the barricade, after which the general exit occurs. Again there is a rush of workers almost immediately after the first break, who usually spread over the hill, bustling around the gate, gradually widening the circles, and finally push out into the surrounding herbage. At first the exit hole is the size of a pea, perfectly round, and plainly shows that sand and soil have been used under the gravel to seal up the gate. The whole appeared to have been cemented, probably by the moisture of the night dew.

"The process of closing the gates is even more interesting to the observer than the opening, as the various steps are more under his notice. . . . At nest A the closing was chiefly from within. The workers pushed the sand from the inside outwards with their heads. A grass straw about an inch long was brought from the interior and pushed out until it lay across the gate as a stay for the filling material. Soil was here principally used for closing, a few pebbles being added." In another case, "when the gate was nearly closed a straggling minor came back from the commons and essayed entrance, wherein she failed. Several trials and failures succeeded, whereupon she commenced dragging the dirt from the opening. While thus engaged the major approached with a huge bit of gravel, which she deposited on her comrade with as much nonchalance as though she were one of the adjoining pebbles. At last the minor dug out a tiny hole through which she squeezed into the nest, and the major, who was deliberately approaching close behind her, carrying another pebble, immediately sealed up the opening. During this amusing episode the straggler made no effort to aid in the closing, being wholly intent on entering, and the gate-closer paid no attention to her whatever, beyond the first sudden and satisfactory antennal challenge. Each moved forward to her own duty with the undisturbed plasticity of a machine."

This "by-play" between the gate-closers and the late-returning foragers is not the exception but the rule; nevertheless it does not appear that the foragers ever so far miscalculate their time as to arrive after the gates are completely closed. When the gates are all but closed there is generally but a single ant engaged in the closing process from without; this ant slips in at the last moment, and the process is finally concluded from within. The gates are similarly shut during the day-time if the weather seems to threaten a heavy rain-storm.

In disposition the Occident Ants, though provided with very formidable stings, are exceedingly mild and unwarlike—so much so, indeed, that even when greatly incommoded by the tiny but viscous erratic ants which Dr. McCook observed on one occasion to have impertinently established a nest within their "clearing," they would not dislodge or even fight their insignificant foes, but "entirely abandoned their old avenue, cut down and around the erratic colony, and made an opening on the edge of a slight ridge several inches beyond the disputed territory, but still in the line of the avenue which they had been using in their work. A tithe of the pains required for this task would have literally cut out and carried away the whole nest space of the erratics, whose scant numbers of diminutive warriors could have been overwhelmed in a moment by the legions of their huge hosts."

Lastly, Dr. McCook has satisfactorily ascertained that these Occident Ants present the same habits of "harvesting" as those which were previously known to occur in the allied species of Florida and Texas. His work as a whole deserves warm commendation, and we trust that the success which has attended his study of the sundry species of ants that have hitherto engaged his attention, will induce him to extend his researches to those other species on the American continent which present habits and instincts, if possible, more remarkable than those which he has done so much to elucidate.

GEORGE J. ROMANES

OUR BOOK SHELF

The Story of our Museum, showing how we Formed it, and what it Taught us. By the Rev. Henry Housman, A.K.C., &c., &c. (London: Society for Promoting Christian Knowledge, 1881.)

THIS is a most excellent book for a boy with a taste for natural history. It describes in a pleasing and natural way how two boys living in a country village in Gloucestershire began to make a museum. It narrates all their difficulties, their failures, and their successes; and how, by perseverance, and with very little expense, they gradually formed a collection illustrating the whole range of the natural history and antiquities of their district, including, besides, postage-stamps and autographs. How much pleasure and how much knowledge are to be obtained while forming such a collection is very well shown; and though there is little novelty in the book, occasional diffuseness in the treatment, and hardly any passages that will bear separate quotation, these trifling deficiencies do not at all detract from its merit as a book for boys, which is all that it pretends to be.

The one decided innovation on the almost universal practice of collectors is, the strong recommendation of a natural system of mounting butterflies and moths. The usual mode of exhibiting the lepidoptera, all set out with expanded wings on one horizontal plane, is objected to as being monotonous and completely false to nature. Of course in an extensive systematic collection this method is absolutely necessary, for classification, easy reference, comparison, and critical examination; but in forming a purely local collection, the superior advantage of the natural system of mounting are strongly advocated, at least for the butterflies and all the larger moths. These should be exhibited sitting or flying, with the wings elevated or depressed, as if alive, and the legs and antennæ placed in natural positions. Of course this requires glass cases for these insects as for birds; but when the collection is restricted this is no objection; and by exhibiting the preserved larvæ, eggs, and pupæ, along with the perfect insects in all their different natural attitudes, it is maintained that much more instruction will be afforded, while the effect will be far more picturesque and pleasing than the straight rows of unnaturally expanded insects can ever be.

The only other part of this volume calling for further notice here, is an appendix, "On the Arrangement of Natural History Collections," in which the more natural and attractive arrangement of the galleries of public museums is strongly advocated. As regards the higher animals, there is nothing fresh in these recommendations; but the author also urges the exhibition of complete series of such fossil species as illustrate the persistence of types or the development of forms throughout considerable geological periods. This, however, is never done in our great public museums. In the case of living animals the species are exhibited in systematic groups, while no attempt is made to show the equally interesting geographical grouping; while with extinct animals an opposite

mode is followed, and all are arranged stratigraphically, without any attempt to show the more interesting developmental or time-series. Thus, in both cases the most interesting and instructive methods of arrangement are entirely neglected in favour of systems which are adapted solely to facilitate study by specialists, but which are comparatively unimportant and uninteresting to the public. Even to this day it does not seem to be realised by curators of museums, that the collections for study and those for public exhibition require to be arranged upon totally distinct plans; and that the method which is the very best in the one case may be, and usually is the very worst in the other.

ALFRED R. WALLACE

Geology of the Counties of England and of North and South Wales. By W. Jerome Harrison, F.G.S. (London: Kelly and Co., 1882.)

ALL who have had occasion to use the valuable Post Office Directories of the English counties published by Messrs. Kelly and Co., will have noticed that the imperfect notes on geology contained in former editions have now been replaced by very accurate and well-written articles on the subject. These notes on the geology of the English counties have been drawn up, evidently with much skill and labour, by Mr. W. J. Harrison. In each case the scattered maps and publications of the Geological Survey have been very carefully studied, and the various memoirs and notices on the geology of each of the counties contained in miscellaneous journals and magazines faithfully summarised. The result is that the numerous readers of those widely diffused publications, the County Directories, have at hand a reliable sketch of the geology of the district in which they live, carefully brought down to the date of publication. What is perhaps of still greater importance is, that these sketches include references to all the principal works bearing on the subject, so that the reader is told where he may find fuller and more detailed information upon any point in which he may be interested. We can scarcely conceive a method by which useful geological information could be more widely diffused, or made more easily available for those who wish to obtain correct ideas concerning the geology of the district in which they live. These sketches of the Geology of the English Counties have now been collected into a volume, and constitute a very useful work of reference. We have tested it in many ways, and find that in almost every case the latest information, even when published in journals of very restricted circulation, has been discovered and made use of. Mr. Harrison's essays are clearly written, and each of them is preceded by a list of the local Natural-History and Scientific Societies, the members of which collect information bearing on the geology of the county; of the museums in which rocks and fossils from the county are preserved; of the publications of the Geological Survey bearing on the county; and of such other works as in any way refer to the subject. In all cases where he was in doubt Mr. Harrison appears to have sought the assistance of competent authorities, the result being a work which is exact, and at the same time is written in a popular style. There are numerous excellent woodcuts, most of which appear to be taken by permission from the publications of the Geological Survey and the Geological Society. We can heartily recommend this book as a convenient and reliable work of reference.

University College Course of Practical Exercises in Physiology. By J. Burdon Sanderson, M.D., LL.D., F.R.S., with the Co-operation of F. J. M. Page, B.Sc., F.C.S., W. North, B.A., F.C.S., and Aug. Waller, M.D. 8vo, pp. 75. (London: H. K. Lewis, 1882.)

THIS book is a *multum in parvo*. It gives in a most condensed and yet most clear and precise form, an account of the method of performing the most important experiments in physiology. It will be useful not only to

students, but to practitioners who wish, with a small expenditure of time and labour, to become acquainted with the present state of our information, and the most important points in physiology, and the experimental data on which our knowledge rests. The exercises relating to the physiology of muscle and nerve are especially worthy of commendation. They make clear to the student the different arrangements of electrical apparatus, the comprehension of which is to many an insuperable difficulty, not only during their student's career, but during the whole of their lives. The few and simple diagrams in the text are just what were wanted to make the experiments readily understood. Half an hour spent with this little work will, we think, give to the beginner a better grasp of the subject of which it treats than days spent over more elaborate text-books, however good the latter may be for advanced students.

Mémoires de la Société des Sciences Physiques et Naturelles de Bordeaux 2^e série, tome iv. 2^e cahier. (Bordeaux: 1881.)

WE draw attention to this number specially for the benefit of such as are interested in the early history of arithmetic. It contains (pp. 161-194) an able paper by M. Paul Tannery (who is known by his previous similar work upon the "Collection Mathématique" of Pappus in tome iii. pp. 351, &c., of these same *Mémoires*) on "l'Arithmétique des Grecs dans Héron d'Alexandrie." He goes carefully into the question of the authenticity of the several so-called Heronian writings, and analyses those which he accepts, and concludes with one or two specimens of the approximate methods employed. We need only mention the names of Cantor, Martin, Hultsch, and Rodet as being those of the authors whose works and statements are discussed. Other papers are: M. Hauteux, "Etudes météorologiques de la Gironde à la Plata"; M. Millardet, "Pourridie et Phylloxera; étude comparative de ces deux maladies de la vigne"; M. Royer, "Recherches sur le passage du mercure à travers les liquides"; and M. Ponsot, "De la reconstitution et du greffage des vignes." From this enumeration it will be seen that some of the papers are of a very practical character, touching the interests of the commonalty. M. Debrun contributes a short note (and illustration), "Sur un nouveau baromètre amplificateur."

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.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Hypothetical High Tides

I SHOULD like to be allowed to ask two questions on this subject: First. Could the vegetable accumulations from which the coal has resulted have escaped destruction if, during their subsidence, the world was subject to such tides as Mr. Ball postulates? It is difficult to understand how this could be if the shales and sandstones which overlies the coal be of marine or estuarine origin. Second. What do the Palaeozoic conglomerates disclose on the subject? The shingle of beaches heaped up by the tide, having each layer of sand and pebble laid at the slope of the beach face, exhibits when cut at right angles to the trend of the beach the continuously oblique bedding which represents this slope, the vertical heights of the shingle bed thus laid up representing the extreme rise and fall of the tide and surges. This may be seen in the case of the Lower Eocene shingle in Bickley Cutting of the Dover Railway and in the case of the early Glacial shingle in deep pits at Henham and Halesworth in Suffolk. The latter show a tidal rise and fall there of more than twenty-five feet, the former not so much. The same structure obtains in the case of sandbanks left dry by the tide, and of such