

SCIENCE.

SCIENTIFIC GOSSIP.

Dr. Darwin is one of the most industrious of laborers in the fields of research, he having produced two new books in the present year—one on the movements of plants, and one on the formation of vegetable mould through the action of worms. On both subjects much had already been made known through the publication of scattered papers by various observers—the author himself having been the most assiduous and the most communicative. Like all works from his pen, the two new volumes are exhaustive of the subjects of which they treat, embodying not only his own observations, but all obtainable information, due credit being always given to previous or contemporary authors. Like all successful investigators, Dr. Darwin evinces a considerable amount of enthusiasm for the task he has at any particular moment in hand, and this gives rise to a tendency to exaggerate its importance—a fault which is not to be regretted, but which the critical reader should keep in view. The worm may be the chief mould-maker in a moist climate and in favorable situations; but in taking an extended view of the operations of nature throughout the world, there can be little doubt that the growth and decay of vegetation by atmospheric influences alone is the greatest factor in the production of the soil. The worm is nevertheless a very efficient agent in the same work. By weighing their casts for twelve months within a certain area, it has been found that, if scattered over the whole surface, they add as much as one-fifth of an inch to the top soil of pasture land, or an inch every five years. Proofs are detailed in support of this generalisation, one remarkable instance having come under the author's own observation. A field adjoining his house was first ploughed in 1841, after which it was found to be covered with flints of all sorts, from the size of a child's head downward. Thirty years afterwards these flints were found to be buried in the mould, not one of them being visible, and on digging it was ascertained that the soil which had been deposited on the surface must have been supplied at the rate of 83 thousandths of an inch per annum, the rate having no doubt been much slower at first, and afterwards considerably quicker. The process by which the stones are buried appears to be duplex—the worms undermining them, and depositing their casts alongside till the crown of the stone is level with the sward, after which they are covered over. Dr. Darwin has no doubt that the change in his own field was certainly brought about by the worms; but some of the credit should surely be given to the growth and decay of vegetation, to the droppings of the animals in the pasture, and possibly to the deposit of dust carried about by the wind. The leaves and stalks of plants transmit a certain portion of the soil from the

the wind. The leaves and stalks of plants transmit a certain portion of the soil from the roots into the air, and then let it fall in various ways. In the estimation of a slow continuous process it is not safe to overlook the most insignificant factor. That the worm does a great deal of the work is certain, and indeed it has been found that the estimated weight of worm castings thrown up in one year amounted to upwards of 18 tons per acre. It appears to me, however, that there is in all such calculations one source of fallacy which has been overlooked. The worm works the same ground over and over again, its operations being confined to a few inches from the surface. It turns over the soil without making any actual addition to it. The instances given of the remains of Roman houses buried, 20, 30 or 40 inches below the surface cannot, for this reason, be safely attributed to the action of worms. It is easy to understand how stones may be sunk a few inches by them; but they cannot go on with the work of undermining indefinitely, and any further accretion of surface soil must be due to its being carried there by other agencies. The action of vegetation is limited in like manner, but it penetrates to greater depths, and plants derive some of their nutriment from the atmosphere as well as from the solids dissolved in water, and brought from a considerable distance. Dr. Darwin and his sons have made measurements which show that in the course of two or three centuries large blocks of stone, such as one which was found to be between 6 and 7 feet long, 3 wide, and 15 inches deep, may become completely buried. This is surely proving too much. Worms cannot remove soil from below the centre of such a mass of stone, even when it lies on the surface, and they cannot bury it unless the materials are brought to them by other agencies.

A much better case is made out in favor of the worm as playing an important part in the work of denudation. When its casts are carried away by floods and other agencies it may go on bringing fresh soil to the surface for an indefinite period or distance. It may remove earth from below the edges of a large stone till the mass topples over and finds a lower level. But here also it has competition in the vegetable world, and all undermining creatures help in the work. The mole, the rabbit and the wombat lend their aid in dry earth, while the crayfish and the platypus work assiduously in submerged banks and dams. To isolate the work done by the worm is a difficult matter, and it may easily be exaggerated.

Dr. Darwin is quite at home in his description of worms and their habits. They have neither eyes nor ears, but their digestive organs are highly developed, a gizzard, or something similar, being a chief member of the series. They are semi-aquatic, for they can

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live nearly four months submerged in water, while dry air speedily kills them. They lie near the surface of their holes, so that birds can easily draw them out. Their chief instinct appears to be in keeping themselves warm and comfortable, as they line their holes with leaves, and sometimes plug up the orifice with the same material. Although without vision, they are sensible of the action of light, and although deaf to vibrations of air they are particularly acute in detecting those produced by sound transmitted through solids. They appear to have a sense of smell so far as it is useful in guiding them in the search for food, but it is difficult to discriminate between this and taste. Their sense of touch is very delicate, and all their other perceptions may be modifications of this. They have great powers of suction with their mouths, and with one moiety of their bodies in their holes they have great strength, so that they can gather stones ~~of various sizes and shapes, and use them as a substitute for teeth.~~ They manifest a slight degree of intelligence in dragging leaves into their holes, laying hold of that point which offers least resistance to the work of dragging them in. This instinct was manifested even when variously shaped pieces of paper were substituted for the leaves. Without any defined brain they have cerebral ganglia which serve the purpose very well. They are omnivorous, but have a preference for onions and celery, and swallow small stones and pellets of earth wherewith to triturate their food in their gizzards. Although usually found within a few inches of the surface, they are sometimes dug up from much greater depths, but it can hardly be supposed that they carry on their soil-making work when so buried. Their operations are almost exclusively beneficial, the damage done by them to seeds and roots being inappreciable. They do not become extensively acclimatised in dry climates, where they can only live in sheltered damp situations. This new book of Dr. Darwin's is one of the few written by him which have no very obvious or direct bearing on the theory of evolution, and yet he does not seem to be out of his ground in dealing with its subject, which is by no means new to him, he having read a paper on it in the year 1837 before the Geological Society.