with his own relatively greater knowledge of the subject, Dr. Eastman will doubtless do better in Volume II. Meanwhile this first volume forms a wonderful storehouse of facts, drawings and names; and no more reliable compendium of the paleontology of invertebrate animals is to be obtained.

The copy submitted for review bears date 1900, and there is no indication of the fact that pages 1–352 were first published in November, 1896. They were issued in a separate wrapper, with title marked Vol. I., Part I., and dated London and New York, 1896. But as it happens, this Part I. was *not* published in London: the publishers refused, and still refuse, to sell it in England, and I owe my copy to the kindness of Dr. Eastman. Therefore both title pages are bibliographically incorrect—'for trade reasons.' I am also informed that the sections by Dr. Dall and Professor Hyatt were distributed some time ago; but that was no doubt a private matter, which cannot affect the date of the new names.

Trade reasons must also account for the fact that the English editions of so many German scientific works are printed with a smaller page, into which the illustrations do not fit. But it is to be hoped that there is no real need for such works to be printed on porous paper. This is particularly unfortunate in the case of really useful books, such as the present, deserving of permanent correction and annotation.

F. A. Bather.

The Meyer's Kinetic Theory of Gases. Oskar Emil Meyer, translated from the second revised edition by Robert E. Baynes. London, New York and Bombay, Longmans, Green & Co. 1899. Pp. xvi + 472.

"I undertook therefore to exhibit the kinetic theory of gases in such a way as to be more easily intelligible to wider circles, and especially to chemists and other natural philosophers to whom mathematics are not congenial. To this end I endeavored, much more than was otherwise usual, not only to develop the theory by calculation, but rather to support it by observation, and found it on experiment."

This extract from the Author's Preface, apparently written in English by the author, will be recognized by all who know his treatise in any form, old or new, as an accurate description of his work. Boltzmann, in the *Vorwort* to his *Gastheorie*, remarks: "Jedoch verfolgt das Meyer'sche Buch, so anerkannt vortrefflich es für Chemiker und Studirende der Physikalischen Chemie ist, völlig andere Zwecke." The contrast between the purpose of Meyer and that of Boltzmann is as marked now as it ever was; for the new edition of Meyer follows very closely the lines of the first. The nut is still cracked for us in the first part of the book and the kernel exposed, while the shell is carefully saved in the mathematical appendices for those who may be disposed to try their teeth upon it.

The clear yet compendious character of the treatise has made it an excellent book to consult; and it has therefore seemed to the reviewer worth while to make a somewhat detailed comparison of the new English edition with the old German one, in order to note the developments which have been made during the past twenty-three years in what may be called the physicist's, as distinguished from the mathematician's, knowledge of gases. The following quotations are accordingly selected to illustrate the most important of these changes. They touch many, but not all, interesting features of the kinetic theory. It will be seen that the time since the first edition of Meyer appeared, in 1887, has been for this theory a period of confirmation and careful improvement rather than one of revolution or rapid advance. The nature and results of intermolecular attraction, the conformation and internal properties of the molecule, these are the problems with which the theory is now engaged, and these are problems with which progress may well be slow.

In the following reviews the title of each successive chapter, up to the mathematical appendices, will be given, even when the chapter contains nothing deserving of special mention as new.

Chapter I.—*Foundations of the Hypothesis.*

Chapter II.—*Pressure of Gases.*

Chapter III.—*Maxwell's Law of the Unequal Distribution of Molecular Speed.*