

suffering hosts was expressly designed in order that man might appreciate the benevolence of the "Creator." Such a conception is too horrible to be entertained by reasonable creatures; nevertheless, it is in perfect harmony with certain other grossly anthropomorphic conceptions of Deity that are too commonly taught amongst us.

The general reader will not be able to follow M. Van Beneden very closely, unless he possesses a considerable amount of zoological knowledge; and he will find the book overladen with scientific terms. The naturalist, on the other hand, will be disappointed by the paucity of literary references. Whilst our author shows himself to possess a profound knowledge of the facts of commensalism, his volume is very deficient in the treatment of the subject of parasitism, properly so called, more especially when he deals with those forms that are known as Entozoa. He has omitted all mention of some of the most important helminthological contributions and discoveries of recent times. Thus, there is no allusion to Lewis's "find" respecting nematoid hæmatozoa, and almost nothing is said of the ravages produced amongst domesticated animals by a variety of well-known internal parasites. In some places our author misleads, as in the case of the history of the discovery of *Trichina*, where Sir J. Paget's name is altogether omitted; and also, in the case of *Bothriocephalus*, where Knoch's views on the possibility of infection without the necessity of an intermediary bearer appear to be countenanced.

Some of the illustrations are very poor, and the misspelling of authors' names and of technical words is exceedingly frequent. The author appears to be but little informed respecting the writings of German and English helminthologists. Notwithstanding these defects, M. Van Beneden's book ought to be purchased by every intelligent naturalist.

T. S. COBBOLD

OUR BOOK SHELF

The Scholar's Algebra: an Introductory Work on Algebra. By Lewis Hensley, M.A. (Oxford: Clarendon Press; London: Macmillan and Co., 1875.)

THIS is one of the Clarendon Press Series, hence we are saved all necessity of remarking upon the get-up of the volume. We had hardly expected that Mr. Hensley could have imparted any freshness to his treatment of so hackneyed a subject as an Elementary Algebra, but he has done so, and we have read his work with much interest. It does not follow the usual course observed in similar treatises either in its contents or in their arrangement. Our author himself expressly states that the work professes to be an introductory one on algebra. He takes up the scholar who has been well-grounded in arithmetic and endeavours to explain from the outset what algebra is, what its aims, and what the chief forms of its utility. In this attempt he has succeeded, and the work is likely to be of use to students who are reviving an acquaintance with the subject acquired at school, but especially is it suited to self-taught students. For these latter it is, we think, one of the best text-books hitherto brought out. The first seventy pages are devoted to the symbols, signs, and elementary rules; in this section we have a good chapter on Ratio and Proportion, including a glance at incommensurables. Though treated at this length, the scholar is hardly likely to grow weary in his work, and he is laying at the same time a safe and solid foundation for future use.

In Part II. we have Algebraical formulæ (Interest, the Progressions), then Equations (Simple and Quadratic), next Investigation of Methods (Involution and Evolution), closing with a supplement on unknown quantities, Inequalities, Indices (fractional and negative). The third Part opens up to the student under Algebraical formulæ, Permutations, Binomial Theorem, Notation, Harmonic Progression, and simple series, then Equations (more advanced than the previous ones), Surds, Indeterminate Equations and applications of Horner's method. We have then a chapter on Continued Fractions¹ and another on Logarithms. Some idea of the character of the work will be got from the order and nature of the subjects above mentioned, and it will be seen that a prominent feature is the importance attached to methods of calculation. Indeed, Mr. Hensley says he has remarked in the Universities a growing disposition to compel the student of the higher mathematics to interpret his results numerically. To this he gives the weight of his experience: "There can be no better guarantee that he understands what he is about." We may mention that the extension of meaning of the negative sign and of symbols generally, though but slightly glanced at, is yet introduced to the reader's notice. No place is given to properties of numbers, multinomial theorems, convergency of series, higher series, or probabilities. The curriculum is much that laid down by the London University for candidates for the first B.A. (Pass), and we can recommend the book before us as one well suited for such candidates, as containing all they require, and but little beyond what they need take up for the examination.

We shall touch lightly here upon the errata. They are not very serious, and though somewhat numerous, do not by any means come up to the usual standard in this respect of first editions. On p. 98, line 5, for youngest read eldest; p. 127, last three lines, statements should be *vice versa*; p. 205, line 5 up, read 7×52 .

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

Fritz Müller on Brazil Kitchen Middens, Habits of Ants, &c.

[MR. CHARLES DARWIN has kindly sent us for publication the following letter, addressed to him by Herr Fritz Müller, the well-known naturalist, brother of our contributor, Dr. Hermann Müller, and who has for so long been devoting himself to natural history researches in Brazil.]

My dear Sir,—In Desterro I met with two young men (M. Charles Wiener, of Paris, and M. Carl Schreiner, from the National Museum of Rio) who, by order of the Brazilian Government, were examining the "Sambaquis" of our province. I accompanied them in some of their excursions. These "Sambaquis," or "Casqueiros," are hillocks of shells accumulated by the former inhabitants of our coast; they exist in great number, and some of them are now to be found at a distance of several miles from the sea-shore, though originally they were, of course, built near the spot where the shells lived. Some are of considerable size; we were told that a Sambaqui on a little island near San Francisco had a height of about 100 metres; but the largest I have seen myself did not exceed 10 or 12 metres. As to the shells of which they are composed, the Sambaquis may be divided into three classes, viz.: (1) Sambaquis, consisting of many different species of bivalve and univalve shells (Venus, Cardium,

¹ We observe that our author says that these were first used by Lord Brouncker; it has been shown that Cataldi has a prior claim to this distinction.

Lucina, Arca, Ostrea, Purpura, Tritonium, Trochus, &c.), all of which are at present living in the neighbouring sea. (2) Sambaquis, consisting almost exclusively of a small bivalve shell, the "Birbigas" of the Brazilians (*Venus flexuosa*?), exceedingly common in shallow bays or salt-water lagoons, the bottom of which is of mixed mud and sand. (3) Sambaquis, consisting exclusively of a species of Corbula, which I have not yet seen in a living state; all the Brazilians also, whom I asked, and who are perfectly acquainted with any edible animal of their marine fauna, are unanimous in affirming that this shell does not live now on our coast. From one of these Corbula-Sambaquis I obtained a specimen of a small Melampus, which I have found living near the mouth of some rivulets, where fresh and salt water are mingling in ever-varying proportions. When the lowlands of the Lower Itajahy and some of its tributaries were as yet beneath the level of the sea, they would have formed a large estuary, and here probably the Corbulæ lived. The fragments of human skulls which we found in one of these Corbula-Sambaquis were of truly astonishing thickness, whereas those I have seen from other Sambaquis are hardly thicker than our own. Among the tools which are to be found in the Sambaquis, stone-axes are by far the most frequent. But as M. Wiener will probably soon publish a full account of his researches, I will now no longer dwell on this subject.

Some time ago I sent to Germany for publication a note on the relation between our Imbauba trees (*Cecropia*) and the ants which inhabit their hollow stem. As there may be some delay in publishing, I will give you a short abstract. Mr. Belt has already stated that the ants farm scale-insects in the cells of the Imbauba stem, and he believes that their presence must be beneficial. This is no doubt the case; for they protect the young leaves against the leaf-cutting ants (*Oecodoma*). Now there is a wonderful contrivance by which, as in the case of the "bull's-horn acacia," the attendance of the ants at the right time and place is secured. At the base of each petiole there is a large flat cushion, consisting of most densely-crowded hairs, and within this cushion a large number of small white pear-like or club-shaped bodies (specimens inclosed) are successively developed, which, when ripe, emerge at the surface of the cushion, like asparagus on a bed, and are then greedily gathered by the ants and carried away to the nest. The object of the dense hair-cushion appears to be (1) to secure to the young club-shaped bodies the moisture necessary for their development; and (2) to prevent the ants from gathering the unripe bodies. In most cases it is by honey-secreting glands that the protecting ants are attracted; now Mr Belt observed ("Nicaragua," p. 225) that the honey-glands on the calyx and young leaves of a Passion-flower were less attractive to the ants than were the scale-insects living on the stems; this would most likely be the case with the Imbauba, and it is probable that the use of the little pear-shaped bodies is to form an attraction stronger than that of the scale-insects, and thus to secure the attendance of the protective ants on the young leaves. As far as I could make out, the club-shaped bodies consist mainly of an albuminous substance. The ant colonies are founded by fertilised females, which may be found frequently in the cells of young Imbauba plants. Each internode has on the outside, near its upper end, a small pit where the wall of the cell is much thinner than anywhere else, and where the female makes a hole by which she enters. Soon after this the hole is completely shut again by a luxuriant excrescence from its margins, and so it remains until about a dozen workers have developed from the eggs of the female, when the hole is opened anew from within by these workers. It would appear that the female ants, living in cells closed all around, must be protected against any enemy; but notwithstanding a rather large number of them are devoured by the grub of a parasitic wasp belonging to the Chalcididæ; Mr. Westwood has observed that the pupæ of the Chalcididæ exhibit a much nearer

approach to the obtected pupæ of the Lepidoptera than is made by any other Hymenoptera" ("Introd. to the Modern Classif. of Insects," Part XI., p. 162). Now the pupa of the parasite of the Imbauba ant is suspended on the wall of the cell by its posterior extremity just like the chrysalis of a butterfly.

I hope you will have received a paper on *Æglea*, a curious Decapod inhabiting the mountain rivulets of our Serra do Mar. Lately I obtained a large number of specimens of this *Æglea*, and among them a female with eggs in an advanced state of development. Thus I was enabled to satisfy myself that, like so many fresh-water and terrestrial animals, the marine allies of which undergo a transformation, our *Æglea* does not experience any metamorphosis.

FRITZ MÜLLER

Itajahy, St. Catharina, Brazil, Dec. 25, 1875

Prof. Tyndall on Germs

YOUR able correspondent "Inquirer" would hardly blame Horatius for taking his enemies one at a time. May I not, then, claim his indulgence for following, in an extremely humble way, the example of the gallant Roman? He may accept my assurance that during the last five months I have found Dr. Bastian quite enough for me.

Moreover, I do not think it likely that Dr. Sanderson and myself will ever cross swords upon this question. Our relation, I am happy to think, will be one of co-operation, not of antagonism. The experiments on pure infusions, not those on mixtures of solids and liquids, to which "Inquirer" directs my attention (*NATURE*, vol. vii., p. 180), are, in my opinion, too scanty, and too little in harmony with each other, to bear an inference of any weight. To Dr. Sanderson I prefer leaving the repetition of them, with the full confidence that the ability and candour for which he is so distinguished will lead him to a right result.

In repeating these experiments, it would, I think, be well to bear in mind the remarks of Dr. Roberts (*NATURE*, vol. vii., p. 302), however unimportant they may seem to Dr. Bastian. I would also suggest the substitution, in boiling, of an oil-bath for the Bunsen burner, and, in sealing, the abandonment of the blow-pipe and the use of the simple spirit-lamp flame.

Experiments on milk and pounded cheese are, it may be observed, at present beside the mark. They shall be subjected in due time to the scrutiny already bestowed upon really liquid infusions. It ought not to be forgotten that the jungle we have entered has been growing umbriferously for the last six years, and it is only bit by bit that the sunlight can be let in upon it.

"Inquirer" may count on my sympathetic readiness to minister, however humbly, to the delight he takes in following "every investigation which tends to the development of science." If he cares to see my infusions, it will give me great pleasure to show them to him. Condensed abstracts only of my investigation have been laid before the Royal Society and the Royal Institution; a fuller account of it will follow by and by. Meanwhile, I hope "Inquirer" will accept the assurance that I have been strict—I might say abject—in my adherence to the conditions prescribed by Dr. Bastian in his books.

JOHN TYNDALL

Heathfield, Feb. 13

[The following letter has been sent us for publication by Prof. Tyndall.—ED.]

PERMETTEZ-MOI de vous dire combien je suis charmé que vous apportiez dans la question de la génération spontanée la grande autorité de votre esprit philosophique et de votre rigueur expérimentale. C'est tout à la fois un honneur pour mes recherches et une vive satisfaction personnelle que les conclusions auxquelles vous êtes arrivé s'accordent si bien avec celles de mes propres travaux, malgré la différence des méthodes que nous avons suivies. Le tour piquant que vous avez su donner à vos expériences les fera pénétrer plus avant que les miennes dans l'esprit de tout lecteur que n'égareront pas les idées *a priori*.

Dans le numéro du 5 février courant du *British Medical Journal* le docteur Bastian accepte sans réserve l'exactitude de toutes les expériences de mon mémoire de 1862. (*Annales de Physique et de Chimie*).

Il accepte également, sans nul doute, les résultats de celles que j'ai publiés en 1863 et en 1872 sur le sang, sur l'urine, sur le jus intérieur des grains de raisin, exposés, dans l'état même où la vie a formé ces liquides complexes, au contact de l'air pur,