

THE FLOUGH OF THE ANIMAL WORLD.

MR. DARWIN has written another of those wonderful books in which he works out the cumulative effect of an apparently very minute cause when multiplied by an immense multiplier.—first, in number, and then in duration,—and shows us that so accumulated, it is of enormous, instead of very minute, significance. The next time you are asked to take for his subject in the TECHNICAL LIBRARY—a really fine

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as that so accumulated, it is of enormous, instead of very minute,
significance. The cause which effect on our planet he takes for
his subject? In the work of the Earth-worm,—a totally blind

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creature, with very poor means of any kind; and the results
which it produces on the distribution of the soil on the
surface of the globe, he proves to be immense. Mr. Darwin
believes, on evidence which seems very satisfactory to his
mind, that each English earth-worm probably passes, on
an average, about twenty ounces of matter through its
body in the course of a year; but then it brings that
quantity of matter to the surface of the earth, and there de-
composes it, and brings it up in a form very different from that
in which that matter existed before it passed into the worm.
In the first place, the earth is finely triturated in the gizzard
of the creature, and triturated with the fibrous parts of the leaves
on which it feeds, and with which it lines its burrows, so that
the mould which results is what we know as vegetable mould,
a totally different substance for the purposes of the farmer and
the gardener from the substance on which the worm first begins
to eat. Mr. Darwin, however, shall tell us in his own words
what he has proved the result of the earth-worm's work to be:—

“Worms have played a more important part in the history
of the world than most persons would at first suppose. In
almost all humid countries they are extraordinarily numerous, and
for their size possess great muscular power. In many parts of Eng-
land a weight of more than 100 (100,000 kilogrames) of dry
earth annually passes through their bodies, and is brought to the
surface, on each acre of land, so that the whole superficial land
of vegetable mould passes through their bodies in the course of every
few years. From the culchings of the soil burrows the mould is in
contact, though slow movement, and the particles composing it are
then rubbed together. By these means fresh surfaces are continuously
exposed in the action of the carbonic acid in the soil, and of the humic
acids which appear to be still more efficient in the decomposition of
rotta. The penetration of the humic-acids probably hastened during
the digestion of the many half-decayed leaves which worms consume.
Thus the particles of earth forming the superficial mould are sub-
jected to conditions eminently favourable for their decomposition and
disintegration. Moreover, the particles of the entire earth suffer
some amount of mechanical trituration in the muscular gizzards of
worms, in which small stones serve as mill-stones. . . . When we
behold a wide, furrowed expanse, we should remember that its
smoothness, on which so much of its beauty depends, is mainly due
to all the inequalities having been slowly levelled by worms. In its
various relations that the whole of the superficial mould over
any such expanse has passed, and will again pass, every few years
through the bodies of worms. The plough is one of the most ancient
and most valuable of man's inventions; but long before he learned
the use of it, he had regularly ploughed, and still continues to be
thus ploughed, by earth-worms. It may be doubted whether there
are many other animals which have played so important a part in
the history of the world, as have these lowly-organized creatures.”

When we consider that a single earth-worm is not sup-
posed to pass more than twenty ounces of earth through
its body in the year, such a total result as this seems
almost incredible. But then we must remember that from
at least 20,000 to 30,000 of these creatures are believed
to be at work on every acre of British earth avail-
able for their activity, and that in Great Britain there are
32,000,000 millions of such acres. If less than a million of earth pass
through these creatures on every acre of such acres in the year,
320,000,000 tons of earth are brought to the surface by them in
Great Britain alone, in a single year; and when this large weight
of soil is multiplied by the number of years during which their
agency has certainly been at work,—Mr. Darwin thinks a million
years not at all an extravagant estimate,—the effect that they
have produced in making the vegetable mould of the world so
hardly to be exaggerated. For ages before man appeared on the
earth, the soil in which his food was to be produced was being
ploughed by millions of infinitesimal ploughs, which not only
triturated the soil into much finer particles than our ploughs
can crush it, but also essentially altered its chemical con-
stitution, so as to make it infinitely better adapted for raising
those richer products which higher organizations need.

We call attention to the subject, however, not, of course,
because we can add anything whatever to the evidence adduced
by Mr. Darwin, or to the physical inferences which he has so
thoroughly deduced from that evidence, but because he has said
nothing concerning what seems to us one of the most import-
ant of the aspects of the case,—the bearing of this discovery
of his on what is ordinarily called the argument addressed to
those conscious beings in Nature. Hitherto, the tendency of
Mr. Darwin's writings has been declared by the great school of
Continental Atheists to be all in favour of their materialistic
view of Nature. It has been shown, they think, that what was mis-
taken for antedepoxy purpose by our older naturalists, was nothing
but the selective tendency, necessarily resulting from the
great conflict for existence, to favour such variations in organiza-
tion as help the individual to live, and to extinguish such varia-

tions in organization as render the individual less fit for the great
struggle. It has often been pointed out that, though this criticism
would have some weight as regards all those variations which
benefit the individual even in their initial and immature state,
it has no weight as regards those variations in organization
which do not benefit the individual at all until they are com-
plete. The unfitness of a nerve, for instance, is supposed
to be the rudimentary stage of a new perception; but though a
new perception of the outside world, so soon as it is really com-
plete, would constitute an immense advantage to the creature
possessing it, a new unfitness which carried no new percep-
tion of external things, might well constitute one of the greatest
conceivable disadvantages in the conflict for existence. This
consideration, however, has not hitherto been strongly upon the
minds of materialistic Atheists, probably because we have had
little of the history of the initial stages of those organs which,
in their mature stage, are of the greatest advantage in the animal
world, to bring the drift impressively before the imagination. In
the case, however, of the subject of Mr. Darwin's present study, it
appears perfectly clear that the benefit conferred on the world at
large by the work of the earth-worm is almost in inverse pro-
portion to the benefit conferred upon the individual by that
work. In other words, the more earth passes through the
worm in proportion to the nourishment which it receives,
the more benefit is conferred on the world at large, the
more ploughing is done by the earth-worm for the bene-
fit of other creatures, and the more is the soil chemi-
cally improved by the agency. Yet, of course, the less work
the worm has to do for its own adaptive nourishment,
the better would be its chance of obtaining that nourishment,
and of multiplying its species. We gather, indeed, from what
Mr. Darwin says, that part of the essential structure of earth-
worms—the gizzards, in which the earth is powdered, by being
crushed up with the little stones swallowed for this purpose—
is provided solely for the execution of this entire work, and is not
to be found at all in other varieties of the species which live in
meat or water, and feed exclusively on food as being vegetable
matter, without taking the trouble to grind down an enormous
proportion of unwholesome soil, for the sake of the very minute
fragments of organic matter which it may happen to contain.
The function of earth-worms in their ordinary state appears to
be closely analogous to that of the miners who grind quartz for
the sake of the grains of gold which they had scattered through
it, but with this difference, that the miners do not know
how to find the grains of gold in equally large supplies in any
other way; while the earth-worms, but for the instinct which
compels them, at certain parts of the year, to swallow so large a
quantity of earth, would find a much richer supply of the
nourishment most suitable to them on the surface of the ground,
without passing so much that, to them, is pure waste through
the mill, for the sake of an minute proportion of food. It seems
perfectly clear, then, that the instinct of the earth-worm has its
end, mainly, not in the good of the individual which does that
work, but in the good of other and more highly organized beings,
who did not even begin to exist on the earth for ages upon ages
after the earth-worm had been preparing the surface of the planet
for their appearance. These creatures pierce and grind down and
bring to the surface the particles of the earth, not for their own
good mainly,—for they would obtain that good equally well, at
the less expense of labour, if, like the wood and water worms,
they fed on vegetable matter only,—but for the ultimate good
of Man. The earth-worms are the ploughs by which the surface
of the globe was being prepared in pre-Man harrowings long before
either we or our harvest had been even conceived, except in the
mind of that Eternal Wisdom to which the future is present,
and the present contains the agony of the future.

No one, we think, can read Mr. Darwin's remarkable book
without being convinced that the Earth-worm works less for
itself than for the future of the globe it inhabits, and would
have been quickly superseded in the conflict for existence by
some other creature whose organization is more economically
adapted to secure solely its own nourishment and multiplication,
had not the plan of the Universe included a deliberate
preparation for slowly approaching, but will distant, ages as
well as for the immediate future. Mr. Darwin, at least, clearly
regards the borings of the earth-worm as being their ex-
planation in the course of millions of years, rather than
in the immediate advantage of the creature which undertakes
them, as being the result of disinterested skill. He indicates
clearly that so far as regards the good of the creature itself,