

the castings of worms, and this would account for the absence of malarial fevers.

The worms sent home by Mr. Millson have been submitted to Mr. F. E. Beddard, who reports that they belong to a probably new species of the genus *Siphonogaster*.

We trust that Mr. Millson will continue to send home further accounts of his valuable observations, and that the example he has set will be followed by others stationed in our colonies. S. N. C.

#### MUSEUMS FOR PUBLIC SCHOOLS.

ALL teachers, I have no doubt, have experienced the refreshing interest that boys and girls take in objects of natural history. And not in natural history merely, for whenever the lesson, no matter what it is about, admits of being illustrated by specimens, then the presence of these specimens gives a point to the description and produces an effect that otherwise would be wanting. Take your young audience in imagination into the country or to the seaside, and show the nest and bird, insect, plant, seaweed, or crab you are describing, and you know you can sustain their attention throughout. It is equally certain, too, that, in describing the characteristics of any particular place, it is desirable to be able to indicate by something more than the bare statement what is meant by "solan-geese and other sea-fowl," and such expressions. How vague often are the ideas produced by the words ruby, marble, granite, isinglass, and other "articles of produce," even though well described, when the actual article itself is bound to implant the nature of the object in the pupil's mind, and the description at the same time. How much could be taught in a very agreeable way, moreover, with a series of specimens exhibiting the manufacture of certain important fabrics from the raw material, and especially those that are made in the immediate district of the school.

It will be generally admitted, I think, that schools should be provided with the means of giving such instruction: the difficulty is, how can it be done? Suggestions have been made on several occasions that the specimens in our public museums should be made available for the purpose. Dr. James Colville, in a paper on "Public Museums as Aids in Teaching,"<sup>1</sup> has pointed out that he is allowed to draw upon the Glasgow Museum for specimens. In Liverpool, alone, however, as far as I know, is the circulation of museum objects carried out in a satisfactory and systematic manner. A good account of the method is given in a pamphlet on a "Proposed Circulating Museum for Schools and other Educational Purposes," by the Rev. Henry H. Higgins, published in 1884; and in the Report which was issued by Mr. Thomas J. Moore, the Curator, later in the same year. The Museum distributes a series of boxes of specimens, and these are removed from school to school at stated intervals.

In many districts, however, and especially where the public Museum is more or less remote, the system so generously inaugurated by the Liverpool Museum will not be found available. In some of our large provincial towns, indeed, where there is a Museum, such a scheme could not be carried out without a great extension of the work of the Museum, for which there is at present no provision. Where this is so, and alas, it is quite general, an attempt is made in many of our schools to gather together what must necessarily be a desultory and very limited collection. I am afraid that few schools, indeed, can show such a typical series of natural history specimens as that sketched by Prof. Flower in NATURE (vol. xli. p. 177).

Here, then, is a good work for the secondary schools which are now and again springing up all over the

<sup>1</sup> Read before the Philosophical Society of Glasgow in 1888.

country. In each of these academies and high schools there is a science department, which, besides its chemical apparatus and the like, can boast, no doubt, of a number of objects gathered at random. And though these may be far more numerous than the specimens to be seen in the ordinary school in the next street, still, how far is the collection from being systematic and typical! The specimens are usually kept, moreover, in drawers, and at any rate with little attempt to display, arrange, or name them. But were the facilities for gathering specimens increased; were a room set apart and furnished with cases for their reception; were, in fact, the secondary school encouraged to get together a double series of objects—one for circulation in the surrounding district, and one for its own use—the benefits now being enjoyed in Liverpool might be extended to other towns without waiting for the public Museum to take the matter up. For each town, in this way, one or two reasonably typical collections, including actual specimens, models, and diagrams, would be provided; and the amount expended at present in individual endeavours would go far towards having this done with considerable completeness.

A good outline of what should be aimed at in such a museum is given in the article by Prof. W. H. Flower, cited above. He has also contributed a series of papers on "Methods," which will be found of the utmost service (NATURE, vol. xv. pp. 144, 184, 204); and it will be seen from these latter that it is quite possible to prepare a great portion of the museum in the school. Still, no better model could be copied than that provided at Liverpool, both as regards the choice of the specimens, and the method of circulating them. The pamphlets referred to above contain information on both points. I should only take the opportunity of recommending that which I have incidentally mentioned in the opening sentences, viz. the addition of important articles of commerce and manufacture.

With such a museum at the disposal of our schools, and provision made for its growth, and the display of a duplicate series of specimens in the secondary school itself, the results of our teaching would be far more real and lasting, and we might now and then touch a sympathetic chord, and awaken an interest having a life-long influence.

ALEXR. MEEK.

University College, Dundee.

#### JAMES CROLL, F.R.S.

BY the death of this well-known writer geological literature loses one of its most voluminous and able contributors. Though not in the proper sense of the word a geologist, he had made himself well acquainted with many geological problems, and first attracted notice more than five-and-twenty years ago by the brilliance and suggestiveness of his attempts to solve them. He was born in 1821 at Little Whitefield, in Perthshire, and after the usual brief schooling of a peasant's son he was apprenticed as a millwright in his native village. The employment allowed him leisure for reading, and he devoted himself with ardour to the study of philosophy and of physical science. At the age of twenty-four, however, the effects of an accident which he had met with in boyhood compelled him to seek a less laborious vocation, and eventually he became agent for an insurance company. These early years gave but little promise of the particular bent of his genius by which he would attain distinction. Eventually his general acquirements and the zeal with which he was known to devote his spare time to philosophical reading attracted the interest of the governing body of the Andersonian University and Museum in Glasgow, and in 1859 he was appointed keeper at that establishment. He had already found his way into print by publishing anonymously a

volume on the "Philosophy of Theism." But his new position in an institution devoted largely to the teaching of science led him to throw himself more fully into the study of physics. In 1861 he published, in the *Philosophical Magazine*, his first contribution to scientific literature—a paper on an electrical experiment of Ampère's.

About that time the Geological Society of Glasgow was founded, and became the centre of an active company of geologists who specially took up the study of the traces of the Glacial period, so striking and abundant in the west of Scotland. Croll was drawn into the prevalent enthusiasm, and soon with characteristic ardour and acumen began an investigation of some of the physical difficulties which had arisen in the course of geological inquiry. In 1864 he published his remarkable essay, "On the Physical Cause of the Change of Climate during the Glacial Epoch." This paper speedily attracted the notice of men of science. In it the author endeavoured to find a true cause for the extension of snow and ice during the Ice Age far beyond their present limits. For this purpose he invoked the aid of astronomical and terrestrial physics, and he provided an explanation which captivated geologists by its simplicity as well as by the wide range of phenomena which it helped to elucidate.

It was this paper which laid the foundation of his scientific reputation. It was likewise the means of opening up for him a new and more congenial employment, for it led to his being selected by the present Director-General of the Geological Survey to take charge of the maps and correspondence of the Survey in Edinburgh. He was appointed to this office in 1867, and found himself able to prosecute with more vigour than ever the researches in physical geology which had now so great a charm for him. The question of the origin of climate led him into a far wider field of investigation than he had at first contemplated. It brought him face to face with many theoretical problems which geologists had been unable to solve. These he attacked with characteristic energy. He enforced his arguments with a single eye to the discovery and establishment of truth, and exposed without reserve views which seemed to him erroneous. With no intention of rousing controversy, he soon found himself in collision with other writers who disputed his arguments. One of the most interesting and vigorous of these disputations was with the late Dr. W. B. Carpenter, regarding the theory of Oceanic Circulation. Croll maintained with great force and with general approbation the position for which he contended, that the prime motors in the circulation of the ocean were the winds. After publishing many papers on this and cognate subjects, he collected, condensed, and partly re-wrote these, adding fresh materials to them, and issuing the whole as his well-known work on "Climate and Time in their Geological Relations," which appeared in 1875. Though much division of opinion was aroused as to the real value of some of his views in relation to the establishment of sound geological theory, there was a general recognition of the originality and acuteness of his mode of dealing with accepted facts and principles, and of the value of his writings as stimulating and directing inquiry. He was accordingly elected a Fellow of the Royal Society in 1876, and the University of St. Andrews conferred on him the degree of LL.D.

By degrees, however, Dr. Croll's health began to fail. He suffered so intensely from pains in the head that he was compelled, in 1881, to resign his appointment in the Geological Survey, and retire on the miserably small pension to which, by the rigid rules of the Civil Service, his length of service only entitled him. By exercising the greatest care he was still able at intervals to resume his studies in geological physics, and to publish occasional papers, partly in reply to his critics, who were now increasing in number and pertinacity. In 1885 he published a smaller volume embracing some of these

papers, and much new material under the title of "Discussions in Climate and Cosmology."

Dr. Croll's investigations into the geological history of terrestrial climate had led him to consider the question of the origin of the sun's heat, and thence to reflect on the probable condition and development of nebulae and stars. The later chapters of the volume just mentioned were devoted to these subjects, which he would fain have discussed more at length, had not the increasing failure of his bodily powers warned him that, if he wished still to return to that philosophy which was his first love, he must husband his remaining strength. Nevertheless, the attraction of these astronomical problems proved insuperable. He continued to work at them, gradually enlarging the scope of the investigation until it embraced not the earth and the sun merely, but the origin and development of the whole material universe. At last he followed his usual method, gathered together his various contributions to the subject, trimmed, enlarged, and modified them, and published them in a separate volume, entitled "Stellar Evolution and its Relation to Geological Time."

The publication of that work marks the close of his labours in more definitely scientific inquiry. He was now free, with such remaining strength as he could command, to re-enter the field of philosophical speculation in which he had spent his earliest years of mental exertion, and which for nearly thirty years, through all the engrossing attractions of geological inquiry, had never lost its fascination for him. Accordingly he betook himself once more to the study of such subjects as Force, Matter, Causation, Determinism, Evolution, and proceeded to apply the facts and principles with which he had in the interval been dealing so actively to the problems in philosophy that had aroused his thoughts in the early years of his life. In spite of his increasing infirmity, he persevered in committing to writing the ideas which he had now matured, and this year he sent to press his last work, published only a few weeks ago, "The Philosophical Basis of Evolution."

Of all recent writers who have contributed so much to current scientific literature, probably no one was personally so little known as Dr. Croll. His retiring nature kept him for the most part in the privacy of his own home. But he endeared himself to those who were privileged with his friendship by his gentleness and courtesy, his readiness to help, and the quiet enthusiasm with which he would talk about the topics which absorbed his thoughts. After quitting the Geological Survey of Scotland he tried residence at different places in hopes of finding one where his failing bodily health would least impede the powers of his mind, which he retained with singular freshness up to the close. He settled at last in the town of Perth, where he spent the few remaining years of his life. Struggling on in spite of several ominous warnings, he finished his last book just before the final stroke which carried him off on Monday, the 15th inst.

A. G.

#### NOTES.

THE President of the Board of Trade has appointed a Committee, to consider whether any, and if so what, steps should be taken for the provision of electrical standards. The following are the members of the Committee:—Lord Rayleigh and Sir William Thomson (representing the Royal Society), Prof. G. Carey Foster and Mr. R. T. Glazebrook (representing the British Association for the Advancement of Science), Dr. John Hopkinson and Prof. W. E. Ayrton (representing the Institution of Electrical Engineers), Mr. E. Graves and Mr. W. H. Preece (representing the General Post Office), Mr. Courtenay Boyie and Major P. Cardew, R.E. (representing the Board of Trade).