

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, about 600,000; and they are sorely in need of 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.

Modern Æsops.

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 Mr. Harte of 'literary piracy.' 'Of the five fables given,' says Mr. Lanigan, 'four have been stolen *verbatim et literatim* 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 literatim*.' I also find in the 'Bric-à-Brac' of *Scribner's Monthly*, for May, 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 Bazaar*, published during the Homeopathic fair in the Phoenix city, contained the following, which many of our readers may have missed seeing: "The Improved Æsop, 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 earth-worm 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 recognize the whereabouts of their victim by conglomerations 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 there find the worms partly or entirely outside their holes. Few of the many who have learned thus 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 rôle 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 means appear to the end, but the author has now supplemented his numerous works by a special monograph on the subject, and has fortified and amplified his early studies and conclusions. As Darwin says, some observant farmers are aware that objects of all kinds left on the surface of pasture 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 worms' castings. The doubt 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

* The Formation of Vegetable Mould, Through the Action of Worms; with Observations on their Habits. By Charles Darwin. With illustrations. \$1.50. New York: D. Appleton & Co.

a day; but, according to Darwin, 'a very much larger amount must be ejected by worms in their natural state, at the periods when they consume earth as food instead of leaves, and when they are making deep burrows.' In corroboration of this opinion, Darwin has tabulated the results of numerous observations on the 'weight of the castings accumulated at the mouth of a single burrow.' 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 Nilgiri mountains one casting even exceeded this latter weight. 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 swallow a greater amount of earth 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 53,767 in an acre. This latter number of worms would weigh 356 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 their habits and doings for many years. 'Near Maer Hall in Staffordshire, quick-lime had been spread, about the year 1827, thickly over a field of good pasture-land which had not since been ploughed. Some square holes were dug in this field in the beginning of October 1837; and the sections showed a layer of turf formed by the matted roots of the grasses, $\frac{1}{2}$ -inch in thickness, beneath which, at a depth of 2 $\frac{1}{2}$ 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. 130.) Again, a quantity of broken chalk was spread on December 20th, 1842, over a part of a field near Darwin's house. '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 dug across this part of the field; and a line of white nodules could be traced at a depth of 7 inches from the surface. The mould, therefore (exclusive of the turf), had been thrown up at an average rate of .22 inch per year.' (P. 139.) In view of such operations we can readily account for the burial of ancient cities and towns, and a number of cases in point 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, Chedworth, Brading, 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.

Judge J. E. Stallo's 'The Concepts and Theories of Modern Physics' is the latest volume in Messrs. D. Appleton & Co.'s 'International Scientific Series.' The Messrs. Appletons' scientific list includes 'The Chemistry of the Hydrocarbons and their Derivatives,' by

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 detraction 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 North-east. These numbers, at present, occupying their immediate occupations, about 600,000; and they are nearly in need of the liberalizing influence of just such a man as Mr. James, having been too long shut 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 most satisfying tyranny of this body of clergymen that James 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, 1881.

H. H. BOYDCE.

Modern Slaves.

To the Editors of THE CRIC:

On Sunday last I read in the *Freeman* a clipping from the *London Echo*, in which six stolen bibles are quoted from a new book and ascribed to Mr. Horatio Mann. In a card in Woodley's *Freeman* Mr. G. T. Langdon claims for himself the authorship of these fables, and accuses Mr. Mann of "blatant piracy." "Of the five bibles given," says Mr. Langdon, "one has been stolen (written) from my notes, 'Out of the World,' published five years ago." In the first place, six bibles instead of five are given in the *Freeman*; and, unless I am mistaken, there was but one volume of "Out of the World." In Mr. Langdon's book, which is dated 1874, I find the six bibles, but they have not been reproduced "verbatim or divinely." I also find in the "Irish Bibles" of *Scott's Monthly*, for May, 1879, the fable of "The Wolf and the Lamb," and some others which are not in Mr. Langdon's book, with this introduction: "The *Chicago Herald*, published in the Homeopathic Era in the Pleasant City mentioned the following, which many of our readers may have missed seeing: 'The Improved Slave, or Impoverished Modern基督徒, by Rev. Horatio Mann.' Here, it will be observed, is a difference of two years in Mr. Mann's favor, for which Mr. Langdon should account."

NEW YORK, Jan. 11, 1881.

F. F. W.

Science

Worms as Earthworms.*

THIS curious earth-worm comes within the cognizance of the ordinary observer chiefly as a useful tool to be employed as a hook and line used for attracting fish for the sport of the angler. The juvenile representatives of the brotherhood of the red have generally learned to recognize the whereabouts of their victim by conglomerations of little pellets of earth here and there; and knowing these are wont to cautiously explore localities so indicated with lantern at night or in the early morning, and there find the worms partly or entirely outside their holes. Few of the many who have learned thus 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 1849, however, Mr. Darwin had appreciated the rôle that it plays and communicated to the Geological Society of London a special memoir "On the Formation of Mould" by worms. Considerable respect was accorded respecting his conclusions, so insignificant did the worms appear to the end, but the author has now supplemented his numerous works by a special monograph on the subject, and has fortified and amplified his early studies and conclusions. As Darwin says in one of his earlier papers: "Worms are aware that objects of all kinds left on the surface of pasture land after a time disappear, or, as they say, work themselves downward." This disappearance is of course due to an automatic process of the objects sinking down, but really to the cumulative effect of worms' castings. The doubt which 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.

Hence, in experiments made on worms in confinement and fed on leaves, found that they ejected above-eight grains of earth

a day; but, according to Darwin, "a very much larger amount must be ejected by worms in their natural state, at the periods when they consume earth as food instead of leaves, and when they are making deep burrows." In corroboration of this opinion, Darwin has tabulated the results of numerous observations on the weight of the castings accumulated at the mouth of a single burrow. 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 Highgate mountains one casting even exceeded this latter weight. 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 swallow a greater amount of earth on poor than on rich land, in order to obtain sufficient nutriment." (P. 165.) In another place we are told that Hansen found that "three mice eat 135,000 living worms in a hectare of land, or 3375 in an acre. This latter number of worms would weigh 3375 pounds, taking Hansen'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 Hansen believes that worms are twice as numerous in gardens as in open fields." On the other hand recent observations demonstrate that worms may occur in even much greater numbers than were found by Hansen.

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 their habits and doings for many years. "Near Mans Hall in Staffordshire, quick-lime had been spread, about the year 1857, thickly over a field of good pasture-land which had not since been ploughed. Some square holes were dug in this field in the beginning of October 1857; and the sections showed a layer of soil formed by the matted roots of the grasses, 4-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. 120.) Again, a quantity of broken chalk was spread on December 20th, 1857, over a part of a field near Darwin's house. "The chalk was laid on the land for the sake of observing its usual course period to what depth it would become buried. At the end of November 1857—that is, after an interval of 29 years—a trench was dug across this part of the field, and a line of white nodules could be traced at a depth of 4 inches from the surface. The mould, therefore (exclusive of the turf), had been thrown up at an average rate of .22 inch per year." (P. 121.) In view of such operations we can readily account for the fertility of ancient sites and towns, and a number of cases in point 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, Cheddington, Breading, and elsewhere, the subsidence 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 other 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.

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* The *Formation of Mould*, Through the Action of Worms, with Observations on their Habits. By CHARLES DARWIN. With Illustrations. Ed. by NEW YORK: D. APPLETON & CO.