Worms. By CHARLES DARWIN. (Murray.)

To the kindness of its author I am indebted for an early copy of the latest, but I hope not the last, of the works from the pen of Charles Darwin. "Vegetable mould and earthworms" shows the most notable characteristics of our greatest naturalist as clearly as, perhaps more clearly than, any of its predecessors. The recognition of the great work done by the continued recurrence through long periods of time of causes themselves of the slightest, the patience and persistence in observation and experiment, the acuteness with which the large generalisations are made, are all here as of old.

The introduction deals mainly with "vegetable mould," and states the conclusion based upon the observations recorded further on in the book, that all the mould in which the roots of our flowers are fixed and find food has passed, not once but many times, through the intestinal canals of worms. For these animals on the whole obtain their food by taking earth into their interiors, and as this passes through them absorbing the nutrient matter it contains.

An account of the structure and functions of worms follow. In this, on page 19, occurs a passage that would possibly confuse to some extent the young comparative anatomist. "The circulatory system is well developed. Worms breathe by their skin, as they do not possess any special respiratory organs." Is it not rather the fact that the circulatory system in worms is very ill-developed, and that the only fluid that can be actually called blood is contained in no definite vessels, but in the general body cavity? The vessels that do occur in the worm contain a liquid of such nature that it is held to be not blood, but a respiratory fluid. Gegenbauer truly describes the vessels under the vascular system, but the following passage from Huxley's Invertebrata seems to show that we have here to do with a system of vessels containing a fluid that is not true blood, but that probably has air dissolved in it. "A colorless fluid containing colorless corpuscles, and answering to the blood of other invertebrated animals occupies the perivisceral cavity [general cavity of the body]: but in addition to this, there is a deep red fluid devoid of corpuscles, which fills a very largely developed system of pseudhæmal vessels." Next worms are proved to be capable of distinguishing between light and darkness, to be sensitive to alterations of temperature, to have feeble power of smell and of taste, but to be as deaf as the proverbial post. As to mental qualities, they are timid, their sexual passions are of sufficient strength "to overcome for a time their dread of light:" they have a trace perhaps of social feeling and they are clearly capable of attention. They show intelligence in their manner of plugging their burrows, seizing the part of the leaf in a majority of cases that enables them most easily to draw the leaf into the burrow. This demonstration of intelligence was rendered yet more incontestable by numerous experiments with paper triangles.

A number of statistics are then given as to the amount of earth brought to the surface by worms, as to the gradual sinking of great stones that lie on the surface of the ground, as to the number of worms living within a given space.

The study of Roman villas at Abinger, Chudworth and Brading, of a buried pavement at Beaulieu, of Roman towns at Silchester and Wroxeter shows that these indefatigable Annelids have been busy for centuries concealing beneath their castings ancient buildings whilst lesser remnants of antiquity as coins and vessels have been through their agency preserved for the archæologist of later times.

The fifth chapter deals in great minuteness of detail with the action of worms upon land so far as denudation is concerned. The geologists tell us that the general action of water upon land is to wear it down, to carry material from higher levels down to lower ones. A constant transference of matter from the upper regions towards the sea-level is effected by the fall of rain upon the mountains, the flow of springs and rivers seaward. Wind also does its work in denudation. And in this process of wearing down worms give no little aid. For the small stones and rock-particles that pass through their intestinal canals are slowly disintegrated in their passage, and where surfaces of land

are inclined the castings flow downwards and are washed downwards by rains. Even where the castings from the worms are not carried downwards as a whole, the particles of earth that they contain are by the rain washed out and carried away. Wind also blows the castings and the pellets into which they often break up to no small distances. In the seventh chapter, which like the sixth deals with this subject, on page 284, is there not a printer's error in calculation? The mean of 0° 45′, 1°, 3°, and 3° 30′ is 2° 3′ 45″, not 1° 49′.

To sum up: the results of Charles Darwin's latest contribution to scientific literature are as follows. Worms disintegrate, denudate, prepare, preserve. They disintegrate rocks. They denudate the land. They prepare the soil. They preserve ornaments and relics of antiquity. The rocky particles they swallow are worn down by the acids of the alimentary canal of the worms through which they pass. The castings, urged by rain and wind, are each so much earth-matter in course of transference from higher to lower levels. The earth that passes through the worms is finely divided, and forms an excellent mould for the growth of plants. Coins and their kindred, dropped upon the surface of the ground, are by degrees covered with earth through the agency of worms, and are thus preserved often through many centuries. To this new knowledge as to the importance of these apparently insignificant beings thus furnished to man let us add the further evidence to all readers of Charles Darwin's power of experimental research and of generalisation.

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