has partly succeeded and partly failed. But fresh hands have taken up the work and it will not be abandoned. Nor is his removal to this country in any wise a desertion of the cause. He wishes merely to transfer his labor to a new field, working in the same spirit as before among his Scandinavian countrymen in the Northwest. These number, at present, counting their immediate descendants, over two thousand; and they are largely indebted to the liberalizing influence of just such a man as Mr. Janson, having been too long shut off from intellectual contact with the Nineteenth Century by their 'evangelical' Norse Lutheran Synod. It speaks very poorly, in fact, for the culture and the intellectual status of the Norwegians that they have allowed themselves to be ruled so long by a corporation which would find its proper place in a museum of antiquarian remains. It is the soul-paralyzing tyranny of this body of clergymen that Janson is endeavoring to break, apparently with encouraging success. He is an eloquent and forcible speaker, and has a great future before him in the field which he has chosen.

NEW YORK, Jan. 10, 1882.

H. H. BOYESEN.

To the Editors of the Critic:

On Sunday last I read in the Tribune a clipping from the London Echo, in which six clever fables are quoted from a new book and ascribed to Mr. Bret Harte. In a card in Monday's Tribune Mr. G. T. Lanigan claims for himself the authorship of these fables, and accuses Harte of theft and piracy. I have no doubt that six of the five fables given to Mr. Lanigan, 'four have been stolen verbatim et literatum from my volumes, "Out of the World," published five years ago.' In the first place, six fables instead of five are given in the Tribune; and, unless I am mistaken, there was but one volume of "Out of the World." In Mr. Lanigan's book, which is dated 1878, I find the six fables, but they have not been reproduced 'verbatim et literatum.' I also find in the 'Erie & Bravo' of Sunday's Journal, for May 25, 1875, the fable of 'The Wolf and the Lamb,' and some others which are not in Mr. Lanigan's book, with this introduction: 'The Chicago Hospital Banquet, published during the Homeopathic fair in the Phoenix city, essentially Harte. What do we readers have to do with it? Seeing "The Improved Esop, for Intelligent Modern Children." By Bret Harte.' Here, it will be observed, is a difference of two years in Mr. Harte's favor for which Mr. Lanigan should account.

NEW YORK, Jan. 11, 1882.

F. F. W.

Science

Worms as Earthmakers.*

The common earthworm comes within the cognizance of the ordinary observer chiefly as a useful bait to be impaled on a hook and thus used for attracting fish for the sport of the angler. The juvenile representatives of the brotherhood of the rod have generally learned to take Harte of its working habits. Some of their victims being aggregations of little pellets of earth here and there; and knowing ones are wont to cautiously explore localities so indicated with lantern at night or in the early morning, and then find the worms partly or entirely outside their holes. Few of the many who have learned this much of the animal in question have ever thought of the important functions in the economy of nature performed by the humble being. Even as far back as 1837, however, Mr. Darwin had appreciated the role that it plays and communicated to the Geological Society of London a special memoir 'On the Formation of Mould by Worms.' Considerable scepticism was evoked respecting his conclusions, so insignificant did the meas appear to the end, but the author has now supplemented his numerous works by a special monograph on the subject, and has fortified and augured in many studies and conclusions. As he says, some observers find that objects of all kinds left on the surface of pasturage land after a time disappear, or, as they say, work themselves downward. This disappearance is of course due to no automatic process of the objects sinking down, but really to the cumulative effect of worm castings. The doubt that such a statement may excite will be dissipated by a knowledge of what a worm can do in a given period, and the multiplication of that amount by number and time.

Hensen, in experiments made on worms in confinement and fed on leaves, found that they ejected about eight grains of earth


a day; but, according to Darwin, 'a very much larger amount must be ejected by worms in this state, at the periods when they consume earth as food instead of leaves, and when they are making deep burrows.' In corroborative of this opinion, Darwin has tabulated the results of numerous observations on the 'weight of the castings accumulated at the mouth of a worm.' Before weighing the castings were dried (excepting in one specified instance) by exposure during many days to the sun or before a hot fire. These castings for each hole generally exceeded an ounce in weight after being dried, and sometimes nearly equalled a quarter of a pound. On the Ngori4 mosquito plains, in one case, the castings amounted to 64 lbs. The largest castings in England were found on extremely poor pasture land; and these are generally larger than those on land producing a rich vegetation. It would appear that worms have to work a great deal on poor than on rich land, in order to obtain sufficient nutriment. (P. 162.) In another place we are told that Hensen found that 'there must exist 133,000 living worms in a hectare of land, or 537,679 in an acre. This latter number of worms would weigh 358 pounds, taking Hensen's standard of the weight of a single worm, namely, one gram. It should, however, be noted, says Mr. Darwin, 'that this calculation is founded on the numbers found in a garden, and Hensen believes that worms are twice as numerous in gardens as in corn fields.' On the other hand recent observations demonstrate that worms may occur in even much greater numbers than were found by Hensen.

A little calculation will convince the most sceptical that worms with the habits thus indicated and in the numbers known to occur must in time produce great effects. Mr. Darwin has been observing his worms for half a month, and has measured 194.345 cubic inches of soil, and the section showed a layer of turf forming the matter of the grasses, 3-inch in thickness, beneath which, at a depth of 24 inches (or 3 inches from the surface), a layer of the lime in powder or in small lumps could be distinctly seen running all round the vertical sides of the holes. (P. 169.)

The chalk was laid on the land for the sake of observing at some future period to what depth it would become buried. At the end of November 1871—that is, after an interval of 29 years—a trench was cut across this which showed that the chalk was completely covered by the turf. The mould, therefore (exclusive of the turf), had been thrown up at an average rate of .22 inch per year. (P. 169.) In view of such operations we can readily account for the burials of ancient villages and towns, and a number of cases of this kind are cited in a special chapter on the part which worms have played in the burial of ancient buildings. The subsidence of pavements, the burial of Roman villas at Abinger, Cheshord, Bradford, and elsewhere, the entombment of the Roman towns of Silchester, Wroxeter, etc., are shown to be mainly due to the action of worms. We can readily comprehend, therefore, how it is that the more ancient cities which once flourished in Asia and the older seats of civilization have been covered to such a depth as to have been entirely concealed, even without taking into consideration the accumulation of dust.

But we have already lingered too long over Mr. Darwin's interesting and suggestive treatise. For information on the habits of worms and the other effects which they produce in the configuration of the surface of the earth, as well as for much other incidental information, we must refer to the volume itself. That it is well written and well worth reading Darwin's name implies.

Scientific Notes.

* A Small Telescope, and What to See With It, is the title of an article by Prof. Simon Newcomb, which will appear in the March number of Harper's Magazine.

Messrs. Macmillan & Co. announce Fifty Years of Science, being the presidential address delivered by Sir John Lubbock at the semi-centennial meeting of the British Association, in 1881.