

Prof. Hertwig has availed himself of the latest inquiries, we may call attention to two figures of the pineal eye of Chameleon and Hatteria, copied from Prof. Baldwin Spencer's memoir in the *Quart. Journ. Micr. Sci.* of last year. Full justice is done by Prof. Hertwig to Mr. Spencer's researches and their significance. We can cordially recommend this text-book of embryology as presenting a decided advance in scope upon the current German treatises on human embryology, one of its merits being that it embodies, among other good things, the teachings and many of the drawings of our "unvergesslicher" Balfour.

E. R. L.

A TREATISE ON ALGEBRA.

A Treatise on Algebra. By C. Smith. (London: Macmillan, 1888.)

THIS, the latest text-book on elementary algebra, is intended for the higher classes of schools and for the junior students in the Universities. The title of the book "*A Treatise on Algebra*," together with the fact that in the preface the book is affirmed to be complete in itself, is likely to convey the impression that the work is more extensive and ambitious in its scope and design than is really the case. In regard to the matter treated of, it covers much the same ground as Todhunter's "*Algebra*," which it greatly resembles; it differs from it chiefly in a different arrangement of the parts of the subject, and in the introduction of elementary notions of "elimination" and "determinants."

As regards rearrangement of the subject-matter, there is one very gratifying novelty: before making any use of infinite series, the author introduces a chapter in which he discusses some of the tests of the convergency of such series. There is no doubt of the soundness of this course, and for this single reason many teachers would be inclined to prefer this book to others of the same nature.

The principal feature of modern elementary algebraical text-books seems to be that they are written without any reference to the light shed upon the relative importance of different parts of the subject by the progress of algebraical research. A comprehensive survey of the existing knowledge of the science should induce an author to lead the schoolmaster, and not to follow him. It is not too much to expect that a book like the one under notice should bear some traces of what is taking place in the development of the science to which it seeks to introduce a student. It is perfectly true that certain fundamental notions must necessarily be presented in much the same detail relatively in every book, independently of the date of production; but beyond this an author may easily be too conservative in his ideas to be able to compile a work which shall be of the greatest advantage to a student who intends subsequently to continue his reading at a University or elsewhere. Even from the narrow point of view of an examination it would be advisable to give some small indications of the directions in which explorations have been recently taking place, for it is well known that problem papers at the Universities and elsewhere frequently contain matter taken from researches quite recently published. The absence of modern ideas in a book gives a teacher but little opportunity of pointing out to promising pupils the roads to the

frontiers of the science. This is the more to be deplored just now, when a premium is placed at Cambridge upon originality of thought in connection with examinations for Fellowships.

As an instance of what is meant, it may be observed that the subject of "reversion of series" is omitted altogether, although it has of recent years come into great prominence. As a fact, for the last three years one of the chief points of interest in pure mathematics has been Sylvester's theory of reciprocants, which are simply reversion invariants; that is to say, those functions of the coefficients of a convergent series which remain unaltered after the process of reversion has been carried out. One has a right to expect, for this reason, that a "*Treatise on Algebra*" published at the present time should make some allusion to the existence of such a process; in the older text-books, such as Young's "*Course of Mathematics*," and the "*Algebra*" published in Chambers' series, the subject received a special heading, whilst in more recent works it appears merely as an example. The present time is not happily chosen for its complete banishment.

"Scales of notation" give place here to "systems of numeration"; this is in accordance with the German "*Zahlensysteme*," and seems to be a more suitable nomenclature.

The definitions throughout the book are very carefully given. One or two are open to criticism, as in the case of "cyclical order"; this is defined in reference to a "cyclical change of letters." In modern mathematics this process is termed a "cyclical substitution of the letters," and is one of the fundamental ideas of the extensive "theory of substitutions." There seems to be no good ground for shirking the word "substitution," which fulfils requirements of simplicity and suggestiveness, and is the word with which the student will afterwards become familiar. It seems a pity that in the chapter on permutations the opportunity is not taken to introduce a few of the leading ideas of this theory.

In defining "symmetrical expressions" the author states that an expression which remains unaltered by the "cyclical change" is *also* considered symmetrical; the modern definition of a symmetrical function is that it is such that it remains unaltered when any substitution is impressed upon the letters. The expression $(b-c)(c-a)(a-b)$, instanced by the author as being also called symmetrical, is in reality a two-valued (sometimes called an alternating) function, falls under a different (the alternating) "group of substitutions," and is not properly called symmetrical.

In the chapter on theory of numbers—a particularly clear one—the idea of congruences is happily introduced with Gauss's notation. One would have liked to see also some of the notions of Sylvester's "constructive theory of the partition of numbers," as the ideas are very simple and useful, and moreover algebraically expressible most elegantly. The partition of numbers is rapidly becoming a most important part of the "theory of numbers," a fact which must soon be recognized by authors of books of the same scope as this one.

Other portions of the book which are well presented are "factors" (including many of the first notions of the "theory of equations"), "imaginary and complex quantities," and "binomial theorem."

One would like to see "piles of shot" relegated to the examples, as in these days of rifled guns and elongated projectiles it seems an anachronism. The book is logical well printed, and illustrated by the best set of examples that can be found in any book of the same kind.

P. A. MACMAHON.

OUR BOOK SHELF.

My Telescope. By a Quekett Club Man. (London: Roper and Drowley, 1888.)

THIS volume is described by its author as a simple introduction to the glories of the heavens. It is not designed as a guide to the use of a telescope, but simply to give such an account of its teachings as may interest non-astronomical readers. The main features of the various celestial bodies are described, but, for some reason or other, comets are not considered at all. Most of the descriptions are very meagre; thus, nebulae and star-clusters are disposed of in a page, and that not closely printed; even the sun—"the ruler of our system"—is described in a little over three pages. The scantiness of the information given is the greatest fault of the book.

In the little that the book does contain, many mistakes occur. Thus, the moon is stated to present a marbled or mottled appearance because her surface is unequally refractive (p. 62), and the velocity of light is twice put down as 184,000 miles per second (pp. 46 and 72.)

The illustrations are moderate, and the book has a generally neat appearance. The place it is to occupy in astronomical literature, however, is not very clear, as there are already many cheaper books in existence which contain the same information, and much in addition.

Hand-book of Perspective. By Henry A. James, B.A. Cantab. (London: Chapman and Hall, 1888.)

THIS small book contains the principles of perspective explained in a plain and concise way. The author seems to have taken great trouble to make his meaning as clear as possible, and has spared no pains in getting together a good collection of examples, which are all worked out and accompanied in each case by a diagram.

The examples themselves would form a useful and practical course on the subject, since they are arranged in a progressive order, starting with the projection of a single point, and taking up in turn lines, surfaces, and solids.

Beginners will find this volume very serviceable to them, pictures as well as diagrams being given to illustrate the various positions of planes, lines, &c.

LETTERS TO THE EDITOR.

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Coral Formations.

IN the last paragraph of my letter which appeared in your issue of the 15th inst. (p. 462), I remarked:—"It is quite reasonable to suppose that the dead coral so dissolved in the formation of lagoons is carried out as material for fresh coral growths."

Mr. T. Mellard Reade, in a letter on the same subject, dated 22nd inst. (p. 488), in criticizing the results published by Mr. Ross's letter of the 15th (p. 462), remarks:—"I believe that at no

place on the surface of the globe are such dead shells being supplied at a rate that would even balance this supposed rate of chemical destruction."

Can Mr. Reade give any observations or figures in support of his view of the rate of accumulation of oceanic calcareous deposits?

Laying aside all question as to arithmetical error, and without committing myself to the accuracy of Mr. Ross's figures (or even insisting on my own), as to the amount of dead carbonate of lime dissolved in any given time by sea-water in lagoon formation, but taking it as a fact that it is soluble in a marked degree (as is proved by the experiments made by Mr. Ross and myself), and that coral reefs can only exist in regions under the influence of the great warm tropical ocean currents, then we may expect the waters of coral-bearing regions to contain a greater proportion of lime than is found elsewhere, thus forming the calcareous food for continuous extension of the coral formations.

Of course, a distinction must be drawn between the so-called dead and living coral, in thus far that the latter is protected from the solvent action of the sea-water by its vitality, while the former, as referred to in my last letter, is peculiarly susceptible to this influence.

ROBERT IRVINE.

Royston, Edinburgh, March 26.

Professor Rosenbusch's Work on Petrology.

READERS of NATURE interested in the study of petrology will be grateful to Dr. Hatch for his lucid review of Rosenbusch's great work, and those who are not able to profit directly by the German original will be glad of the *résumé* given of the latest classification of the massive rocks according to the views of the greatest living authority on the subject.

A translation of Rosenbusch's book into English is much to be desired. Rich as we are in fragmentary literature on the subject, a leading text-book is still wanting. Dr. Hatch would deserve well of his fellow petrologists if he would give them a translation of the work he reviews so well. There might be room for some cutting down in dimensions, especially in the treatment of the "neo-volcanic" rocks. Rosenbusch himself is conscious that this part of the work is, perhaps, a little overloaded with detail, as he says that with a new structure "the scaffolding is not removed before the house is finished," and possibly a competent translator might consider that a little less scaffolding would still be sufficient.

There will no doubt be more or less difference of opinion among authorities as to the correctness of the views which have governed Rosenbusch in his system of rock-classification, especially on one or two points. But none will deny that this classification, with the immense research and study accompanying and supporting it, fully given to the student in this latest work, are a splendid achievement.

Dr. Hatch does well, especially in the interest of younger workers in petrology, to insist on the purely arbitrary nature of any system of classification, so far as the separate "rock-types" are concerned; such types passing more or less gradually into others, on either side of them, in all cases. Rosenbusch himself points this out, but a further emphasis of the warning was well in place.

In working with a large text-book like the one in question, with its minute treatment of small details, the student is apt to neglect this consideration of the passage of one rock into another, or at any rate to devote too little attention to it. Nothing, however, could be a greater safeguard to him in this respect than to make for himself a tabular arrangement of Rosenbusch's system, so that the eye can follow in a moment the relationships of the different rock-types to each other. I think it is a pity that such a map, as it were, does not accompany the book. The attentive study of it would not only much assist the worker in his detailed use of the book, but would also greatly aid the beginner to "keep his head level" and steer clear of the sad pitfall of going in too much for "pigeon-holes."

Perhaps an outline table of this sort, which I inclose, may be of a little use to some of your readers, if only to give a compact view of Rosenbusch's classification and of how he connects the main rock-types in series through the four divisions of plutonic rocks, dyke-rocks, palaeo-volcanic rocks, and neo-volcanic rock.

An amplified table on the same model, with the various