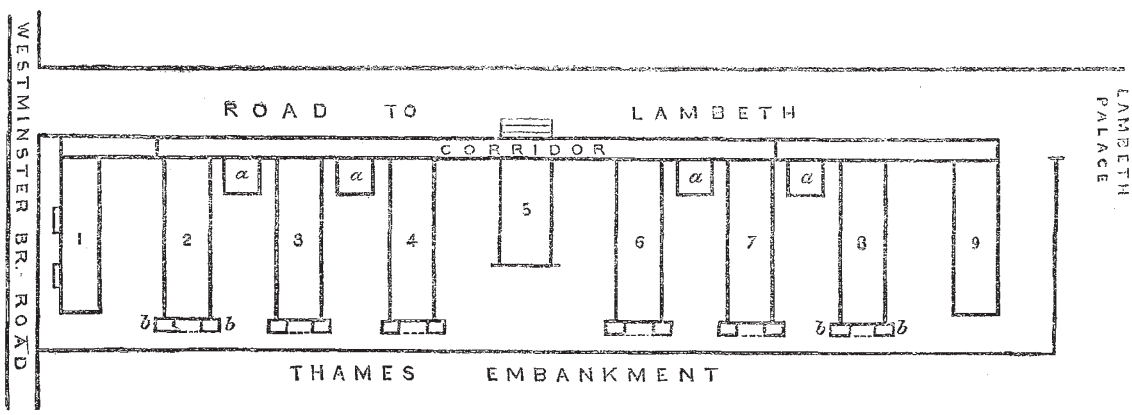
The principal channel of communication between the several blocks of the building is one long corridor on the ground flat or floor. This corridor runs the entire length from the administrative block (No. 1) to the block for contagious diseases (No. 8). But the portions of the corridor which lie between blocks 1 and 2, and between blocks 7 and 8, take the form of an open colonnade. For the rest of the distance, it is intrinsically an internal passage. The open, or colonnade, portion which leads to block 8, the assigned seat of infectious disorders, is carefully cut off from the rest of the corridor by closed glass doors, so that all contamination of the other blocks of the building by the infected air is simply impossible. The open air-space which intervenes is ample for the neutralisation and destruction of atmospheric infection of any kind. The marvellous extent of space covered by this hospital is perhaps best estimated by stating the actual length of this corridor. The continuous length of the spacious passage is 916 feet from end to end. A very pleasant and convenient communication between the several blocks is effected on the second floor by a casemented passage, which runs along the main corridor. The communication for the third floor is along the open flat roof of this casemented passage; and above this there is no communication at all between the blocks. The effect of the light and airy outlook, giving the impression of altogether unrestricted lightness and freshness, which is encountered in passing along these higher passages of communication, is very charming and agreeable. There is scarcely anything in the arrangements of the buildings which is more striking and pleasant to an observer upon a first visit. The open passage at the top is guarded by a balustrade, which is very profusely ornamented by large urns made of artificial stone; a material which has been largely employed in the ornamental parts of the structure. This compound, which is a special patent, is formed of dissolved flint mingled with sand, the material being then saturated with silicate of potash under exhaustion or pressure. It is expected that this artificial stone will possess very enduring qualities, but from the present aspect of these urns the



writer of these lines inclines to think that the material yet needs further evidence of endurance and success before it can be held to have established the character at which it aims.

In addition to these corridors of communication, there is a still longer passage in the basement, extending quite from the administrative block to the Museum and Schools at the farther end of the structure, and giving immediate access to the department for washing linen, and to the Anatomical Schools and mortuary receptacles which lie beyond under the shadow of the old walls of Lambeth. There is also a sunken but open-air way running from end to end of the building immediately within the parapet trenching upon the river-embankment, which gives still further facility for the transport of heavy material. This channel of communication is very ingeniously and completely masked from observation both from the building itself and from the external space.

The important and interesting details relating to the arrangements which have been made within the large wards themselves to fit them for their beneficent work, must be reserved for another article.

R. J. M.

THE COLLECTION OF INVERTEBRATE ANIMALS IN THE FREE PUBLIC MUSEUM, LIVERPOOL

IN October 1861, when the Natural History collections presented to the town of Liverpool by the grandfather of the present Earl of Derby were removed from Duke Street to the building which they now occupy, the question arose, how should the museum be made as fully as possible to answer the requirements of the population by whom it was to be supported under the provisions of the Library and Museum Act.

The Curator, Mr. Moore, whose invaluable services are too well known to require further notice on my part, having on his hands, besides the duties of general superintendence, the re-arrangement of the extensive series of Mammalia and Birds, together with preparations for the reception of a similar series of Fishes and Reptiles, availed himself of my offer of assistance in obtaining and arranging a collection of Invertebrate animals, our stock of which at that time included little beyond some corals and a few very miscellaneous specimens.

The accommodation available for the proposed collection consisted of the central areas of a suite of five rooms

27 feet in breadth, the total length being 250 feet. Space was thus provided for eighteen table-cases, each 10 feet long, set transversely. One important point was therefore settled by the shape of the building. The series had to be conformed to a linear arrangement. In some respects this was a serious disadvantage. The classes of Invertebrate animals cannot well be represented in a single ascending or descending series. Probably it would not be possible on any symmetrical plan to indicate their proper positions relatively to each other; but some palpable incongruities might be avoided by the use of table-cases on a ground-plan, resembling in form a tuning-fork. The Protozoa, as the stem, pass naturally enough on one side by the Rotiferæ and their allies to the Annelida, Echinodermata, Crustacea, and Insecta; and on the other by the Cœlenterata to the Molluscoida and Mollusca; the greater size of the specimens forming the latter prong of the fork, compensating for the vastly more numerous species in the former. The importance of a suitable ground-plan for cases in Museums seems to be much underrated. When a class of students visit a museum frequently, the localities of cases containing special groups become indelibly impressed upon the memory. Why should not this be turned to good account?

In preparing the first scheme of the collection, it seemed to me essential that plain, and moderately simple, printed descriptions of the life history of the animals should accompany the specimens, but, as it was clearly impossible to describe every species, or even every genus, it became necessary to fix on some mode of associating in groups a number of species to which the descriptions might apply. Such divisions as "classes" and "orders" were manifestly too large; whilst "families" varied from a single genus, including a solitary species, to an army of more than a thousand genera, *e.g.* the Cerambycidæ and Curculionidæ in the Coleoptera. It was with some regret that the idea of attaching a readable sketch to each division of a given rank in recent systems of classification was relinquished, but it was found to be impracticable; and the life history sketch thus became the foundation of the system eventually adopted. Whether it might be a few species, or a genus, or a family, or an order, that seemed to afford suitable scope for a paragraph of readable and instructive matter, it was decided that such a group should be segregated, so as to form the unit of the series. Eventually, in order that the sketches, which it was proposed to print for the purpose on tablets, might all be in positions where they could conveniently be read, it was found to be expedient that each group, or unit, should occupy an equal space; and as the blocks on which the table-cases rested were to be fitted up with trays or drawers, twelve of which would occupy the table-case without loss of room, these trays or drawers were adapted as the receptacles and boundaries of the groups.

The drawers measured twenty-seven inches in length by sixteen inches in breadth, and their number in the eighteen table-cases, when completed, would be 216. Then arose the problem, how best to divide the twenty classes of Invertebrate animals into 216 groups, each of which should be capable of affording materials for a biological notice, such as might be read with interest by any intelligent visitor.

The entire plan of the table-cases, and the limits of most of the groups, were committed to writing before any considerable advance had been made in procuring specimens. In one respect this circumstance was found to be very advantageous—our *desiderata* were at once well-defined. It was an object that each of the groups should be illustrated by carefully selected specimens, and until this could be attained, other acquisitions need not be sought for. In making purchases, such an object steadily kept in view exercises a powerful influence against the seductive attractions of "great bargains," which often turn out to be great misfortunes to a Museum. Moreover, in accepting donations, it is sometimes convenient to be able to refer to a fixed plan. Where room is scanty, as in most Museums, nothing is more subversive of order, or more fatal to an instructive arrangement, than the gift of a collection, coupled with a stipulation that it must be displayed in some special way. It is far better to forego the possession even of a valuable series of specimens, than to sacrifice order for their sake.

The number of groups, 216, will, no doubt, appear to have been determined simply as a matter of convenience. To a certain extent this is true. After a careful reference to the best available authorities on each of the Invertebrate classes, in which much assistance was afforded me by the many valuable scientific works in the Free Public Library of Liverpool, and by the catalogues of the collections in the British Museum, it seemed probable that most of the prominent forms in all the classes might be exhibited in pairs, with their names attached in very legible type, in an area less than a thousand square feet; and that they might appropriately be disposed in 240 groups, occupying twenty table-cases. For these, the suite of five rooms above referred to would have been sufficient, but two large circular stoves occupied the room of two table-cases, and the groups had to be reduced to 216 in number, instead of 240, as in the original design.

For constant exhibition to the public, the series may perhaps be regarded as quite sufficiently extensive. Four table-cases contain the Protozoa and the Cœlenterata. Seven are given to the Molluscoida and Mollusca, in which department the collection includes representatives of about eleven hundred out of the thirteen hundred genera and sub-genera adopted by Messrs. H. and A. Adams in their work on "The Genera of recent Mollusca." Three cases are occupied by Echinodermata, Annelida, and Crustacea. This is by no means in proportion to the other parts of the series, and here it is that the want of the two absent table-cases is most felt. Four cases hold the Arachnida, Myriapoda, and Insecta, in which all the orders are fairly illustrated, except Strepsiptera. Stylops has not yet arrived—perhaps this may meet the eye of some friend who, for love, money, or specimens, may be willing to supply the deficiency.

It is hardly necessary for me to point out the difficulties and disadvantages which must attend an attempt to form a collection in which the whole of the Invertebrate classes are divided into a given number of equal groups. If all very distinct forms are to be exhibited, some groups must be heterogeneous in composition, but not necessarily very many. Such forms as Pycnogonum, Forficula, Siphonaria, Sagitta, Cydippe, &c., may have to appear as interlopers; but the printed tablet may explain the irregularity of their position, and render the disadvantage simply a

negative one,—in such cases the plan cannot afford much help to the memory. On the other hand, the tray or drawer containing an entire group can, with the utmost facility, be moved, to be re-arranged, to illustrate a lecture, or to occupy a different position in the series.

In the present unsatisfactory condition of "classification," probably the only thoroughly scientific mode of conveying information respecting an assemblage of organic forms, is that adopted by Professor Huxley, Professor Rolleston, and others, of describing completely a single included species; but this method seems more suited for students than for a mixed company, such as have visited our institution since October 1861, during which period the admissions to the Liverpool Museum have exceeded four millions one hundred and sixty-two thousands. The mode of arrangement adopted within the groups will be described in a subsequent notice.

HENRY H. HIGGINS

UTILISATION OF SEWAGE

A Digest of Facts relating to the Treatment and Utilisation of Sewage. By W. H. Corfield, M.A., M.B. Oxon, Professor of Hygiene and Public Health at University College, London. Prepared for the Committee of the British Association. (London: Macmillan & Co. 1870.)

DR. CORFIELD, now the Professor of Hygiene and Public Health in University College, London, after having been a most distinguished student in the old University of Oxford, has put before the world in a well and large printed volume of something less than 300 pages, a clear, readable, and reliable *résumé* of the "Great Sewage Question." The labour which has been thus expended in lightening the labours of others can be adequately judged of by but few persons; but amongst those few may perhaps be reckoned individuals who, like the writer of this review, have for their sins or through their foolishness, been entrapped into serving on the drainage committees of Local Boards, and have felt themselves compelled, in the way of expiation, to purchase, if not to peruse, the hydra, or rather the medusa-brood of blue books which parliamentary commissions and privy council offices are so constantly giving off. Had Professor Corfield always given chapter and verse, page and paragraph, for his citations from the vast number of volumes to which we allude and he has referred, he would have put his claim to credit on the score of painstaking laboriousness more prominently before the eyes of his readers, though he might not thereby have made the reading of his work much the easier for them. As it stands, his book is eminently easy of comprehension, and we will, without further preface, say a few words as to the general outlines of the ground he professes to cover in it.

The first 103 of the 282 pages of which the book consists, are taken up by an account, which is partly archæological, and partly, we regret to say, as yet not so, of certain systems for dealing with refuse which all alike labour under an amenability to an objection which our author, like ourselves, would appear to judge to be fatal to them. This objection he thus states (pp. 59, 60)—"The question, in fact, to be solved would appear to be with all the methods which require hand and cart labour: how can the refuse matters be kept as long as possible without being positively dangerous to health? instead of, as it should be, how can they be got rid of as fast as possible? This consideration at once stamps all methods of removal by scavenging, and must of itself bind them to a false principle, and lead to their condemnation." They are rightly, we would suggest, called systems of Conservancy, professing, as they do, to *keep* something awhile, which it would be better to lose at once. This portion of the professor's book is closed with a quotation from the "First Report of the Rivers' Pollution Commissioners" relating to one of those methods which at the present moment would appear to enjoy a considerable popularity; and this quotation we will follow his example in reproducing, observing by the way that to the words "First Report of the Rivers' Pollution Commissioners," there should have been added the words, "appointed in 1868, published in 1870, p. 50," to save readers the trouble of referring to another Blue Book put out by another set of Commissioners appointed in 1865. The quotation is to the following effect:—"Add to those circumstances the enormous aggravation of all the difficulties of the plan, when not 50 but 5000 households have to be provided with the necessary appliances, and are induced to work them properly, and we can have no hesitation in pronouncing the dry earth system, if superior for institutions, villages, and camps, where personal or official regulations can be enforced, entirely unfitted to the circumstances of large towns."

With his fifth chapter, p. 104, Dr. Corfield begins the history of the particular sanitary apparatus which is known on the continent as the "*Cabinet Anglais*," and with the various modifications, applications, and bearings, agricultural and hygienic, of the means for the water carriage of refuse, the rest of the book is filled up. Prof. Corfield is something of a physicist and of a chemist, and, thirdly, of a biologist; and it is to be expected, and will be found, that he is not ignorant, firstly, that water-carriage is the cheapest of all modes of carriage; secondly, that ammoniacal gas is dissolved in, and most tenaciously held fast by when dissolved in, one-thousandth of its own volume of water; and that, thirdly, this same chemical element, "the valuable constituent of sewage *par excellence*," can, when thus carried to land bearing crops, be taken up by them and used by them in their synthesis of albuminates for us animals. The obvious corollary of these rudimentary truths is the acceptance of the principle of the disposal of sewage by irrigation, to the rejection, except under exceptional conditions, of all others; and this corollary our author thus states for us (p. 176), "All other systems than that of removal by water go upon the principle that it is not dangerous to leave excretal matters, either in a crude state (pail closets) or mixed with some absorbing or deodorising material (various other forms of closet) for a certain time in or about houses. The fundamental principle being obviously a wrong one, it is not to be wondered at that such systems continually fail. . . . The water carriage system, on the contrary, sends all the refuse matters at once to a distance in the cheapest manner possible by the mere action of gravity. . . . Figures are stubborn things to deal with, and the sanitary