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Murray's Disguises of Nature

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BY

ANDREW MURRAY, F.R.S.E.

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On the Disguises of Nature: being an Inquiry into the Laws which regulate External Form and Colour in Plants and Animals. By ANDREW MURRAY, F.R.S.E.*

I have long thought that an inquiry into the laws by which the external—or what may be called the extrinsic—forms and appearance of organic objects are regulated, might worthily and profitably exercise the faculties of some of our deeper thinkers. It is a subject to which, so far as I know, nothing has been done; at all events, no one has yet offered any explanation of what these laws are; and we may even be said to be ignorant whether there be any such laws or not.

In the hope that a statement of the subject may induce some one better qualified than myself to turn his attention to it, I propose to group together a few facts illustrative of some of the different aspects in which the subject may be regarded, and to indicate the interesting nature of the speculations to which they may give rise.

One very curious branch of the subject, with which I shall begin, is the resemblance which certain plants and animals bear to other objects, animate or inanimate, as, for instance, an insect to a leaf, a moth to a bee, &c. I have styled this the disguises of nature; a phrase which, although it does not apply to all the kinds of resemblance which I shall have to notice, sufficiently indicates their general nature. Other resemblances, such as the general family resemblance in the facies of animals spread over a whole continent, or the resemblance to be found in species confined to a particular kind of locality, will also receive a portion of our consideration; but these cannot be called disguises, and will fall to be discussed under a separate category.

The disguise is usually one of two kinds. It is either an imitation of an animate or of an inanimate object. These we

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may take up separately. Not that I wish it to be thereby inferred that they differ from each other either in their conditions or the laws which regulate them; that is a question upon which we are not yet prepared to adjudicate; but I merely so take them for the convenience of obtaining some kind of order or arrangement into which to group the heterogeneous mass of facts which bear upon the subject.

I shall first cast a hasty glance over a few of those curious resemblances where we find one animal assuming the form and appearance of another, as a butterfly pretending to be a wasp, a fly a bee, &c.

I do not mean to include in this category those resemblances which the fancy of man loves to discover in all around him. Like Hamlet, we can see a camel or a weasel figured in every cloud, and, like his, they prove often very like a whale. It will be sufficient, as illustrations of such resemblances, to refer to the death's-head moth, which carries on its thorax not a bad figure of a death's head and cross bones; or to the Orchids and other Epiphytes, which we may compare to gaudy butterflies or other insects; or to the fern called *Aspidium Barometz*, known as the Tartarian or vegetable lamb. It grows on the elevated salt plains west of the Volga, and its rhizome presents, when the fronds are removed, a rude resemblance to the shape of the lamb. It is covered by a soft downy substance, of a reddish-brown colour, which may be compared to a fleece. Like the stems of other ferns, the inner parts are soft and pulpy, and the sap of a rich red colour resembling blood. From these materials a number of fabulous stories have been concocted, which are related by Struys and other authors—such as that the plant has the shape and appearance of a lamb, with feet, head, and tail, distinctly formed; that it feeds upon grass, turning round upon its stem to reach it; that garments are made of its fleece; that the wolves feed upon it, and are very fond of its flesh, from the resemblance it bears in taste to the animal lamb; and, in conclusion, after telling a number of such tales, Struys adds with commendable, though somewhat tardy caution, "Many other things I was likewise told, which might however appear scarcely probable to such as have not seen them."

But leaving such fancies, we shall find plenty of curious imitations among plants and animals, so exact, that man's fancy is not required to originate them, but his judgment to eliminate the deception. As we shall presently find in the other class of disguises, so here the greatest number is to be found in the insect tribes.

The clear-wing moths have so great a resemblance to bees, or wasps, or flies, as to have received the name of *Apiforme*, *Bombiforme*, *Vespiforme*, *Tipuliforme*, according as they wear the dress of a honey-bee, a humble-bee, a wasp, or a gnat. Moths and butterflies, although belonging to very distinct divisions, sometimes assume the appearance of each other, as, for instance, *Callimorpha helcita*, and *Danäe Hegesippe*, which are so metamorphosed, that the moth might be taken for the butterfly, or the butterfly for the moth. Many moths also greatly resemble the Caddice flies (*Trichoptera*), as *Adela frischella* and *Molanna angustata*. A moth named *Adactylus Bennettii*, looks very like a small species of *Tipula*. Many two-winged flies have a most striking resemblance to bees, of which I may select, as examples, the *Volucellæ* generally, the *Gasterophilus equi*, or perfect insect of the Bot, and the *Bombylii*, more specially the *Bombylius major*, which carries its disguise farther than usual. Every one knows that the bee has a long tongue; the fly has not; but as if to imitate the long tongue of the bee, which is often extruded, the *Bombylius* has a long rostrum or snout sticking out like the tongue of the bee—the relative proportion being well preserved. The *Asaphes*, although bees, are yet bees of peculiar structure and habits: they make no hives or nests for themselves, but enter the nests of other bees, and deposit their eggs there, to be reared at the expense of the owners of the nest. They are dressed exactly like other species of *Bombi*, and doubtless thus escape detection on their pilfering and illegal expeditions. *Psychoda phalænoides* is a small two-winged fly, which anybody at first sight would mistake for a moth. *Gibbium Scotias* is a beetle, having considerable resemblance to a flea when seen in profile, and a still greater resemblance, when looked at from above, to a small brown spider, which every one sees too much of in summer. Many Coleopterous

insects are found in ants' nests, seemingly created to pass their lives there; for some are eyeless, and many so exactly resemble the ants among which they live as to be not easily recognisable. Many examples of similarity between unlike and distant families occur also in this class, although the resemblance chiefly applies to distribution of colour. Take, for instance, some of the *Lycidæ*, and compare them with *Paristemia* and *Pœciloderma*, two genera of Longicorns, where the colour, although most unusual and startling, is distributed exactly in the same manner, and produces the same effect.

In plants, similar resemblances between distinct orders and families exist. I may refer to the tree-fern (*Alsophila*) and the Cycad (*Stangeria*), like each other, and yet belonging to distinct orders; or to the *Sesleria cærulea* and *Carex rupestris;* to the *Potentilla alpestris* and *Ranunculus alpestris;* to *Polygonum Convolvulus* and *Convolvulus sepium;* to *Tamarix gallica*, and many of the cypresses, or to *Calluna vulgaris* and *Hudsonia ericoides*,—all as showing respectively much similarity to each other in the foliage, and yet belonging to different families.

Such are some of the resemblances in the organic creation, which might without impropriety be termed impostures or personations. It is difficult to suggest any probable theory by which they may be accounted for. Some, no doubt, can be explained as being found in species which are the outliers or transitionary links connecting two different orders or families together; as, for instance, *Adella frischella* and *Molanna angustata*, connecting the Lepidoptera and Trichoptera; *Carex rupestris* and *Sesleria cærulea*, connecting the carices and the grasses, &c. But there remain a vast number of instances which cannot so be disposed of. On what principle are the clear-winged moths, and numerous two-winged flies, invested in the robes of bees? Kirby and Spence thought that the meaning or object of such imitations on the part of some of them (the *Volucellæ* for instance, which deposit their eggs as parasites in bees' nests), was to allow of their entering the nest without being discovered. This may be so; and at least in the case of *Asaphes*, of which I have above spoken, probably is so, although we know that the bees

are not very easily deceived, as it is well known that they will not even allow intruders of their own species from a neighbouring hive to enter with impunity. The fact may be, however, that although we notice them repelling some intruders from a neighbouring hive, many may enter unnoticed, and in like manner some *Volucellæ* may escape detection while others suffer for their intrusion. But admitting it to be so, this only explains the purpose of their being furnished with this livery; it by no means explains the means or law through which they receive it. It may be that if the law (supposing there to be such a law) under which the bees received the creative impulse, and assumed their form and colouring, admitted an influence from the condition and character of their birthplace, the same influence might be extended with a similar effect to the *Asaphes* and *Volucellæ*, seeing that the creative birthplace might probably be the same as that of the other, as their actual birthplace in point of fact is. My idea as to this, however, will be better understood after the reader has perused the second part of this inquiry.

But even after accounting for the class of impostors which make some use or profit of their disguise, there remain others, such as the clear-winged moths, still unaccounted for, where not only the colouring of the body, but also the additional transparence of the wings, is had recourse to to complete the deception. Further, there is the case where the same colours similarly and sometimes bizarrely disposed, are repeated in different families of insects. On this point, I may observe, that when such bizarre markings, or similar dispositions of colour occur, it usually (although not invariably) happens that the insects bearing them are from the same country. There are, for instance, several species of Coleoptera from Old Calabar in which singularly distorted angular yellow marks occur on a black ground on the back (*Nesioticus flasopictus*, *Nyctiobates regius*, *Nyctiobates militaris*, *&c.*); and a *Lycus* from Jamaica bears exactly the same amount and proportion of colour as *Pœciloderma terminale*, also from Jamaica—a scarlet body with a bright ultramarine tail, and so on. Such singularities suggest two explanations: the one, the possibility of new species arising from hybridisation—and we scarcely yet know enough of the

true affinities of the different families of Coleoptera to be able to say whether such hybridisation might be possible or not in the cases I refer to. Another speculation may be, that their creation took place under similar conditions and influence of locality, which indeed, so far as we know it, corresponds with the present habit of life of the different species alluded to—the larvæ of the *Lycidæ* being wood-feeders, like the larvæ of the *Longicornes*, and a similar conformity of habit doubtless also existing between the larvæ of *Nesioticus* and *Nyticobates*, and of other equally illustrative species which might be mentioned.

But let us now turn our attention to those resemblances which consist in an imitation of inanimate objects, or of such animate objects as, from their masses, may in one sense be looked on as inanimate. One very common phase which we find this assume, is a general similitude to the ground on which the animal lives. How closely the colour of our common hare assimilates to the benty braes in which its form is placed; and still more, how the colour of the arctic hare, the polar bear, and other animals which live in the frozen north, fits to their snow-clad land. What a near resemblance does the grouse bear to the heather in which it couches. How well the partridge accords with the general hue of the stubble. How difficult it is to see the ptarmigan beside the gray stones among which it sits. Turning to the water, what more complete match can be found to the sandy bottom of the sea than the back of the flounder or the skate; or to the muddy bottom than the back of the plaice? Look at the tree-frog, so delicately and freshly green, sitting secure among the leaves which he so closely resembles; or at the North American frog, which is found on walls covered with gray lichen, with which he so exactly corresponds, that if he would only sit still no one could see him. Recollect the speckled snakes and serpents, with their coloured patterns so exquisitely blended, and so exactly resembling the tangled herbage through which they glide. Look at the lizards, some of the most lively green, suited to the foliage of the trees on which they live; others gray, like the stones among which they run; or yellow, like the sand on which they bask. Let us not forget the chameleon—which,

certainly, whatever be the cause (whether it be an accidental result from mental emotion, an instinctive impulse independent of its will, or a deliberate intention to produce the effect), does exhibit a most striking resemblance in colour to that of the substances on which it rests, and a more marvellous power of adaptation to the variations in their hue than perhaps any other living creature. Remember the crocodile or alligator floating silently down the muddy stream, so like the trunk of a tree, that the unwary animal drinking on the margin only sees the deception for a moment, when the tree suddenly starts into life, and the victim is hurried below the waters locked in the reptile's formidable jaws. These are examples taken from the vertebrata, but we find similar deceptions repeated, only more frequently and more carefully, in the lower classes of animals. In insects, this is more marked than in any other class. In beetles, the form the deception takes is very frequently that of a pellet of earth or stone (*Byrrhidæ*, *Ceutorhynchidæ*, *&c.*), sometimes even a piece of silver or copper ore (*Chlamydæ*). We see a small beetle creeping along a plant; we stretch out our hand to take it; at the slightest motion it drops to the ground, its legs and antennæ collapse and are clasped close to its body, and all that remains is a small object, often irregularly marked by prominences, which is so like other little pellets of earth as to be scarcely distinguishable from them, and we only recognise it again by patiently waiting in silence until the insect has regained confidence, when it gradually and timidly protrudes its antennæ and legs, and puts itself in motion. A very common deception among beetles, particularly among the *Longicornes*, which feed on wood, is to resemble the bark of the trees on which they feed, or, in some instances, the lichens which grow upon them (*Rosalia alpina*, *Prionus cervicornis*, *&c.*) The *Orthoptera* carry the resemblances they assume more to specific objects. The whole of that tribe partakes more or less of the hue of their dwelling-place. The leaf-insect (*Phyllium*) is an example which will occur to every one. The *Mantis* is only a shade less like a leaf; and some are green like a young leaf, others brown and withered like a dried up and decayed one; and in some we find that a change similar to that in the leaf itself takes place; they are fresh

and bright green in their youth, but fall into the sear and yellow leaf in the same way and at the same time of year as their prototype. A genus of locusts (*Eremobia*), which is confined to sandy deserts (Arabia, Egypt, Algeria, Sahara, &c.) furnishes another very striking example. The locusts found in less arid regions have the colours vivid, the upper wing brown or green, and the lower often bright blue or red. In the desert species, the body and upper wing are subdued to the same tone as that of the sand of the desert, and the lower wing has faded into a pale pink; and this concordance of colour exists in all the *Eremobias* or desert-livers which have yet been described, the pale pink colour of the under wing only being in one or two species replaced by a similarly faint shade of yellow, which is obviously equally well adapted to the purpose of harmonising with sandy ground, and possibly indicates a yellower tinge in the sand of the particular district which those so coloured inhabit. The orthopterous insects, known as walking-sticks, exhibit an imitation of another character. Their resemblance to dried sticks and straws is most perfect; and their long awkward-looking legs, sprawling in every direction, add to the deception. In their last and complete stage, they have little wings like dried leaves; and in some species, imitations of dried leaves, or rather of broken portions of dried leaves, are also appended to their legs. In the *Lepidoptera* (more especially the moths), we find not less resemblance to surrounding objects. So much is this the case with them, that few can be found which are not so provided. The great majority pass the day in quiescence, resting on the trunks of trees, under leaves, or on rocks, walls, or stones; and so exactly do they resemble the object on which they rest, that even when we see them fly from one spot to another, and alight under our very eyes, few but an entomologist would detect them. The pattern of speckled gray which generally composes the upper wing, although marked enough when displayed in a cabinet, is in reality a marvel of imitative skill. If any one will take a walk round a country house, and look carefully along the walls, he will probably see a number of moths resting on them, every one so ingeniously deceptive that he will readily admit that he

has probably overlooked the half of them. The green and brown hues, imitative of every variety which foliage assumes, speak for themselves, and I therefore pass them over; merely repeating, that the number of insects so coloured is beyond calculation. But it is not only in the perfect state that these animals exhibit this persistency of imitation; their larvæ are, if less universally, not less strangely and successfully metamorphosed. Look at the larva of the peacock-moth, and see how exactly the general ground-colour harmonises with that of the young buds of heather on which it feeds, and how closely the pink spots with which it is decorated correspond with the flowers and flower-buds. I should say that one half of the caterpillars of moths and butterflies are green, closely resembling the hue of the leaf on which they feed; and when a part of the body only is exposed to view, the resemblance is often restricted to that part, as may be seen in the larva of one of our tiger-beetles (*Cicindela campestris*), which lives in a hole, from which its head and thorax alone protrude; and these are of the same green as the perfect insect, while the rest of the body is of the usual whitish-yellow of a grub. There are few gardeners who have not in their time been surprised to find that they have taken a fleshy caterpillar between their fingers when they have thought to break off a dead twig; the geometers, or loopers, having the strange habit of stretching themselves out stiff and stark like a twig on the shrub or tree on which they feed; and as, like a vast number of the insect tribes, each is pretty much confined to one plant, or family of plants, for its food, we find that the resemblance is carried out to the extent of making the insect resemble the twigs of the particular plant on which it feeds, and, to add to the deception, is embossed at suitable intervals with one or two eminences, made to imitate the buds on the side of the twig.

Among the denizens of the waters we certainly do not find so many instances of disguise; still we are by no means without examples. In one small crustacean, *Caprella phasma*, which in these days of tanks and vivaria must be familiar to many of my readers, exactly the same habit is repeated which we have found among the loopers. It is a linear animal, about half an inch in length, semi-transparent, and of the same

colour and consistency as a zoophyte, such as an *Antennaria* or *Plumularia*. If put alive into a tank containing a bunch of these zoophytes, it fixes itself among them by its hind legs; and stretching out its body, and every limb and joint, as stiff and rigid as iron, it requires a careful examination to be able to detect it. Among the marine annelides, too, we find the hue of the green, purple, and red sea-weeds exactly reproduced in *Nemertis* and *Planariæ*, &c. The mollusca do not furnish such striking instances of resemblance to particular objects—the amount of concealment shown in the sea-shells being chiefly confined to veiling the glowing colours of the shell under a coarse yellow epidermis, which corresponds in colour to the bottom of the sea on which they lie. Not that we are absolutely without instances of the place of life correspondingly affecting the colour, as for instance in the *Patella pellucida* and the *Patella cærulea*, the former of which is dark, and of the colour of the frond of the large *Laminaria*, on which only it is found; and the latter, which is confined to the stalk, is paler, and of its hue:—an instance, however, on which I put no weight, because it may be pled that both the *P. cærulea* and *P. pellucida* are the same species, modified by food; and where we have an *embarras des richesses* in the choice of unchallengable illustrations in other classes, it is unnecessary to burden ourselves with the defence of doubtful examples in this. Of the lower animals, the *Actiniæ* furnish some good examples of disguise. I can hardly suggest a more perfect one than *Actinia troglodytes* in a sandy pool, its tentacles being so exactly marbled like a sandy bottom, that the pool may be paved with them all expanded, and yet the casual observer—ay, more, the attentive but uninstructed eye—never see one!

The illustrations which I have thus far made use of are drawn from animals exhibiting these disguises permanently, and without variation; but there is another class of imitators which I must not pass over, those which have as it were more than one disguise in their wardrobe—one for summer and another for winter; as, for instance, the Alpine hare, the stoat or ermine, the ptarmigan, some grouse, &c.; and this a disguise which is made more or less perfect according to the severity of the winter, which is the accompaniment, I shall

not say cause, of the change; for in species which constantly inhabit snowy regions, we find that the farther north we go the whiter they become—in the extreme north sometimes becoming replaced by a different species, wholly and permanently white; as in the case of the Arctic hare taking the place of the Alpine hare—both white, but the Arctic of treble-distilled purity compared with the Alpine. In other instances, the change is not dependent upon the seasons. In fish, it is a familiar instance that the colour varies with the colour of the waters. The trout in clear streams and lakes is silvery white; in peaty waters, dark. The Lochnagar trout, for example, where the waters are dark and peaty, is nearly black on the back. The flounder, which exactly resembles the ground over which it hovers, changes its hue in an amazingly short time, on passing from one bank to another of a different colour. Anglers who use minnows for bait know that if they are put in a light-coloured vessel they become pale; and if they be transferred to a dark one, they will become dark in the space of an hour. A similar though more permanent alteration takes place in various birds. Colquhoun, in his entertaining volume, the "Moor and the Loch," says, "In the low corn districts, such as Lanarkshire, Renfrewshire, and the Border counties, the grouse are of a very light brown, borrowing a tint from the stubbles on which they delight to feed." "Forty or fifty are often taken at a time (by snares) during the period between the corn being cut and carried. All these birds are so light in their colour as more nearly to resemble partridges" (p. 112). And we find the converse of this to take place in partridges. "These moor partridges," he says, "which spend much of their time in the heather, are of a darker colour than those of the Lowlands." (Foot-note, p. 113.)

Do any such resemblances as we have been speaking of obtain in plants? They are comparatively few certainly; but in some of the lower plants they certainly do exist. The crusted lichen often bears a close resemblance to the rock on which it is found, and the olive-tinted fucus to the wet reefs which it covers; but the examples are few in plants, and, what is not to be overlooked, we can see no purpose for their existence.

The hasty glance which we have thus cast over animated creation sufficiently shows three things—*first*, that the most perfect imitations of inanimate objects do occur; *second*, that this is not a rare or exceptional thing, but one found in every class of animals, and in some found so frequently as to be the rule, and the want of it the exception; and, *lastly*, that so apparent is the means to the end, that it is plain that there is a purpose in it, and that that purpose is the concealment of the animals that bear the disguise. Now, how does this come about? Is it the result of any general law; or must we be satisfied to say that these disguises have been given by Providence for the purposes of the preservation of His creatures, and rest there? I apprehend not. This is not the mode in which the Creator carries out His ends. It is indeed very easy to say, that a special exercise of the creative power has been used in these disguises in every separate instance; but if it is so, it is different from all we know of the other workings of Providence. A great law in all of them is set in motion, which, while regardless apparently of minor details and individual interests, yet, by its general working, most efficiently provides for them. Through the operation of such laws elsewhere, we see everything harmoniously and necessarily assuming its place and its form; and we cannot doubt that such a great law also exists in this matter.

What is this law? I cannot tell; but it has occurred to me, that the law may perhaps be found somewhere in the direction of an analogous force to the great law of attraction, otherwise called gravitation. Like draws to like, or like begets like. We have seen that in all the instances to which I have referred the external appearance of the animal bears definite relation to the appearance of the soil on which it lives, or the objects which surround it. It would appear as if there were a *genius loci*, whose subtle and pervading essence spread itself around, penetrating and impregnating the denizens of the place with its *facies*—possibly only affecting some, the conditions of whose entry on existence render them more liable to receive its impression than others; more probably affecting all, some more and some less. How this mysterious influence

may operate, it may be bootless to inquire; but is it unphilosophical, or inconsistent with the simplicity and grandeur of nature, to suppose that one great idea should contain the elements of the laws which regulate all the different constituent parts of the created world? that as by attraction the material particles forming the solid globe gravitate to each other—as by the action of chemical affinities a like law regulates their intermixture—so a law of attraction should operate in the immaterial world of thought, and influence the phenomena of organic creation?

Assuming, then, as I think we are entitled to do, that some such law does exist, it will not be an unfair test of its truth to inquire whether its operation, like that of all other such laws, extends to all alike; whether its influence is extended both over the just and the unjust, over the rapacious and the inoffensive; or if it has only a partial bearing, confining itself to the weak and the defenceless, as a means of escape, in the absence of means of defence. So far as this goes, it bears the test sufficiently well. The crocodile receives the impress of its laws as well as the chameleon; the Polar bear or Arctic fox as well as the Arctic hare; the Mantis, which preys on other insects, as well as the leaf-insect, which feeds on leaves. In the one case, the deception is applied for offence; in the other, for defence. And if we remember that the numbers of those preyed upon must necessarily infinitely preponderate over those which prey upon them, we shall not be surprised at a much greater number of creatures using the disguise for protection than for offence.

Another test which may be applied is more difficult of answer. Looking at it as a law, ought it not to operate by itself, independent of assistance from the animal itself;—that is, if an animal assumes a disguise, ought not the disguise to be complete, pure and simple, without the aid of contrivance or trick on the part of the animal? A beetle, for instance, is exactly like a pellet of earth or a seed, but only so when its limbs are all contracted and placed close to its body. In addition to the resemblance, we must have here the instinct of the animal to throw itself into its proper attitude to produce the disguise. True, the natural instinct of fear leads it to

shrink into itself; and we may look upon the resemblance as merely an accidental quality which is brought into play by this instinct. But this hardly seems to meet the difficulty. Two concurrent conditions are needed to produce one effect; and we can scarcely hold that the same law which in other instances produces the effect by its sole action, also, unaided, produces the effect resultant from a double action.

Were such a law of affinities or attractions as I have suggested to regulate the external phenomena of creation, we might expect that, as we do in chemistry, so here we should find many affinities opposing each other, and that the attraction of the colour or appearance of the soil, or habitation of the species, would only be one of many elements by which the conditions of its form and appearance would be determined. This would meet an objection which might otherwise be raised against my suggestion—viz., that on many animals there is no indication, or at least no apparent indication, of an affinity in appearance to the character of the place in which they are found. True, the answer may be likened to that used by the phrenologists, who, when some man with all the good bumps commits an atrocious crime, explain the anomaly by telling us he had counteracting bad bumps. The answer, by force of association, rather approaches the ridiculous; we are inclined to look upon it as a quirky evasion, but this is owing to its misuse and exaggeration; in sober earnest, it is so only when misapplied. Every one of us, if we ask our own conscience, must admit that we have a constant fight going on between our good and our bad inclinations; and the same struggle between opposing qualities, between opposing habits, and opposing laws, is to be seen in every branch of science.

Should my view appear of a nature tending to throw light upon the phenomena of creation, I apprehend it will not be found of less weight if I go a little further, and offer to extend it to the phenomena of life (as in contradiction to the phenomena of creation). These are by no means the same thing. If applicable solely to the phenomena of creation, my suggestion might apply to all such cases of permanent similarity to the *solum in quo* as I have adduced;

but could not, or at all events could only by a more complicated and indirect route, apply to cases of temporary or seasonal variation. No original law of attraction by similarity could regulate the appearance of the variable hare at its creation, because such attraction could only affect it once; and if the hare were once created white or brown, its creation is over, and further change through that law at an end. But if we look upon the rule as subsisting not only at creation, but all through life, and as a great law or influence affecting life, then the subsequent changes of the hare from brown to white, and back again, are in accordance with it. The greater whiteness of all animals at the Poles is explainable; we perceive under what law the fish or the bird assumes the hue of its feeding-ground, although we remain in ignorance of the *modus operandi* of the law.

There is yet a further step, which the advocates of a modification of species might not hesitate to take—viz., to abandon the idea altogether as a law of creation, and confine it to a rule of life. Combined with a belief in the modification of species, it might help us to see how, through its influence, so far as outward appearance is concerned, an Alpine hare might become the Arctic species; how the desert locust might be derived from the common one; how a moth like a weather-beaten, lichen-encrusted rock, should proceed from one from the woods, and so on. There may be truth in the idea that changes in species do arise from the modifications of climate, food, &c.; but I confess that, in the present state of my information on the subject, I am not inclined to look upon such instances as the above as cases where such modification has taken place, but rather as instances of the exercise of the original law I have assumed, or of some other such law of equivalent force and application; and would hold, that while such law may be exercised co-ordinately and simultaneously with one producing a certain amount of modification of species, it cannot be substituted for such modifying principle; still less can the instances of its operation be adduced as proofs of the existence of that principle.

As I have already said, the fact of a great family resemblance subsisting among all the creatures belonging to one

continent and its dependencies, although not properly falling under the head *disguise*, must not be lost sight of in considering this question, and would seem to have a special bearing upon this phase of it. That such great regional resemblances exist, every naturalist knows. Contrast the deep and gloomy Javanese forests, with their gorgeous epiphytes and poisonous-looking plants, with the fir-clad alpine scenery of Norway—the arid plains of Africa with the beauty of our West Indian Islands—the strange Australian scrub with the Tartarian steppes—and see how distinctive and marked is the general character of each; and not less marked in general effect than in individual detail. Show an experienced naturalist or botanist a new plant or animal, prating nothing of its whereabouts, and yet ten to one he will correctly tell the country from which it has come. There is an undefinable facies about them which enables the practised eye to allot to them their proper station, as the detective officer is said to be able to tell the felon, meet him in what company he may; and this family, or rather regional facies, extends around the particular country as the air of its climate envelopes it—as, for instance, in the Gallapago Islands, which lie nearest to America, although 500 or 600 miles distant from it, it is found that although the animals are for the most part distinct, they yet bear the American facies.

Now, although we find this regional character so well marked as I have stated, it stands to reason that all are not equally well defined. Where the contrast in climate and condition of life is great, the difference in organic productions is great likewise. The contrast is much greater between the fauna and flora of this country and West Africa than between those of this country and North America; and of course the converse is true likewise. Where the conditions of life are similar, the animal and vegetable products, although distinct, are found to be similar also. This gives rise to that most interesting class of plants and animals known as representative plants and animals.

But this is a word which is used with two significations, only one of which is properly applicable to my present inquiry. One kind of representative species (and that is the

kind with which I am not at present dealing) is where a specific function is allotted to widely different species, in countries whose climate and conditions greatly differ. For example, the scavenger duty, which in cold countries is mostly performed by the burying beetles, is in tropical countries performed by heteromerous beetles, a totally distinct tribe. These represent each other in their functions, although not in their form or character. The representative species with which I have to deal are those which are found, in similar countries, replacing each other both in form and function. As in plants, the *Cacti* of South America replacing the *Euphorbiæ* of South Africa, the *Epacris* of Australia taking the place of the heath of the Cape, &c.; in insects, the *Eleodes* of California taking the place of the *Blaps* of Siberia, the *Eucrania* of the deserts of Northern Patagonia replacing the *Ateuchi* of the deserts of the Old World; in reptiles, the crocodile of the Old World superseding the alligator in the New; in birds, the ostrich in Africa represented by the rhea in South America, and the emu in Australia; in mammals, the leopard represented by the jaguar, the camel by the llama, and so on.

Now, it is to be observed that this class of representative species is only to be met with when similar conditions of life exist in both countries. The ostrich, rhea, emu, for instance, find the climate and the extensive plains suited to their structure and mode of life, in all the three countries where they are found; they are not to be met with in mountainous countries; the prehensile tailed monkies, the agile squirrels, &c., are only to be found where there are trees; and so in every other instance. Would it not, then, appear that the general character or facies of the animals in different regions is the result of some special influence or condition in the country peculiar to each? and if we adopt this view, must it not follow as a corollary, that, where the conditions are the same, we should see the same facies appearing in each. Now, in point of fact, in those cases where the conditions approach to the same, we see enough to show it to be probable that it is so. I would go further, and say that there is good ground for holding that, were they really *identical*, we should see the

same facies reappear. Let me illustrate this by two or three instances showing the effect of different degrees of nearness of condition. Compare the United States with Europe: the conditions are similar but distinct; so is the fauna. Compare the salt deserts of the Caspian with the salt deserts of the Mormons: the conditions are here more similar; and recent discoveries tell us that the facies of the fauna of these two countries is singularly alike. Compare the Gold Coast, Gabon, &c., and a portion of the coast of Mozambique. Among the Coleoptera, we find Goliaths in both, and many other species allied to species on the opposite side of the continent. They are not the same, but only belong to the same genera. Is this the result of intercommunication, and does it indicate the existence of a similar zoological belt extending across the country? It is mere conjecture to say, No; subsequent explorations must solve the question; but it seems in the last degree improbable that the climate of the coast should extend through the centre of the land. And, lastly, compare the fauna and flora of the Arctic regions of Europe, of Asia, and of America, where the conditions cease to be different, and we find that *there* there is no longer a separate facies—the type of all three is the same. The light in which I look upon these facts is, that where, in a similar latitude, we have similar conditions of existence, we have dependent upon and flowing from that similar zoological provinces, or separate, distinct, and isolated patches, having nothing whatever to do with each other, but, at the same time, possessing allied species; and this I maintain, not through intermixture of species, or by modification of species, or by the passage of the same species from one continent or one part of a continent to another, but by the same conditions of creation presenting themselves for the evolution of the creative idea. Of course, in saying this, I do not speak of identical species, which may have passed from one place to another by the ordinary means of migration or intercommunication. I speak of the general typical resemblance which we find in species distinct and peculiar to each region; and my idea is, that as close a general resemblance would have been found, although each of these regions of the continent of which I speak had been separated from each other by

thousands of miles, irrespective of latitude and hemisphere (the same conditions, of course, existing in other respects).

In short, if we could find two countries exactly corresponding in every respect, however widely separate, I should expect to find, not, of course, the same *species* in both (for as we have different species in our own and every country, so we must expect to find them there), but species of the same families and of the same genera, and, more than that, species very closely allied in form and appearance. It may be said, it is easy to argue from an *if;* but I think here I am able to offer something more than an *if.* No doubt the northern Arctic shores which I have instanced are not widely separated from each other; but I am able to refer to instances of places widely separated presenting conditions as nearly as possible identical, and producing species correspondingly similar. The first case is that of the blind cave animals found in the caves of Europe and Kentucky. Here, in a nearly corresponding latitude, yet in position separated by half the globe, are caves extending for miles into the bowels of the earth; and far in the interior of these caves,* where impenetrable darkness and everlasting silence reign, living eyeless creatures are found—more particularly a number of different kinds of insects. The number of genera and different forms yet known is few, but the number of species is considerable—almost every freshly examined cave furnishing something new. Now, the extraordinary thing is, not only that, in the different caves in Europe, the new species found in almost every fresh cave belong to already known cave genera,† but that the species found in Kentucky also belong to the same genera. The first species discovered there was *Anophthalmus Tellkampfii*, which so exactly corresponds in form and appearance to the European species, *A. Schmidtii* or *A. Bilimekii*, that any one but an entomologist would say they were the same. *Adelops hirtus* and *Adelops Tellkampfii* have since been found; and,

* Schiodte says of the Carniolan caves, that the blind insects are not found until about two miles from the mouth of the cave.

† The cave genera are, with one exception, confined to caves;—the one exception is the genus *Adelops*, of which some blind species are found, not in caves, but in dark places, under moss, &c.

in their turn, they so exactly resemble the Carniolan species *Adelops Milleri* and *Adelops Freyeri*, that the same may be said of them. Here, according to my view, the creative influence, acting under the same conditions, produces the same results—that is, produces creatures as nearly identical as can be without being the same. Nature never repeats herself; and we could not, therefore, expect the very same. And the inference I draw receives a double confirmation from the fact, that a great many of the European caves may be viewed as thoroughly isolated, and as free from communication as the Kentucky from the Carniolan; and I know of instances in which the inhabitants of such caves are not specifically distinct —the Auvergne species from the Pyrenean, the Pyrenean from the Carniolan, and so on. I may therefore say, that in the case of these caves we have a subterranean region as distinct and well defined as any purely geographical region in the upper world. Whether we may find other species of *Anophthalmus* or *Adelops* in the caves of Australia, or in caves yet to be discovered in tropical countries, is another question, and one which would not necessarily much affect the view I have taken, even although the species which might there be found should belong to new genera; for, in the first place, there may be more genera yet to be discovered in Europe—(I have no doubt there are)—and already we know several European genera which have not been found in America, and the converse may in all probability be yet found to be the case with regard to America; so that the mere discovery of a new form would go for nothing—the rather that our knowledge of the fauna of the subterranean region is as yet too limited to allow us to say whether a new form bears its facies or not; and, in the second place, the temperature, or, what is still more likely to affect the fauna of caves, the degree of moisture, may be sufficient to constitute a different class of subterranean region. The European and American is a wet subterranean, the Australian may very probably be a dry one; but if it should prove not to have different conditions, I then should most confidently look for the occurrence in them of new species of the European genera, *Anophthalmus* and *Adelops*.

Another region, *sui generis*, may be adduced as possess-

ing in a certain, though less marked degree, special conditions of life under which similar peculiar forms have been evolved in distant countries, viz.—the interior of ants' nests. As already said, entomologists have of late years found many Coleopterous insects, not met with elsewhere, in the interior of ants' nests. Some of these (the *Clavigeri*, the *Formicosomi*, *&c.*) are invested with the outward appearance of the ants among which they live; others have no special resemblance to their hosts; but the point to which I press attention here is, that the true ant-nest species are found in ants' nests, and nowhere else; that a peculiar facies (in many cases a peculiar structure) belongs to most of them, probably to all which exclusively inhabit ants' nests. The search into ants' nests for these exceptional Coleoptera has been carried on very keenly for some years past in Europe, but as yet little has been done in foreign countries. The little that has been done has furnished very interesting results, and results quite in keeping with the view I have been maintaining. Species of *Paussi* (a marked genus with an exceptional structure, and believed to be absolutely confined to ants' nests) have been found in Spain, in West Africa, at the Cape, at Natal, in the East Indies, at Hong Kong, in Australia, &c. Researches in North America have likewise shown resemblances to our European species in other less exceptional species found in the ants' nests there. We must remember, however, that such a habitat is less defined and restricted, and more subject to the intrusion of external influences than the other special regions of which we have been speaking. There is another kind of condition allied to the last, also drawn from the insect kingdom, which furnishes another instance in support of my position. I mean the singular coincidence of form and appearance shown by all the species of water-beetles, wherever found. The conditions of life in a piece of water vary little, and we see as little variation in the appearance of its occupants. Entomologists have had their ingenuity exercised in endeavouring to account for the presence of apparently the same species of water-beetle (for instance, *Colymbetes notatus)* in distant countries—in New Zealand and Great Britain; and I have myself suggested, that the eggs or larvæ may have been transmitted in the water-vessels of

ships; but it may be that the species is distinct, only that the characters are too slight to catch our eyes. At any rate, there is no doubt about the fact, that water-beetles are so close in structure to each other as to allow of only a very few genera, the great majority belonging only to a small number of distinct forms; and the chief difference appears to depend upon their being carnivorous or vegetable feeders. Again, there is a small beetle (*Ædpus fulvescens*) found on our shores half-way between high and low water mark, and which certainly passes more than the half of its existence under the sea. There are two or three others of similar mode of life, but I more particularly refer to this one. Its usual place of abode is between the flat strata or leaves of shale or other foliaceous rock; and it is provided with means of securing and enveloping itself in a sufficient supply of air to last during its submersion, so as to maintain life, and move about unwetted. On the coast of Chili, a similar small species (*Thalassobius testaceus*) is found living under the same conditions, and having the same facies as our *Ædpus;* sufficiently distinct to be made into a separate genus, but a genus taking its place next to *Ædpus*.

It may be said, that if my views on this point were really sound, we should in like manner find the fishes and mollusca of our own seas, and of those of Chili, &c., bearing the same type. But this by no means follows; for observe, in the first place, we are here comparing an animal created to suit an abnormal condition with those in a normal condition, and it might be expected that the abnormal condition would express itself more forcibly in any deviation of structure than the normal condition; and, in the second place, we are comparing land animals with sea animals, and we are not entitled to assume that the amount of variation in the condition of life necessary to influence the creative idea in the one is the same as that in the other; or that the same tests indicate the relative amount of variation in condition of life in both. On the contrary, we have every reason to suppose that the reverse is the case—namely, that the creative idea in sea animals was (or is) influenced by a less amount of variation in the conditions of life than in land animals. In all animals and plants, the phenomena of life bear a perfect

relation to the phenomena of creation. As already said, the animal created in and bearing the typical facies of any geographical region, is suited to the conditions of life in that region, and thrives better there than anywhere else; and cannot live at all in regions which are much opposed to its native one. The reindeer could not live in the deserts of Sahara, nor the lion in the snows of Lapland. In fact, we may say, that where we find one set of phenomena, we shall also find the other. If we find a region of which the flora and fauna are typically peculiar, we shall find that that flora and fauna is not suited, at all events not so well suited, to any other region. They may live in another region which has approximate conditions of life to their own, but will not thrive in it so well as in their own; and however similar the other region may be to it, they will never make their way in it in opposition to its own native fauna and flora, so as to usurp their place. If, therefore, in nature, we find a special fauna confined to a special district, we may assume that the same conditions which influence its restriction to such local habitat also influenced its original creation. Applying this to the question of the relative amount of variation in condition of life necessary to have influenced the phenomena of creation in land and sea animals respectively, we see that if this had been alike in kind and amount, we should have had the same facies in sea animals nearly all over the globe; because temperature and some other particulars, which will suggest themselves of their own accord to the reader (the great difference in the amount of which forms so important a condition of life on land), are so equal all over the sea that they could form no efficient barrier, were their effects no greater there than what they are on land. All the differences that we can detect between one region and another in the sea, would prove no barrier to the passage of most animals on land. We must therefore allow, that the inhabitants of the sea are either more susceptible than land animals (and *that* both in the phenomena of creation and of life) of the differences in the medium in which they live, or else that there exist in that medium other elements influencing the inhabitants of the sea, which on land do not affect animals, or which we cannot appreciate. If we admit this, we

can have little difficulty in suggesting some of the specialties which may have given rise to different marine regions. The difference between the extent of sea and dry land in different parts of the globe, the greater depth and wider extent of the sea in the south, the different distribution of land, the different ingredients of which the shores are composed, combined with temperature, depth, climate, weather, currents, and possibly even some small difference in the relative proportions of the chemical constituents of the sea itself,—all must operate in affecting the phenomena of life and creation; and it is through the influence of such particulars that we can explain the differences of type in the marine fauna and flora of seas separated from each other only by a few miles of land—as, for instance, the Pacific Ocean and the Gulf of Mexico at the Isthmus of Panama, or the Mediterranean and Red Seas at the Isthmus of Suez.

If there be any such law, it must have been in operation during past geological epochs as well as at the present time; and wherever we can find any stratum containing animal and vegetable remains, marked by a similar facies to that of the animals and vegetables which we now find in any existing region, surely we may draw from them a tolerably correct inference as to the climate and nature of the country in which such bygone forms once lived. If we find, for example, that the fauna and flora of the oolitic period bears a certain resemblance in facies or type to the present fauna and flora of Australia, we may assume that those regions of which the oolitic strata are the debris bore in their time a corresponding amount of resemblance in physical condition to the present state of Australia.

So much for similar conditions of locality producing similar plants and animals. It remains to consider what are the conditions which so influence the creative or vital powers, and how they operate. Can my suggestion of the attraction of resemblance to the character of the birthplace have any bearing here? Its application is certainly less apparent, but, I should say, may still exist. We must remember that there may be, and no doubt are, many points of resemblance which our faculties are unable to appreciate, but which yet exist;

and many which, although we cannot nominate, we yet are sensible of. Most men have some idea of their own of the general character of the different continents—something indescribable, but which yet associates well, in their ideas, with the plants and animals which they know to inhabit them. The essential element of some such inappreciable character may be that which, communicated to the whole animal and vegetable creatures of a continent, gives them that general empirical resemblance which we admit, but cannot embody in words or explain to another.