

The Action of Worms in the Formation of Favourable Mould.  
By CHARLES DARWIN, M.A., LL.D. Murray.

Most persons will be surprised to learn what Mr. Darwin teaches them in this volume, and proves by a series of careful and minute experiments, that earth-worms perform the most important functions in renewing the fertility of our soil, and therefore in supplying the food of man. These creatures are not very often seen, unless accidentally turned up in digging in a garden; but the soil itself to the depth of one or two feet literally swarms with them, and every one must know what disfigurement the 'worm-casts' make in a smooth lawn or grass-plot. These little mounds, which are of circular form, and about an inch high, are the excreta of the earth-worm, and consist of digested leaves and earth washed in from the boring of the holes. They are, therefore, manure applied to the roots of grass; and so abundant is the constant supply of watered food brought to the surface, that Mr. Darwin calculates, from data very carefully obtained, that from sixteen to eighteen tons of earth are annually spread over each acre. The little heaps are dissolved by rain, dried and blown away by the wind, dispersed by the feet of grazing animals, and very largely eaten with the grass by the animals themselves. By these means the virgin earth brought up by worms is again enriched by passing through a second series of animal stomachs. And it is probable that, in eating much earth serves to digest, and to neutralize the acids of the fallen leaves the worms largely consume, so earth in great quantities taken into the stomachs of grazing animals performs the same function for them, and assists in the digestion of the green fodder.

Mr. Darwin further shows that the worm exercises an intelligence which it is very difficult to explain in a lowly creature, and, moreover, is one totally hitherto. He has proved that the worms nearly always draw into their holes dead leaves with the stalks upward. Any one may notice that the worm-holes are generally-plugged with bits of sticks, leaves, even feathers or scraps of string, or with little stones or stones piled over them. This operation is performed by the worms at night, when they come out of their holes, either partially, or to move to another spot. It is thus that the 'early bird' of the proverb secures the worm; for though the creature is so timid and sensitive that it withdraws when it feels the tremor of a heavy foot, it is not conscious of the light tap of a stick or thimble on the watch to possess upon it.

The object of stopping up the holes appears to be twofold. First, the leaves are drawn down and gradually consumed—a process by which the greater part of the autumnal leaves is got rid of in a very short time; secondly, the hole is stopped to prevent the entrance of ants, beetles, or other noxious creatures. The holes, however, do not exclude air, which is thus conveyed to the roots of plants, and is a most important stimulus to their growth. The reason why the stringy stalk is left upward is because the tip of the leaf is first consumed, after being lubricated with saliva. The raising of soil, and the consequent burial, after many cen-

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bination of 'crimson velvet, pale blue, and salmon colour' as desirable, and goes on to speak in terms of appreciation of amber, orange, crimson and sage green velvet! It is quite clear that she has recently yielded herself too much to the idea of art as a thing for a class, with this result, that what she proposes presumes an amount of controlling good taste in arrangement which, we fear, will be very seldom found. She recommends a complete eclecticism, as it seems to us, without any really controlling principle; and, in fact, on most important points her book leaves us precisely where it found us. It grieves us that we are not able to give a more favourable report on this volume, which is evidently the result of much observation and labour; but Mrs. Haweis must lay down some more definite and simple principles, and write in a style more consonant with these, than, it seems to us, she has done in the present instance.

*A Handbook of English and Foreign Copyright.*

By SIDNEY JERROLD, of the Middle Temple, Barrister-at-law. Chatto and Windus.

The position of copyright has not advanced a whit toward a more satisfactory position, notwithstanding the great efforts that have recently been made for this end. The recommendations of the Copyright Commission of 1878—some of them so shrewd and practical, and some that seemed to many persons so much otherwise—were so far embodied, with other recommendations, in a bill which Irish obstruction or Irish agitation has unfortunately set aside. Things are therefore *statu quo*. Mr. Jerrold's book will thus have a fair chance of being useful before he needs entirely to modify it, for it has happened that when a bill has been thrown aside in this way, it has taken a considerable agitation to revive it and press it forward. In no sphere more than in the political one are the words applicable, 'sufficient to the day is the evil thereof.' Mr. Jerrold's handbook is valuable because he gives in the most succinct form a sketch of the laws of Copyright in America and the chief countries of Europe, as well as in this country. It is very astonishing in how many points the English law differs from the American one—a circumstance which causes Mr. Jerrold to say, with some slight accent of asperity, that some of them may be due to 'the unscientific character of English legislation.' 'In England,' Mr. Jerrold tells us, 'a book need not be registered in order to the vesting of copyright; but no action for infringement of copyright can be brought, before the proprietorship or the copyright of the book has been registered in the register-book of the Stationers' Company. Copyright rests on the first publication, and not on registration; but in the United States it dates back to the recording of the title of the book.' No person in the United States, again, can claim copyright unless he has sent a copy of the title before publication to the Librarian of Congress at Washington, and has forwarded two copies of the book ten days before publication.

It was proposed by the bill that has fallen

into abeyance to assimilate the English law to the American in this respect, making registration compulsory, and laying down 'that no one should be entitled to take out proceedings for infringement prior to registration.' The whole question is one surrounded by irregularities, doubts, difficulties, anomalies; and no greater service could be done to the country than some reduction of it to simplicity. Mr. Jerrold's book, in bringing out so clearly many of the defects, dubieties, and cross-purposes of the present law, is certain to have a good influence, and he deserves some recompense for his labours, which we hope he will receive.

*Freaks and Marvels of Plant Life; or, Curiosities of Vegetation.* By M. C. COOKE, M.A., LL.D. Society for Promoting Christian Knowledge.

This book of Dr. Cooke's is a delightful study in plant life—well-informed and informing, written in a style alike graceful and popular, and admirably illustrated. The earlier portion is devoted to the carnivorous plants—the Sundews, Venus's Fly-trap, Side-saddle, Pitcher plants, &c.; then follow chapters upon the 'Gyration of Plants,' upon Sunflowers, Sensitive Plants, and so on; and the second portion is devoted to the treatment of various characteristics of plant-life, Luminosity, Mimicry, and so on, and to some brief account of those plants which figure in the world of mysticism and in history. It is quite evident that Dr. Cooke has made himself acquainted with the latest botanical researches; and those to whom Mr. Darwin's works in this department, as well as those of Hooker, Balfour, and others, are practically inaccessible, will find themselves made possessors of much of their teaching under his guidance. It is due to the author also to say that his quiet and unobtrusive references to his belief in a Power behind all these fair forms of life give a special value to his work which only too few books of the kind possess.

*The Action of Worms in the Formation of Vegetable Mould.* By CHARLES DARWIN, M.A., LL.D. Murray.

Most persons will be surprised to learn what Mr. Darwin teaches them in this volume, and proves by a series of careful and minute experiments, that earth worms perform the most important functions in renewing the fertility of our soil, and therefore in supplying the food of men. These creatures are not very often seen, unless accidentally turned up in digging in a garden; but the undersoil to the depth of one or two feet literally swarms with them, and every one must know what disfigurement the 'worm-casts' make in a smooth lawn or grass-plot. These little mounds, which are of circular form, and about an inch high, are the *excreta* of the lob-worm, and consist of digested leaves and earth sucked in from the boring of the holes. They are, therefore, manure applied to the roots of grass; and so abundant is the constant supply of undersoil thus brought to

the surface, that Mr. Darwin calculates, from data very carefully obtained, that from sixteen to eighteen tons of earth are annually spread over each acre. The little heaps are dissolved by rain, dried and blown away by the wind, dispersed by the feet of grazing animals, and very largely eaten with the grass by the animals themselves. By these means the virgin earth brought up by worms is again enriched by passing through a second series of animal stomachs. And it is probable that, as eating much earth serves to digest, and to neutralize the acids of the fallen leaves the worms largely consume, so earth in great quantities taken into the stomachs of grazing animals performs the same function for them, and assists in the digestion of the green fodder.

Mr. Darwin further shows that the worm exercises an intelligence which it is very difficult to explain in a brainless creature, and, moreover, in one totally blind. He has proved that the worms nearly always draw into their holes dead leaves with the stalks uppermost. Any one may notice that the worm-holes are generally plugged with bits of stick, leaves, even feathers or scraps of string, or with little stones or cinders piled over them. This operation is performed by the worms at night, when they come out of their holes, either partially, or to move to another spot. It is thus that the 'early bird' of the proverb secures the worm; for though the creature is so timid and sensitive that it withdraws when it feels the tremor of a heavy foot, it is not conscious of the light hop of a thrush or blackbird on the watch to pounce upon it.

The object of stopping up the holes appears to be twofold. First, the leaves are drawn down and gradually consumed—a process by which the greater part of the autumnal leaves is got rid of in a very short time; secondly, the hole is stopped to prevent the entrance of ants, beetles, or other noxious creatures. The holes, however, do not exclude air, which is thus conveyed to the roots of plants, and is a most important stimulus to their growth. The reason why the stringy stalk is left uppermost is because the tip of the leaf is first consumed, after being lubricated with saliva. The raising of soil, and the consequent burial, after many centuries, of old ruins and foundations to the depth sometimes of many feet, is attributed by Mr. Darwin mainly to the action of worms. He finds that bits of bone or cinder spread as manure over pasture lands are always met with an inch or two below the surface in the course of a very few years. All these facts show that small but continuous action produces results of the greatest importance in the economy of nature. In fact, it is becoming almost doubtful if our food supplies would not fail us if there were no such creatures as lob-worms.

The best way to observe the habits of earth-worms, since their operations are performed at night and under the earth, is to keep two or three of them in a large flower-pot of garden mould, which must be occasionally

watered. By strewing on the surface various seeds, leaves, bits of bread, meat, &c., we can find how they are drawn in and consumed. The seeds generally germinate, and probably the rootlets serve as food; for a plant will often wither in a pot which accidentally contains a worm. By bringing a candle suddenly at night one may often find them partly exposed on the surface. But it is very extraordinary, and Mr. Darwin is unable satisfactorily to explain it, that, though the creature is totally blind, it certainly is in some way susceptible to light, for it will very often withdraw when the candle shines on the pot.

Worms digest their food by a gizzard, which contains little pebbles. They are very greedy creatures, and if we consider the unhealthiness of decaying leaves left long on the surface, we shall feel grateful to the industrious but unseen scavengers which get rid of them so rapidly and so effectually.

*Volcanoes; what They are, and what They teach.*

By JOHN W. JUDD, F.R.S. Kegan Paul and Co.

*The Brain and its Functions.* By J. LUYK. Same Publishers.

These form respectively the thirty-fifth and thirty-seventh volumes of the International Scientific Series. Professor Judd's work, alike from its subject, the manner of its treatment, and the excellence of its illustrations, ought to be one of the most popular of the series; and it will probably be read by many to whom science as a rule is a somewhat irksome study. Indeed there are few for whom the full description of particular volcanoes here given will not have an interest. Professor Judd's central position is that a volcano is 'a kind of great natural steam-engine,' and the volume is substantially an observation of this steam-engine at work. Stromboli, Vesuvius, the Kammerbühl, &c., are closely examined for evidences of its operation. More important, however, in some respects, than these observations, is the bearing which they have upon the natural system of which volcanoes form a part; and the author devotes an able chapter to this point, showing how volcanoes act as compensating influences to what we may call Nature's 'tear and wear.' Denuding influences are ever at work, and were these left unchecked in their operation the earth would soon be effaced; but here volcanic action in its varying forms comes in, and, as Professor Judd beautifully shows, these natural agents, which are generally regarded as calamitous in their destructiveness, are really means of restoration and reconstruction. We are sorry that space allows us only to give the reader a whetted appetite for what he will find to be delightful and nourishing intellectual fare.

The subject of 'The Brain' is not a new one in this series. Already we have had Dr. Maudsley's 'Responsibility in Mental Disease'—a work which has claimed and received wide attention; and we have also had more recently Dr. Bastian's remarkably able work on 'The Brain as an Organ of Mind.' The