MAN

A SPECIAL CREATION;

OR, THE

PREORDAINED EVOLUTION OF SPECIES.

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CHAPTER I.

Natural History and its Object.

If we convey ourselves back through the dim ages of the past to the dawn of human existence on our planet, and place ourselves, in imagination, beside the founder of our race as he receives the short edict without comment or explanation, directing him to multiply, to replenish the earth, and subdue it; to most of us it would have sounded as if in mockery of the noble but weak and helpless being to whom it was addressed. Unaided reason, looking at the vast number and varied forms of the creatures that then filled the earth, would see that each and all of them were adapted in every particular to their several modes of existence; that each was provided with adequate means of attack or defence; that each possessed a mysterious intuitive knowledge as to the mode of carrying out all the operations relative to its welfare and existence: in short, that each was perfect in itself.

On the other hand she would see—naked and

unarmed as man was then—that his slow pace, weakness, and comparatively diminutive form, contrasted badly with the fleetness of some, with the great strength and colossal size of others; and finally she would come to the conclusion that this last and fairest of Nature's works was an anomaly physically incapable of carrying on an existence, subject to competition, much less of filling and subduing the earth.

But stern necessity compelled man to attempt the seemingly impossible task, and the result has shown the feasibility and justness of the great edict. The work is now on the point of being accomplished, and reason points out to us that another decree has already necessarily gone forth, viz., that we learn to govern the mighty kingdom that we have conquered. This also, a nearing necessity is about to compel us to undertake; and any neglect or mistake in the execution of the work will be inevitably fraught with the most disastrous consequences.

We are now rapidly obtaining almost complete power over the great kingdoms of organic nature, and more especially in the Animal Kingdom human agency is partly removing and otherwise modifying many of those checks and balances by

which Nature, during the untold ages of the past, continued to harmonize the relations and to adjust the proportions of its numerous tribes.

We begin to see dimly, and, as it were, in the far distance of the future, dark shadows of the injurious results which the continuous action of such agency—unchecked and undirected—will shortly bring about. How to avoid such results is to us a problem of the utmost importance, and its solution is closely connected with the welfare of rising generations. But at this critical period, as at all such in our history, Nature, as if anticipating our necessity, seems, by producing the vast generalising minds of Cuvier and Linnaeus —the apostles of a new science—to have providentially raised up adequate guides to direct us at the exact time we urgently required them.

These great men laid the broad and deep foundations of a science which, when hereafter practically applied in its leading branches to meet the rising wants of man, will be of the first importance, and second to none other in utility. Its illustrious founders will more and more be looked upon as among the greatest benefactors of the human race.

But the great edifice of Natural History is as

yet very far from being completed, though materials are being quickly accumulated for the purpose. Our knowledge of the structure and classification of organisms, whether plant or animal, is already far advanced; but we are still in the back ground as regards many facts connected with their reproduction and perpetuation, and with their modes of subsistence and habits of life, and we are especially ignorant of the great majority of those various causes and circumstances which act and re-act, either directly or indirectly, on any particular group of organisms, either to its injury or to its advantage.

But if we will advance the science of Natural History towards practical utility, all these are points on which we must be thoroughly informed; and in this direction the great works of Charles Darwin lead the way. They form, as it were, a new stage in the advancement of the work. The great mass of curious facts, which he has collected and so lucidly set forth, are highly suggestive of new ideas, and will lead, in time, to the accumulation of more such, by stimulating and directing enquiry in this particular line. They will remain a noble and permanent addition

to our knowledge of Natural History, when the great theory they are brought forward to support will probably have long crumbled away.

In some cases theories may be said to constitute the durable and massive rock-hewn stairs by which we ascend the continually rising edifice of science; in others they are the patched-up framework, and, so to speak, the ever-shifting scaffolding by means of which new materials are raised to their proper place in the building. Both kinds are essential to progress, and their degree of stability must be tested by the pressure of reason and investigation, rather than by noisy opposition which is of no avail.

As some of the views relative to the origin of species, and of man in particular, which it is intended to set forth in the following pages, are, in a great measure, opposed to the "Darwinian theory," it will be necessary to discuss many of the leading arguments by which it is supported.

It seems to be an essential law of Nature that the agents or forces employed in the regulation of our world shall be constant in quality and quantity, and that the expenditure be so proportioned and adjusted that there shall be no waste of force, nor yet any lack of the proper

amount required. This is equally true of the animal kingdom, which, in reality, consists of a varied series of machines, each destined to do a certain amount of work with the smallest possible expenditure of force; and to accomplish this requires machinery so perfect in its construction as not to entail any waste of power in its working.

These forces of nature are the same or closely correlated, whether acting on inorganic matter or on organised beings; but, in the latter case, they are subordinate to an additional force, the greatest and most essential of all, viz.: the "vital force," which, whether it be a single force or the resultant of many, does not concern us at present. But analogy leads us to infer, and observation confirms the truth of such inference, that this inscrutable agent is also limited in quantity and that its expenditure must be strictly economised by the adoption of a perfect mechanism.

The gradual accumulation, as it were, of such forces, in connection with a continually increasing power or manifestation of mind, for higher and ulterior ends which at present we can form no conception of, seems to have been an object of

Nature since first she called forth organised existence on our Planet. In other words, the great chain of organic life is the machinery by which Nature translates and converts the forces of inorganic matter for use in connection with the working of mind. This onward and upward progress, from the lowly forms entombed in the ancient Cambrian Rocks to the monsters of the Tertiary period, has been effected not by fiats and miracles in opposition to pre-ordained laws, but by means acting in harmony with those laws and by adaptations suited to existing conditions; and thus, from the long history of the past, is derived the sure prediction of a grander future.

From such considerations we get a faint and partial outline of the stupendous problem, Omniscience alone could comprehend, solved by the Creator when He determined to call forth organic life on the earth. And hence also we partly see the necessity for instituting, in the first place, several primary types or plans of structure by the possible specific modifications of which organised beings shall be more perfectly adapted to the varied conditions in which they are placed. The individuals of each carrying on all the operations of life under conditions which no possible

amount of modification, short of change of type, could enable their contemporaries of another class to do without entailing such waste of power as would prove fatal to their existence. Class, order and species are introduced by Nature, to enable her to accomplish successfully the purposes for which creation was designed.

The Animal Kingdom is limited to some five or six of those primary types or sub-kingdoms, which, in turn, are made up of a limited number of classes and so on until we reach species. Group is subordinate to group, and as we descend the members of each group resemble each other more closely.

The theory of gradual transition or modification from common progenitors is alone thought competent to account for the general likeness borne by the members of the various groups; and this it would very successfully do were the transitional forms anywhere to be found, but, until they are forthcoming, the theory rests on an assumption. But it is argued that owing to the imperfections of the Geological records, such forms may not have been preserved, or remain to be discovered in places hitherto inaccessible to man—and so the case stands at present.

Further on we shall endeavour to shew, on scientific grounds, that no such transitional creatures could ever have existed.

It is a plain fact that the distinct types or plans of structure in the Animal Kingdom are, up to the present, limited to some five or six; and it follows of necessity that there must be a certain likeness or unity of plan pervading the structural confirmation of the various subordinate groups belonging to any primary type of organisation. The individuals of one group must bear a certain likeness or relation to the individuals of another group belonging to the same type. Their principle structures, in whatever way produced, whether by like or unlike causes, must be homologous, though each individual were a special creation; and so the often repeated argument of construction after a common type, the embodiment of a mental conception, is fully competent of itself to explain any general likeness borne by the members of the various groups.

CHAPTER II.

Homology and Rudimentary Structures.

Mr. Darwin, in his elaborate work on the "Descent of Man," arrives at the following conclusion, viz :—"The early progenitors of man were no doubt covered with hair, both sexes having beards, their ears were pointed and capable of movement, their bodies were provided with a tail, having the proper muscles."

Before entering into any of those arguments on which this conclusion is based, let us try and get some conception of the sort of creature that is described in the text. According to the "Darwinian theory" it is not necessary that such a creature should resemble closely any of the Anthropomorphous apes at present in existence, although it must be of the quadrumanal or simian type, and of considerable size. But the fact of such creatures having pointed and moveable ears would tend to place them much lower in the scale than most of our present

quadrumana. Such a trait is correlated with the form and is characteristic of the lower orders of mammalia; it is to a certain extent incompatible with the simian type of structure; and if we place them in a lower order, we must do away with the simian form, and with the beard, which is also characteristic of a higher order; but to do this would be to do away in part with Mr. Darwin's conclusion.

As regards the tail, owing to the facility with which the quadrumana can use their limbs to ward off insects, this organ is not required in them as in many other quadrupeds to act as a fly-flapper, but is used as an organ of prehension, or as a balance to steady the movements of the creatures amongst the branches of the trees, and it can only serve those ends in the smaller and lighter species that lead arboreal lives; but no reasonable amount of development would make it strong or heavy enough to be of any use in either respect to the larger and heavier species: in them it would be simply a useless appendage, and so we find it invariably wanting or rudimentary. Analogy would further lead us to infer that it was also wanting in the ideal progenitor mentioned above, but this clashes with the state-

ment contained in the text, which, taken as it stands, gives us the outline of an ideal creature almost as strange and heterogeneous in structure as were the fabled Satyrs of the poets of ancient Greece and Rome; and the probabilities are that no such creature ever existed.

Seeing that all the divisions and sub-divisions of the vertebrata are formed by the modifications of one common type, we must necessarily expect to find as we descend, an increasing homology between the subordinate groups, and consequently the searching out of homologous structures is a favorite pursuit with anatomists of the present day, and is in some instances carried to a pedantic extreme. One sees in the transverse tendinous lines, which give strength to the rectus abdominis muscle by dividing it into sections capable of acting independently, vestiges homologous to the abdominal ribs of reptiles; a second sees, or perhaps fancies he sees, a rudimentary homologue to the extensor muscle of the tail in animals attached to the os coccyx in man; a third considers the whole external ear and its muscles as a useless rudimentary appendage, the hereditary remnant of a more developed organ in some lower animal.

A little consideration suffices to show that such conclusions are mere assumptions without foundation.

On looking at the external ear in man, we at once see that a great portion of it—the pinna,—stands out from the head, and that it is being mechanically interfered with in various ways, that it has a certain weight, and is acted on to some small extent by gravitation; and unless adequate means are taken to counteract such continuous interference it will, in time, become more or less displaced, and partly lose its shape, or droop in a degree proportioned to its size. This tendency is in a measure counteracted by the elasticity of the fibro-cartilage of which the pinna is formed, and by ligaments of fibrous tissue; but such purely mechanical supports would gradually yield to the continuous action of the agencies mentioned above, unless supplemented by a more vital structure—the muscular, regulated by nervous supply, as we see they frequently do in animals when the muscles of the pinna cease to act from paralysis or any cause that stops their supply of nervous force. This result would be less apparent in the case of the human ear, owing to its form and comparatively

smaller size; but the difference would be one of degree and not of kind. Bearing this in mind, we are prepared to meet with two sets of muscles in connection with the external ear. One set, the attolens attrahens and retrahens seem to guard against any tendency towards displacement of the organ. The other set, the intrinsic or proper muscles of the pinna, by their action assist in preserving the shape of the ear. The major and minor helicis preserve the fold of the helix and prevent its unravelling. The transversus auricular muscle passing from the convexity of the concha to the convexity of the helix, tends to draw the two folds nearer to each other, and so produces between them a sulcus or depression of the cartilage behind or outside which causes it to rise in front into the prominence known as the antihelix, one of the uses of which is to serve as a sort of mechanical buttress to the fold of the helix. If you press down with the fingers the fold of the helix towards the antihelix, you will clearly perceive that the latter offers a firm support to the former. In like manner every fold and prominence of the ear have their use; they give to the organ its peculiar shape. They give it strength to preserve

that shape, and they are themselves preserved, and partly, if not altogether, formed in the first instance by muscular power, in a way similar to that by which the muscles of the back assist in gradually producing the proper curves in the spinal column of the infant. These folds and prominences further guard the opening of the ear to a great extent from the intrusion of foreign bodies, and they protect it from the direct action of the wind, for let it blow in what direction it will, some fold or projection prevents its entering the meatus in a direct line.

The human ear is further correlated with the human face and form. It has a certain amount of expression peculiar to itself, and it assists in forming the general expression of the features. We all know that expression cannot be produced without the action of muscles under nervous control, and in this we see another use for the muscles of the ear. Every one is aware of the utter blank of a paralysed face, and if the ear be involved, the same blank extends to it, though in a less remarkable degree.

As regards a tubercle noticed on the outer margin of the ear, it simply marks the termination or is formed by the termination of the

complete folding in of the cartilage that forms the fold of the helix above; it is more or less apparent in every ear. Below this tubercle the cartilage is continued downwards, with slight if any folding inwards.

Not a single fact can be adduced to show that the external ear or its appendages are in any degree rudimentary, or that they are the remnants of more developed structures of some former and lower species; but many facts go to prove that they are not, and that they are fully and perfectly developed in relation to the human form.

On looking at the skin or integument of man, we find that it has a tendency to gravitate downwards, and fall into loose pendulous folds. This tendency is, to a great extent, counteracted by its being bound to the deeper and stronger fascia of the body by fibrous tissue of more or less strength; and in some parts, as about the joints, where it is necessary that the skin be more firmly fixed, we find distinct and well marked ligamentous bands of fibrous tissue, which might be named osteo-cutaneous, connecting it to the bones. Such ligaments may be seen clearly proceeding from the side of the first and second

phalangeal bones of the fingers to the integument about the finger joints. They were first dissected and described by Professor Cleland of the Queen's University in Ireland. But there are parts of the body that will not admit of the integument being solely kept in position by such fixed mechanical structures as the above. These are the parts connected with expression, as the forehead, face and neck. There muscle is added to serve the double purpose of giving support and of producing expression.

The platysma myoides may be taken as one of the best examples of a muscle having this double purpose. We all know how liable the skin of the neck is to fall into folds; this the platysma in a great measure prevents, and hence the creased appearance of the skin of this part in old persons. It is, besides, one of the most powerful muscles of expression, and might be named the Tragedian's muscle, from its great development in most of those men. In them its contractions are very marked, and can be seen at a good distance. Its action is generally involuntary, but it is under the control of the will in some persons. When well developed, its fibres extend into the axilla, and partly over the

Deltoid muscle on the shoulder. When so developed, it may be seen to brace and draw up the skin of those parts. Its fibres in those places are, if I mistake not, described in the "Descent of Man" as anomalous slips without use, the remains of the paniculus carnosus of brutes. The entire platysma is described as being derived from the paniculus. The connection of the "anomalous slips," mentioned above with the platysma, can be demonstrated in the dead subject, and also by their contractions in the living individual in whom the platysma is under the control of the will. They all go to form one useful and well-developed muscle, that cannot be at all looked upon as a rudimentary vestige.

From the way in which the os coccyx is dealt with in the same work, a reader unacquainted with anatomy would come to the conclusion that the presence of this bone in man pointed unmistakably to his descent from some creature possessing a tail; and that it was hardly of any use beyond this in the human frame. Now the fact is that this bone is of the utmost importance to man. It gives attachment to many muscles and ligaments connected with the functions of every

day's life. Its size and shape are perfectly adjusted to its use in these respects. It fulfils a definite purpose; it could not be larger or smaller without injury to the general economy, and consequently it cannot be looked upon as a rudiment. The pieces of which it is composed are ossified one to the other, and, therefore, are incapable of being moved by ordinary muscular action, and hence a muscle homologous to the extensor muscle of the tail in brutes, supposed to be seen attached to them, can have no existence; it could not be of any use, as it could not act or produce motion owing to the ossification of the coccyx, and, therefore, if it were ever developed, it would soon disappear or degenerate into mere fibrous tissue.

The fact of any organ or structure being small in comparison to its homologue in some allied species or genus does not entitle such organ or structure to be looked upon as in any degree rudimentary, or as the result of inheritance from the more developed structures, if it can be shown that it fulfils adequately certain purposes in the general economy of the individual. But there are a few instances in which it is difficult to assign any particular use to structures so reduced

as regards comparative size. The wing bones of the apteryx may be taken as one of the best examples of truly rudimentary structures without any functional use whatever. Two explanations are given: one, that they are hereditary vestiges, and the result of gradual transition from fully developed structures; the other, that they are retained in conformity with a typical plan. The latter explanation leads to a question as to how or by what means they are so retained.

It is one of the great characteristics of the vertebrata that the limbs or appendages to the central axis, however modified or displaced to meet different ends, shall never exceed in number two pairs. If we except certain forms that seemingly are being degraded from a higher position, probably tending towards extinction as the apoda among fishes and the Ophidian order of reptiles, the vertebrate type has a strong inherent tendency to produce one or both pairs of limbs. In fish these limbs serve to balance and steady the movements and to check progression; but in many cases they have little power to aid progression. And it may be taken as a general rule that as we ascend from the lower to the higher forms, we find the limbs ob-

taining greater size and power for the performing of higher functions; the advancement is from below upwards; this in itself is quite in accordance with the Darwinian theory; but in these lower groups, except those mentioned above, in which we find the limbs rudimentary, we cannot look upon them as the vestiges of more developed organs of some higher creatures. In such cases we cannot admit the hereditary hypothesis, and although they may be looked upon as "nascent organs" about to be more fully developed hereafter, yet their presence can be more satisfactorily explained by admitting the existence of some innate tendency in nature to produce in each group the more essential characteristic structures of the vertebrate type. And so the rudimentary wings of the apteryx, and the germs of teeth said to be found in the young of ruminants, and in the fœtal whale before birth, may be due to this same tendency, though such structures are not incompatible with the hereditary hypothesis.

There is also a structure—the vermiform appendix—met with in man that at first sight appears to be rudimentary and of no use whatever. Yet it may have served some purpose

during fœtal life; and I think it can be shown that it serves a purpose in the adult individual. We know that the cœcum is the most distended portion of the intestines; that it often contains large accumulations of fœcal matter, which give it weight, and cause a drag on it that would tend towards its displacement, which would be fraught with serious consequences. To guard against this it must be firmly retained in its place in the right iliac fossa. This is effected by a fold of serous membrane, known as the peritoneum passing over the anterior surface of the gut. It is loosely connected behind with the areolar tissue of the iliac fossa. Both these structures would gradually yield if long subjected to any continuous strain; but this is further guarded against by the gut taking an upward direction under the name of the ascending colon, which portion is similarly bound down by peritoneum. From the end of the cœcum arises the vermiform appendix. It is coiled upon itself, and is completely surrounded and fixed in that coil by a firm fold of the peritoneum. It looks almost like a cord attached to the end of the cœcum, knotting it by means of peritoneum to the iliac fossa, thereby securing the cœcum more firmly in its

place: the coils prevent its slipping. This use can easily be demonstrated by dissecting the cœcum from the peritoneum and iliac fascia when it will still be found to be retained in its position by the vermiform appendage.

The fine down or lanugo found on the human fœtus is considered as a rudimentary structure, indicating our descent from some early progenitor that was provided by nature with a covering of hair, though in reality it seems to be a temporary structure intended to assist the vernix caseosa, a sebaceous matter that protects the skin from the macerating effects of the liquor amnii which surrounds it.

Seeing that man, under all the conditions in which he is placed, requires more or less covering as a protection against cold, wet, or even heat—it matters not whether it be clothes or a hut in which he takes shelter—the adoption of either shows the same absolute necessity for some such protection. And in the half-human state, before man was capable of providing himself with either, can it for a moment be admitted that "sexual selection," which Mr. Darwin brings forward to explain the difficulty, was capable of gradually divesting him of his neces-

sary covering in opposition to the stronger law of "natural selection," which, we should think, would act with greater force in preserving a structure of the first importance to its owner? It is an assumption, without proof and against reason, to conclude that "sexual selection" could bring about results so disadvantageous to the immediate welfare of any creature. Such half-human beings could have had no idea of providing themselves with an artificial covering; and can we think that they had such a true conception of naked beauty that, stimulated by sexual rivalry, they gradually attained to their ideal, which they then transmitted so unalterably to their descendants, that the vitiated tastes of the latter, though stimulated by the same sexual rivalry, and operating for some thousands of years, have been unable to change it in the smallest degree. Such a supposition cannot be entertained—or, if so, how is it? That many barbarous tribes have not succeeded in establishing the hereditary transmission of some of those mutilations of person, which, they consider, give them increased beauty; or how is it that some Eastern nations—remarkable for their ancient civilization—have not succeeded in establishing

a bald race as the embodiment of their conception of beauty, in accordance with which, from time immemorial, they have been in the habit of carefully removing the greater part of the hair from their heads, and, in some instances, from their eyebrows and eyelids. This happy result has been more nearly attained by the civilised nations of Western Europe through a disease of the hair, induced and spread by the general adoption of unsightly wigs.

The beard has been subjected to a similar persecution, and its thinness or absence is pointed to as being brought about by such means. But the fact of its still requiring to be dragged out by the roots, after many centuries of such treatment, casts a doubt on the power of "sexual selection" to bring about the results attributed to it, and leads us rather to seek for some other explanation—an explanation that will probably be found to be related, or connected in some way, with virility in the individual and the race.

The presence of hair also, at the same time, on the most exposed and protected parts of the body, presents a difficulty not to be explained by either selection.

It is noticed by Mr. Darwin that when the hair and beard differ in color, the latter is always lighter or fairer than the former. In monkeys possessed of a beard, the same rule is said to be observed. And this is brought forward as a further proof of man's descent from some such creature. Since my attention has been drawn to the subject, I have noticed instances in which the reverse obtains, the hair being very fair whilst the beard was of a dark brown color. But I think it will be admitted that arguments based on the color of the hair or beard have very little weight on either side of the question.

On the whole, if we except the remnants of a few structures that served a purpose during fœtal life, it cannot be satisfactorily shown that there is a single rudimentary structure in the human body; and this we might infer from the extreme perfection arrived at and exhibited in its entire organisation.

CHAPTER III.

Structure and Function.

"He who believes," says Mr. Darwin, "that* each animal has been created as we see it, must occasionally have felt surprise at seeing habits and structures not at all in agreement. And," he adds, "what can be plainer than that the webbed feet of ducks and geese are made for swimming. Yet there are upland geese with webbed feet which rarely or never go near water. And no one, except Audubon, has seen the frigate bird, which has all its four toes webbed, alight on the surface of the sea. On the other hand, grebes and coots are eminently aquatic, although their toes are only bordered with membrane. What seems plainer than that the long toes of gralatores are formed for walking over swamps and floating plants? Yet the water-hen is nearly as aquatic as the coot, and the landrail

* "Origin of Species."

nearly as terrestrial as the quail or partridge, living in meadows instead of swamps. In such cases, and many others could be given, habits have changed without a corresponding change of structure."

From the statements quoted, it is argued that in time a change of structure which might go on to a change of species, would, no doubt, follow the change of habit; and the deeply-indented web in the foot of the frigate-bird is adduced as a probable example of structure beginning to change with the supposed change of habit.

Now grebes and coots are eminently aquatic in their habits, and we have good reason to think that they have been so during many ages. And, at first sight, we conclude that if change of structure gradually follows change of habits, we ought to find it taking place here. The habits of these birds require that they shall be able to swim well, and no kind of foot is so effective for the purpose as the webbed foot. And if the transition theory were correct, we ought to find a tendency towards its formation. But Nature, as if in protest of half measures and transitional steps, institutes a different type

of foot more perfectly adapted to the habits and wants of these creatures; yet so totally different to the webbed feet of swimmers as to exclude its being looked upon as in any degree tending towards the formation of that type. The membranous lobes bordering the toes of grebes and coots are so peculiar that some naturalists have arranged them in one order, under the name of Pinnatipedes. These lobes enable the birds to swim with great ease, and are quite compatible with their requisite power of running.

For the purpose of swimming the webbed type of foot is the most effective but it is the least effective for progression on land; web-footed birds walk badly, and, as a rule, they can hardly be said to run unless they use their wings. Owing to the tender nature of their feet, which are adapted for paddling over soft marshy ground, they cannot walk much over rough or stony land without getting lamed from having their webs punctured or torn, and as regards "upland geese" that are said rarely or never to visit water. Geese are large and heavy birds, and whether in the wild or tame state are essentially graminivorous and cannot exist without a certain amount of pasturage with at least as much water

as will afford them a daily supply of drink. From these facts we can deduce the necessity for their form and structure.

In bleak upland districts as the frost and snow set in, unless a special provision were made by man, geese would be unable to obtain either food or drink, and would inevitably perish if nature had not provided them with long and powerful wings to carry them where they might obtain both. This is the meaning attached to those long lines of geese that may be seen flying southward as the cold season draws near; the places which then are most likely to afford to them a constant supply of food are the low marshy districts lying along the larger streams and rivers. But to live and obtain food in such places they must be able to swim with facility, and their size and weight exclude the possibility of their being able to do so with any other modification of foot than that with which Nature has provided them. Those birds that swim much without being web-footed are of comparatively small size, and are enabled to do so by means of lobed and elongated toes which give them a length and breadth of foot in proportion to their size, very much greater than that of other birds. Such a type of foot

could not be extended to large and heavy birds; to be of use to them, it would require to be of such a size as would render it an unsightly encumbrance. Hence we see an imperative reason for geese retaining their webbed feet and powerful wings.

Extensive upland moors are generally well supplied with tarns and pools which are visited daily in the summer time by any geese that may be in their vicinity. As regards tame geese bred in upland districts, if one were to examine closely a flock in the late harvest he would generally find that some of the quills had been pulled from their wings; on asking the cause of this he is immediately informed it is to prevent their flying to some distant water; and in the summer time when the water grows scarce in such places, the wells must be carefully covered over, to prevent the geese getting into them to wash and drink. You may also see a flock dash about on the dry ground and flap their wings as if in the water. They are then said by the country people to be wishing and flapping for rain. Such facts show clearly that geese under all circumstances are impelled by instinct, habit, and necessity to resort to water wherever it may be found.

Let us now examine the family of Rallidae and see if they present any change of habits or habits not in accordance with structure. These birds live chiefly in low marshy places and amongst the sedges bordering the sides of streams and lakes, and it is of the first importance to them that they shall be able to make their way with ease and rapidity through the tangled herbage and run over the floating plants met with in such places. With a view to this their bodies are wedge-shaped or compressed from side to side, and their toes are greatly elongated. Their entire structure is characteristic of speed of foot, which we have seen is incompatible with the webbed type. And this shows us the advantage derived from the structural organisation of these birds remaining as at present constituted. Their great length of toe in comparison to their size by presenting a tolerably large surface to the water, enables them to swim with more or less facility; but as might be expected they swim slowly unless membraneous lobes are added as in the case of coots; and consequently the water-hen when she wishes to cross a stream or go to a distance over water generally prefers to fly. The membraneous lobes on the toes of coots en-

able them to swim well with greater ease, and do not interfere with their power of running through reeds and sedges.

The landrail, whose pleasing crake may be heard in the late evening in contrast with the equally pleasing pipe and bleat of the snipe, frequents meadows in the breeding season; but it will be noticed that those places are selected, if available, that afford the best cover. They are generally heard close to a ditch or drain containing stagnant water, and grown over with weeds and coarse grass, or in the vicinity of rushes and sedges growing by the side of a marsh or lough, in which they instantly conceal themselves if alarmed, and in those places their course can only be made out by means of a dog trained to follow their trail; and sometimes, when too great a quantity of marsh and water interferes, it cannot be followed at all. The rapidity with which they make their way in such situations is truly astonishing, and is intimately connected with their welfare, even as a protection against their enemies; for otherwise, in many districts, they would probably be exterminated by boys and dogs. At the close of the breeding season they are generally unable to fly, and then their

sole safety depends on their power of running and concealing themselves. Now, those are some of the habits and structures that Nature is accused of not having formed in accordance.

If we were informed accurately of the habits and mode of life of any particular bird, without having seen it or without knowing anything of its appearance or structure, we could form a tolerably correct idea of both; and in this we would be guided chiefly by a knowledge of the organisation of some well-known family of birds, the habits of which corresponded to great extent with those of the bird under consideration. In this way the family of the Laridae or gulls may be taken as affording a key to the structure of the frigate bird.

Gulls pass a great part of their time on the wing in search of food, and, as a matter of course, their wings are large and powerful; their feet are not much used either for walking or swimming, and are not greatly developed. They seem rather to float and rest upon the surface of the water than to swim, and this helps us to understand a curious fact in connection with them, viz.: in some instances in which I have seen gulls shot at and winged as they sailed over the

beach, though they fell upon the rocks close to the water's edge, they never tried to escape as most other birds would by fluttering along the ground, or by running into the water. They appeared as if conscious that they lived and sought their sustenance solely upon the wing, and, deprived of which, they had no hope of being able to live or obtain food, and so submitted passively to their fate. I shall not easily forget the desponding and pitiful look of those poor birds as they lay helplessly upon the beach. Each almost seemed to say, "Why did you strike me down? I lived in harmless enjoyment. I was a source of pleasure to many; I gave life and beauty alike to the water and the cliff."

Seeing that gulls swim very little, unless their habits were closely studied one would be led to think that their webbed feet were of no great advantage to them; but it may be noticed that when gulls stoop to pick up anything from the surface of the water, they steady themselves for a moment by striking the water with their webs, and by partly standing on it as it were. In this way they are constantly using their webs with advantage. But they also light upon the water and plunge below its surface in pursuit of prey; and in proportion

to their size they would find it difficult or impossible to get on the wing again unless they had webbed feet to act effectively on the water as they tried to spring from its surface. The albatross even requires to run many yards flapping its wings along the surface before it can rise into the air, and this it would be impossible for it to do without webbed feet.

Now, frigate birds are often met with far out at sea. They remain almost constantly upon the wing, sailing high over the surface of the water, into which they suddenly plunge in pursuit of any fish that may appear near the surface.

In accordance with their habits, their wings are extremely developed and their feet are very small and we must think are not used much, if at all, for swimming. But as long as their habits are what they are, as long as they continue to derive their sustenance from the wave, they must retain the webbed structure. Owing to their great extent of wing, they do not require so complete a web to enable them to rise from the water as any of the other birds to which they are allied, but their four toes being united by membrane adds comparatively to its breadth and makes it so much the more effective for this pur-

pose. It does not alter the case much whether they light upon the water or not; so long as they pitch into its depths they will require their webs in rising from it again; but one is led to think that they do occasionally light on the water, and Audubon testifies to the fact of their doing so. They are said to build in trees, and are probably enabled to perch more securely, owing to the membrane uniting their toes being deeply indented. On the whole it is manifest that the feet of the frigate bird are webbed in direct proportion to its wants, and in accordance with its habits, and that apparently neither of them are changed in the smallest degree.

Mr. Darwin says:—"If it could be proved that any part of the structures of any one species were formed for the exclusive good of another species, it would annihilate my theory, for such could not be produced by natural selection."

We often find in the same animal, structures that serve a double purpose to the advantage of their owner; and consequently it is not to be wondered at if we meet with few, if any, the exclusive use of which relates to the good of another species. Such can rarely be necessary,

for nature is economic and ordains that, as far as possible, the same structure shall serve different ends. Consequently there are many structures that, whilst they serve a purpose in connection with the wants of the animal to which they belong, appear also to be unmistakably constructed with a view to their meeting the wants of a different species.

The fleecy covering of the sheep may be taken as one of the best examples of such structures.

If looked at alone in relation to the animal, it is a structure not well adapted to serve the function it was designed for. It is greatly too warm and too cumbersome in hot weather. In wet weather it admits the rain to the back of the animal, which often gives rise to scalding or excoriation of the skin, and gets so saturated with wet as to add greatly to its weight. It is particularly liable to get matted by collections of dirt, and it interferes greatly with the animal's power of running, and prevents it making its way quickly through shrubs or bramble; and finally it is by no means so effective a protection against cold or wet as a short thick covering of hair, and consequently such a covering could not be produced by natural selection, but rather in

opposition to it. On the other hand it is a structure peculiarly adapted to the wants of civilised man, and if not formed exclusively for his good, it is more intimately connected with it than with that of the creature to which it belongs. It cannot be argued in this case as in some others that are opposed to the theory of "natural selection," that it is the result of "sexual selection," which has overbalanced the essentially greater power of "natural selection;" and although selective breeding greatly modifies and improves the quality of the fleece, it could not have produced it in the first instance, and even when produced we have no knowledge that selective breeding could perpetuate it in opposition to the law of "natural selection," the action of which would be to reject it as unsuitable to the wants of the animal. In fact sheep, as a species, must have been produced in direct opposition to "natural selection," and if removed from under the fostering care of man would soon become extinct. Their young, which in every age has been justly regarded as the type of innocence and helplessness, would be snatched up by birds of prey, and the full-grown animals would be exterminated by the carnivorous tribes.

How then in opposition to such enemies, could they in the first instance compete successfully in "struggle for existence" with swifter and stronger animals? There is only one explanation (namely), as a special creation designed solely for the use of man, and as such they were no doubt matured under suitable, perhaps exceptional conditions. Looked at in any other way their existence is an enigma not to be explained by any theory of selection as yet propounded.

The sting of the bee also exhibits a modification of structure which if its perfection were admitted, would according to Mr. Darwin's statement be fatal to his theory. The backward serations of this organ are formed as exclusively for the good of other species as the poison which it conveys is formed for their injury. It is not nor cannot be denied that the latter is perfectly adjusted and elaborated with a view to the injury of other creatures; can it then be admitted that the agency whatever it be that perfected the latter, failed to perfect the former; or that it produced a powerful offensive weapon the using of which owing to faulty construction, involved the death or mutilation of its owner; or was the power

that perfected the wonderful visual organs, and the still more wonderful and inscrutable instinct of these creatures, unable to perfect in the same time the coarser structure of their stings? All the works of Nature reject such a conclusion. The serrations met with on this organ are so plainly related to the welfare of other creatures and so entirely opposed to the law of natural selection, that Mr. Darwin, to overcome the difficulty, concludes against all analogy and experience, that the sting of the bee is as yet an imperfect organ, though it is not plain even according to the law of natural selection how a variation so prejudicial to its owners could in the first instance increase to any great extent. But there is a simple explanation that avoids all the inconsistency of such a supposition, viz.: that bees have many enemies and would probably soon be exterminated if Nature had not provided them with a suitable weapon of defence, but then for the good of other creatures, it was necessary to adopt some means to prevent their becoming pests by using it too freely or unnecessarily; and this the serrations effectually do, and consequently these creatures instinctively avoid using their stings unless captured, or in defence of their nests.

If natural selection were at all capable of playing the great part attributed to it by Mr. Darwin, a part in which anything like pre-ordination or direction is not admitted, and that has for its only object the sole welfare of the individual species, regardless of the good of all other creatures, we ought to find no carnivorous tribes existing, natural selection having rendered the flesh of each animal unwholesome or poisonous to every other. This is not impossible for many creatures are actually so; but it is the exception and not the rule and has been ordained probably for a special purpose if we could find it out. Again, in the want of particular organs that many creatures might be supposed to possess, we see a special modification ordained for the good of other creatures. For instance the Ophidian order of reptiles has heretofore played a necessary part in maintaining the balance of the animal kingdom, and in some places does so still to a great extent by keeping in check the too rapid multiplication of smaller animals; but to accomplish this serpents must be of all sizes, and the smaller species, had they not been armed with poison fangs, would have been the most helpless of all creatures; and as a matter of

course they would soon have been exterminated. But Nature provided them with weapons of defence from which all other creatures instinctively shrink. We only know by experience and research which species are poisonous and which are not. The lower animals exhibit the same fear of both kinds; and we ourselves show almost the same horror of both, and destroy them alike when opportunity offers. Now we know not—as far as external conditions go—why one species should be poisonous and another harmless. It would be to the advantage of all the smaller species to be armed with poison fangs, yet "natural selection" has been unable to provide all alike though they live under the same conditions. But it has evidently been ordained for the good of other creatures. If all were rendered poisonous, they would be the scourge of the animal kingdom; but the few that are necessarily rendered poisonous as a protection against their enemies, extend this protection to the harmless species by their outward resemblance of them. Thus the advantage derived from the adoption in a few instances of such a special protection is as great as if it had been extended to every species of the whole

order and at the same time the injurious results of such an extension are altogether avoided. How utterly any "selections," apart from pre-ordained and unerring direction, fail to account for such facts.

CHAPTER IV.

Varieties of Color and Form.—Cause of Color among Races.

The varieties of color met with in the great class of birds are in most instances so inexplicable by the laws of "natural selection," that Mr. Darwin, to account for them, calls in the aid of "sexual selection," and devotes a great part of his work on the "Descent of Man" to a discussion of the subject; and towards the conclusion he meets the unanswerable argument of the Duke of Argyll that proves to demonstration that "beauty and variety" for their own sake are the real objects sought to be attained, by a statement, the weakest contained in his book,* viz., that he attributes such varieties of color rather to "capriciousness of taste in birds themselves." But the difficulties that present themselves, in trying to account for

* "Reign of Law," by the Duke of Argyll.

them by "sexual selection," are equally numerous and insuperable.

If the more brilliant coloring of the males were at all due to sexual selection—to their being rendered more attractive to the females on account of any slight variation in color, we ought to find the law to prevail among all birds. There is no conclusive argument to show why this should not be the case. Yet, in numerous instances, the birds of both sexes are equally plain colored or brilliantly colored. The explanation that in the latter the females hatch in covered nests, and can, in consequence, take on with impunity the colors of the male is not sufficient, but rather shows us—owing to the many exceptions to the rule—that we must look for some other cause to account for the plainer coloring of the females than that of utility in rendering them less conspicuous during incubation; for, in very many instances, they build in holes and inside buildings, or they construct covered nests, or more frequently open nests, so situated as to be concealed from view by a thick foliage. In such cases we are forced to reject the argument based on utility to account for the plainer color of the females. Besides, in

many cases, the colors, though plainer and less strongly marked than in the males, render their owners hardly, if at all, less likely to be seen; and, so far as we know, Nature never institutes half measures. When she adopts protective coloring, it is complete and effective. On the other hand, female birds of bright color often construct open nests, or the males even sit on the eggs. These facts conclusively show that the situation or construction of the nest, whether open or covered, has very little to do in determining either the plain or brilliant coloring of female birds. Again, the explanation that the bright colors of the female, when similar to those of the male, are gradually derived from the latter through inheritance, and therefore are not opposed to the supposition that the colors of the male are due to sexual selection, is unsatisfactory, unless it can be shown that all female birds will in time gradually assume the same colors and appearance as the male; but it is hardly possible to do this, in the face of facts, that indicate, as a general rule with few exceptions, not only a difference in color but a difference in form and structure between the sexes that extends in a more or less marked degree to

the whole Animal Kingdom. Adaptive coloring is also opposed to this view, for there is necessarily a limit to ornamentation. It has bounds beyond which it cannot pass without injury to the owner; and such bounds, we have reason to believe, have been long since reached by the male birds; and if time and inheritance could account for similarity of colors, the females ought already to have attained to the same standard. When birds take on a distinct winter and summer plumage—whether such plumage is protective or not—the difficulties are increased. If Mr. Darwin's supposition be admitted that an ancient style of plumage is resumed during the winter in a modified form, then we must conclude that the ancient plumage of the ptarmigan was white all the year, and such would have been injurious to the bird in the summer season; and as the plumage of the young is said to correspond with the former or ancestral plumage, that of the young ptarmigan ought to be white and especially so as the bird still, according to theory, takes on in winter its ancestral plumage. I do not know that this is so, but I am led to think that it is not so; for in some instances in which the immature plumage

differs from that of the adult. It serves a purpose which we can plainly understand; and we must think it has rather been designed to fulfil that purpose than that it is merely a coincidence in which the colors of an ancestral type serve an end for which they were not designed, and especially so when we have reason to believe that since the establishment of the species, the habits of the mature birds show that to them the fulfilment of such a purpose would be superfluous. For instance, the habits of the lapwing, combined with its powers of wing, are such that in the mature state it can dispense with assimilative coloring as a means of safety. It is always on the look-out for its enemies, which it evades by flight. The favorite building ground of these birds is low moss-land studded with rushes, and generally bordered by a moor, to which, in the breeding season, they give a pleasing, animated appearance as they sport upon the wing, exhibiting their unrivalled powers of flight, and uttering their gladsome cries of "peewit." On open ground like this—if the young took on the showy plumage of the mature bird—they would be very liable to be picked up by birds of prey of all sorts; and consequently, instead

of the dark green and white plumage of the adult, they assume a uniform grey color, marked with a couple of narrow lines along the back, corresponding admirably with the moss and coarse withered grass amidst which they live. The little creatures know instinctively the means of safety with which they are provided; for when the signal cry of danger is uttered by the parent, they separate from each other, and squat on the open ground; and unless you follow some one with your eye, and keep it in view until you come up to it, the probabilities are that you will not be able to find one of them though you know well that at the time they are close to your feet.

In such instances the habits of the birds are opposed to the supposition that they ever adopted assimilative coloring as a means of safety in the mature state, and consequently the immature plumage can hardly be derived from the ancestral plumage of the mature birds. It is plainly taken on for the purpose of protection, and if in cases like this we cannot refer the immature plumage to a similar ancestral type, we are led to doubt such an explanation even in those cases in which we are unable to see any present purpose fulfilled

by the distinct plumage assumed by the young. The blackbird and the robin are familiar examples. The mottled plumage of the young robin is certainly not taken on for the purpose of concealment, and yet it may be protective, for red is a color that excites anger in many birds, and leads them to persecute those birds that assume it. The black robin of India, in which the red is placed under the tail, seems to be particularly persecuted by a shrike that has also got a little red in its plumage; but whether it is owing to its color or not I cannot say, and I have been unable to ascertain the color of the young birds; but if the immature plumage of the bird resembles the adult, it would probably be similarly persecuted by the shrike, and consequently it would be exposed to very great danger until it arrived at maturity and was able to save itself by flight; and in this way the mottled thrush-like plumage of the young blackbird may serve some purpose which we cannot clearly ascertain. Yet Mr. Darwin's explanation that an ancestral style of plumage is retained in those cases, is on the whole probably the best and most satisfactory that can be given, but in many other instances it is unsatisfactory and

improbable. Still it does not afford the slightest proof that the different colors of the male and female are at all due to sexual selection. The two theories stand apart: they are independent of each other: the one may be partially true, and the other wholly untrue. What it proves rather, and what all these discrepancies of color in plumage prove is the complex nature of the agency that produces and adjusts all the varieties of color met with. But that color changes in the species without change of the species itself, and that it even changes in the individual, there is ample proof, though such changes are more apparent in animals under domestication.

Color in animals seems to be in close relation, or to be correlated with the various states and conditions of color as it exists in external objects.

But different animals are affected by different phases of color as presented by the common conditions. Colors that have an influence on one kind of animal may have no effect on others of a different kind, but any permanent change of conditions is sooner or later followed by a change of color. This is apparent in those creatures that take on assimilative coloring; and particularly in those that assume distinct winter and

summer dresses in harmony with the prevailing color of the ground. In India, at the close of the rainy season, the bright green colors of the locust tribe and its allies then prevalent, are quickly followed by colors that keep pace with every stage of the withering herbage, and so we are led to think that the colors of surrounding objects, exert some indirect influence in the determining of color in animals. Again, certain conditions which may be considered abnormal, act so powerfully on the parent as to produce an abrupt and marked variation of color in the young; and in this way no doubt are brought about many of those sudden variations, such as the birth of a black lamb, the presence of which, if allowed to remain in the flock, is said to bring about more such births, and owing to this belief they are generally removed from the flock. Here we have the ordinary conditions that act gradually and bring about constant and uniform results, replaced by extraordinary conditions followed by extraordinary results; and this is not only true as regards color, but also as regards form. Striking peculiarities of the latter often act, not necessarily in the way of a sudden shock, with such intensity on the mind of the

parent as to affect the form of the offspring, and hence the great danger in allowing many of those hideous deformities to be paraded about the streets, or to be exhibited in public. There are facts and beliefs, also, that point to certian forms and degrees of monstrosity as having arisen in this way; and if so, we are induced to include in the same category those abnormal variations which do not amount to actual monstrosity, and yet are not well adapted to the performance of necessary functions, and in proportion to their want of adjustment to external conditions they seem to be without purpose. And although such varieties may be able to perpetuate themselves for a time, they eventually disappear, owing to the want of such adjustment, or as the Duke of Argyll has expressed it in the "Reign of Law," "there must be a correlation between those changes"—that is, between varying parts—"and all the outward conditions amidst which the new form is placed, and live. If this correlation fail, the new form will die." The remarkable ancon sheep probably may have arisen in some such way; yet it is also possible that abnormal states and conceptions of mind may be the exciting cause in other instances.

In the wild state animals are subject to and live amidst conditions that are constant and uniform in their operation, or when they change it is with regularity, at particular times, and suitable provisions are made to meet such changes, and we find that the individuals of any species of animal that live amidst those conditions, present a remarkable uniformity of color and shape. But every locality may be said to have its own conditions, which differ more or less from those of other localities, and if we compare with each other some animals of the same species from those different localities, we generally find that they differ more or less from each other either in size, in color, or in form. Now we must admit the fact that animals are minutely adapted and adjusted to the conditions in which they are placed, and if those varieties are derived from the same ancestral stock, we must admit that external conditions have had some indirect influence in bringing them about, or the forces employed worked with an intimate knowledge of those conditions. But it must be borne in mind that when the difference between two individuals from widely different localities is less than what we might expect, there are causes to account for

it. For example, if we except color alone, and take into consideration the vast geographical range with its extremes of climate over which the human race extends, the difference between any of the varieties of Man is very greatly less than that often met with among the lower animals. But in the case of Man there is a double correlation, one with external conditions, and another with the powers of his mind having regard to his future mastery over conditions. If Man cannot change the conditions he can master them in other ways. He can adopt means by which in reality he equalises their action to a great extent, and hence the remarkable similarity, especially of size and figure, that pervades the entire human family.

On the other hand, animals under domestication are subject to a great variety of conditions without periodicity or regularity, and from many of which they were exempt in the wild state. They are differently sheltered and fed; creatures of different colors and forms are reared up together in close neighbourhood. In fact they are subject to new and irregular conditions imposed by man, and the result is that the characteristic sameness found to exist between individuals of the same

species in the wild state in any given locality is entirely lost, and we find instead a remarkable diversity of form and color. The latter appears to be the first to change. Diversity of color without pattern or regularity, seems, so far, to be as characteristic of animals under domestication as the reverse is of animals in the wild state; yet there seems to be a gradual tendency to the assumption of a uniform white color in many of our domestic animals, and especially in birds, in which the transition appears to start from a black or dark slate brown color, and to be continued upwards through lighter shades of grey which are eventually replaced by white, and so on, until a complete white plumage is obtained. Such changes are often apparent in ducks and geese. I have observed among the former, instances in which the change was effected in the same individuals, a few white feathers at first replaced the brown, and the number continued to increase each year, until in some three or four years the birds had obtained a snow-white plumage instead of their original dark brown one. And this is the rule, as far as I know, with the Egyptian vulture, neophron percnopterus. In India these birds may be observed in every stage

of transition, from the creamy white of the old bird to the dark mottled grey of the young.

Domestic animals of all sorts have a remarkable tendency to adopt more or less white, and we have reason to think that as animals were brought under domestication, white was the first color introduced as a variation, and at present, in India, the domestic buffalo, which, as a rule, is of a uniform black color, shows a tendency to vary a little in this respect by the taking on of a little white in parts. The tip of the tail, the feet and face are often white, or more rarely the entire animal becomes grey. Now this tendency seems to point to white as being the normal color, as it were, to which domestic animals are tending; and, although, in the case of sheep for instance, a white animal may give birth to a black offspring, it is regarded rather as an abnormal variation, and does not render the above surmise less probable. One never sees reddish-colored cattle take on a black spot as a variation, nor black cattle take on any well-defined red spots. Besides it is certain that many birds have actually changed and are still changing to white. There is not a doubt that the original color of the swan was black, and as further inferred by Mr. Darwin, it

it is highly probable if not certain that the birds of the world are becoming more beautiful; but from what we have seen it is utterly impossible to account for such increase of beauty or changes of plumage by any rules of sexual or natural selections. Even if it were at all possible to admit that natural or sexual selections could bring about the results attributed to them in the determining of the colors of the higher animals, we would be obliged to extend their operation in this respect to the entire animal and vegetable kingdoms, for it is manifest that a general harmony pervades the whole, and that such harmony has been brought about by the operation of the same agencies. Creatures low in the scale of creation, with rudimentary visual organs merely capable of distinguishing light could not discern any marked or beautiful variation of color, and consequently they could not select such a variation in preference to a plainer color. Yet many such creatures are possessed of the most brilliant colors, arranged in exquisite patterns; and apart from the Duke of Argyll's explanation that they stand in relation to a purpose having "beauty and variety" for its object their existence is

totally inexplicable.* In fact it is impossible to connect such varieties of color with any other purpose than that of ornament.

Again, such varieties of color are arranged, not only in harmony with surrounding things, but are disposed, as it were, with a view to produce certain effects—effects which are brought out under suitable conditions in connection with which they must be seen, to be fully appreciated or understood. For instance, the variegated and luxuriant beds of flowers that adorn most of our public parks and gardens are very justly admired, yet they are admired as caged birds are admired, for their own beauty alone; one is more or less conscious of a certain want—a want of harmony with surrounding things. There is an abrupt parti-colored artificiality about their arrangement that is never observed in nature. The mathematical precision of the circle, the square, the parallelogram, or other figure, constantly rises into prominence; one is almost more conscious of the figure and the arrangement of the beds than of the beauty of the flowers. The attention is partly drawn from the latter

*"Reign of Law," People's edition, page 235.

by the former; and hence it is that the most extensive flower gardens fail in producing to the same extent those pleasing sensations that are invariably called up by flowers as they occur in Nature. A slightly undulating pasture by the side of a brook or other water, thickly carpeted with daisies and ornamented with a few old hawthorns, far transcends in effect the richest flower garden. An English common covered with brown heath and studded with large irregular clumps of furze in full bloom, and dripping with the morning dew, is a sight of indescribable beauty. It is one of the great flower gardens of Nature, compared with which those of man sink into utter insignificance. Well might Linnaeus thank God as he looked upon such a scene.

Surely in the arrangement of such natural scenes a great purpose is apparent—a purpose of beauty and harmony. It is apparent also in the adjustment of the colors of those living creatures that give life to such scenes, and without which they would assume a lonely melancholy aspect. For example, the great majority of those sea-birds that seek their food upon the wing is white, or almost white, a color which Mr. Darwin admits could not be brought about by,

natural selection, as it renders them too conspicuous; but nature intended them to be conspicuous; they must be visible at long distances as the scenes of which they form a part are wide and grand. The most brilliant metallic tints to be discerned or appreciated must be seen at short distances; they are not intended to be otherwise seen; but white is, beyond all doubt, the most beautiful and effective color for distant views. A flock of small white gulls as seen from the headland on a bright day in clamorous pursuit of a shoal of fish is a very pleasing sight. They are far out in the distance, but their pure white plumage, in striking contrast with the deep blue of the water and the sky, renders them distinctly visible. What a marked difference between them and those large dark-colored ones that lie motionless upon the beach. Their dull grey plumage seems in keeping with nothing that we can think of at the time; but let the scene be changed; let the blue sky be obscured with dark tempest-driven clouds; let the sea be rolled into heaps, and lashed into yellow foam by the violence of the gale. Where then are the beautiful white gulls?—Far inland, skimming over the sheltered fields in search of worms; but

the great heavy ones that lay of late so lazily upon the beach are all life; they continue for hours upon the wing, sailing about the bluff and water's edge. On such occasions the sportsman, if sportsman he can be called, is often seen lying in wait for them in some sheltered nook; their dusky grey plumage is then seen to be in keeping with the dark clouds, the turbid water, and spray-beaten cliffs; it is in harmony with the tumultuous scene in which the bird appears to rejoice, and to which it imparts a peculiar charm. It seems as it were the restless spirit of the storm sweeping ceaselessly about the rocks, rising and sinking almost by the mere effort of its will. On the other hand a brilliant plumage is naturally associated in idea, as it is in fact, with an evergreen vegetation with flowers and sunny skies; and, consequently, those birds that possess it in a high degree are confined to, or have been derived from, the tropics, or they accompany the sun to the north and return again as the cold season sets in. To get an adequate conception of the extreme beauty of the peacock its rich metallic hues must be seen under a summer's sun and not in the dark storms of winter. How striking and beautiful is the effect

produced by a flock of those magnificent birds in their native woods by the side of some noble Indian river, as their gorgeous trains float upon the breeze or sparkle in the sun amid the luxuriant foliage; they seem, as it were, spiritualised beings rather than creatures of earth. One is inclined to venerate the Hindoo customs that have preserved from destruction, in their natural state, things so lovely; and although they may be set down to superstitions connected with the taking of life, the result is not on that account less advantageous or desirable. It is to be wished that some such cause would operate in checking that deplorable propensity for the destruction of wild animals exhibited by all classes of Europeans both at home and abroad—a propensity too often indulged in from mere wantonness, or that the spoils may deck for a day some thoughtless beauty, or with the supposed laudable intention of making a collection—a collection of what?—egg shells or mummied skins, to be stowed away in some private hall, where in a few years they will moulder into dust. For this the loveliest things of creation are being fast exterminated in every country. Each private individual, that he may have "specimens" for

his own gratification, considers himself justified in shooting down our rarest birds wherever they are found, and complacently looks upon himself as laboring in the cause of science, whereas, with a blind perversity, he is striking at its very roots; he is gradually inspiring the general public with a similar scientific bias—with a zeal for making "collections," not through their own exertions, but by purchase, and, in consequence, bird-stuffing has become a trade of commercial importance; men are everywhere employed in collecting materials, which are every day harder to be obtained. Birds are being driven to the deepest recesses of the forest; but such places afford them only a short respite; they are quickly followed up and killed. The islands of the Eastern Archipelago are being pillaged to their very centres; their matchless birds are being ruthlessly exterminated; their skins are bartered for trifles by the rude inhabitants. The splendid birds of Paradise will, ere long, be known only as things of the past; there is a price set on their heads that will act as effectually as that formerly set upon the wolves of the British Isles. We look back with disgust upon those Roman gourmands that not only

introduced at their feasts rare and costly birds, but even dishes composed of their brains and tongues; yet their power of doing harm was trifling and confined to narrow bounds, but ours is unlimited; it extends over the earth; we indulge our appetites in a different way, we do not make dishes composed of their brains to gratify our palates, but we make ornaments of their skins to deck our women and our halls. In our blind selfishness we are extinguishing the fairest forms of earth—we are robbing posterity of those things which Nature intended them to possess; instead of the living animals, they shall receive from our hands learned descriptions and life-like drawings. But what shall it profit them to know that we were intimately acquainted with their structures, that they were allied to this or that family of birds; and, above all, to know that our houses and museums—public and private—were plentifully supplied with the most gorgeous specimens, that the feathers were used in reckless profusion as ornaments of dress by our women of the higher classes? They will look back upon our luxurious habits and pseudo-scientific attainments in natural history with scorn and indignation. With all our boasted

superiority over our so-called utterly barbarous ancestors we have been unable to add one individual to the long list of domestic animals originally reclaimed by them from a state of Nature. With all our knowledge of structure, habits and classification, what useful wild animals have we been able even to introduce and naturalise in that state in countries suited to their wants. These great and unexplored fields of Nature have been totally neglected by us as they have been for long generations, although they were entered by our ancestors before the dawn of history, and have yielded such rich returns as have made the human race a success upon the earth. They still continue to invite our attention, and promise inexhaustible wealth to those that would explore them.

The adding of one useful or beautiful species to the number of our domestic animals would be of high importance, or even its transference in the wild state over larger areas would be very desirable, and a step in the right direction. We have no reason to think that many of the wild animals, domesticated and naturalised by our remote ancestors, were at all more tractable than the wild animals of the present day; indeed the

probabilities are that they were greatly less tractable, and their complete domestication must have been a tedious and difficult matter and must have been accomplished by men of very superior practical minds. The introduction of all those useful species of animals, whether mammal bird or fish, that are at present confined to certain localities and to particular tracts of country into other countries, and especially into neighbouring countries, ought not to be a very difficult matter, and is well worthy of encouragement. The multiplication and extension to the greatest possible extent of useful and beautiful animals, and the elimination and destruction of those loathsome and injurious creatures that abound in most places are matters connected with our immediate welfare, and must sooner or later occupy the serious attention of all civilised governments.

Those noxious and predaceous tribes have hitherto assisted in adjusting the proportions of the various groups of the animal kingdom, and in maintaining the healthy balance of the whole, but as man's power over the animal kingdom increased their agency was, in many cases, rendered superfluous and injurious. The land

carnivorous tribes were the first to demand attention, and the first that it was absolutely necessary to keep in check.

But to return to varieties of color and form. We have seen that there is some close relation between them and external condition—that in the production of both color and form, those conditions are never lost sight of; and the question is, have those conditions any influence, direct or indirect, in bringing about in the first instance, and afterwards in perpetuating those varieties? We cannot for a moment believe that external conditions have any direct influence in bringing about variation, notwithstanding that the varying organism, if normal, is always moulded in harmony with them.

But external conditions act indirectly by means of a something that goes as it were between those conditions and the organism, that connects them and brings them into relation with each other, a medium of communication by which knowledge passes from one to the other, a mechanism that works as it were in effect with an intimate knowledge of both, however far they may be distant or separated from each other, and that may be assumed in some way to pre-

side over and to direct the moulding of all organisms.

Can we form any idea of the means or agency employed? Of what it is in its ultimate essence we can form none; but otherwise we may arrive at some knowledge of it by comparing the effects resulting from its operation with the effects produced in a somewhat similar way—by, as we suppose, some modification of the same mechanism, but to the manifestations or results of which we have given the name of instinct or intuitive knowledge—a power which is of necessity given in various degrees to lower animals to enable them to carry on those operations that are indispensable to their existence, independent of all teaching, which is placed beyond their reach, and without which they could not continue to exist.

The working of such a power, though it may be allied to, is not to be confounded with those ideas of the mind that seem to arise instinctively, yet are so blended with reason as to render it impossible to say where the one begins and the other ends. Such ideas are associated with more or less reasoning power, and may either be right or wrong. But instinct, pure

and simple, is independent of all reasoning power, and never errs in the slightest degree. Man is also possessed of this power to some little extent. It is more apparent in childhood than in the grown individual. Even in some cases the likings and dislikings shown by children to particular persons, are in a great measure instinctive in their nature, also that mysterious foreboding of ill noticed by so many persons, that forces itself on the mind and holds its place there, despite all that reason can do to drive it away—a certain, yet dim revelation that seems foreign to and independent of the mind to which it is being manifested, is truly instinctive. But in the lower animals, although exhibiting various degrees of intensity minutely adjusted to the requirements of the animal, it manifests itself clearly and informs the creatures so thoroughly as to exclude the possibility of doubt or of mistake in the carrying out of its dictates. It is, as it were, intimately possessed of a knowledge of the wants of all creatures and of the varied means by which those wants are to be met, with the power of putting such means in force. It informs the birds of passage of the approaching storms, and prompts them to seek

refuge in far distant lands. It directs them in their course and leads them to particular places with a precision as unerring as if those places lay within the range of their vision. Reason has enabled man to ascertain his whereabouts and to steer his course to distant localities with accuracy; but any mistake in his calculations or imperfection in his instruments fills him with doubt and leads him astray. Not so with instinct—its knowledge is direct. It spans distance, and leads its possessor with certainty, as if by sight, to the desired locality, with the conditions of which it seems to make them acquainted. It also is well exemplified by the migrations of fishes. In one instance I have seen young eels in their passage from the sea, making their way up an almost perpendicular cliff on the beach thirty feet or upwards in height, and down which a small rill of fresh water trickled through a whitish moss which grew thickly along its course. They ascended through or beneath the moss which gave them the necessary support. On raising a quantity of it in places, numbers of them were exposed at different elevations. Now were they in this instance being led astray, merely impelled to follow the fresh

water, and afterwards to perish from its failure or for want of suitable conditions? About one hundred yards from the top of the rock there was a small lagoon supplied from oozing springs in the neighbourhood, and bordered with reeds. It contained a considerable quantity of water all the year, and from it the rill proceeded by which the eels were making their way into it to remain until the time came for them to return again to the sea, which lay close beneath the rock. Although there were much larger rills in the vicinity, similarly collected from oozing springs, and making their way to the sea with a gentle winding descent, no eels could be found following their course; and for the obvious reason that they formed no pond or collection of water suited to their wants in which they could rest.

But it is needless to enter into the many and complicated workings of this mysterious power, as imparted to the lower animals, whether manifesting itself in its knowledge of distant localities, and their conditions, or in its intimacy with all the details of construction based on the soundest scientific principles and shown forth in the various fabrications met with among the great class of insects.

Now what is this power of such vast importance in the working of the great organic kingdom of Nature?

Mr. Darwin's elaborate reasoning, as given in his "Descent of Man," does not satisfactorily account for instinct. He lays great stress on the fact that birds, under conditions in which they are not exposed to danger, exhibit no signs of fear; but that they afterwards acquire it from experience. Now, if this reasoning were to be admitted in the case of birds, it would have to be extended downwards to the invertebrate classes; but, when applied to the latter, it utterly fails. And, even in the cases mentioned, we might as reasonably say that Nature withheld a knowledge that was superfluous under the circumstances, but conferred it afterwards when required.

But let us follow up instinct a little further, and see to what conclusion it leads. The honeycomb of the bee and the web of the spider are equally regarded as undoubted works of instinct. The former collects the material of which the cells are composed; the latter derives from itself the material which it arranges so skilfully. So that, so far as the working of instinct as regards con-

struction is concerned, it makes no difference whether the animal collects the material or derives it from its own organisation, and in many instances the materials are partly furnished by the animal itself and partly collected from other sources, both are formed into a structure of more or less complexity, which is also set down as an undisputed work of instinct. For example, the larvæ of many insects construct themselves coverings, in which they pass the pupa state, from particles of sand or vegetable matter cemented together and lined by material supplied by themselves. Thus, whether none, a part, or the whole of the materials of which such fabrics are constructed is derived from the organisation of the creature, the working and arrangement of them are, and can only be attributed to instinct. It is essential to bear this in mind, for those cases lead us on insensibly by narrow steps to what have been and still are looked upon as vital processes attributed to development, or under the name of development. But what is development dependent on? what is the agent that regulates and presides over it in this neutral ground? The larva of one insect makes itself a case composed in part of extrane-

ous particles, and in part of material derived from itself. The finished structure is looked upon as a work of instinct, yet the vital and instinctive processes are here so blended that we cannot tell where the one begins and the other ends; and, as we descend to lower groups, these processes become still more inextricably blended, rendering it impossible to account for them as under the control of separate forces. The larva of another insect makes itself a case out of and by additions to its own skin. Can we say the latter is accomplished through the vital processes and ignore the working of anything like instinctive direction in its construction. Both serve a temporary purpose, and are cast aside by the perfect insect. The cabbage butterfly is led by instinct to deposit its eggs on the cabbage plant; when the larvæ are fully grown, they are directed by it to select the proper places in which to pass their pupa state, and it further directs the creatures in the fabrication of a structure by which they are fixed securely in their places. Now, does the power of which instinct is a manifestation cease to act, and lie dormant with the insect in the pupa state again to assume its activity in the perfect insect? We cannot think

so. This mysterious agency is still used; its working is now manifested in a somewhat different way—in the changing of the skin of the larva and in constructing it into a pupa case, as certainly as in the instances of those larvæ that made themselves cases of other materials. Vital processes play a part in both. In the latter the dictates of instinct are carried out in part by muscular movement, which is in itself a vital process necessary in the construction of the fabric, and, in the former, partly by changing and adding to a structure belonging to the larva through the operation of development, which is looked upon more directly as a vital process; both are alike under the guidance of what, for want of a better name, we call instinctive direction, and produce alike structures that serve the very same ends, and only differ slightly in the way in which they are produced and formed. The action in both is resolved into varieties of motion, the result of vital processes under the guidance of the same force. In one a complex muscular apparatus acts on special organs, producing visible movement in the arranging of the particles; in another a no less complicated apparatus is employed to act on the particles at

shorter distances, producing a movement which is invisible to us. In other instances both processes are combined in various degrees. Thus, the pupa case, no matter how constructed or of whatever material, is undoubtedly a work of instinct. This leads us a step further. With the completion of the pupa case the necessary preliminaries are gone through to enable the creature to commence a new development to fit it for a new phase of existence. The vital processes are again at work in the change of tissues, and in the development from them of new organs. But hitherto during the preliminary stage we have seen that the vital processes acted in compliance with instinctive direction, and we cannot now suppose that analagous operations require the guidance of another force, or that the vital processes act or are capable of acting without guidance in the development of new organs; for in the production of those organs the future conditions amid which they are to work are clearly held in view, and to those conditions they are most minutely adjusted. But we have seen previously that an intimate knowledge of external conditions however situated as regards place, was among the clearest

manifestations of instinctive power, and therefore we are justified in concluding that the vital processes act to a certain extent under the direction of the same power in the development of all organs and organisms. Consequently we are not justified in those latter analagous cases connected with development to bring in the operation of another force to account for them, we are not justified to make exceptions of those cases in favor of another force. Inheritance will not account for them under variation. Inheritance is the name given to that series of occurrences in which the offspring resembles the parents, because the resemblance of one individual to another is noticed almost always to arise in connection with common descent from the same parents. Yet it very often happens that we meet with an individual that bears such a close resemblance to some other person whom we had known, that we should be likely to mistake the one for the other did we not know that they were strangers to each other, and speaking perhaps different languages. Now in such instances as those, inheritance as ordinarily understood can have nothing to do with the resemblance, which must be due to some other cause; still, in any

case, inheritance does not well explain how those resemblances are brought about. Instinct itself is continued from the parent to the offspring and has been attributed to the inheritance and justly as long as the offspring resembles the parents, but variation is altogether opposed to inheritance; when conditions change or new conditions arise, inheritance is cast aside and a new form with new instincts is introduced, suited to the new conditions, and differing more or less from the parent form. But the forces employed are necessitated to work within the established types; they may resort to extreme degrees of modification so long as they adhere to the typical plan, beyond which they cannot go.

Now that mechanism which we have hitherto considered in connection with the manifestations of instinct takes, as it were, cognizance of or is informed of such changes of conditions and sets about directing the vital processes through the medium of special structures within the organism in the producing of new or modified organs adapted to those conditions. It is that by which an effective connection is established between the organism and external things, and by which impressions are conveyed from the latter to the

former, there to be noted and acted upon, giving rise to the various manifestations of instinctive power. It is the great agency concerned in variation and may have been employed in the introduction of new species.

Thus we can conceive that all the phenomena of development and instinct may be but different manifestations of the working of the same power by means of the same mechanism. But in instituting the comparison between them by which we arrived at this conclusion, it was necessary to speak in a great measure of the machinery employed as if it were itself the sole cause and actual power that designed and carried out the work; as for instance, a machine is devised and constructed to perform certain work, and we speak of it as if it performed that work of itself independently of everything else, whereas it is only the means by which the designer does the work. The real power in this case is the mind, for if anything goes wrong with the machine it stops immediately and for ever unless set to rights again by the mind. But the mind could not accomplish the work of itself directly without the use of means by which it is brought into effective relation with that on which

it is about to act. Again, the machine is necessarily so adjusted that it will act on matter only in certain states; and if these are changed it ceases to act; if constructed to act on water in the fluid state it will not act on it if changed to ice. It acts only under those conditions to which it is adjusted.

But to return to the machinery employed in bringing about the phenomena of instinct and development. Can we form any idea of its nature or of the way in which it works?

Although we may arrive at a knowledge of the existence of external things by starting from a knowledge of the existence of self; yet leaving philosophy aside it is apparent that such a knowledge is communicated to the mind through the organisation with which it is connected. The special structures that convey impressions of the external world to the mind are known as the organs of sense. Three of these, the organs of touch, taste, and smell, receive impressions from external objects only when placed in immediate contact with them, but the organs of sight and hearing receive the impressions which they convey to the mind from distant objects by means of a medium or a something that extends between

them and the objects by which they are impressed. They are brought into communication with each other by means of this medium. The vibrations excited in or communicated from the object to the medium are transferred by it to the organ. And when communication is once established impressions will be transmitted in this way from the object to the organ. The degree of accuracy with which those impressions are conveyed to the mind will depend on the perfection of the organ and on its adjustment to receive those impressions. Man through his ingenuity has added greatly to the range of his vision and by this means he is made aware of the existence of bodies that were unknown to him before. His unaided eye was not sufficiently adjusted to receive the impressions that were being transmitted from those bodies; and there are still countless things of the existence of which we are ignorant because our minds are not possessed of organs fitted to receive impressions from them. There is no doubt the possession of such organs would open up new fields of enquiry and would render untenable many conclusions the validity of which is now unquestioned. Even the same sense organs show a vast difference in adjustment in

different persons. We are amazed at and cannot understand the wonderful powers of touch exhibited by blind persons, many of them can even find their way without assistance about that part of the country in which they live. There are some persons that would account for many of the phenomena presented by lower animals as due to an additional or sixth sense, but whether this be so or not, there is no doubt as to the wonderful powers and extreme perfection of those sense organs which they possess in common with man, but if such additional powers are withheld from man, they are withheld for wise ends. It is ordained that man shall raise himself higher and higher in the scale of creation by acquiring knowledge for himself; and for this purpose he is endowed with reason, a faculty that far transcends in power all those other endowments by which knowledge might stand revealed to him. By means of it he builds for himself a noble and lasting edifice on which he looks with pride as the result of his own persevering industry. Man's large brain is a complicated apparatus adapted for reflection and reasoning, by which processes it is ordained that he shall arrive at a knowledge of those things that concern him.

The smaller brain of brutes is a simpler apparatus, so adjusted that those things which concern the creature shall stand revealed as in a glass, or as if through ordinary sense organs without any process of reasoning, which requires a larger and more complicated mechanism, hence, the great precision of the latter or intuitive mode.

But to return, we are made aware of the existence of distant objects by means of media in which those objects excite vibrations which are communicated to special organs, and by them transferred to the mind. In the case of the organs of hearing, the vibrations are communicated chiefly through the air, but in that of the organs of sight, they are transmitted, with amazing rapidity, through an extremely attenuated and imponderable ether; but we have already seen that a knowledge of distant objects, or what in effect amounted to a knowledge of them, when such objects were not within the range of sight or hearing was among the manifestations of instinctive power; and we know further that such a knowledge must have been brought about by some means, and the only conceivable means, and the means to which analogy points is the

existence of a communication between the organism and external things ; in fact the existence of an ether still more attenuated than that through which light travels. The properties of such an ether, or medium, being its capability of being excited to motion or vibration by all objects, and of transmitting such vibrations to special organs by which they might be communicated to the mind, in some instances, and in other instances the organs so impressed would react on the vital processes independently of mental consciousness, directing them to work in particular directions, or, in other words, the impressions received by such an organ, instead of being communicated to the mind, is transferred direct to what are called nervous centres, which centres are arrangements of nervous matter, which, when stimulated, issue nervous force which manifests itself in motion, independently of the will, or even without the mind being aware that such actions are taking place. Such a mode of action would be closely allied to what physiologists call reflex actions, the only difference being that in the ordinary reflex actions, the objects from which the stimulus is derived, or the cause of it is more immediately

under our observation: for instance, in those that take place in connection with the processes of digestion and circulation, the stimulus arises within the organism. The presence of food in the stomach gives rise to an impression which is transferred along the nerves that lead to the nervous centres that preside over digestion. The impression is there noted, and force is issued accordingly by those centres and transmitted back along the nerves that lead from them, giving rise to the necessary motions or actions. Such centres are made, as it were, conscious, or conscious in effect of the degree or amount of force required. The mind is generally unconscious of those vital operations which are altogether removed from its control, and it was essentially necessary for the good of the organism that this rule should obtain, but at the same time it opens to us a complex system of adjustments so perfect and minute as to be utterly incomprehensible. On the other hand, in the stimulus that gives rise to actions known as instinctive, the cause of the stimulus is less apparent, and is sometimes communicated from remote external objects, to some special organ, and transmitted by it to the proper nervous centres which in

turn issue the requisite amount of nervous force. In many instances, the impression received by the organ passes direct to the nervous centres without the mind being at all conscious that such impressions are being communicated to the organism, just as in the case of some of those purely reflex actions that had their origin within the organism. Again, the communication may take place through the mind, the impression being transmitted from the organ to the mind, and from the mind on to the proper centres.

It is to be noted that what is meant by a receiving organ in those cases is not only any of the ordinary sense organs, but any structure within the system, and especially within the brain, fitted to receive impressions from distant objects through any suitable medium. It is not necessary that such an organ should be represented externally on the body, whether as an eye or an ear or a touch papilla, if the conducting medium can reach the organ its vibrations will impress it directly, and we have reason to think that the medium we are now discussing pervades all material substances and consequently all organic tissues, as heat or electricity would. It is only when the grosser material media that

cannot pervade tissues, are used as the means of conveying information to the organism, that we find external sense organs; everyone knows that the real organs are situated within the brain. If the communication between the touch papilla and the brain be cut off we cease to feel; and so the real organ of hearing is within the brain, but the gross material waves of air, could not reach it there, it must have an external mechanism which they can reach and such mechanism must be adjusted so as to be impressed by those waves which impressions are conveyed to the sentient organ in the brain; if that organ be diseased we cease to hear though the external structures may be perfect. The same remarks apply to the eye, for light or rather the medium by which it is conveyed, though extremely attenuated and imponderable, will not pass through animal tissues or only through special tissues which are known as transparent. Thus we see that in the case of the higher animals, there are three obvious ways by which they are brought into connection with external things, and through which their knowledge of them is obtained. These are sight, hearing and touch, for taste and smell are only modifications of touch. Now

although we are often informed of the existence of bodies by all three at once, yet each is essential to our welfare, and each imparts its knowledge through a medium peculiar to itself. We could not learn of the existence of a body at rest and in darkness unless by touch, direct contact, the body itself being the medium and exciting cause. Again, it is necessary that we should have a knowledge of distant bodies in motion when out of sight or in darkness, in this case the air is the chief medium that carries the information but it conveys impressions through comparatively short distances, but we require to be still further informed of the existence of bodies at all reasonable distances, whether at rest or in motion. The medium of communication in this case is an imponderable ether. Thus we see that each sense organ must have its own proper medium from which it receives information. Now, the connection established between external things and the organism in these three ways would not be nearly sufficient to meet all the wants of organic life, and consequently they utterly fail to account for all the phenomena presented by organisms; and therefore, persons are willing to admit the existence of additional

sense organs, but, from what we have seen, an additional sense organ, wherever situated, would require a medium essentially different from any of the other three, to establish a communication between itself and external things. We have seen also that those media that act in connection with the visible sense organs are only effective at certain distances, even the vibrations of the light bearing ether seem to grow fainter and fainter as the distance increases; but if the universe is an undivided whole; if the vast systems of which it is composed act and re-act on each other they must be connected by means of a something that would pervade and extend between them, a something capable of receiving impressions from the things it is in connection with and further capable of transmitting such impressions to all distances, and finally of imparting them to organs adjusted to receive them.

We have been led upwards step by step, from ponderable material media, to the imponderable light-bearing ether, and from this to an ether still more subtle and attenuated, the existence of which in the working of the universe would seem to be a necessity, by means of it, or of something allied to it, we can understand more fully or to a greater extent all the phenomena of organic life.

Although we know nothing of what force is in itself, and only judge of it from its effects as manifested in bodies mechanically set in motion, or in things seeking to attain the density and equilibrium proper to some new state they have assumed, their former one being disturbed, whether by molecular changes of state, as in chemical operations or otherwise. The enormous explosive force exhibited by a drop of nitro-glycerine is a measure of the force by which the gases, or the elements of which it was composed, were originally brought together; and if those identical atoms could again be collected, the same amount of force would be used in uniting them, or in so changing their state, that they would unite by chemical affinity to form the original compound. In this case there was neither a gain nor a loss of force. There was no force generated, it was existing force set free —a re-manifestation of the force expended, or rather stored up, in their particles in bringing them into the condensed state.

Again, there is a great amount of force set free by the changing of a drop of water into steam; but the very same amount of force would be required to condense that steam again. On

tracing up the cause of this manifestation we find it to be due to heat, which enters into combination in definite proportions with these substances in their different states. In such combinations it is known as latent heat, because it does not at all raise the temperature of the substance it has united with. As to the nature of heat, or what it is in itself, we cannot form the remotest conception, and only know of it as a force that manifests itself in connection with matter. But even here we cannot rest, for a slight change of the conditions that produce heat gives rise to a manifestation of electricity, and eventually we find the one convertible into the other, and so on through all the imponderable forces. They are constantly shifting and receding before us, and finally we are driven to the mind in its manifestation of will as the standpoint most likely to afford us the clearest view of the nature of force. Here it seems, as it were, to exist of itself without cause; yet it requires a medium—that of organisation—for its manifestation; and although we have reason to believe that it is the greatest and most powerful of all forces, that power seems to lie in its control over the other forces of Nature, which it employs as servants to accom-

plish its dictates. Among the natural forces there is no such thing as creation or destruction of force that we know of; but it is the peculiar property of mind to adopt means by which they can be turned into new channels; and although the human mind cannot create force, it can so regulate its expenditure by the adoption of a suitable machinery, that, from a given source of supply, it can accumulate it in large quantity for the accomplishment of some designed work; and, in many instances, it can even stow it away in some fixed form to be afterwards turned to account. This is equally true of Nature; she accumulates it by her machinery, and has vast quantities stowed away to be used up afterwards in the accomplishment of her works. The force stowed away in coal is a familiar example. What was the machinery used in this case?—The organised living structure of the vegetable kingdom working during vast periods of time. Every individual of that great series of plants, to accomplish its destined work, had to be constructed on the truest scientific principles; for we ourselves know that if we construct a machine imperfectly, or on false principles, the force at our command is all used up in trying to

move the machine, and, consequently, there is no force remaining to accomplish the designed work. The result is nil—the whole thing is a failure. The same rule of perfect construction is observed upwards through the animal kingdom. There is a certain amount of force used in the building up of all their tissues. The materials of which these tissues are composed are derived from those substances which are taken in as food and further prepared under the direction of the nervous system, and finally subjected to the action of what we only know by name as vital force.

But although a great amount of force is necessarily expended in all those operations, yet, in the higher animals, there still remains a great quantity stowed away in particular tissues to be expended in other ways—in moving the animal from place to place, and in acting on other bodies, and in the working of mind. The more perfect the animal machine is the more force there is available for these higher purposes; and, consequently, man, the very ideal of perfection in bodily structure, has an enormous force at his disposal for these purposes, and especially for the working of mind.

We have seen that the adoption of means for the utilization of force, and for the turning of it into new channels for the accomplishment of certain preconceived works, was one of the peculiar attributes of the human mind. We have seen, also, that the works of Nature have and are being accomplished through the use of means that similarly utilizes and directs the forces of Nature in their working, and consequently those means must be looked upon as ordained by and under the control of mind; but in this latter case there has been no failures from tentative and imperfect means: all are perfect as the mighty mind by which they were designed. We have seen that the will requires the medium of organisation to manifest itself, and its great power seems to lie in its being able to control other forces, and to use them in carrying out its dictates. We extend any of our limbs by an effort of the will. Let us see how it works. The will does not itself issue the force that moves the limb, but it acts immediately on certain nervous centres that preside over the motions of the limb. It induces in these centres molecular changes of state, which changes are accompanied by the liberation of a force closely allied to, if

not identical with electricity; this force is conducted along the nerves to the muscles of the limb, and there in turn excites in them molecular changes which causes the muscles to contract with more or less force according to the degree of change induced in them. These facts lead us to believe that the will can only act or manifest its power through some suitable medium. But the action of the will extends beyond the visible medium of the individual organisation it is united to. It is capable of exerting an undoubted influence over other minds and organisms otherwise than through this medium. It would appear to act in some way through that imponderable medium that we have been discussing—to excite in it vibrations that affect other minds otherwise than through visible sense organs; and in this way we can understand and explain many phenomena in connection with the will that otherwise are incomprehensible. Of these phenomena, mesmerism is one of the most striking. The mesmeric state was said to be caused by the transference of nervous matter from the brain of the operator to the brain of the patient; but this hypothesis is untenable. It seems rather to be brought about in this way. The will of the

operator is generally much stronger than that of the patient, or the mind of the latter assumes a state of passivity highly favorable to the reception of the impressions excited by the will of the former. The effect of the impressions is, as it were, to disconnect the mind of the patient and its ordinary sense organs, so that few if any impressions reach the mind from external things through these organs. The mind of the patient is then to a great extent under the control of, and acts under the direction of the will of the operator. It would appear also that if the mesmeric state be often induced in the same individual, that that particular cerebral organisation that receives the impressions becomes more developed, or at least much more sensitive to the mesmeric influence, and in this way a troublesome disease may be established.

Such phenomena, if not resolved into a question of organisation, must depend on some power or property of the mind that enables it to receive information apart from the medium of organisation. But it is an admitted fact that the process of thinking is accompanied by a waste of brain substance, or rather by molecular changes of brain substance, which changes would neces-

sarily excite motion or vibration in the subtle medium under consideration, for we know that in every change of matter there is a manifestation of force of some kind, and of every degree of intensity,—sometimes making itself known through all the senses, and again barely perceptible through some one sense, but this certainly is not the limit of the manifestations of change, it is only the limit of our powers of perception. We prove this to some extent by extending those powers by inventions such as the microscope, but the limits of the manifestations of change even in this direction can never be reached; but we cannot think that Nature, that has ordained, and that rules by her laws all the molecular changes of matter is, or has been unable to construct an organism capable of perceiving those changes.

Thus we can conceive such a mechanism as that by which we have sought to account for the phenomena of instinct, to consist of an extremely attenuated and imponderable ether or medium extending between and pervading all material things, and capable of being impressed or thrown into vibration by matter and by every change of matter, however minute such changes may be,

and of special structures or organs in all organic beings, whether plant or animal, capable of receiving such impressions, and further capable of directing the vital processes to act in accordance with those impressions, or in accordance with the knowledge which they impart to the organism whether in the development of the organism, or in the regulation of the instincts of the fully-developed individual, or in the production of a new variation or a new species, adapted to live under new conditions.

We have now gone through what we conceive to be principal mechanism employed in the construction of organisms in correlation with new or changed conditions, such mechanism not acting on the organism through the ordinary sense organs ; but in addition we have seen previously that external objects sometimes acting on the parent through the organs of sight, affect the offspring. In the great majority of instances, it would appear that they act normally and in alliance with that more recondite and essential machinery that we have been discussing, and in this way what may be called normal varieties of color and form are more quickly established, or when the conditions are varied and change-

able, as under domestication there is, especially as regards colors, a blending of them without any fixed pattern. But in a few instances, and under circumstances not well understood, external objects act through the sight abnormally on the mind of the parent, and the result is an organism, all the parts of which are not in perfect correlation with external conditions or an organism not correlated as a whole with the conditions amid which it is placed. Such organisms eventually die out; but if the want of correlation be slight, they may perpetuate themselves for a time, or the variation will gradually disappear. But as regards those external conditions that act normally through the sight of the parent, a careful study of them, accompanied by experiments, would, to a certainty, enable man to establish many useful and beautiful varieties; and in the case of birds, he may yet succeed in obtaining varieties of color in definite patterns.

We have seen previously that birds and mammals, and especially those under domestication, had a tendency to the assumption of a white color; but we shall find that this is also true of man.

White as a color has always been symbolic of

truth and purity, and of all that is noble and good. In both the Old and New Testament it is always connected with spotless purity. The common expressions being washed white as snow and being clad in white raiment, invariably refer to regenerated man; and although these expressions are to be regarded in a spiritual light, yet, like many other scriptural statements, they may be found to have their counterpart in the physical world. And this actually seems to be the case. It is an undoubted fact that the great ruling race of the world is characterised by the possession of a white skin; it is a mark of the highest variety of the human family; it is in reality not incompatible with any climate; it will be the color of the future inhabitants of the world.

Notwithstanding that there are some writers who contend for the beauty of a dark skin, and that the colored races are greatly more numerous than the others. It is not the color to which man is now tending, it will not be the color of the civilised nations of the future. We cannot shut our eyes to the fact that the dark skin prevails amongst the lower races of man, and is characteristic of the lower grades. That a tropical climate is the cause of such color is

merely a popular delusion, echoed by one writer after another, and is the result rather of a hasty generalisation than of a careful enquiry, and rests chiefly on the following assertions—viz., that the inhabitants of tropical countries are dark colored, that European families that have resided for some generations in such countries have grown darker in color, and that even Europeans return considerably bronzed after a residence of a few years.

But we find colored races extending north and south far beyond the tropics, even beyond the temperate zones. And again we find the natives of some civilised tropical countries, such as India, exhibiting every degree of color, although living in the same locality, some of them dark almost as negroes, some olive colored, some with merely a slight yellow tinge, and some few that may be said to have lost every trace of color. These facts do away with the assumption that a tropical sun is of itself, regardless of other circumstances, the cause of color, and force us to seek for some other explanation.

On passing along the streets of any of the larger cities of India, one is astonished at the vast difference in color presented by the natives,

and the question naturally arises as to what is the cause of these various shades of color. Fortunately the country itself, with its system of castes, furnishes a key by which it can be answered.

There is abundant evidence to show that in the case of man, as well as in that of the lower animals, abrupt variations of color sometimes arise—a white or fair child may be born of dark parents. Yet this evidence proves nothing more than that the fair races of man can be derived from the colored races; but it does not prove that they have arisen in this way as sudden variations, for there is the most convincing proof to show that they have arisen gradually.* They are the result of natural laws working in accordance with, or in relation to, the conditions of life of the various races. If we examine those conditions, we shall find that they are always followed by constant results, and further we find that when those conditions are changed, the results are also changed. Now if it be in the power of man to change the conditions at will,

* I have noticed among very dark tribes that the first sign of change to a lighter color appears in the palms; they may be noticed of various shades, proportionate to the depth of color exhibited by the body generally.

he can, as a matter of course, change the results —or, in other words, he can determine the color of the individual race. Now man has, and is still changing the color of races, although he has not been aware of the fact; and such changes are more apparent in those countries in which the various classes are obliged by law or custom not to marry out of their own class.

The Coolie classes of India, and others that labor much in the fields or follow outdoor employment, are, as a rule, very dark in color, whilst the higher classes, and especially those that carry on trade in the larger cities, or are otherwise employed at indoor work, are many degrees fairer in color. Some of the higher class Brahmins are already fairer in features than are some of the inhabitants of southern Europe. The Parsees in India are also very fair, and that they will ere long be a white race may be inferred from the fact that some few of unmixed blood have already, as it were, passed the line of demarcation that separates the white from the colored races.

On looking into the modes of life of these different classes, one of the first things that strikes us as playing an important part in the

determining of color, is the degree of exposure. The first mentioned classes pursue their outdoor labors, as a rule, almost in a state of complete nudity, a small strip of calico merely encircling the loins; and even this, in many instances, is partly replaced by a cord, or tape. They seldom wear any other covering while at work, or lounging about their villages, unless they are compelled by cold weather; and their children, of both sexes, up to the ages of eight or ten years, seldom wear any clothes at all. These classes are for the most part very poor and very ignorant, and live in a state of wretchedness and filth. Many of them are unable to purchase beyond the merest trifle of clothes, and even the farming classes that might be supposed to be able to procure a proper amount of clothing, do not appear to do so. But, apart from this, they show on all ordinary occasions, an utter disregard for clothes, and that love for the display of dress exhibited by other classes in India, is only manifested in them by the wearing of rings and wristlets, etc., of silver or other metals. Now let us turn to some of the higher classes. They never appear beyond their houses without being decently clad in clean white clothes. They also

frequently carry umbrellas, by which they are further protected from the direct rays of the sun; but still it is usual for many of them, especially the trading classes, to sit in their houses, or verandahs, naked to the loins, over their wares or goods. Their children also go about the houses often quite naked, although they are gaudily dressed when taken out of doors. But it is very evident that with the advance of knowledge and civilisation, even this tendency of the trading classes to remain partially naked in their houses, will fast wear out. There is obviously a dislike arising among them to be seen even partially naked, and there is no doubt the habit will, sooner or later, be entirely done away with, and then all traces of color will be found to disappear gradually. But from those statements it is not to be inferred that exposure in the nude state is of itself altogether sufficient to produce a black skin, or that the constant wearing of suitable clothing is sufficient to produce a white one. There are other causes—moral and intellectual—that play an important part.

There seems to be, among the dark races, some remarkable relation between depth or in-

tensity of color, and a certain indifference to the naked, or partially naked state; and this indifference seems to increase in proportion as they are removed beyond the pale of civilisation. They appear, as it were, not to know that they are naked. There is, in this respect, an intellectual and moral deficiency in their nature, and this deficiency plainly denotes inferiority of race, of which intensity of color is one of the outward expressions. Those who would trace the descent of the great servile races of Africa from Ham, may find in such deficiency a more potent cause for their servile condition, than the reputed curse of Noah—a cause that would act similarly on every race of man, regardless of descent. One of the first signs or first steps in the improvement of those races is a feeling or knowledge, however slight, of their degraded condition, a dawning sense of shame which is of necessity accompanied by a desire to better their condition. But such a feeling denotes not only a moral, but an intellectual rise or improvement; and without this improvement, the utmost protection from the elements would not, of itself, suffice to produce a fair skin. A high degree of civilisation, which may be looked upon as a measure of the

high intellectual capacity of the race, is essentially necessary in the evolution of the white skin; were this not the case, we should expect to find certain races, such as the Esquimaux, that are compelled by the rigour of an Arctic climate to be thoroughly clothed of a white, instead of a dirty yellow color; such a color is also an effectual argument against the current supposition that a cold northern or southern climate is the sole cause of a white skin. The dark skins of the naked savages of Terra del Fuego may be adduced as a still more effectual argument against such a supposition. The color of the Fuegians shows us, in a very forcible manner, that any climate coupled with exposure and an uncivilised state, will produce and perpetuate a colored race; a cold climate, however, acts indirectly in the evolution of a white skin, by stimulating the intellect in the devising of the appliances of civilised life, as a protection against the cold. If such devices are not resorted to, and that the race braves the elements as the Fuegians do, there is no advance made towards a fair complexion.

From the examples before mentioned it is manifest also that a tropical climate is not of

itself, apart from the habits of uncivilised life, sufficient to produce or perpetuate a dark race, although it greatly favors those habits of life that mark such races.

Since arriving at these conclusions I have learned that such probably was and may be still the opinion of Dr. Livingstone. He tells (as stated in one of his books of travel) some of the natives of Africa in words to this effect, that if they adopted the customs and cleanly habits of the white man that they too would become white; and Dr. Prichard even quotes instances of negroes becoming gradually white.*

As regards the generally received opinion that European families long resident in tropical countries grow gradually darker in color, it can only be true under certain circumstances; if they adopted the rude habits of the black tribes they lived amongst, they would undoubtedly in time come to resemble them more or less. But where this is not done they assuredly retain their fair complexion. No better example can be taken in support of this view than some of the women of wealthier class of Jews of unmixed blood who have resided for centuries in India. They pre-

* "Natural History of Man," 3rd edition.

sent skins as may be seen in that of the face and arms, of extreme whiteness and delicacy, and compared with which those of Europeans—all freckles, boils and prickly heat, the outward expressions of curry, beer and brandy, contrast badly. Such a skin is the result and expression of moral and intellectual superiority, and of the conditions of highly civilised life. It is absolutely incompatible with the habits of uncivilised life. A very few minutes exposure to the direct rays of that tropical sun under which it has attained such perfection, would blister it as effectually as boiling water. Even European officers and soldiers playing at cricket with the arms exposed on a very cloudy day, have them very often severely blistered.

There are some persons who hold the opinion that a white race may be manufactured out of a colored one by the intermarrying of the one race with the other. They forget that a black race might as easily be made by the same means out of a white one. It is not the plan of Nature. Even according to the Scriptures, the higher race was heretofore prohibited from forming such an alliance with the lower one. Such is also the teaching of Nature, if it were attended to. If

the higher race is greatly less in point of numbers than the lower race by which it is surrounded, and with which it freely intermarries, the result will be that the higher race will disappear without permanently raising the lower race, unless they had previously shown a disposition to advance of themselves, and this will in some measure account for what are called black and colored Jews, intermarriages with the dark races the original Jews happened to live amongst, and the fact is that those people are now only Jews in name, proselytes to the Jewish religion,* and it will entirely depend on their habits of life whether they are to rise or sink in the scale of humanity. Something similar to the case of the dark Jews may be seen in the Portuguese settlements in India, the few have not succeeded in changing the color of the many, but the many have changed the color of the few, and ultimately it will be a question of civilisation whether they are to be fair or dark.

But it is on castes and classes of unmixed blood that conclusive arguments as to the causes that operate in the regulation of color are to be based.

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* See "Genesis of the Earth and Man."

It might be brought forward as an objection to the opinions we have advanced, that the soldiers of the native Indian regiments are not at present noticed to be growing fairer; but we cannot suppose that any great change could take place in individuals who have lived as their fathers lived before they enlisted and who still live in their original way when off duty. It might be further objected that many of the native princes of India are not so fair as they might be supposed to be; but it must be remembered that some of them have risen and some of them have been adopted from the lower classes. Where this is not the case they are remarkably fair; but the mere fact of their being princes gives them no advantage over the intellectual and higher class Brahmins in the acquisition of a fair complexion.

That the people of Southern Europe are, as a rule, darker in complexion than those of Northern Europe, is in reality no argument against those opinions already stated, but is rather an argument in their favor; otherwise we ought to find them very much darker in complexion than they are.

There is certainly no proof that those people have grown darker, or are growing darker, but it is more apparent that they are growing much

fairer. There is another statement that European families long resident in tropical countries acquire dark hair and eyes. We ought to expect this as regards the eyes. Those organs are, alone, in a great measure exempt from the conditions that affect the body generally under civilisation. The glare and intense brightness of the tropics are not to any great extent shut out from the eyes, and consequently they acquire or retain more dark pigment than would be required in northern countries: even white cattle in India have exceedingly dark eyes. But there is certainly no reason that I know of that the hair should grow darker, and I am confident that it will be found that even fair hair will yet be common among the natives of tropical countries.

We see that young children in Europe in a great majority of instances have fair hair; as they grow older the hair gets darker, in some instances not changing much, but remaining fair during adult life; in other instances it changes to brown, sometimes almost to black. Now what does this fact point to? It unmistakably shows when looked at in connection with others already stated, that the transition is from a darker to a fairer variety. And this same rule, differing only in degree, ob-

tains among the natives of India. I have seen instances of slightly fair and yellowish hair amongst young children of the fairer and higher classes of Hindoos. It afterwards changes to black as the children grow up ; and the children of the darker classes have invariably brown hair, even sometimes it may be met with of a very light brown color. Those children are also much fairer in complexion when young than they are afterwards. Such facts as these are, as it were, prophetic of the future, and show us in the clearest manner that causes are at work sufficient to evolve from the present colored inhabitants of India and other tropical countries, a fair race in its highest acceptation.

Mr. Darwin brings in the aid of natural and sexual selections to account for the varieties of color presented by the races of man ; but they evidently fail to account for them to any extent. It is well known that the very dark classes in India are not exempt from those diseases that affect Europeans. They are even more subject to malerial fevers than Europeans. It is true, however, that they do not suffer much from sunstroke. They can work with impunity for hours under a burning sun with the head exposed, although they

generally wear a large "puggaree" wound round it. But I do not think color has anything to do with this immunity from sunstroke. It depends rather, I think, on the cerebral constitution and acclimatisation. It is very remarkable that European children do not seem to be affected much by the sun in India. They may be seen almost at all hours about the military lines playing under the sun without any efficient covering on their heads. In fact, unless they are at school they can hardly be kept within doors. But with the exception of this immunity from sunstroke, the natives suffer equally with Europeans from the diseases commonly met with in the country. Indeed they may be said to suffer more. If they lived as many Europeans live in India, they would die out in great numbers, for there is a certain innate energy in the European constitution, even when weakened by excesses, intemperance and disease, that far surpasses that of any dark race.

It has been noticed by some medical officers that Europeans with light or fair hair and florid complexions suffer less from the diseases of tropical countries than persons with dark hair and sallow complexions; and, so far as I know,

there appears to be good grounds for this remark. There is not the slightest doubt that such persons, when of temperate habits, and free from any inherent or engrafted constitutional disease, suffer much less than others; in fact they seem, to some extent, proof against disease, and especially against malerial fevers.

Although the black skin is inseperably connected with inferiority of race, yet Nature has not produced it merely to mark that inferiority. It is better adapted to the requirements of barbarous tribes than a white one could be, and it looks much better under the hard lives such people are mostly obliged to lead. I need hardly say that, under their conditions of life, a white skin smeared with mud and filth and parched with the sun, would be a very disagreeable sight; besides, it is much too tender for exposure to the elements; but a sun that would blister and almost char a white skin, despite any amount of seasoning, has no effect on a black one; and this cannot be the result of long exposure, for dark children of some six or eight months old seem not to be affected by the sun as they are carried about naked or otherwise exposed to it; but this power of resisting the parching effects of the

elements would be superfluous in civilised states of society.

Now, although it is certain that white races have and are still being derived from dark races, it is also possible that the dark races may have been derived from an original white race; nor is it altogether improbable that the founder of the human family was of the fair variety; and, indeed, the scriptural statements relative to the reputed founder, Adam, and to the after spreading of man, rather favor that opinion, and an inference may be drawn from them that the dark varieties afterwards arose with the degradation of the race. But at present there is apparently no transition of fair races in this downward direction; the change is upwards; yet such a change is not equally apparent amongst all dark races; it is only to be clearly recognised where centres of civilisation have been established, and where considerable progress has been made; and then it is, in a great measure, assisted by those barriers of class which prohibit marriages between individuals of different classes. In this way there goes on a sort of natural selection. The intellectual and moral qualities of the higher classes accumulate until a high degree of perfec-

tion is reached; and, by a wise law of Nature, such classes are always the ruling classes, and they only cease to be so when they lose that moral ascendancy, or are surpassed in this respect by others. The lower classes are either gradually raised to the same standard, or, if they are incapable of rising, they give way before the higher; they are, in fact, to use a scriptural phrase, "cast out from before them;" but it does not follow that they are always to be cast out by the sword. They have infringed the unalterable laws of Nature, and by those laws they are sternly dealt with, and the result is that they are in a state of physical as well as mental degeneration, and bear within themselves the seeds of their own extinction; and in them "the sins of the fathers are visited upon the children." It is a decree of Nature that cannot be evaded, and from it those philosophers who, led away by the arguments of Malthus, fear that the earth will ere long be over-populated and insufficient to maintain its inhabitants, may derive some consolation. In it they may see an easy solution of the difficult problem of maintenance, which has led them to set forth the fatal doctrine that would confine to certain limits the increase

of population. They would commence their limitations with the noblest variety of the human family; they would reduce in number the great governing race of the world, whilst the savage hordes of the more uncivilised nations would of necessity be left to multiply at will, the inevitable result of which would be that they would in time overflow the numerically weakened nations of Europe; they would tread on the heart of civilisation, and establish again the horrors and miseries of the dark ages.

If such a catastrophe would be avoided for the common good of all, it must be avoided by increasing rather than diminishing the number of those who are alone fit to rule among the nations; it must be avoided by their carrying order and law into the very hearts of the most barbarous countries, and by establishing in them centres of civilization and progress. In such a work the nations of Europe would find ample employment for their surplus populations—a work in which Russia alone, led by higher instincts, is vigorously progressing—progressing like old imperial Rome. Her philosophers are not engaged in inculcating the doctrine of the necessity of limiting the increase of her popula-

tion. But other nations of Europe that heretofore led the way in conquest and colonisation, now allow their mighty resources to lie unused; they will colonise no more; they will extend their rule no farther; they are even troubled by qualms of conscience as to the propriety of retaining many of those places long under their rule; they will not again deprive rude and aboriginal races of the just right of self-government —that is, they will not deprive them of the right of carrying on amongst themselves systems of wholesale robbery and murder, and of spreading desolation over vast extents of rich territory; they will not, on conscientious grounds, rule such races for their advantage, and for the advantage of their own people, and force them to spend their energies in useful labor, in the developing of the resources of their countries, and in the construction of roads and canals for the purposes of trade; they now prefer to stand still, apparently secure within their barriers, enjoying the fruits of their former activity, and, instead of employing some of their enormous wealth in opening up fresh fields of enterprise for their hardy sons, they prefer rather to listen to the absurd teachings of that false philosophy that

would limit the increase of their number, as a panacea against destitution and its accompanying evils, forgetting that they alone have made them what they are, and that on their number and vigor their future existence will depend; they are perplexed by the well-meaning but premature sentiments of peace congresses, crying "peace! peace! where there is no peace," to a world full of violence and crime—the unfailing results of ignorance and barbarism. But they cannot stand still with impunity; they must employ their wealth and resources in providing for their increasing populations in the way that Nature has ordained; they must fulfil their high mission for the universal good of man, in the spreading of civilisation throughout the world by the administration and enforcement of just laws. In this way they may guard against and prevent those increasing evils which sap their constitution, dealing with them as an experienced surgeon deals with actual disease by cutting boldly at its roots, regardless of those transient pangs which unnerve the timid and sentimental. In this way they may hope to limit the growth of those huge and ominous monuments dedicated to crime, lunacy, destitution and

disease—monuments at which the very "senses ache," as prophetic—not of the long-expected millennium, but of one vast lazar-house—a universal bedlam, looming forth, as it were, in grim mockery of man's progress!

CHAPTER V.

The Progressive Development of the Nervous System.

Professor Huxley says in his work, entitled "Man's Place in Nature," that "the difference between a gorilla's skull and man's is truly immense. In the former the face predominates over the brain case, in the latter the proportions are reversed;" and that "the structural difference between man and the highest apes is great and significant; that every bone in the gorilla bears marks by which it may be distinguished from a corresponding bone of man;" and that "in the present creation at any rate no intermediate link bridges over the gap between man and the troglodytes." And again as regards their mental powers, that they are separated by an "enormous gulf," that the difference between them is "practically infinite."

Yet notwithstanding this vast difference in every way between man and the higher apes,

many naturalists consider them as belonging to one order—primates. The grounds on which this classification is sought to be established rest altogether on their physical structures, for no comparison can be made between their mental powers. But man's physical structures are intimately correlated with his powers of mind—the one is expressive of the other, the one places man far apart in an order by himself, the other does the same.

It is admitted that there is no living connecting link between man and apes, neither has there ever been. A form intermediate between man and the troglodytes would be a truly monster form not in correlation with any known conditions, and consequently incapable of existing without the interposition of a miracle. But the gap which naturalists cannot bridge across they try to diminish in various ways. Professor Huxley says that as regards physical structures, "the difference which separates man from the gorilla and chimpanzee are not so great as those which separate the gorilla from the lower apes." And he apparently shows that the difference between the lightest known human brain weighing only thirty-two ounces, and the heaviest

weighing sixty-six ounces, is much greater than that between the lightest human brain of thirty-two ounces and a gorilla's weighing twenty-one ounces. But notwithstanding that there was a difference of thirty-four ounces between the human brains and only eleven ounces between the smallest human brain and the gorilla's, yet if idiocy be excluded, there was no such difference between the mental powers of the individuals as this great difference in brain weight would lead us to expect. Indeed, if both were subjected to the same mental training, there would be found very little difference in all the essential attributes of the human mind. But no comparison at all can be instituted between the mental powers of the human individual and the gorilla, although there is only a difference of eleven ounces between the weights of their brains. Looked at in an ordinary point of view we can hardly account for this fact.

But, let it be noted, that any table intended to give the absolute weights of each brain of a series of human brains without any comparison, with or without any reference to the entire body weight of the individual is altogether unsatisfactory, and leads to the grossest errors.

We know that every change within the body is accompanied by an expenditure of nervous force which represents chiefly so much waste of brain substance, which substance may be looked upon in the animal machine as the prime moving power. Now it is evident that the quantity of this moving power must bear a certain proportion to the absolute weight and size of the machine that it has to keep in motion that amount which would suffice for the working of a small machine would not do for a large one; and consequently, if we leave out of consideration that which we have no means of determining—viz., the amount of brain substance used in mental operations, for all other operations of the body, such as nutrition and motion, &c., a well-developed man of thirteen or fourteen stones weight would require a much greater amount of brain substance than a slight but fully developed Hindoo woman often not weighing more than five stones in weight; and this would of necessity considerably lessen the difference between the remaining amounts used by both in the working of mind. But the difference between them may be made still smaller unless that we suppose—which we have no right to do—that the

microscopic structures, *i.e.*, the ultimate fibres and cells are of the same degree of fineness in both brains; but it is highly probable that the smaller brain is the more finely organised of the two. We know for a fact that the tissues of different animals—viz., their blood cells, their muscular fibres, and their nerve fibres and nerve corpuscles, &c., differ enormously in size when those of the one are compared with those of the other; and this helps us to understand why the elephant, from his much greater size of brain, is not a wiser animal than man, for I think we may safely infer that the ultimate nerve fibres and cells of his brain are much coarser than those of man, and consequently that in the case of the elephant a larger quantity of brain substance is required to do an amount of work that would be done by a much smaller quantity or weight of the more finely organised human brain; and this taken in connection with the very much larger quantity necessarily required in the working of his ponderous body, would go to show that man has essentially the greater brain, that he has actually a greater volume of brain substance set apart for mental processes than the elephant. Of course we could not expect to

find any very marked difference as regards the size or measurements between the ultimate nerve fibres of individuals of the same species; yet I think it will be admitted that there often is a difference, and that the brain of one person may be more highly organised than that of another—in fact, it may be formed of finer tissue. From this it follows that to derive any useful information from a comparison of the weights of different brains, their fineness of organisation, and the weight and size of the individual body to which each belonged, must be taken into account. Looked at in this way, we can partly understand how it is that a small terrier dog is often quite as sagacious an animal as a very large mastiff, or even how it is that those tiny ants, barely one line in length, are possessed of all the marvellous instincts exhibited by the largest species measuring almost an inch in length.

But when brains belonging to different species, such as those of man and the gorilla, are compared together with a view to determine the order to which each species belongs, it is absolutely necessary to look at them in this way.

Now when we find that a large gorilla weighs nearly thirteen stones, or almost three times as

much as many a full-grown Hindoo woman—for I believe that even some of them may be met with under five stones in weight—we must admit that the volume of brain that each possesses, taken by itself, gives us no idea whatever of their respective degrees of mental power, or of the proportion that the one mind bears to the other; for even leaving the texture of each out of consideration, it is evident that for purely animal work the gorilla in proportion to his weight, will require three times as much brain substance as the woman, and this will of course deduct largely from the amount at his disposal for mental work. On the other hand the only deduction beyond that due to body weight that can be made from the woman's brain, will be a proportionally greater amount necessarily used in the co-ordination and production of the much greater number and variety of the muscular movements of which she is capable. But even against this may be set off the very great amount of brain substance used by the gorilla in the almost continuous muscular strain his mode of life necessarily entails.

On these grounds we are inclined to believe that so far as brain substance is concerned, that

man is separated by a wide gulf from the gorilla, and that from such a comparison no connection can be established sufficient to place them in the same order.

Notwithstanding the great difference in the size of human brains, we have tried to show how it is that no such difference is found to exist in the mental powers of the individuals; and even if such brains be looked at apart from their mental powers and solely in connection with the body-weight of each individual, it will very often be found that the small brain is larger in proportion when compared with the size of the body of its owner than the large brain of the greatly-larger individual.

In this way, if the capacity of the human skull be looked at in connection with the size of the other bones of the body to which it belonged, it will be found that the average capacity of the human skull is very little, if anything, increased in the present time beyond what it was in the most ancient times of which we have been able to obtain any record of man's existence. But in any species of higher animals, man included, if the cranial capacity be taken in connection with the bony framework, it will give a fair ap-

proximation of the mental capacity of the individual; and this shows us that the mental capacities of the earliest human beings, whose skulls we have obtained, were not inferior to the average mental capacity of people now in existence; and, no matter how ignorant or barbarous those primitive people may have been, their skulls testify to the fact that they had the same capacity for receiving knowledge that most persons have in the present age. The rudest flint implement coeval with the dawn of human existence is proof positive that the hands which formed it were perfect as human hands could be, and that the mind which directed them was not in any essential particular inferior to that of the cunning workman of any subsequent period down to the present time.

That capacity for receiving knowledge which is found to exist among all savage tribes is not to be confounded with that higher order of intellect which stamps with superiority the civilised races of man. The latter is mental capacity long turned to good account in the acquisition and storing up of that useful knowledge which acts on society with a sort of reflex influence, branding the individual and the race

with the mark of nobility, and causing them to transmit that mark to their descendants. But among the savage races mental capacity lies, to some extent, unused, or, as more frequently happens, used solely in the devising of evil, in which they manifest a high degree of mental power, but power exercised in a way that necessarily leads to deeper degradation and ultimate destruction.

The above statements are not to be understood as implying that the human brain is incapable of increasing or diminishing in quantity, or of improving in quality, but that its range of increase or diminution is confined to comparatively narrow limits, and within which it must necessarily have been created. This comparative fixity as regards cranial capacity exhibited by the human race stands out more clearly when contrasted with that of the other mammalian orders.

If we examine in succession as a whole the bony framework of the different orders of mammalia, from those now in existence to those of the tertiary period, we find, as we go back in time, that the bones increase in coarseness; they become greatly more bulky, and all the ridges and processes are more strongly marked, showing

the enormous muscular strain to which they were subjected. But what strikes us chiefly is the greatly diminished size of the cranial cavity when taken in connection with the size of the bony framework to which it belonged. The whole is indicative of a reign of purely brute-force almost entirely guided by animal instinct.

Professor Owen, speaking of what is known of extinct forms of life, says, that they yield "the legitimate deduction that there has been a succession of species illustrating in the main the progressive perfection of the nervous system and the concomitant predominance of mind over matter."* But this deficiency, or rather this smallness in the size of the brain exhibited by the mammals of the tertiary and post-tertiary periods, denoted no imperfection of the animal machines. All of them were perfect in their organisation, and in complete harmony with the conditions of life under which they lived, and their several degrees of intelligence were in proportion to their wants.

But all the information that we have been able to collect, up to the present, relating to the primi-

* "Owen's Palæontology," page 449.

tive inhabitants of the earth, leads to the conclusion that in whatever physical way man commenced his existence as a species, he must have commenced it with all his mental faculties complete. The oldest human crania obtained from the caves of Europe stand forth in support of this view. They form an exception to the rule of small cranial capacity that obtained among the other mammalian tribes of that remote period.

Now if the theory of the gradual evolution of man from some lower animal were true, we should certainly find human crania showing a marked gradation in the size of the cranial cavity, with a corresponding thickness or coarseness of bone; and this gradation we would expect to find even long after his having attained the specific human form. The vast period of time also required by the gradual evolution theory in the changing, or in the elaboration, of a new species from an old one would greatly add to the chances of our being able to find the transitional forms, inasmuch as the number of such forms would of necessity be incredibly great, extending, as they did, over so long a period, and, consequently, they would be pre-

served in proportionately greater numbers; yet the fact is that neither in the case of man, nor other animals, do we find any transitional forms that are not sharply defined as marking the limits of species. That connection or transition noticed between all the species of an order is strictly limited; it jumps, as it were, from one species to another; it does not connect any two by insensible gradation; no intermediate forms are found to connect either living or extinct species.

But man's form is also incompatible with that lower range of intellect which is invariably connected with smallness or deficiency in the volume of the brain, and which requires to be supplemented to a proportionate extent by instinct.

Professor Huxley, with a view of more clearly demonstrating the connection between man and the troglodytes, and to account for the enormous difference in the functions of the brains of each—a difference that bears no proportion to their difference in volume—uses a very ingenious simile by which he tries to prove that there is no necessary proportional relation between variation in function and variation in structure. He says in words to this effect, that if you take two watches exactly alike in make and rate of going,

and crush lightly the bearings of the balance-wheel of one, that from that moment it will cease to go; and he remarks that slight as that variation or alteration in structure is, that it is accompanied by an infinite variation in the function of the watch, which was its power of measuring time. He then applies this to the human brain, stating that if you change in the minutest degree that portion of the brain on which the power of speech depends, that the individual would become suddenly dumb; and he goes on to say that "a race of dumb men deprived of all communication with those who could speak, would be little indeed removed from brutes, and the moral and intellectual difference between them and ourselves would be practically infinite, though the naturalist should not be able to find a single shadow of even specific structural difference."* Now what does this prove? It proves that in some instances structures must be so minutely and elaborately adjusted to the functions they are intended to perform, that the slightest alteration of them in any way destroys the function altogether; and looked at in this light, there is

* "Man's Place in Nature."

indeed no relation between variation in function and variation in structure. But in reality the argument rather proves the reverse of that which was intended; for it is evident that the watch so altered would to all intents and purposes cease to be a watch, and if constructed in the first instance with this imperfection, or want, it would never have been a watch at any time. It is the performing of the function for which it was designed that makes it a watch, but in its slightly altered condition it is a useless collection of wheels and pivots, etc., without any meaning. In the same way, if man had been created without the faculty of speech, he never would have been man. He could not compete successfully in the struggle for existence, and would disappear from creation unless he were specifically changed. The watch, with its delicate machinery moved by a spring, is to the man what a rough clock, moved by heavy weights, is to the gorilla. There is no connecting link between them. You must pass at once from that modification of machinery adjusted to weights as the moving power, to that adjusted to the spring; no half modification will suffice. The machinery in either case must be essentially altered. The slightest inter-

ference in any other way than in radically changing the type brings its functions to an end, and in like manner the slightest alteration or deficiency in man's brain that would take away from that standard capacity for the reception of knowledge common to every race of man would be fatal to his existence as man. He could not retain the human form and live ; a human form without human capacities of mind, would, under any circumstances, be a melancholy sight—an anomaly among the works of Nature, an unreal thing that would pass away like a shadow.

Although we do not know what were the initial forms, geology and palæontology fully establish the conclusion that the history of organic life on the earth, from its earliest dawn to the present time, has been one characterised in the mean by a gradual advancement from lower to higher forms, which in turn seem to point onward to a reign of mind, through the increasing preponderance of the nervous system. Now there are some persons who imagine that this advancement betokens some imperfection in the organisation of the lower forms, as if Nature had been tentative in her efforts. But the history of past life, as traced out in the rocks, effectually ne-

gative such an opinion. All fossil remains of organisms, from the lowest to the highest, are characterised as having had the same equal perfection in structural adaptation of organs to their intended functions.

Among groups of fossils known as "persistent types," the oldest species of the series are as highly organised as the latest. The lingulæ of the Silurian seas were as perfect in every particular as those now in existence. Their continuing unchanged during this stupendous period of time opposes the belief that slight variations having arisen in some unknown way, go on gradually increasing, until radical changes are effected. It is no satisfactory answer to say that the conditions of oceanic life under which they lived did not change much to them, although there may have been many changes that affected to a great extent organisms of different types of construction. Those who believe the Darwinian theory must, to be at all consistent, admit that in so great a period of time variations would to a certainty have arisen, which under the law of natural selection, favoring the more improved forms, would have ultimately led to essential changes of character; for it is one of the greatest

defects of the gradual transition theory that it admits in some cases, and necessarily implies in all, the existence of a certain amount of structural imperfection at some period in the history of species, for more or less structural imperfection must remain during the transitional period, or until that complete modification to which the first variation only pointed was attained by the species. But to admit this is to admit imperfections in the works of Nature, against the most overwhelming proof to the contrary.

Professor Owen says in his work on Palæontology*, that the duration of types and species, as a general rule, is inversely proportional to rank and intelligence. There appears always to have been a sameness in the nervous system amongst the invertebrate orders. Living species of invertebrate types are, in all probability, possessed of no more intelligence than their most ancient representatives; and although the appearance of fish and reptiles was marked by a great stride in the advancement of the nervous system, and clearly foretold a still greater,

* "Owen's Palæontology," page 53.

yet we have no proof that the nervous system or intelligence of any species of fish has advanced beyond that stage in which it was first ushered in, although it would appear that the Dinosaurian reptiles showed a very considerable advance in this respect beyond others of their class. But when we come to the mammalia, we find clear evidence of a nervous system continuing to advance with the age of the group beyond its initial proportion. This advancement extends even to the individual species, and is continued to the present time.

It may be noticed that dogs differ considerably in cranial capacity, and those individuals of any variety with the largest and best formed heads are always the most intelligent. Even those neglected dogs that are allowed to congregate about Indian villages, and live as best they can on offal and other refuse matters, have apparently flatter and smaller heads than European dogs. But a more marked difference in cranial capacity exists between the domestic dogs and their wild, or partially wild, congeners. Yet amongst wild animals there appears to be a gradual increase in cranial capacity going on at present, and those individuals that have a larger

average capacity than their fellows, are more easily domesticated. I saw in India two cheetahs almost fully grown, they were both found when quite young, and were reared up much alike; they however differed from each other slightly in size and shape of head. The one with the larger and better shaped head was very docile, and liked being stroked and patted almost as much as a cat; on the contrary the other one was fierce and vicious and could not be trusted.

There is no doubt also but that the cranial capacity and intelligence of animals are greatly increased by their being brought under domestication. The same remarks apply in a measure to young animals bred in zoological gardens or menageries; and very probably if they were allowed more liberty, and kept properly under control and not over-fed, that they, or rather their offspring, would in time become thoroughly domesticated. The old scriptural phophecy of the lion and the lamb lying down together, might then in fact be fulfilled in a way not hitherto contemplated by the divines. However, leaving the possibilities of the future out of the question, it is certain that in the past this expanding intellectual capacity of the higher

animals has been of the greatest advantage to man. It enabled him, in the first instance, to attempt and to carry out successfully the domestication of those creatures that supply so many of his wants, and add so greatly to his comforts. Its achievement marked one of the greatest strides made by man in the path of progress; and the universal worship of these animals that prevailed in the early history of the world shows how thoroughly the good they conferred was appreciated, and as some suppose this animal worship may have had its rise in the general sense of gratitude and admiration expressed by men towards the persons that first taught them to bring those creatures under subjection.

Astronomy partly reveals to us that the bodies dotted throughout space, pass through successive stages, that they have not been and shall not remain for ever as now constituted. It seems to point to a time in the past when the earth was unfit to sustain organic life, and to a time in the future when existing conditions shall have all changed and passed away, never again to return. The vast unknown periods of its chaotic and azoic states were preparatory of the

present, as the present is of the future; geology comes forward to corroborate the teachings of astronomy. It, too, points to a time, however remote, when the first lowly but prophetic forms of life broke as by enchantment the mighty solitude, and ushered in the dawn of a new order of things—the beginning of that long ascending series of organisms which has now reached its final climacteric in man.

It would appear that each period in the history of any planet has its particular work allotted to it, and that this work must be completed within that period; and therefore, notwithstanding the eternity of that duration in which Nature works. She seems to economise each moment of passing time in the carrying out of her designs so that none may be wasted; and we are led to think that the introduction of initial forms of life marked that stage in the progress of the earth when the conditions of its surface were so altered as to be compatible with or favorable to their existence. Yet it would appear that those conditions remained for long periods afterwards unfavorable to the introduction of higher forms. But as time rolled on, the earth became more and more fitted for the sup-

port of organic life. It became, in fact, more healthy; and the different types of organisation, and especially the state of advancement of the nervous system at any time, may be taken as a measure of the degree of salubrity then arrived at. Thus we pass upwards from the invertebrate types of the lower silurian rocks to the placoid and ganoid fishes, and on to the reptiles of the oolitic formations. But as yet the rank and steaming earth, however well adapted to meet the wants of the great reptilian orders, and however favorable and necessary for the elaboration of its rich flora, precluded the introduction of mammalia; and although a few of the lowest forms occur in secondary formations, it is not until we arrive at the tertiary period that we find them about to be introduced on a large scale; and then the general coarseness of their organisation, together with a nervous system less advanced than that of the mammalia of the present time, was such as would have enabled them to live in the most unhealthy jungles of that period. Even now it is apparent that domestic animals, owing to their finer organisation and more highly developed nervous system, will not live or thrive under conditions suited

to the coarser organisation of their wild congeners.

The same rule obtains in the case of man; for although the most intellectual and highly civilised of the races of man can live in any locality where the lower races are found, yet they cannot live in the same way as those races. They must live in a different manner—in a manner suited to their more tender and more highly organised systems. It is certain that the earth has gradually grown more healthy, and it is highly probable that it continues to do so still, and that it will be much more healthy in the future, and more especially so when science shall have crushed out those plagues that follow in the wake of imperfect civilisation. Plagues not the natural offspring of earth, but the monstrous progeny of unnatural conditions brought together by man, and made use of by Nature as terrible but necessary scourges to urge man onward in the path of progress by compelling him to live in a degree of cleanliness more in accordance with his high estate—for, without compulsion, it is very apparent the most civilised communities would not advance in a sanitary point of view, but sink rather into a state too terrible to contemplate.

But the countless organisms of times past whose structures were so constituted as to enable them to live in all the degrees of unhealthiness that the earth has passed through—have played a great part in the working out of Nature's plan of creation. They are the links that connect the past with the present; they are the stirps from which all living organisms are descended. But they were all gradually changed—changed by design to administer to the wants of a new creature about to be ushered on the stage of life; for it is apparent that the great mass of the organisms of the present day are so constituted and constructed as to serve this end most effectually. They are different as a rule to those that existed before man was. The more ancient inhabitants of the world, from their very nature, could not have so well supplied the wants of man had he then existed. These facts alone, in the absence of other proof, would be sufficient to establish the certain inference that man is not only the latest work of Nature, but also the noblest, the great final form had in view from the "beginning" by the creative mind, and towards which Nature has been working during periods that are beyond our power of conception.

Every group of organisms, to whatever period it belonged, fulfilled a purpose that had some relation to the coming of man. The more ancient groups having fulfilled their purposes were superseded by others that approximated still nearer to the great end ever kept in view. For example, the great reptilian class which attained its maximum development in the secondary period, served at least two great purposes. It was the link by which Nature advanced from fishes to birds and mammals; and at a time when higher animals could not exist, the reptilian orders of land and water constituted the predaceous tribes that maintained the proper balance of the animal kingdom. But as time rolled on this office began to be usurped in both these places by mammals and birds, whereas on the declining reptiles devolved less important duties, such as that of acting as scavengers in tropical rivers, a work they are still eminently fitted for, but which must pass away in time when such rivers cease to be receptacles for dead bodies and offal of all sorts. It is highly probable that the class of reptiles may hereafter end in total extinction and have their place supplied by what might be called the permanent

classes of vertebrates—viz., fishes, birds and mammals. But these classes also have and are undergoing changes which have a manifest relation to man's welfare—changes that are as a rule in opposition to that which natural selection might be supposed to favor. The cartilaginous type of fishes, with its strong dermal armour, has given place to the numerous and beautiful varieties of the soft-skinned bony type so invaluable to man as an article of food. So, too, mammals and birds have undergone changes that can only be understood as being brought about for man's especial use. Even in the present time those animals that are unserviceable, or least serviceable to man, are those which appear to be on the decline and tending towards extinction. The whole order of the quadrumana are probably tending in this direction. Thus it appears that during the upward march of organic beings, each group was so constituted as to serve a present purpose having relation to wants existing at the time, such as the filling of the world at any period with the various forms of life and the adjustment of their numbers in such a way as would be conducive to the good of the whole, and a future purpose having relation to the

requirements of new modifications about to be introduced, and especially of that perfect form shadowed forth through all the mighty series.

But the predaceous animals so characteristic of former times are now disappearing; their presence as of old would be superfluous and injurious; they are supplanted by a being armed with powers of destruction that cannot be resisted, and before which the teeming inhabitants of the earth have dropped in submission their useless armour. Thus man is established the great ruling predaceous animal of the world; yet Nature has made other provisions for the safety of her defenceless creatures; she has set limits to the exercise of man's power over them, and beyond which experience has taught him that he cannot pass with impunity. He must, for his own sake, become the protector also of the mute tribes that are placed under him; nevertheless this is not the end for which man was created; nor is the future purpose to be served by man to be understood in the way that many understand it, as referring chiefly to a more perfect state of society, to be attained to by future and wiser generations; such a state will rather mark the closing of that period allotted

for the completion and perfection of man's present larval condition in which is laid the essential basis of that future existence to which Addison thus refers in his well-known lines:—

> "Through what variety of untried being,
> Through what new scenes and changes must we pass;
> The wide—the unbounded prospect lies before us,
> But shadows, clouds, and darkness rest upon it."

For if all the countless forms of life that peopled the earth at any former period were manifestly constituted with relation to a coming time, are we now justified to make an exception of man in this respect? Is he the only animal not destined to serve a future purpose? Are all his faculties and powers constituted solely with regard to the present, and to the wants of the present? Is the serving of a transient temporal purpose that alone for which he was ordained? And is it with reference to this that all inferior animals are rendered subservient to his wants? Is he raised above them merely that he may fondle and devour them, after the fashion of the wolf in the fable? Is the great end of his existence realised in that which constitutes him a mighty ogre? Are all those high aspirations incorporated with his very being, and dearer to him than

life itself, mere mocking delusions that ever "keep the word of promise to his ear, and break it to his hope?" Deductions legitimately drawn from all the works of Nature emphatically answer—No!!!

CHAPTER VI.

Transitional Grades and Origin of Species.

Some years ago the multiplication of species was carried to such an extent by naturalists that it seemed, as it were, a sort of general mania, urging them on to overstep the bounds of prudence in their haste to name and discover new species; but it soon became apparent that they had gone too fast and too far; that mere varieties of the same species were, in fact, named as distinct and independent species; and the consequence is that at present a great amount of confusion and uncertainty exist in many cases as regards the constitution of species and varieties. Nevertheless those disputed cases are merely of controversial importance; they do not in the least point to any irregularity in the working of that which must be regarded as one of the most unalterable laws of Nature (so far as we can judge of it from experience), namely, that law which

establishes and maintains the distinctness of specific forms—a distinctness which even analogy, apart from the positive evidence of palæontology, is sufficient to establish as having been equally characteristic of organic existence throughout all time.

Now such a law is altogether incompatible with the Darwinian theory of the origin of species; for, if the theory were true, the reverse would, to a certainty obtain. Transitional links, almost innumerable, would necessarily be found in many instances, both among living and extinct species. Mr. Darwin admits the difficulty, and says that the distinctness of specific forms constitutes one of the gravest objections that can be urged against his theory. But we can easily understand that the presence of numerous transitional links among either living or extinct species would be foreign to Nature's plan, which is characterised by a gradation sharply defined, and that they would, moreover, be highly disadvantageous, inasmuch as they would lead to confusion by tending to do away with specific distinctions; and we shall see further that the very existence of such links would necessarily have been opposed in many instances, if not in

all, by obstacles of such a nature as to preclude the possibility of their being surmounted.

That great system of living machinery which constitutes the animal kingdom with its primary types and their subdivisions, may be aptly compared to the system of machinery devised by man for the carrying out of his works. In the construction of both systems one common ruling principle must necessarily have been kept steadily in view by the artificers—that is, that they should all be constructed on such a plan as would involve the least expenditure of the power or force at disposal for their working, so that as much as possible of that power might remain for the accomplishing of the designed work; for it is evident that if the machines were constructed on false mechanical principles, all the power at disposal would be more than used up in the mere movement of the machine itself, apart from the extra strain which the performance of work would entail. For example: if we look to locomotive machinery we find that it consists of four distinct types—carriages for land, sleighs for ice, boats for water, and aerial machines for moving through the air, which latter serve also as examples of that imperfect machinery that can-

not be turned to advantage, owing to all the force at disposal for work being used up in the mere movement of the machine.

Now it is apparent that there is no gradation, and that there can be none between these types. The carriage does not pass into the sleigh by any insensible gradation or by any gradation whatever. You must pass at once from the one to the other, from wheels revolving on an axle to slides; you cannot stop half way; you cannot have any intermediate locomotive machine, so also amongst the other two, transition is impossible; to change the one into the other you must change its type. But these types are each capable of being subdivided. The number of wheels on any carriage will as it were mark the species to which it belongs. We may have carriages with six, four, or two wheels; but here also gradation is limited to a great extent; we do not find intermediate numbers. We cannot have effective carriages with five or three wheels, or with one wheel, or with small wheels opposite large ones. In fact we cannot have intermediate links connecting any of the recognised species of carriages. But these species are themselves capable of being divided into a very great num-

ber of varieties according to the different shapes of the body of the carriage; and if we take any two varieties representing the extremes on either side, we find that it is quite possible to connect both by the finest gradations; and in fact we find many varieties intermediate between these extremes in actual use. And if man has had intelligence enough to see what forms of machinery would of necessity be impossible or imperfect, and if he has had power to pass over those forms and select those which are perfect, surely we must concede an infinitely higher degree of such power to Nature. Surely she has had means at her disposal by which she has passed from one perfect type to another without being obliged to pass through a series of imperfect transitional steps. And this is actually what occurs in Nature. She has followed the same plan in the construction of her machinery as man has followed, but on an infinitely grander scale. For instance, we may go on subdividing the vertebrata, yet we find no intermediate links connecting any two sub-divisions; such links do not exist, for their existence would be impossible. But when we arrive at species we find they are capable of being split up into varieties, and

further that the extreme varieties of any species are capable of being connected by intermediate varieties.

Let us now select one or two orders of mammals—the chiroptera and man for example, and see if it be at all possible to derive them from any other known orders of the mammalian class.

Mr. Darwin says "In bats, which have the wing membranes extended from the shoulder to the tail including the hind legs, we perhaps see traces of an apparatus originally constructed for gliding through the air rather than for flight," and as regards flying squirrels that are enabled to glide through the air by means of their extended flank membranes, he says: "I can see no difficulty, more especially under changing conditions of life, in the continued preservation of individuals with fuller and fuller flank membranes, each modification being useful, and each being propagated, until by the accumulated effects of this process of natural selection a perfect so-called flying squirrel was produced."*

Now flying squirrels and flying lemurs are the only mammals except phalangers that we know of, that so far as flight is concerned, approximate

* "Origin of Species," p. 181.

in any degree towards the chiroptera which are endowed with perfect powers of flight, and consequently they will serve our purpose better than any others in the inquiry as to the possibility of bats attaining to that power by the gradual accumulation of slight modifications of structure.

It is manifest that the extended flank membranes of these creatures enable them to glide long distances through the air; yet those membranes are so constituted that they do not interfere with their necessary powers of climbing; on the contrary they afford greater security to the animals in their movements among the branches; but as they can never be used in springing upwards, to an animal on the ground they would not only be functionally useless but a real hinderance besides; consequently these creatures are more confined to a life among the trees than many others of the groups to which they belong. They have not to descend to the ground as others have to get to a distant tree; they can glide over the distance and spring from bough to bough with the utmost security; they can easily escape their enemies, and reach in a short time such places as will afford them a plentiful supply of food. These ends are accom-

plished in such a way as renders it impossible to detect the slightest imperfection in the working of those special structures with which the animals are furnished. They are in fact functionally perfect.

If the wings of a swallow were to be increased to any extent beyond their present standard dimensions without increasing the weight and muscular power of the bird, it is very evident that for the purpose of flight they would be far less effective than before ; and it is likewise evident that when flank membranes attain to a certain width, proportionate to the weight of the animal, that for gliding purposes they are then perfect, and any increase in their size after that standard has been attained to would only render them more cumbrous and more difficult to manage, whilst it would add little if anything to the distance over which the animal could glide, and consequently such increase would be in opposition to the working of natural selection.

But notwithstanding, let it be granted that a transition towards the attainment of bat-like wings has proceeded to some extent, and let us suppose that the change has been as yet confined to the lengthening of the fore arm. Now the increase of membrane obtained in this way

would not have the slightest effect so far as flight is concerned; yet the change would greatly interfere with the animal's power of running along the branches, and this power would necessarily continue to diminish as the bat-like structure of the wing advanced, and it would be nearly altogether lost long before the wing attained the dimensions necessary for flight; in fact a very slight lengthening and divergence of the metacarpal and phalangeal or finger bones for the support and extension of the membranous skin would render it almost impossible for the animal to use the fore limbs in climbing or walking along the branches. Even so long as the wings fell short of the size and proportions necessary for flight, and so long as the pectoral muscles for working them remained undeveloped, they could be used at best only for the mere purpose of gliding through the air. But the entire extent of membrane yet gained could not possibly compensate the animal in any way for the loss of its former speed and facility of movement.

Now from this it follows that in every stage of that transition leading from flying squirrels and lemurs to bats, mechanical imperfections in the construction and adaptation of structures to

function would necessarily exist; and, in some instances, those structures would be so inadequate to the performing of necessary functions, as to bring about the death of the individual, partly from the exhaustion induced by the undue strain and excessive labor entailed on it through the faulty construction of its organs of locomotion. Such creatures could not, like those endowed with full powers of flight, search out those trees and alight on the very branches where most food was to be obtained; they would be obliged to light on the trunk or larger arms of such trees as lay within the range of their gliding powers, and from those situations they would have to pass to the extremities of the branches. But this would be rendered difficult, or impossible, according to the amount of modification which the anterior limbs had undergone in their transition towards the formation of wings; and so it is almost self-evident that the transitional stages that would necessarily have to be passed through, according to the Darwinian theory, in advancing from flank membranes to wings, such as those of the bat, would not only be incompatible with the welfare of the individuals, but even incompatible with their continued existence.

Thus it is utterly impossible to believe that bats could have originated in any such way as that of passing through a series of transitional imperfections; and if they are to be at all derived by birth from any other order of mammals, it must be admitted that nature has had means at her disposal which enabled her to compass the distance at a single bound, and such an act would only differ in degree from what is known to occur frequently within the domain of Nature (namely), the sudden appearance by birth of extreme variations, or of monstrous forms, from normal individuals of any species. Many of those births are quite as wonderful and incomprehensible as would be the birth of a new species; and, did we not actually witness the occurrence, we should most assuredly look upon it as an impossibility; nevertheless, we cease to wonder at such births, or learnedly regard them as sports of nature, not to be equalled or surpassed by her serious works; and we continue to limit the operations of Nature in accordance with our own narrow views of possibility.

And now in like manner as regards man, the difficulties to be overcome in his case by the Darwinian theory, in a physical point of view,

are equally, if not more insuperable, than those which we have noticed in connection with the chiroptera.

It has been remarked that the human form is that towards which Nature has been tending in her upward march through the successive grades of life which have peopled the earth at any period, and, consequently, we are prepared to find that it is the form in which the vertebrate type has attained its highest and most perfect development.

On examining the skeleton or framework of the human body, we notice that it is so constructed that the centre of gravity falls through it in such a way as enables man to preserve the upright position without, or almost without, the expenditure of muscular force. A line representing its course would fall from the head through the large opening at the base of the skull, midway between the condyles of the occipital bone, and then in front of the dorsal, and through the bodies of the lumbar vertebræ, or rather slightly posterior to them, in a well curved spine, and through the centre of the hip joint and in front of the knee joint, and through the middle of the instep of the foot. By this

arrangement, the weight of the body in the upright position falls on the bones, as a weight would on the head of a straight stick balanced in a similar position. Thus a man can stand upright, if he balances himself properly, without the assistance of muscular force; and this is what renders man, even in a mechanical point of view, more perfect than any other vertebrate animal, and it effects a great saving in the expenditure of nervous force, necessarily leaving a greater amount at disposal for use in other ways.

But in giving man the upright position, it was necessary to adopt special measures for the safety of the great central axis of the nervous system. It must be strictly preserved from all jars and concussions. And these ends are accomplished by the S shaped curvature of the spine which adds greatly to its elasticity. This elasticity is sufficient to break the jars resulting from ordinary movements; but it would not be sufficient of itself to break the shock to the nervous system that would result from jumping or descending from a height. In such cases the muscles of the lower extremities are made to assist by partly flexing the joints of the limbs and by alighting on the ball of the foot. The

strain is thus thrown on the muscles by the limbs bending gradually under the weight of the body, and so a shock to the system is prevented.

But this flexed position of the limbs which man assumes in jumping from a height for the purpose mentioned, is the habitual position of the limbs in apes, whether they stand on all fours or attempt to support themselves upright on their legs, and consequently in either way there is a very considerable expenditure of muscular power; but in the half upright position to which they can only attain, they are entirely supported by it, and consequently the waste of muscular and nervous power is so great that they cannot sustain themselves for any length of time in this position. A line drawn to correspond with the centre of gravity of the body when in the most upright position they are capable of assuming, would pass altogether in front of the spine and the hip joints, and behind the knee joints; and on this account the quadrumana are necessarily obliged to walk on all fours; but they are eminently adapted for climbing in forests, or among shrubs in steep rocky situations.

Let us now consider what would be the effect of interfering with the present structures of the

gorilla, by rendering them more human in appearance; let us take away from the length of the arms and add to the length of the legs, and reduce slightly the prehensile power of the feet. Now it is very evident that this change would take away enormously from the animal's powers of climbing. It could no longer climb with its usual facility, and so it would obtain less food with greater labor. The change would also take away from its power of progression on the ground, and render its movements slow and painful, and another stage in the transition would reduce the animal to a state of comparative helplessness. It could no longer obtain sufficient food by climbing, and its organisation precluded the possibility of digging for roots; and such scanty fruits and herbs as might otherwise lie within its reach would to a certainty be picked up by the numerous swift-footed tribes abounding in the same locality. It could not live by preying upon other animals; their capture would be far beyond its power, inasmuch as it had neither the intellect to invent weapons, nor that co-ordination of muscular power required for the effectual using of them; even so long as the creature remained incapable of standing firmly on its legs it would

be impossible for it to wield a weapon with effect, and it could not stand firmly on its legs unless it had attained to the upright form; and as to throwing a stone with precision, it would be still more impossible, yet Mr. Darwin says:—"A manlike animal who possessed a hand and an arm sufficiently perfect to throw a stone with precision, or to form a flint into a rude tool, could, it can hardly be doubted, with sufficient practice make almost anything that a civilised man can make."* But such actions could not by any possibility be performed by any manlike animal falling short of man's proportions; the throwing of a stone with anything like precision, even by man requires long practice.

If we were to stand five or ten minutes with the knee joints bent slightly, so that the centre of gravity would fall behind the joints instead of in front, notwithstanding the powerful muscles of our limbs which then sustained the weight of the body, we should be painfully conscious of having undergone an amount of fatigue that if continued for any length of time would altogether exhaust our strength. The experiment would also help us to form some conception of the

*"Descent of Man," Vol. i., page 139.

enormous labor that would be thrown upon a half-human or manlike animal in its attempts at walking or standing on its bent and tottering limbs; such a state of helplessness would be altogether incompatible with the continued existence of the creature. It would be a state altogether different from any that natural selection might be supposed to bring about, and there are no arguments whatever beyond suppositions to show that it could have been passed through, although there are several by which it is attempted to prove that man retains some traces of having passed through such a state. In some savages it is thought that the foot still retains traces of a former prehensile power, from the use they still make of it in this way. Now Hindoo women may be constantly observed using their feet in picking up things. A milkwoman or coolie girl as she walks along with a pail of milk or water on her head, picks up with her foot, with apparent ease, and without stooping or losing her balance, anything which she happens to see lying on her path. Yet the foot that is so used, exhibits in all cases the most perfect symmetry of form. Its prehensile power, in fact, lies in its extreme perfection and in the freedom

of the toes, which are not crossed and deformed as in Europeans by being forced into narrow-toed boots; but certainly this perfection cannot be reasonably used as an argument in favor of the Darwinian hypothesis.

But let us now consider the matter in another light. Let us take away somewhat from man's present upright form without any direct interference with his intellect. Let us diminish the natural curvature of his spine so that the centre of gravity will correspond with a line falling a little in front of the hip joints. Now this change will necessarily throw additional labor on the muscles of the back, the immediate effects of which will be a feeling of fatigue. But the continued exhaustion resulting in this way will in time lead to physical degeneration, and this will necessarily induce premature old age and weakness, and decay of the intellectual faculties. It would moreover act on the offspring in such a prejudicial way that each succeeding generation would be characterised by increased physical and mental deterioration of which the inevitable result would be the extinction of the race.

And if this end would result from our interfering with man's erect form, despite all that

reason could do to avert it, we cannot admit that a creature almost without intellect could make its way upwards to man's form through much more impracticable states.

Now the arguments that we have used in seeking to establish this conclusion are not based on any assumed hypothesis, but on those laws which have relation to the successful application of mechanism in the carrying out of design, and on facts that are patent to all. For instance the change we assumed as affecting man in general actually occurs among individuals to a certain extent, and may be observed setting in, in most persons, with the advance of age. A person notices that he is rather fatigued after walking a certain distance, and he further notices that this feeling of fatigue gradually increases as he grows older; he does not know the cause but attributes it to old age. But an observer, had he known him for some time, would notice that he stooped forward in walking or standing more than formerly, and that the centre of gravity would in him be represented by a line falling in front of his hip joints, and it is moreover apparent that the cause of this lies in the fact that his spinal column has lost to some extent the natural cur-

vature of youth, and consequently he now moves about laboring under a mechanical disadvantage. He often unconsciously stands with his knees slightly flexed to relieve the muscles of his back by throwing the weight of his body more backwards; and as his spine departs yet further from the normal standard he is obliged to use some support—to lean upon a stick, or in extreme cases upon crutches. And this stooping and bending forward of the spinal column may sometimes be observed setting in very early among many of the dissolute youth of cities when of a delicate or badly developed form of body. In them it seems to be partly inherited and partly induced by dissipation, aggravated by slovenly and slouching habits. And it is generally one of the causes that operate in producing those instances of premature old age so very often met with among the inhabitants of large towns.

Now it is also certain that if those causes which at first lead to imperfections of physical structures, whether characterised by abnormal curving of the spine, or by imperfect development of the muscles of the lower limbs, with a gross and bloated habit of body, continue in operation, that the evils which they give rise to

will continue to increase; this physical conformation of the body will depart more and more in each generation from the normal standard, and such departure will necessarily be marked by a proportional amount of moral and physical disease in the community, and those diseases lead in turn to individual extinction and national degredation and decay, and even, at times, to the extinction of races; for such are the penalties that follow the infringement of Nature's laws.

But although the moral and physical imperfections are intimately and necessarily connected, the moral diseases precede and induce the physical degredation, which sooner or later begins to manifest itself in the formation and expression of the features, if not of the body generally.

Thus we are obliged to reject on physical grounds, as involving impossibilities, the theory that would derive man by gradual transition from some lower form.* But difficulties equally insurmountable oppose the theory when it is considered in connection with mental capacity and

* For a fuller discussion of the difficulties that oppose the Darwinian theory see "Genesis of Species," by St. George Mevart; a work which I had not the pleasure of seeing until those pages were going through the press.

with moral and intellectual faculties; even the hypothesis that assumes the condition of the first human beings to have been one of utter barbarism, has been shown by Argyll and others to be untenable. Mr. Darwin himself impressed by the magnitude of the obstacles that here oppose his theory, with a view of lessening them somewhat, assumes inconsistently with the general tenor of its working that man at first came into being slowly evolved in some warm and genial region where a perpetual summer reigned, and rich fruit trees abounded, always laden with the choicest fruits; and this paradise must, moreover, have been an insular one to prevent the feasting incursions of the fleet-limbed denizens of less happy climes; and no doubt such a region was essentially necessary to the immediate welfare of the first human beings. But why reject the region of the scriptures described as the Garden of Eden? It is simpler and easier of conception, and not associated with such a vast array of inconsistencies, in the shape of grim hobbling satyrs, constantly worried by their more nimble contemporaries as that by which it is sought to be replaced. There is nothing incredible in the scripture narrative; Adam is not described there

as being placed in a state of princely magnificence, housed in a palace, and robed in tissue of gold, but simply as living under the shade of the trees, naked or clothed in skins. But while the scriptures thus plainly and truly describe the lowly condition of our first parents, as regarded outward appearance and social comforts, they do not at all show, or even lead us to infer, that their intellectual faculties or mental capacities were in any way deficient, but they show rather that they were possessed of complete powers of mind by no means below the average human standard.

Mr. Wallace, too, impressed by the difficulties that stand in the way of Mr. Darwin's theory when applied to the human species, concludes that some superior power or intelligence must have superintended and directed the coming of man into existence.*

Now although we meet in this way with species and genera separated by gaps that it is impossible to bridge over, in a physical point of view, yet there is a vast number of species—all the birds of any order, and most species of quadrupeds might be thus connected by the finest

* See "Limits of Natural Selection as Applied to Man," by Alfred Wallace.

gradations without involving any physical imperfections of structure of an insurmountable nature, so far as we could judge of them from outward appearance.

Nevertheless there are barriers which apparently render such gradations impossible. It would appear the tissues of one species of animal differ so in their microscopic structure, in form, size, and mode of adaptation of cell-elements from those of another species, that the forces of development are unable to build up an organism intermediate in structural conformation of tissue between those of any two different species from which it might be attempted to obtain a hybrid offspring. In such cases, and especially when the species are widely different, this disagreement may result from their specific distinctions having probably arisen in their progenitors when in a lower class. But it would appear when the species closely resemble each other—when they belong to the same genus that a proportional resemblance extends also to the structural elements of blood, nerve, muscle, &c.; and, in such cases, the forces of development are able to overcome, to a certain extent, the obstacles resulting from disagreement of tissue, and to build up an inter-

mediate organism fully capable of carrying on existence, but yet not perfect in all its parts, the forces of development failing to perfect those structures essential to generation, the re-productive organs remaining physiologically imperfect. Even in exceptional cases, where the hybrids are so perfect as to produce offspring, the forces employed seem further weakened at each successive effort to overcome the abnormal resistance, until at length sterility results and the creatures die out.

Thus the sterility of one species with another and the sterility of hybrids seem to result from two distinct causes—that of species being due, not to structural imperfection in the organs or their products, but to the entire disagreement and unadaptability to each other of the opposite elements concerned in generation, and that of hybrids to physiological imperfections of structure in the organs of generation themselves.

Now the sterility of species and hybrids may be regarded as being instituted to preserve specific distinction and to prevent that blending of specific forms which would undoubtedly result in the absence of such a law. When species is once established it can never blend with any other—it retains permanently its specific dis-

tinction; and the supposed exceptions to the universal sterility of hybrids are maintained by Kölreuter to have no existence, that in such instances mere mongrels of different varieties are classed as hybrids of distinct species, and he justly regards sterility as the only real test by which extreme varieties may be distinguished from species.

But we are altogether unable to say, either on histological or physiological grounds, so far as generation is concerned, whether that marked disagreement in the opposite elements of generation that gives rise to sterility might not be arrived at by slow degrees by gradual divergence of varieties of the same species, or, in other words, we cannot say on those grounds that varieties might not arise, the offspring of which would exhibit all the sterility of hybrids; and, therefore, looked at in this light, arguments based on sterility of species and hybrids, are not, as generally supposed, fatal to Mr. Darwin's theory. But if, as we have seen, peculiarities of physical structure render certain grades of transition impossible between many species, it is also probable, though we cannot actually prove it, that there are also limits to the gradation of elemen-

tary tissues, that to enable them to build up an organism they must be of certain established types or patterns, and that no intermediate grades of cell elements are capable of existing between those types, and that those extreme differences of cell elements that give rise to sterility cannot be arrived at by gradual changes; and consequently from this it would follow that the most closely allied species could not be united or could not be derived the one from the other by gradual transition.

On those grounds the phenomena of hybridism do afford strong presumptive evidence against the evolution theory of Darwin; and this evidence is further corroborated by the fact that sterility is so far never found to obtain among animals that are known to be positively descended from the same species, however unlike they may be in outward appearance.

But there is another argument based on development. The similarity of the successive steps passed through in the evolution of different embryos is considered to furnish substantial evidence of the truth of the theory; nevertheless, admitting the validity of all the embryologists have stated, I think the value of the evidence is

greatly over estimated. I do not see how those changes of the embryo can materially assist in establishing the theory, when it is borne in mind that the phenomena of development commence in a minute globular mass known as the ovum by fission and multiplication of cells. Now it follows that the representatives of the different types of organisation in their initial stage of development from this primary form closely resemble each other; but this resemblance is the necessary consequence of one common plan; and as the differentiation of parts advances with the further development of the embryo, the higher and lower members of any type, inasmuch as they have their fundamental structures after a similar plan, must pass up to a certain stage through similar changes; but it is certain that this general resemblance is altogether independent of inheritance, it exists of necessity and would extend alike to the planetary worlds if the same types of organisation prevailed upon them.

Man during many generations has been accustomed to frame cosmogonies, and explain the operations of Nature after his own ideas of possibility, constantly shifting his ground and

taking up new positions with the advance of knowledge. So the march of specific forms, as now viewed and judged of from a distant height, may be likened to the march of several flocks of birds over a large irregular plain, intersected by great rivers and numerous impassable dykes. The observer, seeing them from a distance, begins to speculate as to the mode in which the different barriers were passed over; for it is evident to him, from the way in which the birds are dotted over the plain, that they must have been passed at different times, but he is in total ignorance of the grand and effective means by which they were enabled to accomplish the task with such ease and quickness. He has, in fact, no knowledge of the power of flight, or of any other mode of progression than that slow measured movement by which he sees them advance along the plain. And on this he builds up his theory, concluding that they must have walked over the barriers in some way not very different from their present mode of progression, and, consequently, his theory — however far reaching and complicated—is insufficient, and at variance with obvious facts.

So Mr. Darwin's great work, however valuable

as a contribution to science, is an elaborate attempt to account for the phenomena of organic life in such a way as to bring them within the narrow limits of human conception; for, on the whole, his theory of the origin of species is inconsistent with facts, and is beset by many insuperable difficulties, and it is still more unsatisfactory as applied to man's first appearance upon earth, concerning which—if surmises involving manifest contradictions be excluded—we are driven to accept one conclusion, the only consistent one—namely, that man is a SPECIAL CREATION to which that of other species has been subsidiary; and in whatever way he commenced his existence—whether by birth or otherwise—he must have commenced it as man at once perfect in mind and body.

Now the fact of our having no knowledge or conception of organisms originating in any other way than that of development from germinal particles given off from the parent forms, is by no means sufficient to justify our denying the possibility of other modes of origin, and, indeed, from the little that we know of the vast resources of Nature, the probabilities are that many other modes may be possible; and even this mode of

origin by birth or development which appears so natural, when we come to think of it, is one of the greatest mysteries of Nature; and without a knowledge of the fact of its occurrence, we could not even conceive of it. As it is, we cannot at all comprehend why the fact exists, or how the organism is built up in such a wonderful way, or even how it is preserved in opposition to forces that are continually striving to resolve it into inorganic matter, and that eventually do so when old age, disease or accident turn the balance of power in their favor.

Nevertheless, having no knowledge or experience of other modes, we are fully justified in speculating to what extent and in what way creation by birth can be made to account for the origin of species.

When we stand above the sea shore and contemplate the measured regularity with which the waves roll inwards and break among the uneven rocks below, when we hear the hoarse, hollow sound of their ceaseless dashing, and consider that the same melancholy, monotonous wail has gone on ever since the first land arose in dreary solitude amid the dead wastes of the primeval ocean. We are apt to regard most of the phe-

nomena of Nature as having continually gone on with the same unvarying regularity. We soon observe, however, that at intervals of about ten minutes some few waves appear of much greater magnitude than those that preceded them; and this fact suggests the idea of periodicity. We look to the tides and find that they, too, increase at intervals of fourteen days much beyond their daily average height, and that this increase is still greater at longer periods; and on a grander scale, and at vast intervals, the climatic conditions of our planet have also had their extremes of variation. The heat of the tropics and the cold of the polar regions have succeeded each other in the same latitudes. Again, the volcano and the earthquake have had their periods of increased action when the waters of the ocean heaved from their depths, swept over the land with irresistible force, and the earth itself trembled and swayed and sent forth fiery torrents of molten rock and dark clouds of sulphurous vapor.

In fact there is overwhelming proof that at different times the physical forces have displayed unusual energy in the carrying out of their works, the operations of nature going on then

with marvellous rapidity, and geology and palæontology show, in the clearest manner, that the descent of organic life has also been characterised by a marked periodicity. Whole groups of newer and higher forms have appeared at successive intervals through the entire series from the paleozoic to the tertiary epoch. We descend through Graptolites, Echinoderms, Brachiopods, Cephalopods, cartilaginous, bone-clad and Sauroid fishes, Enaliosaurians; and on land the great Herbiverous and Carnivorous reptiles, Birds and Mammals; and, on those data, it may be confidently asserted, that the secondary causes concerned in the creation of species have manifested, at times, increased activity; that there have been periods when they swept with all their power like a mighty wave over the face of Nature; and such a mode of action of the creative force is graphically described in the first chapter of the Book of Genesis:—"And the earth was without form, and void; and darkness was upon the face of the deep, and the Spirit of God moved upon the face of the waters."

Now there is apparently only one way in which creation by birth could be made to harmonise with this mode of action, and that is by

deriving one species from another of the same order at different periods when certain conditions had set in suitable to the new species; and, in conformity with this view, it is supposed that when the earth had arrived at a stage, favorable to the existence of organic life, that not a few accidental struggling monads, inconsistent with the grandeur, magnitude and completeness of Nature's mode of acting, but countless numbers of the primordial forms of all the great types and classes of animal life that have since peopled the earth, were ushered into being, each typical form, like the egg of a fowl, or the roe of a fish, having within itself, though not visibly expressed, all the elements of the higher and more developed forms about to be derived from it afterwards, with a latent energy capable of introducing them one after another, when called into activity, by the arrival of new and suitable conditions; and this would appear to be the meaning attached to the creation of types, before they had come into actual existence, "of every herb of the field before it grew."

By such a mode of origin, we get rid of the inconsistencies attendant on the deriving of one type from another, for adherence to type seems

to be a principle from which Nature never departs under any circumstances, and as the development theory requires at least one primordial form to begin with, it is only reasonable to suppose that the creative forces could as easily have produced several types of such forms as a single one. Even the so-called "spontaneous generation" would not affect this surmise, unless it could show that under all the various conditions met with throughout the world it produced the same forms. If it could not show this, then it is more than probable that under different conditions it would produce different types.

Now, in this way, the vertebrate type derived from its own primordial form would have advanced contemporaneously with the others, though in much smaller numbers, instead of originating accidentally, after long and devious wandering through the molusca.

But we are further led to think that that differentiation in structures which has marked all the great orders of fishes, has also had its rise or was shadowed forth among the lower forms before the vertebrate structure was attained to, and consequently the first fish-like representatives of

any order might be introduced at once in great numbers, and at a period anterior or subsequent to the introduction of the others; and it is probable that such creatures would leave no trace of their existence in the rocks, inasmuch as their vertebræ would have consisted of a soft cartilage, and their integument also of a soft perishable material, and likewise many of the Reptilian orders may have been similarly derived from different orders of fishes. And if so, we cannot suppose that all the Mammalian orders have originated from one or more pairs derived in turn from a single pair of reptiles.

Indeed the derivation of them in this way in accordance with the Darwinian theory, would have occupied a period of time so inconceivably vast that it would probably extend back to the deposition of the lowest stratafied rocks, and hence the supporters of the theory are obliged to add period to period until geologic time itself is more than exhausted.

In this ascending series certain cardinal forms would be set apart from their fellows, and necessarily in diminished numbers the higher we ascended in the scale, and those forms would mark the line of ascent to the higher classes,

they would be as distinct from the ordinary time-serving members of their respective groups, as queen bees are from the workers. The great succession of life would have had its central currents altogether distinct from the wide-spreading waters on either side, through which they ran in unbroken lines from the earliest organisms to the great classes and orders now in existence. The different orders of mammals, as we now find them, would have had their types arranged and mapped out, though not outwardly expressed, in classes far below them, whilst genera would have had a more recent one, each genus perhaps being represented at first only by a single species from which the others sprung in time.

Now we find that the Reptilian class had attained its maximum development towards the latter part of the secondary period, that the cold-blooded orders of this class headed the animal kingdom. They lived under conditions that would have been in all probability fatal to most Mammalian orders, nor would the sustaining powers of the earth have been able to meet the wants of both classes had they existed contemporaneously.

But if creation by birth be admitted, then the

Mammalian class is directly descended from reptiles, and if so, it is not to be imagined that all the different Mammalian orders of land and water are derived by gradual divergence from one or more pairs of mammals of the same species, produced in turn from one form of reptile. This certainly could not have been the way, for it is beset, as we have seen, with innumerable difficulties. But it is more reasonable to suppose that at particular times, and at different places or centres, certain species—set apart from the others—of most of the great Reptilian orders both of land and water, were each of them as capable of giving birth to, or of establishing corresponding primary mammalian species, as some one species of reptile would have been of producing a single pair. And this is the only way we could possibly escape the many insurmountable difficulties that would necessarily have attended those stages of utter helplessness that would have to be passed through in the evolution of the land mammalian tribes from those of the water, or *vice versa*, and moreover, such a supposition, appearing as it does, reasonable and natural when merely contrasted broadly on the grounds of probability with the Darwinian theory of the origin of species,

can and will almost to a certainty be established as a fact if the theory of creation by birth be established as such, otherwise the general resemblance borne by the lower members of the reptilian class to sauroid fishes, and of the near approximation of the higher to mammals, and birds are altogether inexplicable, so far as that approximation could not be accounted for by adherence to type. And so, instead of all the mammalian orders having diverged from one or more pairs of a single species, each order would have originated from many pairs, derived at different places or centres, from the species of an allied preceding order of reptiles.

Thus the first or initial Cetaceous tribes might have been derived from such creatures as the Pliosaurus, Cetiosaurus and Mosasaurus, whilst on land the great herbiverous monsters of the Pachydermata might have descended from creatures allied to the Scelidosaurus and Iguanidon, and the extinct Glyptodon would have sprung from some ancient Chelonian reptile.

We have been first led to entertain this view from the impossibility of accounting for the Chiroptera by deriving them in any way from any other known order of mammals; for although

we hold that the species of any genus might arise by birth without any gradation from closely allied species, in the same manner as an extreme variation often arises, yet we have no reason to suppose that this is the way in which Orders have arisen, for each is constituted on a sort of lesser type, to which it appears to adhere in all essential particulars; and as we have already seen that the peculiar organisation of bats could not, consistently with the welfare of the creatures, be attained by slow degrees, we were obliged to account for their origin by deriving them from the Pterosaurians.

Now it is obvious that this mode of origin would account satisfactorily for many of the facts relating to the geographical distribution of species, for it would admit of species and genera of different mammalian orders arising and spreading from distinct centres of creation, each separated from the other by wide tracts of ocean. The allied creatures of the one centre would exhibit various degrees of difference, amounting in some cases to difference of species from those of the other, according to the different conditions under which their remote ancestors lived, and it would, to a great extent, be in keep-

ing with, and might be supported by many of the arguments used in the building up of the Darwinian theory, and it is more in accordance with the grandeur, magnitude and distinctness of Nature's operations; but further, it avoids most of the difficulties, and is consistent with some facts that stand in the way of that theory. It is consistent with, and receives some corroboration from the metamorphoses of the Bratrachia. The tadpole furnishes a good example of the mode of transition from fishes to reptiles. The young tadpole is a fish in every sense of the word; but when it attains a certain size, the forces of development are directed to work in a new direction. They change the creature from a water-breathing fish to an air-breathing Batrachian. The well-developed tail is cast off without even a trace of it being retained as a rudiment, showing how easily Nature dispenses with an organ, when no longer required, and two powerful limbs take its place. The large size of the frog, and the extreme smallness of its eggs, render such a mode of development a necessity; for the creature must be sustained in its early stages by such minute organisms as the stagnant pool affords, the eggs of course not being nearly

large enough to enable the young to take on from the beginning the form of the parent and live on land; but an increase in the size of the egg would do away with the necessity of the creatures passing their first stage in the form of fishes; and this, no doubt, has been the way in which metamorphoses was done away with among the earlier reptiles in their descent from fishes.

Again, it is consistent with the phenomena of sterility and hybridism which it explains to some extent; the former obtaining among widely different species, or such species as have advanced separately from a lower class; the latter obtaining for the most part among species of the same genus, or such as have diverged at a later period from a common parentage within the same order, after its establishment; and, further, it is not opposed in any way by geology or palæontology. It is not opposed by the great fact of that specific distinctness of form, which characterises all living species, and which has been equally characteristic of those that are extinct. The closeness of the steps by which one group of ammonites passes into another, forms no exception to this rule, for in such cases

as those where a close gradation is practicable, it is adopted, and so a much greater variety of forms is obtained; but it does not follow that specific characteristics of structure are not strictly adhered to, however small they may appear. It is not opposed by the imperfections of structure that would exist in many transitional grades; and, finally, it is not opposed by extreme variation and monstrous births. But these remarkable phenomena, incomprehensible and inexplicable as they have hitherto been considered, and opposed, as they are, to all laws of inheritance, are consistent with and may be adduced as evidence in favor of the theory of creation by birth, as we have advocated it. Indeed they afford positive proof that there is a power in Nature capable of moulding a new organism without any previous gradation or transition, specifically different in some of its structures from those of the parent forms, and although such structures show, in many instances, a want of correlation, yet they are still a standing proof of the existence of a creative force, which, when normally called into activity in connection with new or changed conditions, is fully capable of producing new forms adapted

to those conditions and specifically distinct from their parent forms.

And on those grounds we believe that the introduction of species has not gone on continuously, but on the contrary that they were introduced in succession at particular periods when such forces were called into activity to meet the rising wants of organic nature.

Now, although palæontology coincides with and favors this view, inasmuch as it does not require the previous existence of transitional grades, but only such as are sharply defined and specifically distinct, even in those separate lines of descent which we have already traced out, and although the comparatively small cranial capacity and coarsely organised structures of the extinct mammalian tribes showed an approximation or relation to the structures of the Reptilian orders that immediately preceded them, still we are unable as yet to distinguish or point to any mammalian relics which we could say positively belonged to an animal which had itself passed the line of demarcation, and was immediately descended from a reptilian form. And so long as we cannot do this, or obtain other conclusive proof, we are unable to say

confidently that the Mammalian orders are descended from a lower class. Indeed, from our very limited knowledge of the vast resources of Nature, it would be presumption to assert that they have come to be after any particular fashion coinciding with our views of possibility. They may, after all, have originated in other ways that we know not of, and that general approximation or relation of classes and orders so much talked of by naturalists, would, in any case, exist as a necessity arising out of adherence to a general type.

Nevertheless we are justified in attempting to find out to what extent that approximation can be made to coincide with our views; and when we find it descending from generalities to minute particulars of structure, we are bound to admit that it does suggest that such resemblance is brought about by some process of development which has been handed down in succession, and without interruption, from one generation to another.

But at all events, in whatever way species have originated, one thing is certain—namely, that they have come to be under the preordination and direction of an all-knowing Creator. But

we are bound to believe also that all of them, including man himself, have originated after the same fashion; and consequently, in accordance with the assumption of creation by birth, man is descended from some lower form.

Yet from what we have already seen we know that he must have descended through a line peculiar to himself. He may have advanced contemporaneously with the lower animals, but he is not of their blood, nor are they themselves of one blood. He stands alone in an order by himself, and from whatever sort of creatures he is sprung, they have for ever passed away, having fulfilled the great end for which they were called into being. And such creatures could not, for reasons already pointed out, have led up by fine gradation to the human form. They could not, as terrestrial animals, advance in this direction beyond a certain grade; and, consequently, we must assume that man was at once ushered into being perfect in his form, with all his faculties complete; and this does away with the difficulty that exists under the transmutation theory of fixing the stage where man commenced to be a moral and responsible being.

But although man commenced to be after the

manner of the inferior animals, there was a something added in his case which was withheld from them, and that something was coupled in him with an intuitive discernment of a future state—a discernment not given in vain, for Nature never deceives any of her creatures—and with the intellectual power of comprehending that this present life is only the initial stage of a responsible existence that is to be continued into other and higher stages without interruption or break in the self-consciousness of personal being.

There is something indescribably grand in such a system of evolution that leads on to higher and higher grades of being. It is more in accordance with the working of a benign Almighty power than the views formerly held of the sudden mushroom-like origin of all living creatures; nay more, the long history of past grades points clearly to the future, and shows that the lasting welware of beings about to be endowed with the awful attribute of an imperishable existence will be best secured by leading them onwards from stage to stage. And here it is the scripture narrative of man's creation becomes of inestimable value—all the inferior tribes of earth are

made to pass under the vision of the Seer as though they arose from its surface moulded of its material, and last of all in the mighty series a creature arises after a like fashion, but strangely different in shape, made after the image of a God, and into this lone form is breathed the "breath of life!" the sublime gift of the Creator!

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