it without learning something new about the history of the series of inventions and discoveries which have culminated in Transatlantic Marconigraphy.

Catalogue of the Collection of Palaearctic Butterflies Formed by the late John Henry Leech. By Richard South, F.E.S. Pp. vi+229; portrait and two coloured plates. (London: Printed by Order of the Trustees of the British Museum, 1902.)

IT is very gratifying to notice how frequently, at the present day, large private collections of objects of natural history, when of real importance, find their final resting-place in the British Museum, or in some other great public collection, where their treasures are available for ever, instead of being dispersed on the death of the owner, and by such dispersion alone, losing a large part of their scientific value, besides the probability of a considerable portion being neglected, and sooner or later lost or destroyed.

Especially is this the case with great special collections, like that brought together by Mr. Leech, at great expense, and with untiring energy and perseverance, from Lapland to Marocco and Algeria, and from thence to Cashmir, and from Cashmir to Japan, including the materials used in the preparation of his great work on the "Butterflies of China, Japan, and Corea," which is likely long to remain the standard authority on the subject. A great part of these collections was formed by Mr. Leech himself in his numerous entomological journeys, while others were procured for him by enterprising collectors like Mr. A. E. Pratt, in almost unknown and unexplored parts of Western China and Thibet. Besides these, Mr. Leech's collection includes (by purchase) the bulk of the collection formed by the late Mr. Henry Pryer, himself the author of the first important separate work published on the butterflies of Japan, which is also noticeable as having been issued in two languages, English and Japanese. On the other hand, there are comparatively few species and specimens from North Africa and Western Siberia.

Mr. Leech also interested himself specially in the variation of species, and purchased a large selection of varieties of European Lepidoptera from the collection of the late Herr Mützell, of Berlin, as well as from other sources; and as the types of new species in Mr. Leech's collection have already been fully illustrated in the works and papers published by Mr. Leech himself during his lifetime, the two plates which illustrate the present memorial volume are devoted to figures of some of the most interesting varieties, chiefly European. Every specimen in the collection is carefully enumerated in the volume before us, the sex and exact locality being carefully indicated, and all types marked.

Entomologists owe a deep debt of gratitude to Mr. Leech himself, to the liberality of his mother, and to the careful work of his friend and coadjutor, Mr. South, in ensuring the permanent value of this unique collection.

Bacteria in Daily Life. By Mrs. Percy Frankland. Pp. 216. (London: Longmans, Green and Co., 1903.) Price 5*s.* net.

MRS. FRANKLAND has compiled an interesting, instructive, and accurate account of the modern developments of bacteriology. Such subjects as sewage disposal, the prevention of tuberculosis, micro-organisms in milk, air, and foods, which are of public importance, are fully dealt with, and the modern ideas regarding toxins and antitoxins are briefly discussed. No one nowadays laying claim to a liberal education can dispense with a slight knowledge, at least, of microbes and their actions, and for such this work will prove an adequate text-book. R. T. HEWLETT.

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 intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

A New Theory of the Tides of Terrestrial Oceans.

IN NATURE of September 4, 1902 (vol. lxvi. pp. 444–445), Prof. G. H. Darwin makes some criticisms upon a paper of mine to which I should like to reply.

Upon referring to pp. 537 and 624 of the paper criticised, it will be seen that it aims at "rude approximations to the cases found in nature," and at a "partial explanation of the tides." In fact, it bears the title, "Manual of Tides, Part ivA., Outlines of Tidal Theory." If, therefore, the paper establishes, even in a few cases, the principal causes of the tides, connecting the latter with the known tidal forces, it can hardly be regarded as a "failure," even though the approximations are rather rough; for I believe this object has not been heretofore attained for any ocean tide, although statements have elsewhere been made by our critic which might, perhaps, lead some people to think otherwise.[1]

Again, granting for the moment that the theory involved in the paper is erroneous, I should still say that if observed facts can be conveniently grouped by aid of it, a useful purpose will have been subserved. In fact, the mere collection of tidal data which a test of any theory implies is here, as elsewhere, not without value. For instance, if our critic could have had this paper before him while preparing his book on tides, he would not have overlooked Berghaus's invaluable cotidal chart and written "No more recent attempt (than Airy's) has been made to construct such a map."[2]

Prof. Darwin's principal criticisms are three in number:—

(1) He sees no use for the equation of virtual work in ascertaining the times of high water.

(2) He thinks that the deflecting force of the earth's rotation cannot be generally disregarded in a first approximation, which is all that my paper aims at.

(3) He does not believe that ocean basins exist the free periods of which are sufficiently near the tidal period to account for the tides.

(1) Concerning my application of the principle of virtual work, Prof. Darwin is mistaken when he says "Mr. Harris takes the displacements as proportional to the actual displacements per unit time." What is really done is this:—The magnitude of the virtual displacement (δx, say) at any given point of the system is taken to be the same for any given time or hour, but varies from point to point. Since the law of the oscillation of the particles is known, viz. it is simply harmonic in time, and the particles throughout the body are at a given instant in like or opposite phases, the virtual displacement at any given point may always be represented by the maximum value of the actual total displacement at the point (*cf.* rule quoted in criticism). In other words, if we choose to consider the small virtual displacement as identical with a small actual displacement corresponding to a time variation, the implied δt will not be constant for all hours. Hence the virtual displacements at different hours are not simply proportional to the actual displacements *per unit time*. He is evidently mistaken when he says, "Thus all sustaining forces vanish at the instant when the displacement is a maximum." Why should they? Surely they generally vary in magnitude and phase for the various parts of an extended oscillating body. Probably the use of the rule quoted in the criticism and founded upon the principle of virtual work can be most readily seen when it is applied to a binodal canal-like area of uniform cross section, selecting for simplicity, say, the nodes as the points of application of the sustaining forces (*cf.* § 63). The process implied in the rule seems to be correct, and, so far as I see, about as simple as it could

[1] "The Tides," p. 177, lines 2–10. [P. 160, lines 16–23, English edit. I thought that the passage referred to would be understood to refer to the ideal case there under consideration.—G. H. D.]

[2] "The Tides," p. 189, lines 10–12. [P. 171, lines 19–21, English edit. This was an oversight; a reference to Berghaus will be found in the forthcoming article on the tides for the German "Encyclopædia of Mathematics."—G. H. D.]