

## CHAPTER VII.

## SPECIES AND SPACE.

The Geographical Distribution of Animals presents Difficulties.—These not insurmountable in themselves; harmonize with other Difficulties.—Fresh-water Fishes.—Forms common to Africa and India; to Africa and South America; to China and Australia; to North America and China; to New Zealand and South America; to South America and Tasmania; to South America and Australia.—Plerodont Lizards.—Insectivorous Mammals.—Similarity of European and South American Frogs.—Analogy between European Salmon and Fishes of New Zealand, etc.—An Ancient Antarctic Continent probable.—Other Modes of accounting for Facts of Distribution.—Independent Origin of Closely-similar Forms.—Conclusion.

THE study of the distribution of animals over the earth's surface presents us with many facts having certain not unimportant bearings on the question of specific origin. Among these are instances which, at least at first sight, appear to conflict with the Darwinian theory of "Natural Selection." It is not, however, here contended that such facts do by any means constitute by themselves obstacles which cannot be got over. Indeed, it would be difficult to imagine any obstacles of the kind which could not be surmounted by an indefinite number of terrestrial modifications of surface—submergences and emergences—junctions and separations of continents in all directions and combinations of any desired degree of frequency. All this being supplemented by the intercalation of armies of enemies, multitudes of ancestors of all kinds, and myriads of connecting forms, whose *raison d'être* may be simply their utility or necessity for the support of the theory of "Natural Selection."

Nevertheless, when brought in merely to supplement and accentuate considerations and arguments derived from other sources, in that case difficulties connected with the geographical distribution of animals are not without significance, and are worthy of mention even though, by themselves, they constitute but feeble and more or less easily explicable puzzles which could not alone suffice either to sustain or to defeat any theory of specific organization.

Many facts as to the present distribution of animal life over the world are very readily explicable by the hypothesis of slight elevations and depressions of larger and smaller parts of its surface, but there are others the existence of which it is much more difficult so to explain.

The distribution either of animals possessing the power of flight, or of inhabitants of the ocean, is, of course, easily to be accounted for; the difficulty, if there is really any, must mainly be with strictly terrestrial animals of moderate or small powers of locomotion and with inhabitants of fresh water. Mr. Darwin himself observes,<sup>1</sup> "In regard to fish; I believe that the same species never occur in the fresh waters of distant continents." Now, the author is enabled by the labors and through the kindness of Dr. Günther, to show that this belief cannot be maintained; he having been so obliging as to call attention to the following facts with regard to fish-distribution. These facts show that though only one species which is absolutely and exclusively an inhabitant of fresh water is as yet known to be found in distant continents, yet that in several other instances the same species *is* found in the fresh water of distant continents, and that very often the same *genus* is so distributed.

The genus *Mastacembelus* belongs to a family of fresh-water Indian fishes. Eight species of this genus are de-

<sup>1</sup> "Origin of Species," 5th edit. 1869, p. 463.

scribed by Dr. Gunther in his catalogue.<sup>3</sup> These forms extend from Java and Borneo on the one hand, to Aleppo on the other. Nevertheless a new species (*M. cryptacanthus*) has been described by the same author,<sup>3</sup> which is an inhabitant of the Camaroon country of *Western* Africa. He observes: "The occurrence of Indian forms on the West Coast of Africa, such as *Periophthalmus*, *Psettus*, *Mastacembelus*, is of the highest interest, and an almost new fact in our knowledge of the geographical distribution of fishes."

*Ophiocephalus*, again, is a truly Indian genus, there being no less than twenty-five species,<sup>4</sup> all from the fresh waters of the East Indies. Yet Dr. Günther informs me that there is a species in the Upper Nile and in West Africa.

The acanthopterygian family (*Labyrinthici*) contains nine fresh-water genera, and these are distributed between the East Indies and South and Central Africa.

The Carp fishes (Cyprionoids) are found in India, Africa, and Madagascar, but there are none in South America.

Thus existing fresh-water fishes point to an immediate connection between Africa and India, harmonizing with what we learn from Miocene mammalian remains.

On the other hand, the Characinidæ (a family of the physostomous fishes) are found in Africa and South America, and not in India, and even its component groups are so distributed,—namely, the *Tetragonopterina*<sup>5</sup> and the *Hydrocyonina*.<sup>6</sup>

Again, we have similar phenomena in that almost exclusively fresh-water group the Siluroids.

<sup>3</sup> See his Catalogue of Acanthopterygian Fishes in the British Museum, vol. iii., p. 540.

<sup>3</sup> Proc. Zool. Soc., 1867, p. 102, and Ann. Mag. of Nat. Hist. vol. xx., p. 110.

<sup>4</sup> See Catalogue, vol. iii., p. 469.

<sup>5</sup> Ibid., vol. v., p. 311.

<sup>6</sup> Ibid., p. 345.

Thus the genera *Clarias*<sup>7</sup> *Heterobranchus*<sup>8</sup> are found both in Africa and the East Indies. *Plotosus* is found in Africa, India, and Australia, and the species *P. anguillaris*<sup>9</sup> has been brought from both China and Moreton Bay. Here, therefore, we have the same species in two distinct geographical regions. It is, however, a coast fish, which, though entering rivers, yet lives in the sea.

*Eutropius*<sup>10</sup> is an African genus, but *E. obtusirostris* comes from India. On the other hand, *Amiurus* is a North American form; but one species, *A. Cantonensis*,<sup>11</sup> comes from China.

The genus *Galaxias*<sup>12</sup> has at least one species common to New Zealand and South America, and one common to South America and Tasmania. In this genus we thus have an absolutely and completely fresh-water form of the very same species distributed between different and distinct geographical regions.

Of the lower fishes, a lamprey, *Mordacia mordax*,<sup>13</sup> is common to South Australia and Chili; while another form of the same family, namely, *Geotria Chilensis*,<sup>14</sup> is found not only in South America and Australia, but in New Zealand also. These fishes, however, probably pass part of their lives in the sea.

We thus certainly have several species which are common to the fresh waters of distant continents, although it cannot be certainly affirmed that they are exclusively and entirely fresh-water fishes throughout all their lives except in the case of *Galaxias*.

Existing forms point to a close union between South America and Africa on the one hand, and between South America, Australia, Tasmania, and New Zealand, on the other; but these unions were not synchronous any more

<sup>7</sup> See Catalogue, vol. iii., p. 13.

<sup>8</sup> Ibid., p. 21.

<sup>9</sup> Ibid., vol. v., p. 24.

<sup>10</sup> Ibid., p. 52.

<sup>11</sup> Ibid., p. 100.

<sup>12</sup> Ibid., vol. vi., 208.

<sup>13</sup> Ibid., vol. viii., p. 507.

<sup>14</sup> Ibid., p. 509.

than the unions indicated between India and Australia, China and Australia, China and North America, and India and Africa.

Pleurodont lizards are such as have the teeth attached by their sides to the inner surface of the jaw, in contradistinction to acrodon t lizards, which have the bases of their teeth anchylosed to the summit of the margin of the jaw.

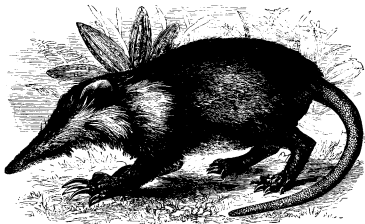


INNER SIDE OF LOWER JAW OF PLEURODONT LIZARD.  
(Showing the teeth attached to the inner surface of its side.)

Now pleurodont iguanian lizards abound in the South American region; but nowhere else, and are not as yet known to inhabit any part of the present Continent of Africa. Yet pleurodont lizards; strange to say, are found in Madagascar. This is the more remarkable, inasmuch as we have no evidence yet of the existence in Madagascar of fresh-water fishes common to Africa and South America.

Again, that remarkable island Madagascar is the home of very singular and special insectivorous beasts of the genera *Centetes*, *Ericulus*, and *Echinops*; while the only other member of the group to which they belong is *Solenodon*, which is a resident in the West Indian Islands, Cuba, and Hayti. The connection, however, between the West Indies and Madagascar must surely have been at a time when the great lemurine group was absent; for it is difficult to understand the spread of such a form as *Solenodon*, and at the same time the non-extension of the active lemurs, or their utter extirpation, in such a congenial locality as the West Indian Archipelago.

The close connection of South America and Australia is demonstrated (on the Darwinian theory), not only from the marsupial fauna of both, but also from the frogs and toads which respectively inhabit those regions. A truly remarkable similarity and parallelism exist, however, between certain of the same animals inhabiting Southwestern America and Europe. Thus Dr. Günther has described<sup>15</sup> a frog from Chili by the name of *cacotus*, which singularly resembles the European *bombinator*.



SOLENODON.

Again of the salmons, two genera from South America, New Zealand, and Australia, are analogous to European salmons.

In addition to this may be mentioned a quotation from Prof. Dana, given by Mr. Darwin,<sup>16</sup> to the effect that "it is

<sup>15</sup> Proc. Zool. Soc., 1868, p. 482.

<sup>16</sup> "Origin of Species," 5th edit., 1869, p. 454.

certainly a wonderful fact that New Zealand should have a closer resemblance in its crustacea to Great Britain, its antipode, than to any other part of the world:" and Mr. Darwin adds: "Sir J. Richardson also speaks of the reappearance on the shores of New Zealand, Tasmania, etc., of northern forms of fish. Dr. Hooker informs me that twenty-five species of algæ are common to New Zealand and to Europe, but have not been found in the intermediate tropical seas."

Many more examples of the kind could easily be brought, but these must suffice. As to the last-mentioned cases, Mr. Darwin explains them by the influence of the glacial epoch, which he would extend actually across the equator, and thus account, among other things, for the appearance in Chili of frogs having close genetic relations with European forms. But it is difficult to understand the persistence and preservation of such exceptional forms with the extirpation of all the others which probably accompanied them, if so great a migration of northern kinds had been occasioned by the glacial epoch.

Mr. Darwin candidly says,<sup>11</sup> "I am far from supposing that all difficulties in regard to the distribution and affinities of the identical and allied species, which now live so widely separated in the North and South, and sometimes on the intermediate mountain-ranges, are removed." . . . . "We cannot say why certain species and not others have migrated; why certain species have been modified and have given rise to new forms, while others have remained unaltered." Again he adds: "Various difficulties also remain to be solved; for instance, the occurrence, as shown by Dr. Hooker, of the same plants at points so enormously remote as Kerguelen Land, New Zealand, and Fuegia; but icebergs, as suggested by Lyell, may have been concerned in their dispersal. The existence, at these and other dis-

<sup>11</sup> "Origin of Species," 5th edit., p. 459

tant points of the southern hemisphere, of species which, though distinct, belong to genera exclusively confined to the south, is a more remarkable case. Some of these species are so distinct that we cannot suppose that there has been time since the commencement of the last glacial period for their migration and subsequent modification to the necessary degree." Mr. Darwin goes on to account for these facts by the probable existence of a rich antarctic flora in a warm period anterior to the last glacial epoch. There are indeed many reasons for thinking that a southern continent, rich in living forms, once existed. One such reason is the way in which struthious birds are, or have been, distributed around the antarctic region: as the ostrich in Africa, the rhea in South America, the emeu in Australia, the apteryx, *dinornis*, etc., in New Zealand, the *epiornis* in Madagascar. Still the existence of such a land would not alone explain the various geographical cross-relations which have been given above. It would not, for example, account for the resemblance between the crustacea or fishes of New Zealand and of England. It would, however, go far to explain the identity (specific or generic) between fresh-water and other forms now simultaneously existing in Australia and South America, or in either or both of these, and New Zealand.

Again, mutations of elevation small and gradual (but frequent and intermitting), through enormous periods of time—waves, as it were, of land rolling many times in many directions—might be made to explain many difficulties as to geographical distribution, and any cases that remained would probably be capable of explanation, as being isolated but allied animal forms, now separated indeed, but being merely remnants of extensive groups which, at an earlier period, were spread over the surface of the earth. Thus none of the facts here given are any serious difficulty to the doctrine of "evolution," but it is contended in this



book that if other considerations render it improbable that the manifestation of the successive forms of life has been brought about by minute, indefinite, and fortuitous variations, then these facts as to geographical distribution intensify that improbability, and are so far worthy of attention.

All geographical difficulties of the kind would be evaded if we could concede the probability of the independent origin, in different localities, of the same organic forms in animals high in the scale of nature. Similar causes must produce similar results, and new reasons have been lately adduced for believing, as regards the *lowest organisms*, that the same forms can arise and manifest themselves independently. The difficulty as to higher animals is, however, much greater, as (on the theory of evolution) one acting force must always be the ancestral history in each case, and this force must always tend to go on acting in the same groove and direction in the future as it has in the past. So that it is difficult to conceive that individuals, the ancestral history of which is very different, can be acted upon by all influences, external and internal, in such diverse ways and proportions that the results (unequals being added to unequals) shall be equal and similar. Still, though highly improbable, this cannot be said to be impossible; and if there *is* an innate law of any kind helping to determine specific evolution, this may more or less, or entirely, neutralize or even reverse the effect of ancestral habit. Thus, it is quite conceivable that a pleurodont lizard might have arisen in Madagascar in perfect independence of the similarly-formed American lacertilia: just as certain teeth of carnivorous and insectivorous marsupial animals have been seen most closely to resemble those of carnivorous and insectivorous placental beasts; just as, again, the paddles of the Cetacea resemble in the fact of a multiplication in the number of the phalanges, the many-jointed feet of extinct marine rep-

tiles, and as the beak of the cuttle-fish or of the tadpole resembles that of birds. We have already seen (in Chapter III.) that it is impossible, upon any hypothesis, to escape admitting the independent origins of closely-similar forms. It may be that they are both more frequent and more important than is generally thought.

That closely-similar structures may arise without a genetic relationship has been lately well urged by Mr. Ray Lankester.<sup>18</sup> He has brought this notion forward even as regards the bones of the skull in osseous fishes and in mammals. He has done so on the ground that the probable common ancestor of mammals and of osseous fishes was a vertebrate animal of so low a type that it could not be supposed to have possessed a skull differentiated into distinct bony elements—even if it was bony at all. If this was so, then the cranial bones must have had an independent origin in each class, and in this case we have the most strikingly harmonious and parallel results from independent actions. For the bones of the skull in an osseous fish are so closely conformed to those of a mammal, that “both types of skull exhibit many bones in common,” though “in each type some of these bones acquire special arrangements and very different magnitudes.”<sup>19</sup> And no investigator of homologies doubts that a considerable number of the bones which form the skull of any osseous fish are distinctly homologous with the cranial bones of man. The occipital, the parietal, and frontal, the bones which surround the internal ear, the vomer, the premaxilla, and the quadrate bones, may be given as examples. Now if such close relations of homology can be brought about independently of any but the most remote genetic affinity, it would be rash to affirm dogmatically that there is any impossibility in the independent origin of such forms as centetes and solenodon, or of genetically distinct

<sup>18</sup> See *Ann. and Mag. of Nat. Hist.*, July, 1870, p. 37.

<sup>19</sup> Prof. Huxley's *Lectures on the Elements of Comp. Anat.*, p. 184.

batrachians, as similar to each other as are some of the frogs of South America and of Europe. At the same time such phenomena must at present be considered as very improbable, from the action of ancestral habit, as before stated.

We have seen, then, that the geographical distribution of animals presents difficulties, though not insuperable ones, for the Darwinian hypothesis. If, however, other reasons against it appear of any weight—if, especially, there is reason to believe that geological time has not been sufficient for it, then it will be well to bear in mind the facts here enumerated. These facts, however, are not opposed to the doctrine of evolution; and if it could be established that closely-similar forms had really arisen in complete independence one of the other, they would rather tend to strengthen and to support that theory.