BOOKS.

MR. WALLACE ON THE DISTRIBUTION OF ANIMALS.*

[First Notice]

To do a work of this kind justice in an ordinary review is almost impossible, and to exhibit in a satisfactory light the enormous labour which its author has undertaken cannot be accomplished, without supposing an amount of technical knowledge on the part of our readers which would be unreasonable.

But the conclusions to which Mr. Wallace's work points are so important, as bearing upon the recent teachings of biology, that we should like to give a general idea of the book. First of all, let us say that it is got up in a style which is worthy of the publishers, the type being clear and distinct; and it is wonderfully free, for a book of its kind, from printers' mistakes. The only matter for regret is that it has not been put in three volumes instead of two, and made uniform in size with Murray's issue of Mr. Darwin's books, of which it really forms a complement. The size of the volumes makes them rather unhandy and fatiguing to any one who goes straight through them, a task which we need scarcely say has to be done with much thought and patience.

There are many instances of important discoveries having been made simultaneously by two different and independent workers, and the usual result is that they quarrel bitterly for the credit. As far as we know, there has been only one exception to this, a case where each discoverer has attributed the praise to the other, and Mr. Wallace shares this unusual position with Mr. Darwin. We can now characterise the theory of the origin of species as a

elaborate proof by Mr. Darwin, that what we call species of animals are not constant, but are liable to slow but certain variation. We may now say that Mr. Wallace's book is the coping-stone of this great arch, for it is nothing short of a demonstration that the facts of animal distribution are the results of the action of two factors, the chief of which is progressive development; and the second, the repeated variations in the relations of the land and sea.

Into the various theories which have been advanced to explain the alterations of these levels, we have no space here to enter, but we wish that Mr. Wallace had given them a fuller consideration. Speculations on the subject are to be met with in classic authors, for we find Nero's greatest victim writing the lines,—

"Veniunt
Senecae, saevius Oceanae
Vinculum rerum laxet, et ingens
Patet Tellus, Tigillum novum
Deterger orbis; nec sit terris
Ultima Thele."

And in this country we do not think sufficient prominence has been given to the theory of the periodicity of such movements, which appears as long ago as 1842 by J. Adhemar, though Mr. Croll has recently attracted attention to a doctrine somewhat similar.

In the first part of his book, Mr. Wallace deals with the principles and general phenomena of distribution, and first of all, he discusses the influence of barriers. The most important of these are deep seas, high mountains, and broad rivers. Islands far away from the mainland almost always have very peculiar animals, found nowhere else; but the differences are sometimes so slight that they are upon the depth of the intervening sea than upon mere distance, a fact which is extremely significant. Shallow straits, like the English Channel or the Straits of Malacca, are not found to have much effect, the animals being nearly or quite identical on their opposite shores. "A change of climate or a change of vegetation may form an equally effective barrier to migration. Many tropical and polar animals appear to be specially adapted to climate, and so the spread of those animals. On the other hand, the absence of enemies, as in the case of the great tortoises of the Galapagos and Mascarene Islands, and the wingless birds of New Zealand, has been the direct cause of the origin of these peculiar species:—"

"Naturalists," says Mr. Wallace, "have now arrived at the conclusion that by slow process of development or transmutation all animals have proceeded from the productions of the species which preceded them, and that every species was specially created as they now exist, at a particular time and in a particular spot, is abandoned, as opposed to the evidence. Thus the existence of animal forms took place very slowly, so that the historical period of three or four thousand years has hardly produced any perceptible change in a single species. Even the time since the last glacial epoch, which on the very lowest estimate, must be from 50,000 to 100,000 years, has only served to modify a few of the higher animals into very slightly different species. The changes of the forms of animals appear to have accompanied, and perhaps to have depended on, changes of physical geography, of climate, or of vegetation; since it is evident that an animal which is well adapted to its condition of things will require to be slightly changed in constitution or habits, and therefore generally in form, structure, or color, in order to be equally well adapted to a changed condition of surrounding circumstances."

The a priori difficulty of believing that such changes actually do take place in species is quite removed by a consideration of what actually takes place in individual animals every year. If two ptarmigan were presented as new and unknown birds to some species-manufacturer, one in its winter and the other in its summer plumage, he would certainly divide them; and we shall see by and by that changes no greater in extent than these have really originated new species, under altered conditions of life.
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(SECOND NOTICE)

GRANTING the facts, now completely established by geologists, that the surface of the earth has been through all time, and is still, undergoing a series of changes, and that there is a constant tendency for all living things to adapt themselves to their surroundings by the simple process of those which are unfit being killed off, we come almost inevitably to Mr. Wallace’s further conclusions. His merit is in working out the details—

“Animals,” he says, “multiply so rapidly, that we may consider them as continually trying to extend their range, and thus any new land raised above the sea by geological causes becomes immediately peopled by a crowd of competing inhabitants, the strongest and best adapted of which alone succeed in maintaining their position.”

No better illustration of this could be taken than that afforded by insects, whose rate of increase is familiar to every one. Their two chief functions are, to afford food for other animals, and to be the means of fertilising flowers. A new field where they would be free from those who prey upon them would place them under different circumstances, and would free them from the necessity of being provided with the means for escape which they generally possess, either in the shape of wings or some kind of mimicry.

If we take some isolated spot, as Kerguelen Island or Madeira, as a new habitat for them, without in the meantime considering what geological change produced it, we find that in their new home the insects whose wings are deficient or absent would not be destroyed, as they would in their old home. That insects are occasionally born without wings, in every class of them, if not established by actual observation, is quite certain to be the case by analogous monstrosities met with elsewhere. We find, further, that in the new locality not only would the wingless insects be protected in a negative way by the absence of their former destroyers, but that they would have a positive advantage due to local peculiarity. Mr. Darwin long ago connected the occurrence of wingless insects in such places as Madeira with the frequency and violence of the gales which occur there, and he came to the conclusion that the winged individuals were blown out to sea and drowned, whilst those which had no wings were protected by their deprivation. The report of the Transit expedition to Kerguelen Island completely establishes this discovery, for moths, flies, and beetles were there found to be quite incapable of flight, though many had stumps or abbreviated wings, showing that their progenitors were formerly fully provided.

If further proof were needed, Mr. Wallace’s careful compilation of facts fully affords it. In Madeira no less than twenty-two genera of insects, which are usually, or sometimes, winged in Europe, have only wingless species; and even the same species which is winged in Europe becomes, in at least three cases, wingless in Madeira, without any other perceptible change having

taken place. But this is not the most curious fact, for when any
new factor makes a change in one direction, it is quite sure not
to limit its influence to that one method. The same climatic
influence which deprives some insects of their wings increases the
size of the wings of others, for Mr. Wollaston has pointed out that
those species which have wings in Madeira have them larger than
the same species in Europe. The meaning of this is plain, for
the insects may obtain a victory over the destroying tendency of
the wind, either by avoiding all struggle with it, or by struggling
victoriously. The European insects have wings which in Madeira
are either too strong or not strong enough, and the struggle
for existence may be successfully made in two ways, either by
ceasing to have wings at all, or by having them stronger.

If we keep in mind,” says Mr. Wallace, “the facts that the minor
features of the earth’s surface are everywhere slowly changing, that
the forms and structures and habits of all living things are also slowly changing,
while the great features of the earth, the continents and oceans and
inland and mountain ranges, only change after very long intervals and
with extreme slowness, we must see that the present distribution of
animals upon the several parts of the earth’s surface is the final pro-
duct of all those wonderful revolutions in organic and inorganic nature.
The greatest and most radical differences in the productions of any
part of the globe must be dependent on isolation by the most effectual
and most permanent barriers. That ocean which has remained
breast-deep from the most remote geological epoch will separate
countries the productions of which most widely and
radiately differ, while the most recently-depressed seas, or the
least-formed mountain ranges, will separate countries the productions of
which are almost or quite identical. It will be evident, therefore,
that the study of the distribution of animals and plants may add
greatly to our knowledge of the past history of our globe. It may re-
veal to us, in a manner which no other evidence can, which are the
oldest and most permanent features of the earth’s surface, and which
the newest. It may indicate the existence of islands or continents now
sunk beneath the ocean, and which have left no record of their existence,
save the animal and vegetable productions which have migrated to
adjacent lands.”

Even the habits of certain animals may be made to tell the
story of previous conditions of the earth’s surface in a way which
at first sight is surprising, and would be certainly disputed, if
the conclusions drawn from them were not fully supported by other
facts. Thus the migrations of birds probably means that they
were originally permanent inhabitants of the countries to
which they migrate for the purposes of breeding, and that
they were slowly driven elsewhere during the winter by very
gradual changes in the climate. Any one who has petted birds
must have been struck with their intense conservatism, and with
the persistence they display in the rejection of any little habit
they may have acquired. Thus a pet canary will be distressed
for weeks if the perch on which he has been accustomed to sleep
is removed. If he sleeps out of his cage, he will visit the old spot
night after night and refuse to be comforted. The same spirit is
displayed in the unvarying routes by which certain migratory
birds take in travelling from one place to the other. Thus the
nightingale crosses from Europe to Africa by three routes
only,—one at Gibraltar, another by Sicily and Malta, and
another by Greece and Cyprus. They are, therefore, always
in sight of land, crossing always in moonlight, and when the
wind is steadily east or west. If we look at the sound-
ings of the Mediterranean, and the geological facts displayed
by them, we find that not a very great while ago those three
routes were tracts of dry land; and the conclusions are inevitable
that the present sea-levels have been altered slowly since the
birds began to migrate, and that the customary routes have been
maintained by the shortening of the life of individual birds
permitting of no recollection of the growing differences. What
changes in the nightingales have been effected by the new necessi-
ties we do not yet know, but we may be certain that an increased
power of flight must have been developed by the drowning of
those unable to cross the increasing expanse of water.

The tendency to migration would be slowly developed, and
would depend, first, upon the changes effected in the foliage.
Thus if a bird depends upon some particular caterpillar for its
food, it will follow that insect; and if the caterpillar depends
in its turn upon some particular leaf, the insect will follow the
leaf. Let us suppose, then, that a rise in the sea-level of Western
Europe lowered the temperature of our own country by covering
a large part of it with water, and thereby increased the severity
and length of the winter, so that some plant or other could bear
foliage for only four months, instead of six; and that as a result,
some particular insect could deposit its eggs with any prospect of
their coming to a maturity during this abbreviated period only,—
then it would follow as a necessity that the bird feeding on this
caterpillar would follow it further south in its migration. If
in succeeding epochs of winter these changes became more
and more material, the limits of the birds’ wanderings
would be enlarged, and so the present migrations would
be and undoubtedly were established. We have no space to
follow Mr. Wallace further through the mass of information
which he has placed in his two volumes. We can only say, in
conclusion, that if there still be any left who have lingering
doubts concerning the “origin of species,” let them read this
book.