These cortical centres are not the places where the crude sensations are received, but the places where they are elaborated, interpreted, and associated with other impressions. They are perceptive centres.

The work of Luciani and Seppilli is an onward step in this difficult subject, and can be recommended as the best book to use for those who have only time for one book. While it leaves many problems unsolved, it gives hopes of a solution, and leaves the conviction that we are on the path towards a scientific and rational conception of the functions of the highest product of evolution, — the human cortex. JOSEPH JASTROW.

THE SEPARATE SYSTEM OF SEWERAGE.

THE respective merits of the separate and the combined systems of sewerage are still topics of animated discussion among sanitary engineers. Experts are not at one upon the question whether there should be one set of sewers through which should be removed the discharges from human beings and the water which in the form of rain falls upon the surface of the ground, or whether two separate and distinct sets should be constructed, each of which should be restricted to the removal of one of these varieties of waste material. The writers of this little book of 183 pages are advocates of the separate system, and believe that its moderate cost makes it possible to carry out a system of sewerage in many cases where the expense of the combined system would make the construction impossible. Most of the literature upon this subject is to be found in pamphlets, and papers presented to scientific societies, which are not available for general reference; and the authors have endeavored to supply a deficiency which their own experience has shown to exist by preparing the work now before us. Their aim has been to explain what the separate system is, what it is designed to do, and to give practical directions for designing and constructing sewers in accordance with that system. They recognize the fact that no single design is applicable to every case, but that each town will present some features peculiar to itself, and that the general plan must be modified to suit the conditions of each case. The dangers connected with, and indeed inseparable from, the old-style yard vaults and cesspools, in which filth accumulates oftentimes for years, are graphically portrayed; and the ordinary methods by which wells and streams become polluted are plainly and concisely explained. These are made a text for a homily upon the need of sewerage in all densely populated neighborhoods. The evils of the combined and the advantages of the separate system are contrasted; and the authors then pass on to the consideration of the designing of plans for the construction of a sewerage system, commencing with the preliminary survey, and carrying them up to the condition of completion, with the house-connections made, and the sewage on its way to the sea or other point of discharge. The volume is, considering its small size, a very comprehensive one, and will undoubtedly be of great service to those engaged in practical work of this kind.

The separate system of sewerage: its theory and construction. By CADY STALEY and GEORGE S. PIERSON. New York, *Van Nostrand*, 1886.

CHALLENGER REPORTS.

THIS bulky volume contains the second report of Professor Herdman on the Tunicata, comprising four hundred and thirty-two pages and fifty plates, and Théel's second part of the report on the Holothurioidea, with two hundred and ninety pages and sixteen plates. The high standard of mechanical execution which has characterized previous volumes is fully maintained in both text and plates.

Professor Herdman's first report treated of the simple ascidians. The present one is devoted to the compound forms; and a final part, to discuss the pelagic groups, will probably appear next year. It was at first supposed that the forms remaining after the simple ascidians had been described could be disposed of with comparative brevity; but the compound ascidians proved, on careful examination, to be a much larger and more varied group than had been anticipated. On account of the difficulty in finding good diagnostic characters, and of the similarity which different species sometimes show in their external appearance, it has been necessary to submit nearly all the species in the collection to a detailed histological examination, and portions of most of them have had to be sectionized — a slow and laborious proceeding — before the relations of their different parts could be satisfactorily determined. Then, in the case of a few species, some interesting peculiarities in regard to reproduction by gemmation required a careful and lengthened examination, on account of the important bearing of these features upon the mode of formation of the colony.

The collection of compound ascidians represents one hundred and two species and varieties, arranged in twenty-five genera. Eighty-eight of the species and ten of the genera are here de-

Report of the scientific results of the voyage of the Challenger during 1873-76. Vol. xiv.: Zoölogy. London, *Government*, 1886. f°.

scribed for the first time. A few simple ascidians, overlooked previously, find a place in an appendix.

Compound ascidians were figured by Rondeletius as early as 1555, but nothing of their structure was put on record until two hundred years later. Even then their relation to the simple ascidians was not suspected, though some of the main points in the anatomy of the latter were known to Aristotle.

Gaertner in 1774, and Renier in 1793, recognized the relations of one or two genera, but the majority of naturalists still confused the compound ascidians with Alcyonaria or with sponges. It was reserved for Cuvier and Savigny to demonstrate beyond all question the close affinity between the two groups of the Tunicata. This was in 1816; and, led by these investigations, Lamarck, about the same time, instituted the class Tunicata. Since then important researches on the compound forms have been made by Milne-Edwards, Gegenbauer, Krohn and Metchnikoff, Ganin, Giard, and von Drasche, as well as other students; while Professor Herdman, in the present paper, has summarized the existing knowledge, and added many remarkable anatomical discoveries of importance for the history of the group, to say nothing of the multitude of details useful to the special student, and evincing a thorough and patient method of study which enforces confidence in and gratitude for his prolonged investigations.

Dr. Théel, in the second part of his work on the holothurians, has not limited his labors to a description of the Apoda and Pedata which were brought home by the Challenger, but has added a short exposition of all the shallow-water forms hitherto known. It was rightly considered that such a monograph was highly desirable, though the difficulty of its preparation was very great, and various gaps necessarily occur in it on account of the frequent imperfections of the descriptions given by some authors. Material from many sources was put at the writer's disposal, especially the very rich collection of the Royal zoölogical museum at Stockholm.

The examination of the vast harvest of the Challenger voyage indicates a double derivation for the deep-sea holothurians. The Elasipoda, though species are found occasionally in shallow water in the arctic regions, cannot be derived from the same source as the usual shallow-water types. On the other hand, a certain proportion of the deep-sea species, such as forms of the Cucumariae, show intimate relations with the littoral fauna. The relations of the littoral to the abyssal fauna are discussed in an admirable manner by Dr. Théel, who regards the primitive holothurian to have been shaped like Cucumaria, with an open stone canal, feet, and a well-developed ambulacral system. Some forms have a great range in depth, the same species varying over seven hundred fathoms. Shallow-water genera sometimes reach a depth of some twenty-nine hundred fathoms, while the species are usually different from those of more moderate depths. The characteristic deep-sea forms, however, are the curious Elasipoda, which, as above mentioned, rarely are found except in the abysses.

Not a single species is common to the Arctic and Antarctic seas, though the shallow-water fauna presents much the same characteristics, and many of the species are very closely allied. Many species are circumpolar, but only a few circumequatorial. About 45 forms are known from the Arctic, 32 from the Antarctic, 135 from the Atlantic and Mediterranean, but no less than 305 from the Indo-Pacific region, which, it would certainly seem, must be the metropolis of these forms of animals.

The great value of Dr. Théel's work is self-evident, and only the limits of our space prevent a more thorough analysis. As it is, we have given but a few indications of the wealth it contains, for which the reader must be referred to the original.

ACCORDING to the latest returns published by the minister of agriculture, it appears, says the *Journal of the Society of arts*, that the chestnut-tree is cultivated in every province of Italy, excepting those of Milan, Cremona, Mantua, Rovigo, Ferrara, Ancona, Bari, Lecce, Syracuse, Girgenti, and Trapani, that is to say, it is cultivated in 56 provinces; and that, out of the 8,257 communes in Italy, it is cultivated in 1,313. The chestnut is cultivated on the most extensive scale in Liguria, and on the least in Sardinia. The total production throughout the kingdom, of fresh chestnuts, is 391,393 tons annually, which would average 1.33 kilograms per inhabitant; in Liguria it reaches 101.5 per head, and in Sicily only 3.57. A considerable quantity of chestnuts is exported to France, Austria, Egypt, Switzerland, and South America; while, on the other hand, a very insignificant quantity is imported from France, Austria, and Switzerland.

—A Parisian electrician has devised a mode of utilizing the residual liquids from bichromate and other powerful batteries. He mixes a porous acid-proof substance with the residual liquids, dries the paste thus produced, and uses it as a charge for batteries for telegraphic purposes.