THE IMMUTABILITY OF THE SPECIES.*

I.

FOR a century and a half, the attention of the scientific world has been repeatedly called to theories purporting to prove the evolution of the species. Before the last dozen years, they elicited nothing but deserved contempt from those conversant with the phenomena of which they treat. Their absurdity was transparent, alike in their conclusion and in the processes by which that conclusion was held to have been reached. They were in succession fully refuted. But there arose a class of men, somewhat superior in intellect and ingenuity to the propounders of these speculations, who were imbued with similar atheistic principles. They directed all their efforts toward the conception of a theory more capable than the others of attaining a respectable scientific *status*. It would have been matter of great surprise, then, if this concentration of intellectual energy had not resulted in something sufficiently plausible to startle the world.

In the year 1859, Mr. Charles Darwin, one of the first naturalists of England, propounded his theory of development, in a work termed *The Origin of Species*. This purported to be a full and conclusive confirmation of the hypothesis of evolution. The theory was elaborate and ingenious, and on its appearance was immediately advocated by many men to whom it was not wholly unexpected. Its congruity with their atheistic views can alone furnish an adequate explanation of the haste with which they declared themselves its advocates. This harmony with preconceived ideas was confessedly the chief inducement urging them to accept the theory. Hear Mr. Herbert Spencer's conception of the spirit in which a person should approach the subject: "Before it can be ascertained how organized beings have been gradually evolved, there must be reached the conviction that they *have* been gradually evolved." The italics are his own. Mr. George Henry Lewes, in an article in the *Fortnightly Review* for April 1st, 1868, says:

> "There can be little doubt that the acceptance or rejection of Darwinism has, in the vast majority of cases, been wholly determined by the monistic or dualistic attitude of the mind. And this explains, what would otherwise be inexplicable, the surprising fervor and facility with which men, wholly incompetent to appreciate the evidence for or against natural selection, have adopted or 'refuted' it."

That Mr. Lewes and other really able men have been so influenced, we entertain not the slightest doubt. But their failure to discover and appreciate the evidence against the theory, we ascribe not to incompetency, but to the bias of a foregone conclusion. We hail with delight the efforts of these men to sustain the theory, confident that, the greater the light thrown upon it, the more glaringly palpable will become its absurdity.

We purpose to show, in this and

* *The Origin of Species.* By Charles Darwin, A.M., F.R.S., etc. Fourth edition.

The Variation of Animals and Plants under Domestication. By Charles Darwin, A.M., F.R.S., etc. Two volumes, 8vo. London: John Murray. 1868.

The Principles of Biology. Vol. I. By Herbert Spencer. London: Williams & Norgate. 1864.

other articles, that the facts which are seemingly so congruous with the conception of evolution are in reality grossly at variance with it, and strictly in accordance with the doctrine of special creations. We will proceed at once to their consideration.

Variations form the data of Darwin's theory. These, as facts, cannot be disputed. Variation is everywhere seen. Scarcely any species, either animal or vegetable, has escaped this tendency. While some species have not presented differences among their individuals sufficiently marked for the formation of varieties, a multitude of other species display modifications which form the characteristics of dozens of widely distinct breeds. Not less than one hundred and fifty distinct strains and varieties have descended from the original wild pigeon, *columba livia*. All these varieties result from man's careful selection, and his judicious pairing of those individuals which possess the required modifications. This he does in sure reliance on the law of heredity, which transmits to the offspring the most minute peculiarities of the parents, saving, of course, when they are brought into conflict with opposite characters. These variations are both in the direction of increase and in the direction of decrease. Here we find a variety formed by the appearance of a modification not observable in the species under nature, and there a variety formed by the total or partial suppression of one or more characters. Now, few portions of the organization are incapable of modification. Darwin has conclusively shown that even the bones and internal organs have been greatly modified. To realize fully the extent and scope of variation, it is necessary to consult Darwin's late work, *Animals and Plants under Domestication*. Many of the modifications — especially those most widely divergent—constitute differences greater than those which distinguish species from species, and, in some few cases, genus from genus.

It may here be thought that we have made too great concessions; that the logical and inevitable conclusion from the facts, as we state them, is the evolution of the species. Not so. For the more numerous and the more widely divergent the modifications are shown to be, the more easily will we be able to prove to demonstration the fixity of the species.

As these varieties (or incipient species, as Darwin conceives them to be) were formed through the selection by man of slight successive modifications, Darwin affects to believe that variations arose in the wild state; that they were accumulated and preserved by nature by a process analogous to man's selection; and that by the long continued accumulation and conservation, through countless ages, of these modifications, the species have evolved from one another. This selective power of nature he infers from the struggle for existence constantly carried on in the wild state, wherein the weak succumb, and the fittest, strongest, and most vigorous survive, and, according to the theory, attain to a higher development.

Many objections have been urged against Darwin's theory. Some have questioned the efficiency of natural selection; and others have contended that selection necessarily implies a selecter. Some have considered Darwinism sufficiently disproved by the absence of the transitional links between the different species. Others have asserted the inconceivableness of the primordial differentiation of parts in organisms when they all presented the simplest structure. Another argument has been adduced

from the tendency of domesticated animals and plants, when neglected, to recur to the ancestral form under nature. Some assume a limit to variation; while others have contended that domestication of itself has introduced something plastic into organisms, enabling them to vary, and that, therefore, the analogy drawn between animals and plants under domestication and those under nature is inadmissible. Others assert that domestic animals and plants have been rendered in an especial manner subservient to the uses and purposes of man. In conformity with this view, they also affirm that the conception of species is, for that reason, not applicable to the creatures under domestication. For ourselves, we concede that the analogy between domesticated and natural animals and plants is a just one, in the light in which the phenomena of variation are generally regarded. For we wholly dissent from the opinion of the introduction by domestication of any thing plastic into organisms, and firmly believe in the operation of secondary causes in the formation of varieties.

These arguments, in the form in which they are adduced, are inconclusive. Their weakness springs from an error into which those who have urged them have fallen, which vitiates at the start all their reasoning. To this error we shall presently advert. But while we cannot concur in their premises, we have something more than an intuition of the truth of their common conclusion.

The facts, of which the *Animals and Plants under Domestication* is a vast repertory, admit of a theory more conformable than that of Darwin to the phenomena of variation; a theory which fully accounts for the appearance of the profitable modifications under domestication, (confessedly inexplicable on Darwin's theory,) and for the formation of races under nature; a theory admitting of still further variation; and which is at the same time strictly in accordance with the doctrines of special creations and of the immutability of the species. This teleological explanation, of which we conceive the phenomena of variation to be susceptible, we will render amenable to all the canons of scientific research. And in doing so, we will rely for our proofs upon no evidence but that furnished us by noted evolutionists.

The seeming concurrence of all the evidence in favor of Darwinism results from a misconception by all of the true nature of its data. In all the arguments adduced by the advocates of special creation in disproof of Darwin's hypotheses, these variations have been tacitly admitted to arise by evolution. That they have thus arisen seems to be taken for granted. In this admission lies their error. Upon this current conception of varietal evolution rests the whole evolution hypothesis. Upon the validity of this assumption we join issue with Darwin, as we conceive that upon this point the whole question hinges. For it is not a little illogical to concede the evolution of varieties, and to deny the evolution of species. If we can show that this assumption is invalid, the whole evolution fabric will fall.

Darwin tacitly assumes that the existing state of nature is the normal or primordial condition of animals and plants. The difficulty hitherto experienced in confuting his errors springs from acquiescence in this assumption. True it is that Darwin does not believe in the validity of this assumption, but merely makes it to show the inconceivableness of the negation of evolution. With him a

species is not fixed but fluctuating, and is merely a subjective conception, having no objective reality. Believing in the converse assumption, we advance the following theory: *That animals and plants have degenerated under nature, and that the favorable modifications arising under domestication are due to reversion to the perfect type.*

Darwin, in treating of variations, refers them indiscriminately to reversion and to evolution. This he does according to no law, rule, method, or formula. The mere circumstance that he has one subject under consideration, suffices to induce him to ascribe to reversion a modification which, in another portion of his work, he, with strange inconsistency, attributes to "spontaneous variability." He affects to deem it a sufficient answer to the ascription of characters to reversion, to appeal to the absence of such characters in the species under nature. If the assumption of degeneration and subsequent favorable reversion can lay even the least claim to tenability, this answer is in no wise satisfactory. If it can be conclusively shown that most, if not all, creatures in a state of nature, are in a degenerated condition, then the irresistible inference will be, in the absence of any other rational explanation, that favorable variations are ascribable to reversion.

While, as Herbert Spencer says, "a comparison of ancient and modern members of the types which have existed from paleozoic and mesozoic times down to the present day shows that the total amount of change (in animals) is not relatively great, and that it is not manifestly toward a higher organization," paleontology furnishes us with many facts showing the great size of ancient mammals, and marked degeneracy in their descendants. Thus, Darwin concurs with Bell, Cuvier, Nilsson, and others in the belief that European cattle—the Continental and Pembroke breeds, and the Chillingham cattle—are the degenerate descendants of the great urus, (*bos primigenius,*) with which they cannot now sustain a comparison, so greatly have they degenerated. Cæsar describes the urus as being not much inferior in size to the elephant. An entire skull of one, found in Perthshire, measures one yard in length, while the span of the horn cores is three feet and six inches, the breadth of the forehead between the horns is ten and a half inches, and from the middle of the occipital ridge to the back of the orbit it is thirteen inches, (*Owen's British Fossil Mammals*, pp. 500, 501, 502.) The common red deer have so greatly undergone degeneration that the fossil remains of their progenitors have been held to be those of a distinct species, (*strongylocerus spelæus.*) An advocate of Darwinism—a writer in the *Edinburgh Review* for October, 1868—differs with Owen on this point, and holds that the common red deer are their descendants, greatly degenerated. From their antlers it is inferred that they equalled in height the megaceros, whose height to summit of antlers was ten feet four inches, (*Owen's British Foss. Mam.*) So marked is the difference in the size of the antlers, says the Edinburgh reviewer, that it would be possible to ascertain approximately the antiquity of a deposit in which they might be found from that fact alone. The horse and the *elephas antiquus* have also been shown to have decreased in size.

Changes similar to these have been adduced by the advocates of evolution, to show the manner in which species have been formed under nature. But these, we apprehend, im-

ply devolution rather than evolution. They also serve, contend they, as illustrations of the harmony subsisting between the organism and its environment. If by this is meant that the organism responds to every marked change in the environment, we admit the harmony. But if congruity between a perfect physiological state and the changed conditions is implied, we demur. Certain conditions are absolutely essential to the growth of characters and to general perfection. When they are so modified as to entail the diminution or loss of any positive feature, this tells upon the organism. Darwin, noting that the appearance of certain characters was invariably consequent upon the presence of certain conditions, says (in order to avoid any thing like a teleological implication) that we must not thence infer that those or any conditions are absolutely necessary to the growth of any organs or characters. That Darwin errs, and that full physiological perfection cannot exist except where there is full general growth, and full growth of all parts or organs, we shall clearly demonstrate when, in a future article, we treat of the laws of compensation or balancement of growth, of correlation, of crossing, and of close interbreeding. But whether there exists harmony between the organism or not, there is none the less deterioration. And when reversion to the type from which the organism has degenerated takes place under domestication, it is termed evolution.

But those proofs of degeneration and subsequent favorable reversion upon which we chiefly rely are those afforded by Darwin himself. On page 8, Vol. I. of his late work, he says, "Members of a high group might even become, and this apparently has occurred, fitted for simpler conditions of life; and in this case, natural selection would tend to simplify or degrade the organism; for complicated mechanism for simple actions would be useless or even disadvantageous." The efficiency of natural selection in this respect we fully concede.

And again, on page 12, "During the many changes to which, in the course of time, all organic beings have been subjected, certain organs or parts have occasionally become of little use, and ultimately superfluous, and the retention of such parts in a rudimentary and utterly useless condition can, on the descent theory, be simply understood." We heartily concur in this explanation furnished by the descent theory, as we fully believe all that is attributed to the law of hereditary transmission, the particularities of the hypothesis of pangenesis excepted.

Treating of a symmetrical growth, he cites the cases of "wrong fishes," gasteropods or shell-fish, of certain species of bulimus, and many achitinellæ, verucca, and orchids, and infers, from their being as liable to be unequally developed on the one as on the other side, that the capacity for development is present, and that it is due to reversion. "And as a reversal of development occasionally occurs in animals of many kinds, this latent capacity is probably very common." (P. 53, vol. ii.)

On pages 58, 59, and 60 are given cases of "the re-development of wholly or partially aborted organs." The *corydalis tuberosa* properly has one of its two nectaries colorless, destitute of nectar, and only one half the size of the other. Its pistil is curved toward the perfect nectary, and the hood, formed of the inner petals, slips off the pistil and stamens in one direction alone, so that when a bee sucks the perfect nectary, the stigma and stamens are exposed and

rubbed against the insect's body. "Now," says Darwin, "I have examined several flowers of the *corydalis tuberosa*, in which both nectaries were equally developed, and contained nectar; in this we see only the re-development of a partially aborted organ; but with this re-development the pistil becomes straight and the hood slips off in either direction; so that the flowers have acquired the perfect structure, so well adapted for insect agency, of dielytra and its allies. We cannot attribute these co-adapted modifications to chance, or to correlated variability; we must attribute them to reversion to a primordial condition of the species." Upon Darwin's hypothesis, all the beautiful, delicate, involved, and harmonious adjustments, coadaptations, relations, and dependencies in organic nature must, at some time, have arisen by evolution. But here he apparently assigns their coadaptation as a reason for not ascribing these modifications to chance, or to correlated variability; as if their evolution were inconceivable. Does this consist with his theory? What difficulty exists against their evolution now, which is not susceptible of being urged with equal if not greater force against their evolution ages ago? Why push the question further back in time? Was the evolution of these modifications less inconceivable then than now? If so, why? In default of an answer, we have no alternative but to conclude that all favorable modifications arise by reversion.

Having given several cases of the "reappearance of organs of which *not a vestige could be detected*," he declares it "difficult to believe that they would have come to full perfection in color, structure, and function unless those organs had, at some former period, passed through a similar course of growth." We surmise that at the moment in which Darwin conceived such a difficulty, his singularly powerful imagination was impaired by over-exercise. We trust that, on the recurrence of such a mental state, he will cease to marvel at us for experiencing a like difficulty in conceiving the evolution of any favorable characters.

After giving the opinion of several naturalists—in which he concurs—"that the common bond of connection between the several foregoing cases is an actual though partial *return* to the ancient progenitor of the group," he says, "If this view be correct, we must believe that a vast number of characters capable of evolution (!) lie hidden in every organic being." Here Darwin, as if he had demonstrated the tendency to revert too clearly for the tenableness of his theory, asserts that the appearance of these characters, which have been by him attributed to reversion, is attributable to evolution. The inconsistency is manifest. But this may be taken as a type of the whole of Darwinism. For the author, after acquainting us, without the slightest apparent hesitation, with facts showing degeneration to have been little short of universal, declares that he is forced to believe that favorable modifications are due to "spontaneous variability," as they are otherwise inexplicable; seeming to be wholly oblivious of ever having mentioned previous degeneration. This reminds us of another inconsistency of which evolutionists are guilty. They never tire of inveighing against the reference of phenomena to what they term "metaphysical entities," such as "vital power," "inherent tendency," "intrinsic aptitude," etc. But this by no means precludes their use of the same phrases when treating of phenomena which refuse to be moulded into even seeming con-

formity to their hypotheses. Again, these characters cannot be due to evolution if they are a return to the ancient progenitor of the group; for that implies the possession of a larger number of characters in the progenitor than in its descendants; which directly militates against evolution, which is an advance from the simpler to the more complex. But Darwinism is in part but an ingeniously disguised and elaborate revival of the idea of Geoffroy St. Hilaire. He conceived "that what we call species are various degenerations of the same type." Races under nature are, upon our theory, caused by degeneration; they are various degenerations of a specific type. Observing that races were thus caused, Geoffroy St. Hilaire, we apprehend, instituted an analogy between races and species, and inferred from the former being various degenerations of a specific type, that the latter were the various degenerations of a generic (or a still higher) type. He was also induced thus to conclude by the fact that characters, which were held in common by all the species of a genus, were in some species in a rudimentary state. But the sterility of hybrids precludes the possibility of this common origin of the species. In so far as this hypothesis relates to species, Darwin adopts it. The fact that races have been similarly caused, he ignores, as that is grossly at variance with his hypothesis of evolution, which lays claim to plausibility only in the absence of any rational explanation of the appearance of favorable modifications under domestication. Were races confessed to be the degenerations of a specific type, then it would be apparent to the capacity of a boy that the appearance of characters under domestication was due to reversion. Had not Darwin accepted the idea of St. Hilaire, his theory would be devoid of its present semblance of unity and coherency. Having started out to prove the common origin of the species *by evolution*, he preserves the appearance of consistency in his illustrations by assuming an identical conclusion, but one arrived at, as he unwittingly shows, *by postulating degeneration*. This furnishes him with a seeming confirmation of his theory; but as these hypotheses of degeneration and evolution are wholly incongruous, the vain endeavor to blend them harmoniously involves him in many inconsistencies and absurdities. Thus, in endeavoring to prove community of origin of the species, he, in conformity with the conception of degeneration, accounts for the appearance of characters by reversion, and then, apprehensive that this attribution would be wholly subversive of his theory of development, ends by inconsistently and gratuitously terming them instances of evolution. The expressions quoted above illustrate this. He has shown that the modifications are due to a *return* to the ancient progenitor of the group, and then says, "If this view be correct, we must believe that a vast number of characters *capable of evolution* (!) lie hidden in every organic being." Many other instances of this inconsistency could be given, but the following will, we trust, suffice. After adducing cases of bud variation, he says, "When we reflect on these facts, we become deeply impressed with the conviction that, in such cases, the nature of the variation depends but little on the conditions to which the plant has been exposed, and not in any especial manner on its individual character, but much more on the general nature or condition, inherited from some remote progenitor of the whole group of allied beings to which

the plant belongs." Mark the consistency. The appearance of nectarines on peach-trees by bud variation is here ascribed to reversion, while in numerous other places it is adduced as one of the most striking instances of evolution. He has cited the cases of bud variation as instances of evolution, to prove community of origin of the species, and then assumes the community of origin of the species to account *by reversion* for the appearance of nectarines and all bud variations. But Darwin may go on involving himself in a succession of absurdities, in the just confidence that, however gross they may be, they will not be observable so long as his opponents admit the evolution of varieties.

On page 265, he declares it "impossible in most cases to distinguish between the reappearance of ancient, and the first appearance of new characters." This of course implies that some characters arise by evolution. Now, how are we to discriminate between those arising by reversion and those arising by evolution? What is the distinguishing characteristic of the latter? Darwin has failed to inform us. We deny evolution in any case —"sport," strain, race, variety, or species. Darwin takes it for granted in the cases of "sport," strain, and variety, after having shown degeneration to have been almost universal. He professes to believe that these are due to evolution. What is evolution? Is it not "a name for a hypothetical property which as much needs explanation as that which it is used to explain"? Whence results this belief in evolution? From intuition? This knowledge of the existence of such a potent factor is doubtless very enviable, especially when it is possessed by able scientists. But—to follow a train of thought pursued in another connection—it needs some guarantee of its genuineness. For the first impulse of a scientific scepticism is to inquire by what means these scientists have acquired such a knowledge of the cause of variations. If it was gained from a study of nature, then it must be amenable to all the canons of scientific research; and these assure us that the appearance of favorable modifications is wholly inexplicable except upon the hypothesis of reversion, and that evolution is merely a name for a cause of which we are presumed to be ignorant. In science an explanation is the reduction of phenomena to a series of known conditions, thus bringing what was unknown within the circle of the known. Does the hypothesis of evolution fulfil this requirement? Has it not been confessed that "spontaneous variability," or evolution, stands in the place of ignorance? Is not the ascription of characters to evolution a "shaping of ignorance into the semblance of knowledge"? Has not Darwin shown that such it is, when he frankly acknowledges his ignorance of the cause of the appearance of favorable modifications, and when he attributes them to "an innate spontaneous tendency"? Of what validity, then, can an hypothesis be, when the assumption upon which it is grounded is, confessedly, wholly gratuitous? Before it can be entitled to a hearing in a scientific court of inquiry, it is necessary that it furnish some warrant for assuming evolution. We rely with the most implicit confidence upon Mr. G. H. Lewes concurring with us in deeming this requisite.

On page 350, Darwin says, "Many sub-varieties of the pigeon have reversed and somewhat lengthened feathers on the back of their heads, and this is certainly not due to the species under nature, which shows no

trace of such a structure; but when we remember that sub-varieties of the fowl, the turkey, the canary-bird, duck, and goose all have top-knots or reversed feathers on their heads, and when we remember that scarcely a single natural group of birds can be named in which some members have not a tuft of feathers on their heads, we may suspect that reversion to some extremely remote form has come into action." A high development of the "extremely remote form," together with degeneration under nature and subsequent favorable reversion, is here manifestly implied.

On page 247, the tendency to prolification is ascribed to reversion to a former condition.

"With domesticated animals," says Darwin, on page 353, "the reduction of a part from disuse is never carried so far that a mere rudiment is left, but we have good reason to believe that this has often occurred under nature."

Speaking of the gradual increase in size of our domesticated animals, he says, "This fact is all the more striking, as certain wild or half-wild animals, such as red deer, aurochs, park-cattle, and boars, have, within nearly the same period, decreased in size." (P. 427.)

On page 61, Vol. II., he says, "It is probable that hardly a change of any kind affects either parent without some mark being left on the germ. But on the doctrine of reversion, as given in this chapter, the germ becomes a far more marvellous object; for besides the visible changes to which it is subjected, we must believe that it is crowded with invisible characters, proper to both sexes, to both the right and left side of the body, and to a long line of male and female ancestors, separated by hundreds or even thousands of generations from the present time; and these characters, like those written on paper with invisible ink, all lie ready to be evolved (!!!) under certain known or unknown conditions." If this is the case, is not the scope of reversion sufficiently wide to cover every favorable modification which has arisen, or may arise, under domestication?

But these extracts from Darwin's *Animals and Plants under Domestication*, strongly confirmatory as they are of our hypothesis, ill sustain a comparison with the last we shall adduce. Fuller concession no one could reasonably desire.

"With species in a state of nature," says Darwin, on page 317, "rudimentary organs are so extremely common *that scarcely one can be mentioned* which is wholly free from a blemish of this nature." Stronger confirmation of our hypothesis, short of a full and unequivocal confession of its validity, we are utterly unable to conceive. Are we not, after this, justified in ascribing to reversion every favorable modification which has arisen or may arise?

Having thus furnished full warrant for assuming degeneration and subsequent favorable reversion, and for alleging the complete gratuitousness of the converse assumption of evolution, let us turn our attention to the grand principle of natural selection.

It is scarcely possible to read Darwin's graphic description of the struggle for existence among animals and plants, and not marvel at their survival. Creatures under nature are subjected to the greatest vicissitudes of climate. Thousands are born into the world with delicate constitutions, inherited from their progenitors. These enter into competition with their fellows for the means of subsistence; and although they eventually succumb, they have, during their short lives, by this competition, in-

duced the deterioration of their stronger companions. All without exception have to struggle, from the hour of their birth to the hour of their death, for existence. Natural extinction carries off those whose impaired constitutions are inconsistent with prolonged existence. Consequent upon natural extinction is the survival of the fittest and strongest. Darwin avers that the weaker portion of the species having been carried off by natural extinction, the next generation, having been derived only from the stronger portion of the race, will be of a still stronger constitution. This is not the case. Natural extinction does not arbitrarily carry off the weak, but merely those whose extremely impaired constitutions are incompatible with life. Many survive between which and the conditions there is little compatibility. And even the offspring of those which are the strongest are subjected in their turn to the same if not worse conditions, and to the same if not severer competition; for the probability is, that the increase in the number of animals and plants has been great. Thus degeneration is ever active. If the climate fails to entail deterioration, and becomes favorable, the same result is produced by the severe competition consequent upon "an astonishingly rapid increase in numbers."

Darwin implies that natural selection is something more than the correlative of natural extinction. That it is, he has not shown. All the facts show that the one is merely the correlative of the other. The semblance of the converse being the case is given, we conceive, by the constant use, when speaking of those preserved by natural selection, of the superlative, as strongest, fittest, most vigorous. Under nature, unfavorable modifications are ever arising, and those animals and plants which possess them in a marked degree are carried off by natural extinction. Natural selection, in its turn, operates merely by the preservation of those organisms which have undergone little or no modification. The two factors are only different aspects of the same process. One necessitates the other. More than this, natural selection is not. That it acts by the preservation of successive favorable modifications, Darwin has signally failed to adduce a single instance to prove. Instances of adaptation he has adduced, but they are invariably, except where man has intervened, those of degeneration. A description of the process of natural selection is always accompanied with an account of the incessant war waging throughout nature, resulting in natural extinction. Following this is natural selection, preserving the fitter, stronger, and more vigorous. Now, a tolerably clear conception of our view may be gained by considering that, although those preserved may be the fitter, stronger, and more vigorous, in comparison with their brothers or contemporaries, they may be—and the vast majority of the instances adduced by Darwin show this to be the case—less fit, less strong, and less vigorous than their progenitors. Those instances adduced which do not imply this, show no advance on the progenitors, but merely a struggle against degeneration and a continuance in the same state. For animals and plants under nature can scarcely hold their own. Many of them are reduced to the lowest condition compatible with life. If they do not remain stationary, their movement is in the direction of degeneration. Does not Darwin's assertion, before adverted to, that rudimentary organs are so extremely common that scarcely a single species can be mentioned which does not possess such a blem-

ish, imply the preëxistence of conditions sufficiently adverse to entail unfavorable changes in almost every point or character in an organism? It is not a little amusing to see that, in numbers of the exemplifications of the process of natural selection given by Darwin, the animals and plants are subjected to extreme vicissitudes of climate, the severest competition, and other unfavorably modifying influences, and although deterioration is acknowledged to result, and it is manifest that all are unfavorably modified, he invariably concludes with the assertion that the strongest and most vigorous survive. This assertion is true in one sense, but is false when viewed with reference to the inference intended to be drawn. It will be seen that the more correct assertion would be, those survive which have undergone less modification or none.

But independently of these considerations; even upon the supposition that natural selection was equally powerful with man's selection in the formation of varieties or races, that as strongly pronounced and as widely divergent modifications as those observable under domestication had arisen under nature, the efficiency of natural selection is a matter of no moment. For the argument therefrom begs the whole question. It takes for granted the whole point really in controversy. It assumes that those modifications which may arise, or which have arisen, are due to evolution. It is not in the least inconsistent with our views that favorable varieties or races should arise under nature. As a matter of fact, we deny their ever having arisen. But we are not by this denial estopped from believing it possible for them to arise in the future. For were the conditions to change, and to become as favorable as those to which animals and plants are subjected under domestication, races would then arise. They would probably be fewer in number, but a nearer approach to perfection could be attained, the conditions admitting; for man's improvement of the animals and plants under his care is retarded, owing to his not being as yet perfectly conversant with the conditions requisite for their full development. But the modifications which may arise under nature will be due to reversion. The improvement of natural species will imply their previous degeneration. Darwin conceives variations to arise by evolution, and concession of this is essential to the validity of his argument. The question then recurs, Are the favorable modifications which have arisen, or which may arise, due to evolution or to reversion? Until this point is settled in favor of the ascription to evolution, Darwin's argument from natural selection is wholly irrelevant.

An illustration may perhaps conduce to a clearer conception of the relation in which the theories of evolution and reversion stand to each other. The following will, we believe, fully serve this purpose.

Conceive a glass tube, bent into the shape of the letter V, of which the left leg alone is clearly visible. In this, water is seen slowly ascending by a succession of apparently spontaneous impulses. "Now," argue a certain class of philosophers, "this is a peculiar case. The water here manifestly does not acknowledge the law of gravitation. It must, then, conform to a law *sui generis*; a law of which we are wholly ignorant; a law which transcends the scope of our intelligence. This law, be it what it may, we will term evolution. Now, as this name, given arbitrarily, is the only explanation of which the singular ascent of the water will admit, we are forced to conclude that the water

will, if similarly confined above as here below, continue to rise for ever. Any theory other than this is inconceivable. The assumption of a limit to the ascent of the water is manifestly wholly gratuitous. What evidence is there to induce the belief that there exists such a limit?" But would not the calculations of these philosophers be signally confounded by the removal of the covering of the right leg of the tube, disclosing the downward course of the water from a certain height? The analogy, we presume, is clear to all. The ascent of the water in the left leg answers to the appearance of the profitable modifications under domestication, the apex of the tube to the existing state of nature, and the descent of the water in the right leg answers to degeneration under nature; while the height from which the water has descended in the right leg, and to which in the left leg it is ascending in conformity to the rule that water always seeks its own level, in like manner answers to the perfect type of the species from which the animal or plant has degenerated, and to which it is reverting.

But, even assuming that the argument from the gratuitousness of the assumption of varietal evolution, together with that from the explanation afforded by the theory of reversion, is inconclusive, there is yet another which may be adduced.

Darwin's theory is condemned by its advocates. For it is one of a class of theories which, they contend, are not entitled to any consideration or hearing in a scientific court of inquiry. Doubtless many of our readers, at least those conversant with science, have spent many a pleasant hour perusing numerous well-written pages filled with protests against the ascription of phenomena to such entities as "plastic force," "vital power," "intrinsic aptitude," "inherent tendency," etc. This attribution is one of the stock objections against every thing which does not tally with the ideas current among positivists. The advocates of Darwin, of whom most, if not all, are followers of Comte, wax eloquent and enthusiastic while on this theme. Here they disport themselves after the manner of men conscious of having alighted on a subject highly calculated to call forth their most happy thoughts. Here their rhetoric is consummate, and their turns of expression singularly felicitous. Their affected indignation at the assumed absurdity of thus accounting for phenomena knows no bounds. So thrilling is this tirade, and so perfect the simulation of honest indignation, that we, though of a somewhat cold temperament, have, through sympathy, often caught and retained for a moment the infection of enthusiasm. When our feelings ceased to have full sway, and when our reason returned, we were in a fit state to appreciate fully the great power of eloquence.

After animadverting thus severely on this ascription of phenomena, it was not to be expected that these positivists would be guilty of the inconsistency of advocating a theory the basis of which was one of these "metaphysical entities." Very little credence, we are sure, would be given to the assertion that the foundation of Darwin's theory was an occult quality. For that theory has again and again been held up to the world as a shining sample of what can be effected in science by conformity to the positive process of discovery. Yet such is the case. Darwin, on page 2, Vol. I. of his late work, says, "If organic beings had not possessed *an inherent tendency to vary*, man could have done nothing." In numerous other portions of his work may be found the reference of varia-

tions to "an innate spontaneous tendency," (p. 362, Vol. I.,) to "spontaneous or accidental variability," (p. 248. Vol. II.,) to the "nature or constitution of the being which varies," (p. 289, Vol. II.,) and to "other metaphysical entities." So frequent is the recurrence of these expressions that it is scarcely possible to open any portion of his work and not alight on one. The whole of Darwin's theory is deduced from this occult quality in animals and plants. And this is a theory advocated by G. H. Lewes, and a number of others who have given in their adhesion to positivism! If this explanation is, as they claim, unphilosophical, are they not bound to withdraw their support from such a theory? Does not their present position argue a total want of consistency? Which is the more entitled to support, even from their own professed stand-point, a theory which refers favorable variations to an innate tendency in organisms, or that which ascribes variations to reversion? No; as any other view would be incompatible with the success of their darling theory, they are perfectly content to consider variation as an ultimate law, even though such a consideration involves a gross inconsistency. Regardless of this, they advance the theory, and, when engaged on a collateral point, marvel at their opponents for doing that which they have done at the start, and complacently extol the clearness of their own views, which have been arrived at by the aid of an hypothesis based upon the same occult quality against which they are now exhausting all their eloquence.

The truth is, that these "metaphysical entities" are in almost as frequent use among positivists as among their adversaries. They are, perhaps, more ingeniously disguised. But a close examination of their speculations will elicit the fact that they guilty of the same (alleged) absur and on a point, as in the present stance, most materially affecting t whole theory. But these expla tions are denounced as metaphys merely to facilitate the reception their finely spun theories. The da of science in any department knowledge is invariably preceded a mist. This acts as a false mediu through which the subjects of scie are dimly seen, presenting a m monstrous aspect. This is render still more distorted by the ingenio but absurd theories of men be upon tracing a want of harmony b tween science and religion. Th hypotheses, at first sight, apparent preclude the need of these phras but they are at last necessitated use them in accounting for phenom na of which the ascription to know factors would be grossly at varianc with their views. The use of the entities is in some cases only prov sional with us, to be abandoned o the advent of true knowledge; fo religion does not shun the light o true science. In this transitiona period between complete ignoranc and full knowledge, these speculativ theories are propounded. They pur port to furnish an explanation of al phenomena, and to dispense with th necessity of using "metaphysical en tities." Their adoption is necessitat ed, contend their propounders, if the converse theories are conceded to be unscientific. This we deny, and ap peal to the existing low condition of scientific knowledge, which precludes for a time the possibility of the for mation of any well-founded theory. This theory of evolution, for instance, is confessedly founded on ignorance —ignorance of the law to which its data conform. But when science ad vances, and when facts are expos ed to the clear sunlight of precise

impartial investigation, perfect mony is observable between sci- e and religion; and the absurd- of the theories which were urged our adoption becomes manifest. t experience justifies our belief t such will ever be the case. For only those departments of know- ge which are abandoned to specu- on which present facts seemingly ariance with religion. We refuse ccept the alternatives which they r, confident that, as they are at iance with religion, they are not legitimate products of true sci- ce.

Races under nature have been med exclusively by degeneration. this we do not wish to imply any ate tendency in organisms to de- erate. The degeneration of which speak is solely induced by the ect and indirect action of the con- ions of life. Upon assuming cer- conditions necessary to full wth, the formation of natural es becomes deductively explicable. is with regret that we observe a sposition on the part of some of advocates of special creation to lieve growth independent of the conditions. The dependence of growth upon the conditions cannot be disputed. Nor do we wish to dispute it; for it is, to our mind, strong confirmation of the doctrine of final causes. The supporters of the evolution hypothesis maintain that an organism has the capacity for adapting itself to any conditions, so that they are not so marked and sudden as to entail extinction. We acquiesce in this thus far — where the conditions are favorable, improvement ensues. But with us improvement implies previous degeneration. And when the conditions are adverse, a change for the worse results in proportion to the change in the conditions. Such adaptation as this we admit. But we fancy Darwin would consider this too teleological to be a concession. Adaptation, with him, implies harmony. This harmony we will not gainsay. But if the conditions induce the total or partial suppression of any part or character, we contend that this adaptation of the organism to the conditions is not consistent with complete physiological integrity. The departure from a state of integrity is directly proportioned to the retardation of growth of either the organism as a whole, or of only one or more of its organs or characters. This repression is the criterion by which to judge of the adverseness of the conditions. For our belief in this incompatibility between full integrity and conditions which entail the loss or diminution of any part, character, feature, or organ, we will, in a future article, furnish full warrant.

Starting out, then, with perfect specific types, we will be able to account for the formation of races without the aid of an equivocal process, without postulating any occult quality, and by means in every way analogous to those which, as Darwin has shown, play an important part in inducing modification.

From the instances of degeneration adduced by Darwin, we may infer that the conditions of life were at one time extremely adverse. And surely, if they were sufficiently unfavorable to involve the reduction of most important organs to a rudimentary condition, they must also have caused the suppression of many minor characters. The climate in most countries has been adequately rigorous to act upon the organization as a whole, and thus entail deterioration in size; and as these unfavorable conditions ranged from those but little unfavorable to those barely compatible with life, the retention of the

organism in each or several of these stages would create diversity of size; for climate acts with different degrees of force in different countries. Then in a single country the animals or plants would be subjected to closely similar conditions, and long continued subjection to these would produce uniformity of size, and indigenous races.

In addition to these modifications consequent upon the direct action of the climate on the whole organization, there would result minor changes. The conditions of life would in different districts or countries be unfavorable to different parts or characters. The reduction of these parts would follow, and this would, through correlation of growth, involve modifications in other portions of the organization. For, says Darwin, "all the parts of the organization are to a certain extent connected or correlated together."

Owing to these causes there would be disproportionate deterioration of the characters. When an organ of which the function is activity would be little exercised, it would become atrophied. Different situations would occasion more or less disuse of organs, and these would consequently be differently modified. Then their modification would call for the modification of other characters. Thus, the legs in some animals are made more or less short by disuse, and by correlation the head is reduced in size, and changed in shape. Loss of characters, such as the crest of feathers on the head, and wattle, conjoined with changes in other parts of the organism, would, through correlation, produce more or less diminution in size of the skull. General decrease in size, and loss of tail or tail-feathers, would lessen the number of the vertebræ, which result would induce other changes. When the hair is affected by humidity of climate or other causes, the tusks, horns, skull, and feet become modified. There is also correlation of degeneration between the skin and its various appendages of hair, feathers, hoofs, horns, and teeth; between wing-feathers and tail-feathers; between the various features of head and skull.

With animals, a small supply of food would cause decrease in size; and with plants, an insufficient quantity of the necessary chemical elements, together with the starvation consequent upon the close contiguity of other plants, would produce the same result. Diseases peculiar to certain localities, heights, and climates have also played their part in the modification of animals and plants.

Given, then, a perfect type, the unfavorable action of these elements —heat and cold, dampness and dryness, light and electricity, disuse, disease, absence of some of the necessary chemical elements, and insufficient supplies of food—together with that of their countless modifications, acting separately and conjointly, directly and indirectly through correlation, is amply adequate to the production of the modifications by which, as we conceive, races have been formed.

That it is possible for characters to appear after having been lost for a great length of time, is amply shown by Darwin in his chapters on reversion. Individuals of breeds of cattle that have been hornless for the last one hundred or one hundred and fifty years occasionally give birth to horned calves. Characters, he assures us, may recur after an almost indefinite number of generations. "From what we see of the power of reversion, both in pure races and when varieties or species are crossed, we may infer that characters of almost any kind are capa-

ble of reappearance after having been lost for a great length of time." Speaking of the transmission of color during centuries, he says, "Nevertheless, there is no more inherent improbability in this being the case than in a useless and rudimentary organ, or even in only a tendency to the production of a rudimentary organ, being inherent during millions of generations, as is well known to occur with a multitude of organic beings. There is no more inherent impossibility in each domestic pig, during a thousand generations, retaining the capacity to develop great tusks under fitting conditions, than in the young calf having retained for an indefinite number of generations rudimentary incisor teeth which never protrude through the gums." The power of reversion is further shown in the cases of pelorism before given. And again, he urges that, "It should also be remembered that many characters lie latent in organisms ready to be evolved (?) under fitting conditions." But it is scarcely necessary to adduce proofs of the possibility of reversion; for, if characters arise in species which have confessedly degenerated, it is the height of absurdity to attribute them to evolution, rather than to reversion.

Many objections, we are sure, will suggest themselves, and many doubts will be expressed whether the theory here enunciated will cover all the facts. We feel confident of succeeding in obviating every difficulty, and in dissipating all such doubts. In this article we have shown upon what an infirm basis the evolution hypothesis rests, and have suggested a legitimate alternative. In our forthcoming articles, we shall show still further weakness of the views of Darwin and Spencer, and point out facts which, while grossly at variance with the development doctrines, afford conclusive proof of the objective reality of the species.

HAYDN'S FIRST LESSONS IN MUSIC AND LOVE.

I

THE Hungarians, like the Austrians and Bohemians, have great love for music. "Three fiddles and a dulcimer for two houses," says the proverb; and it is a true one. It is not unusual, therefore, for some out of the poorer classes, when their regular business fails to bring them in sufficient for their wants, to take to the fiddle, the dulcimer, or the harp, playing on holidays on the highway or in taverns. This employment is generally lucrative enough, if they are not spendthrifts, to enable them not only to live, but to lay by something for future necessities.

An honest wheelwright, called "merry Jobst," on account of his stories and jokes, lived with Elschen his wife, in a cottage in the hamlet Rohrau, on the borders of Hungary and Austria. They were accustomed to sit by the wayside near the inn on holidays; Jobst fiddling, and Elschen playing the harp and singing with her sweet, clear voice. Almost every traveller stopped to listen, well pleased, and on resuming his journey

THE IMMUTABILITY OF THE SPECIES.

II.

OF the several circumstances which led to the conception of the theory here advanced, the first and most important was the recognition of the fact that variation was left unaccounted for upon the hypothesis of evolution. Here, if anywhere, we conceived, was to be found the vulnerable part of Darwinism. It occurred to us that the probabilities were that a theory was false when it had for its data phenomena which conform to no law. Our subsequent inquiries furnished us with nothing by which to rebut this presumption; but with much to confirm it. Our suspicion at last strengthened into conviction, and we became confident that contemplation of the subject of the cause of variation alone could furnish us with a solution of the whole question.

It is of laws alone of which we speak in these articles. All the facts adduced by Darwin we accept, and use them merely as illustrations. We have nothing in common with those who contend that the refutation of Darwinism lies solely with mere compilers of facts—fanciers, florists, and breeders. Darwin has heretofore anticipated nothing but a joinder of issue upon facts. He has apparently never contemplated being met by a demurrer. He has endeavored to confound his opponents by a vast multitude of facts; and, owing to his reverence for whatever has the sanction of antiquity, it has never entered his mind that any one would be so presumptuous as to demur to the time-honored conception of *new growth*, upon which these facts are based. Of this presumption we are guilty when we deny the very existence of organic evolution.

In the preceding article we directly intimated, on several occasions, that no theory other than that of reversion can afford a solution of the mystery of the appearance of favorable modifications. As some little diversity of opinion exists respecting Darwin's views on the subject of the cause of variation, it may be well for us to dwell awhile on this question, and to furnish some evidence substantiating our statement.

Darwin, in his *Origin of Species*, candidly and frankly admits that he can assign no satisfactory reason for the appearance of favorable modifications. He ascribes them to "spontaneous variability," and assures us that "our ignorance of the laws of variation is profound." We might adduce a number of other expressions equally declaratory of his inability to assign the cause of variation; but as the Duke of Argyll has taken such pains to direct attention to this *hiatus* in Darwin's evidence, we cannot refrain from quoting from his *The Reign of Law*:

"It has not, I think, been sufficiently observed that the theory of Mr. Darwin does not address itself to the same question, (the introduction of new forms of life,) and does not even profess to trace the origin of new forms to any definite law. His theory gives an explanation, not of the processes by which new forms first appear, but only of the processes by which, when they have appeared, they acquire a preference over others, and thus become established in the world. A new species is, indeed, according to his theory, as well as with the older theories of development, simply an unusual birth. The bond

of connection between allied specific and generic forms is, in his view, simply the bond of inheritance. But Mr. Darwin does not pretend to have discovered any law or rule according to which new forms have been born from old forms. He does not hold that outward conditions, however changed, are sufficient to account for them. Still less does he connect them with the effort or aspirations of any organisms after new faculties and powers. He frankly confesses that 'our ignorance of the laws of variation is profound;' and says that in speaking of them as due to chance, he means only 'to acknowledge plainly our ignorance of the cause of each particular variation.' Again he says, 'I believe in no law of necessary development.'" (P. 228.)

On page 254, the Duke of Argyll continues:

"It will be seen, then, that the principle of Natural Selection has no bearing whatever on the origin of species, but only on the preservation and distribution of species when they have arisen. I have already pointed out that Mr. Darwin does not always keep this distinction clearly in view; because he speaks of natural selection 'producing' organs or 'adapting' them. It cannot be too often repeated that natural selection can produce nothing whatever except the conservation or preservation of some variation otherwise originated. The *true* origin of species does not consist in the adjustments which help varieties to live and prevail; but in those previous adjustments which cause those varieties to be born at all. Now, what are these? Can they be traced or even guessed at? Mr. Darwin has a whole chapter on the laws of variation, and it is here, if anywhere, that we look for any suggestion as to the physical causes which account for the origin as distinguished from the preservation of the species. He candidly admits that his doctrine of natural selection takes cognizance of variations only after they have arisen, and that it regards variations as purely accidental in their origin, or, in other words, as due to chance. This, of course, he adds, is a supposition wholly incorrect, and only serves 'to indicate plainly our ignorance of the cause of each particular variation.' Accordingly, the laws of variation which he proceeds to indicate are merely certain observed facts in respect to variation, and do not at all come under the category of laws, in that higher sense in which the word law indicates a discovered method under which natural forces are made to work."

It will be seen that we have not gone too far in proclaiming Darwin's inability to account for variation. In the absence, then, of any other rational explanation, are we not necessitated to accept the theory of reversion? What possible objection can be urged against it? Reversion is not a heretofore unknown factor. Nor is it an occult factor. It is constantly recognized by Darwin. Two chapters of the *Animals and Plants under Domestication* are filled with phenomena illustrating its action; and it forms the basis of his lately propounded hypothesis of pangenesis.

In the interval between the publication of his *Origin of Species* and the writing of his *Animals and Plants under Domestication*, Darwin has received no enlightenment as to the cause of variation. A writer in *The North American Review* for October, 1868, holds the contrary, and distinctly asserts that Darwin is inclined to adopt the mechanist theory, to attribute the phenomena of variation solely to the influence of the physical conditions, and to repudiate the idea of a concurrent cause. After speaking of Mr. Herbert Spencer's ascription of variations to the physical conditions, he says:

"In his latest work, Mr. Darwin inclines to adopt the mechanist theory, so far as the cause of variations is concerned. 'We will now consider,' he says, 'the general arguments, which appear to me to have great weight, in favor of the view that variations are directly or indirectly caused by the conditions of life to which each being, and more especially its ancestors, have been exposed. . . . These several considerations alone render it probable that variation of every kind is directly or indirectly caused by changed conditions of life. Or, to put the case under another point of view; if it were possible to expose all the individuals of a species to absolutely uniform conditions, there would be no variability.' When variations of all kinds and degrees, that is, all the gradual differentiations by which the vast multitude of existing species has been

evolved out of the primordial form or forms, are thus attributed solely to the accumulative action of the conditions of life, without any recognition of a concurrent cause in that constant self-adaptation by organisms for which the conditions cannot account, it would seem fairly inferrible that the mechanist theory is supposed to explain the evolution of the species, if not of individual organisms."

Now, there is nothing in the expressions quoted from Darwin's work, which justifies such a construction as *The North American Review* has here placed upon them. Although we, as a vitalist, implicitly believe in the co-operation of other than mechanical causes, yet we fully and most unqualifiedly concur in Darwin's assertion that there would be no variability were all the individuals of a species exposed to absolutely uniform conditions. This fact is by no means incompatible with a belief in "forces which manifest themselves in the organism." We have shown that varieties or races under nature are attributable solely to the action of the conditions of life. Under domestication, the changed conditions are the secondary cause of favorable modifications, reversion being the primary cause. But without the concurrence of this secondary cause, it is wholly impossible for favorable variations to occur. The expressions of Darwin, then, carry with them no implication that variations are solely caused by the changed condition; for the recognition of the power of the conditions to the extent claimed by Darwin by no means precludes the belief in a concurrent cause. The conclusion that a change in the conditions is a cause of variation, and that were there no such change there would be no variability, is necessitated by the theory here advanced. For, an acquaintance with phenomena displaying the action of the physical conditions forces upon us the teleological inference that certain conditions are essential to the full development of characters. Does it not thence necessarily follow that, when the conditions are dissimilar, modifications will result from the individuals of a species being exposed to conditions favorable or unfavorable in different degrees to the growth of some of the parts or features? Darwin's assertion is then quite consistent with a belief in the concurrence of causes not mechanical.

But the discovery of Darwin's opinion on this point is not left solely to conjecture and speculation. Had the *North American* Reviewer carefully perused Darwin's late work, he would have found many most unequivocal declarations of the author's belief in the concurrence of other causes. They recur most frequently.

On page 248, Vol. II., he says "Throughout this chapter and elsewhere, I have spoken of selection as the paramount power; yet its action absolutely depends on what we in our ignorance call spontaneous or accidental variability."

Page 250: "Variation depends in a far higher degree on the nature or constitution of the being, than on the nature of the changed conditions."

On page 291, after giving cases of bud-variation, he says, "When we reflect on these facts, we become deeply impressed with the conviction that in such cases the nature of the variation depends but little on the conditions to which the plant has been exposed, and not in any especial manner on its individual character, but much more on the general nature or constitution, inherited from some remote progenitor of the whole group of allied beings to which the plant belongs. We are thus driven to conclude that in most cases the conditions of life play a subordinate part in causing any particular modifica-

tion; like that which a spark plays when a mass of combustible matter bursts into flame—the nature of the flame depending on the combustible matter and not on the spark." And again, on page 288, "Now is it possible to conceive external conditions more closely alike than those to which the buds on the same tree are exposed? Yet one bud out of the many thousands borne by the same tree has suddenly, without any apparent cause, produced nectarines. But the case is even stronger than this; for the same flower-bud has yielded a fruit one half or a quarter a nectarine, and the other half or three quarters a peach. Again, seven or eight varieties of the peach have yielded, by bud variation, nectarines; the nectarines thus produced no doubt differed a little from each other; but still they are nectarines. Of course there must be some cause internal or external to excite the peach-bud to change its nature; but I cannot imagine a class of facts better adapted to force on our mind the conviction that what we call the external conditions of life are quite insignificant in relation to any particular variation, in comparison with the organization or constitution of the being which varies."

These assertions that there is something beyond the actions of the conditions of life are met with continually in his work, and they fully and conclusively show that he is nowise inclined to adopt the mechanist theory. What alternative have we, then, but to conclude that this occult potent factor is reversion?

We have, we think, sufficiently shown that Darwin does not attribute variations solely to the conditions. But it has been asserted by the *North American* Reviewer, of whom we have often spoken, that Mr. Herbert Spencer declares them to be thus solely due. A dozen careful perusals of *The Principles of Biology* have failed to corroborate such a statement. On the contrary, Mr. Spencer on many occasions makes use of the phrase "spontaneous variations," though, apparently, under protest. It is true that throughout his work there is a constant insistance on the great part played by the physical conditions in causing variations. The greatest prominence is given to this factor. There is also a manifest desire that the mechanical forces be taken as adequate to the production of the phenomena. But nowhere is there clearly expressed a repudiation of the idea of concurrent cause. In some places there is a recognition of it.

Thus, on page 281, Mr. Darwin, after speaking of the action of the conditions of life, says, "Mr. Herbert Spencer has recently discussed with great ability this whole subject on broad and general grounds. He argues, for instance, that the internal and external tissues are differently acted on by the surrounding conditions, and they invariably differ in intimate structure; so, again, the upper and lower surfaces of true leaves are differently circumstanced with respect to light, etc., and apparently in consequence differ in structure. But, as Mr. Herbert Spencer admits, it is most difficult in all such cases to distinguish between the effects of the definite action of physical conditions and the accumulation through natural selection of inherited variations which are serviceable to the organism, and which have arisen independently of the definite action of these conditions."

It may be well to remark that the physical conditions are the sole cause of variation when viewed in their statical aspect; but when viewed in their dynamical aspect, the con-

ditions are, except when the movement is in the direction of degeneration, only the secondary cause. For, upon the theory here enunciated, were all the individuals of a species fully developed, there would be but one race or variety, that is, the perfect type. The existence of a plurality of races or varieties necessarily implies the unfavorable modification of some of the parts or characters of some of the members of the species.

It is hardly possible for any one's common sense to be so impaired, even by speculation or the bias of a foregone conclusion, as to induce a belief that the characters given below have arisen solely by the action of the physical conditions. When the cases are isolated, such a belief is, in a small measure, excusable; but when they are given consecutively, the ascription of the characters solely to mechanical causes would imply not a little aberration of mind.

Numerous instances of bud-variation are given by Darwin. Several of these we have incidentally adverted to. By this process of bud-variation have arisen in one generation alone, and even in one season, nectarines from the peach, the red magnum bonum plum from the yellow magnum bonum, and the moss-rose from the Provence rose. Many other instances might be adduced of the appearance of characters equally strongly pronounced.

That the following characters have not arisen in one generation is confessedly owing to the lack of scientific knowledge as to the conditions requisite for their growth. The English lop-eared rabbit, which is under domestication, weighs not less than eighteen pounds. The pouter-pigeon is distinguished by the great size of its œsophagus; the English carrier-pigeon, by its surprisingly long beak; and the fantail, as its name connotes, by its immense upwardly-expanded tail. In the progenitor of these birds, the rock pigeon, (*columba livia,*) there is not a trace of these characters discernible. It is a matter of great surprise to look at the stringy roots of the wild carrot and parsnip, and then to note the astonishingly great improvement which has resulted from their subjection to more favorable conditions. Gooseberries have attained a great size and weight. The London gooseberry is now between seven and eight times the weight of the wild fruit. The fruit of one variety of the *curcurbita pepo* exceeds in volume that of another by more than two thousand fold!

Now, these strongly pronounced favorable modifications are explicable only upon the theory of reversion. Had they arisen by the slow accumulation, through centuries, of successive, scarcely appreciable increments of modification, their being due to evolution, or solely to the physical conditions, would be less inconceivable. Darwin's professedly favorite rule is, *Natura non facit saltum*—"Nature makes no leaps." But we fail to see nature's conformity to it. We must confess that upon the hypothesis of evolution nature indulges herself with the most gigantic leaps.

It might be urged that, upon assuming, for the purposes of the argument, that Mr. Herbert Spencer does attribute variations solely to the physical conditions, he is thereby discharged from the imputation of advocating a theory which is wholly gratuitous. But he assuredly is not. He is placed by this ascription of variations in no better position, so far as respects this point. He has adduced no evidence in favor of their being thus solely ascribable. His attribution of them solely to the physical conditions is equally gratuitous with his ascrip-

tion of them to evolution. The fact that variations are due to a change in the conditions, and that variations would be absent were all the individuals of a species subjected to absolutely uniform conditions, is, as we have seen, quite compatible with a belief in a concurrent cause. The necessity of a change in the conditions is admitted, and even called for, upon our theory. Mr. Herbert Spencer's assumed assertion of variation being due solely to mechanical causes would necessarily imply a denial of a concurrent cause. But this denial is wholly gratuitous; he has furnished no warrant for it. And again, assuming him to concede a concurrent cause, the question then recurs, Are variations attributable to reversion or to evolution? As we have seen, there is no foundation for ascribing them to evolution—evolution being merely a name for a cause unknown.

In *The Westminster Review* for July, 1865, and in *The North American Review* for October, 1868, Mr. Herbert Spencer is taxed with inconsistency. In his *Principles of Biology*, Mr. Spencer writes, "In whatever way it is formulated, or by whatever language it is obscured, this ascription of organic evolution to some aptitude naturally possessed, or miraculously imposed on them, is unphilosophical. It is one of those explanations which explains nothing—a shaping of ignorance into the semblance of knowledge. The cause assigned is not a true cause—not a cause assimilable to known causes—not a cause that can anywhere be shown to produce analogous effects. It is a cause unrepresentable in thought; one of those illegitimate symbolic conceptions which cannot by any mental process be elaborated into a real conception. In brief, this assumption of a persistent formative power, inherent in organisms, and making them unfold into higher forms, is an assumption no more tenable than the assumption of special creations; of which, indeed, it is but a modification, differing only by the fusion of separate unknown processes into a continuous unknown process." When he proceeds to treat of the waste and repair of the tissues, he finds that they refuse to acknowledge his mechanical principles, and he is forced to assume for the living particles "an *innate* tendency to arrange themselves into the shape of the organism to which they belong." The inconsistency was noted, commented upon, and became the subject of much animadversion.

This inconsistency, however, is comparatively excusable, as the histological phenomena which he had to explain are complicated and involved, and have to respond to the influences of divers parts of the body. But were we to show that his denunciation of the "ascription of organic evolution to some aptitude," is equally applicable to the attribution to "evolution," he would be considered, we are sure, guilty of the grossest possible inconsistency. This we can show; for there is no definition of a "metaphysical entity," to which the term evolution does not answer. Can any one conversant with the works of the first of evolutionists, particularly with his *First Principles*, *Principles of Psychology*, and *Principles of Biology*, gainsay the fact that organic evolution implies a *tendency* in organisms *to advance*, when under the influence of physical conditions, from the simpler to the more complex?

Mr. Spencer tacitly assumes the inevitable "becoming of all living things;" and that organic progress is a result of some indwelling tendency to develop, naturally impressed on

living matter—some ever-acting constructive force, which, concurrently with other forces, moulds organisms into higher and higher forms. Many instances of this we might adduce, but we will quote but two. On page 403, of his *First Principles*, he speaks of "a tendency toward the differentiation of each race into several races." And on page 430, Vol. I. of his *Principles of Biology*, he says, "While we are not called on to suppose that there exists in organisms any primordial impulse which makes them continually unfold into more heterogeneous forms, we see that *a liability to be unfolded* arises from the action and reaction between organisms and their fluctuating environments."

Surely, it cannot, with any show of reason, be contended that the word "liability" is not here used as the perfect synonym of that "metaphysical entity," the word "tendency." If the concurrence of a "liability to be unfolded" and the physical conditions be the definition of evolution, were we not warranted in asserting all that we did, with respect to the implication of organic evolution? Evolution a "metaphysical entity"! The words seem strange. They sound like a contradiction in terms; and we know that it is hard to realize the fact that Mr. Spencer has based his whole theory upon "some aptitude." But can the fact be gainsaid? Do not the thoughts of every one who reads of a "liability to be unfolded," recur to the page where Mr. Spencer stigmatizes such phrases as unphilosophical? Hear again how he characterizes them. "In whatever manner it is formulated, *or by whatever language it is obscured*, this ascription of organic evolution to some aptitude *naturally possessed*, or miraculously imposed on them, is unphilosophical. It is one of those explanations which explains nothing—a shaping of ignorance into the semblance of knowledge." Every reader will, we are sure, concur with us in the opinion that the evolution hypothesis is here clearly condemned. The special creation theory, as here advocated, involves no occult factor. The physical conditions concur with reversion to cause the favorable modifications.

While we do not join in such a strong protest against the use of what are termed "metaphysical entities," as that in which positivists are wont to indulge, we cannot but concede that they have often retarded the progress of science, and directed the course of inquiry into wrong channels. But the true scientist does not altogether eschew their use; nor does science preclude his following a middle course. But that, however, against which we do most earnestly and most indignantly protest is their use for the purpose of showing incongruity between science and religion; and their use when there is a perfectly legitimate alternative. The advocates of evolution endeavor to laugh to scorn such phrases; but, double which way they will, they are forced to use them, if not in one instance, at least in another.

We hope, then, never again to hear "metaphysical entities" urged as an objection against the special creation theory. But we incline to retract that. For the positivists have become, through practice, so well conversant with the phraseology peculiar to this theme, that they are now capable of master-pieces of wit and eloquence. Were they, through fear of the imputation of inconsistency, to refrain from furnishing the world with these, we would be debarred the pleasure of their perusal. With

reluctance would we forego such opportunities of cultivating a delicacy of taste.

In *Appleton's Journal* for July 31st, 1869, Mr. Spencer has declared that "the very conception of spontaneity is wholly incongruous with the conception of evolution." Now, to our mind, the theory of "spontaneous generation" is the perfect analogue of the theory of evolution. We conceive that the latter theory is open to the same objections which are urged by Mr. Spencer against the hypothesis of heterogenesis. "No form of evolution," he declares, "organic or inorganic, can be spontaneous, but in every instance the antecedent forces must be adequate in their quantities, kinds, and distributions to work the observed effects." Now, do not the alleged cases of evolution, equally with those of spontaneous generation, fail to fulfil this requirement? Does not Mr. Spencer's assumption of a tendency as a concurrent cause with the conditions, imply such a failure? What precludes the advocates of "spontaneous generation" from assuming "a liability" in inorganic matter "to unfold" into microscopic organisms? Could not agenesis have resulted from the concurrence of this tendency with mechanical causes? Such an explanation is equally open to the believers in "spontaneous generation." The true *status* of the evolution hypothesis is really no higher than that of the hypothesis of heterogenesis. They are both founded upon similar bases.

Together with the absurdity of adducing alleged cases of necrogenesis as the assumed missing link in the evolution process, might also have been mentioned, by Mr. Spencer, an objection to which the experiments of Professor Wyman are open. It is assumed in those experiments that, if fully matured organisms are not able to stand a temperature above two hundred and eight degrees, their ova would be destroyed when subjected to a temperature of two hundred and twelve degrees. These ova are allowed to stand only a little over three degrees more than a developed organism. Is this a fair supposition? Is it not to be expected that, if a fully matured organism can stand a temperature of two hundred and eight degrees, its ova, which are almost diatomic in character, will sustain a temperature approaching that of incandescence? We trust that this digression will be pardoned.

Before treating of variation under domestication, we may take occasion to disclaim any attempt to account for variations of color. These are not so manifestly due to degeneration and subsequent favorable reversion. They accord with our theory; but as this accordance is not susceptible of the short and complete demonstration of that of all other variations, the limits of our series preclude our entering into a long dissertation on the subject. Nor would the importance of modifications of color justify such a course; for Darwin characterizes them as phenomena of no consequence, and assures us that little attention is paid to them by naturalists.

Under domestication, animals and plants are subjected to comparatively favorable conditions, to conditions of which they have been deprived in the state of nature. Thus stimulated, they display marked improvement, and revert to the perfect condition from which they have degenerated. The favorable changes which they present are noted by man, and carefully preserved by crossing and judicious pairing with those possessing equal advantages. In this way, the best are selected and made to

transmit to their offspring their improved condition. Each breeder's success is determined by the more or less favorable conditions of the situation, district, or country, and by his sagacity and discrimination in selecting those in which occurs the greatest increase of size. As the conditions vary in different localities, and as breeders possess different degrees of scientific knowledge, animals and plants would be differently improved, and thus there is established a series of gradations all answering to the characters of as many varieties. As we have seen, in a somewhat similar manner races have been formed under nature. They were in part established by the retention of the animal or plant in several of the phases of degeneration; while varieties under domestication are in part due to the retention of the organism at each stage of reversion. The greater number of varieties under domestication, as compared with the paucity of races under nature, results in a measure from man's selection retaining the organism at almost every gradation. Under nature, the animals of a district or country freely intercross, and from this intercrossing results uniformity of character and the consequent existence of only one race in a country. Besides, the conditions of life are comparatively uniform in each district; but under domestication man is, by means of his scientific knowledge, continually varying the conditions.

We are conscious that this explanation accounts only for difference of size. It does not show how wholly different characters have been acquired by the various varieties; nor the cause of the possession of the greatest structural differences by individuals of the same species. Were this the sole process by which varieties were formed, one variety would be merely the miniature of the other. Other explanations are required to illustrate the manner in which the great divergence of character observable under domestication, has been effected. These we shall furnish.

Darwin, both in his *Origin of Species* and in his *Animals and Plants under Domestication*, draws particular attention to this divergence of character. It forms a most conspicuous portion of his theory. It displays the gradual acquisition by individuals originally alike of differences as great as those characterizing species.

As Darwin has assured us, there is scarcely a single species under nature which does not possess organs in a rudimentary state. Now, these arise under domestication, and are apportioned among the several varieties. Each organ is developed, and is allotted to a certain variety, of which it forms the peculiarity. In one variety, special attention is paid to the development of a single organ, while the remaining organs are left to be developed in and to form the characteristics of other varieties. Thus the upwardly-expanded tail in the pigeon constitutes the peculiarity characteristic of the fantail, the enlargement of the œsophagus, that of the pouter; and the divergent feathers along the front of the neck and breast, that of the turbit.

By this process— the development of rudimentary organs and their apportionment among the several varieties—a portion of the divergence of character is effected.

These rudimentary organs have been the occasion of many a warm controversy. They are asserted to be totally incongruous with the doctrine of teleology. Their uselessness and occasionally detrimental nature, it is contended, preclude the possibility of design. Several objections have been urged against the doctrine of

final causes; but those who profess to disbelieve in design concur in according to these organs the greatest prominence.

The doctrine of final causes is a conception thrust upon us by a vast multitude of facts from organic nature. But, now and then, exceptional phenomena will present themselves apparently at variance with it. These, as a writer in *The London Quarterly Review* for July, 1869, ably maintains, are merely objections, not disproofs. Owing to a misconception current among the advocates of special creation, they have been unable to reconcile rudimentary organs with the doctrine of teleology. All the attempts heretofore made to harmonize these anomalous features with the doctrine of final causes have been feeble. We may instance one. A Mr. Paget, in his Hunterian Lectures at the College of Surgeons, argues that the function of these organs is "to withdraw from the blood some elements of nutrition, which, if retained in it, would be positively injurious." We can readily appreciate the feelings which induce an evolutionist to smile at this assumption of excretion as the sole function and purpose of a rudimentary organ.

Upon the theory of degeneration and subsequent favorable reversion here propounded, these rudimentary organs are quite congruous with the doctrine of final cause. To obviate the difficulty presented by these parts, we have accepted the interpretation of the evolutionist. This interpretation we adopted at the start. It forms the basis of our theory—its foundation-stone. That for which the evolutionist contends is, that these organs have at one period been fully developed. In this we concurred; for it furnished us with an explanation of the favorable modifications under domestication; while, as we shall show, it is by no means at variance with the doctrine of the immutability of the species. Rudimentary organs imply degeneration, past complexity of structure, and present comparative simplicity of structure; facts at variance with evolution, but strictly in accordance with our theory. We have seen that the idea of the normal nature of the existing natural condition has rendered the advocates of special creation unable to account for the appearance of profitable modifications. The seeming incongruity between rudimentary organs and the doctrine of teleology is a result of the same misconception. A curious confusion of ideas, generated by the assumption of this false position, has urged the opponents of evolution tacitly to contend that animals and plants were originally created with these organs in a rudimentary state, and that the present condition of these parts is a normal one. We, concurrently with the evolutionists, recognize in these organs "traces of old laws"—"records of the past." They are the traces of laws which obtained when the conditions were favorable to the full development of the organs. Under domestication, the conditions are being supplied, and the organs are, in consequence, being developed. On page 386 of his *Principles of Biology*, Mr. Herbert Spencer says, "And then to complete the proof that these undeveloped parts are marks of descent from races in which they were developed, there are not a few direct experiences of this relation. 'We have plenty of cases of rudimentary organs in our domestic productions—as the stump of a tail in tailless breeds—the vestige of an ear in earless breeds—the reappearance of minute dangling horns in hornless breeds of cattle.'"

But together with their being

traces of old laws, they are traces of laws which so far adhere to the present that the laws of the whole organism fail fully to obtain without their concurrence; and their concurrence is consequent solely upon the full development of these rudimental features. In other words, full perfection consists in the perfect coördination of all the parts, and absence of this coördination suffices to throw the organism within the domain of pathology. The reduction, therefore, of any organ to a rudimentary condition is deleterious to the organism as a whole. We are perfectly aware that this needs something more than gratuitous affirmation; but as the adduction of evidence in this place would be inconsistent with the symmetry and continuity of our argument, we are forced to bespeak our readers' indulgence until the publication of the next article of this series. But it is sufficiently clear that, upon assuming the truth of our theory, the difficulty offered to the doctrine of final causes by rudimentary organs is obviated.

It is manifest that the development of rudimentary organs, with their distribution among the several varieties, is but a partial explanation of the great divergence of character. There remain to be shown, then, other processes by which this has been effected.

Divergence of character has been also caused by the development in different varieties of those parts which have been only partially suppressed under nature. This necessarily causes disproportionate development of the characters in the individuals. Proportionate development would occur if all the features of the animal or plant were subjected to equally favorable conditions, and if they were all impartially cared for by man. Convergence of character would thence result. And this convergence of character is at first sight to be expected. For if an animal or plant has, as we have seen, diverged in character under nature, and then reverts under domestication to the original perfect type, that which is to be anticipated is convergence of character. But some part presents a modification in advance of its fellows. This man seizes and makes it the peculiarity of a certain variety. By the careful conservation and judicious mating of those individuals which display a tendency to diverge in the same direction, and of those which tend least to develop new characters, he preserves the type of the variety. Modifications arising in other points of structure are similarly preserved by other breeders, and characterize other varieties. When a variety is marked by a certain peculiarity, the fancier or breeder looks with a jealous eye upon the acquisition by any individual of any new character, even though it be for the better. When, therefore, any individual of a well-established variety displays a tendency toward the production of a new character, it is systematically suppressed. "Sports" are regarded with disfavor by the fancier or breeder, and rejected as blemishes, because they tend to destroy uniformity of character among the members of the variety. Owing to these and similar causes, in each variety a different point of structure is admired, selected, and attended to, and exclusive attention given to its development, to the neglect of the others. All the features are not developed in the same variety, but are distributed among different varieties. Thus, in the carrier-pigeon the length of the beak is the character particularly attended to; in the barb, quantity of eye-wattle; and in the runt, the weight and size of the body.

In this way is effected the disproportionate development upon which divergence of character is consequent. Darwin shows this, with this difference: he believes that the modifications arise by evolution, while we contend that they arise by reversion. Nor does he concur with us in the use of the term "disproportionate development;" for that implies that the presence of all the parts in an individual is necessary to perfection. But he shows the process to be the same, be the law to which the variations conform what it may. On page 245, Vol. II., he says, "Man propagates and selects modifications for his own use and fancy, and not for the creature's own good." And on page 220 he asserts, "that whatever part or character is most valued—whether the leaves, stems, bulbs, tubers, flowers, fruit, or seed of plants, or the size, strength, fleetness, hairy covering, or intellect of animals—that character will most invariably be found to present the greatest amount of difference both in kind and degree."

Strong confirmation of this view that divergence of character is attributable to disproportionate development may be drawn from the fact that those species in which is observable the greatest divergence of character are those whose breeding is directed by fancy or fashion. Where utility guides selection, there an approximation to convergence of character is seen; but where selection is guided by fancy, there is a very strongly-marked tendency toward divergence. In the formation of varieties, fancy nowhere enters as such a predominating element as it does in the breeding of pigeons; and consequently, nowhere else is seen such great divergence. Darwin is ever directing attention to this. On page 220, Vol. I., he dwells upon it with peculiar emphasis. The converse fact is also seen. With cattle, the object of breeders is not the formation of numerous varieties, but merely the improvement of the animals. An objective mode of treatment is here identical with a subjective mode. And here we have comparatively proportionate development, and a consequent approach to convergence of character. After citing convergence of character in the case of pigs, Darwin says, (Vol. II., page 241,) "We see some degree of convergence in the similar outline of the body in well-bred cattle belonging to distinct races."

In the foregoing description of the processes of formation of domesticated varieties, we have assumed reversion as the cause of modifications. We have occasion now to speak of a process which implies a cause that is not reversion. Varieties are formed, and disproportionate development and divergence of character effected, by man's continuing the process of degeneration commenced under nature. Several illustrations of this we will adduce.

In the tumbler-pigeon, the beak is greatly reduced, and, by correlation, the feet have become of a size so small as to be barely compatible with the bird's existence. Its skull is scarce one half the size of the wild rock-pigeon, its progenitor; and the number of the vertebræ has lessened. The ribs are only seven in number, whereas the rock-pigeon has eight. The peculiarity characteristic of this variety is confessedly due to degeneration. We refer to the habit of tumbling which Darwin attributes to disease—to "an affection of the brain." (P. 153.) Other varieties of the pigeon also owe some of their characters to degeneration. In the barb, the beak is .02 of an inch shorter than in the wild rock-pigeon.

Important characters have correspondingly deteriorated. Darwin, speaking of domesticated pigeons, says, "We may confidently admit that the length of the sternum, and frequently the prominence of its crest, the length of the scapula and furcula have all been reduced in size in comparison with the same parts in the rock-pigeon."

Pigs present several cases of deterioration of parts under domestication. Through protection from the climate, the coat of bristles has been greatly diminished. By disuse and man's selection, the legs have become of a size scarcely compatible with the animal's power of locomotion. Darwin requests us to "hear what an excellent judge of pigs says, 'The legs should be no longer than just to prevent the animal's belly from trailing on the ground. The leg is the least profitable portion of the hog, and we therefore require no more of it than is absolutely necessary for the support of the rest.'" Fully to realize the extreme shortness of the legs, it is necessary to see them in the possession of a highly improved breed. Correlation with the legs has led to the complete reduction of the tusks, and has induced the shortness and concavity of the front of the head which are so characteristic of domestic breeds.

With pigs, there is disproportionate development and also convergence of character. This is owing to all the breeders having aimed at the same object, the reduction of the characters given above, and the full development of the trunk or body. On page 73, Vol. I., Darwin says, "Nathusius has remarked, and the observation is an interesting one, that the peculiar form of the skull and body in the most highly cultivated races is not characteristic of any one race, but is common to all when improved up to the same standard. Thus the large-bodied, long-eared, English breeds with a convex back, and the small-bodied, short-eared Chinese breeds, with a concave back, when bred to the same state of perfection, nearly resemble each other in the form of the head and body. This result, it appears, is partly due to similar causes of change acting on the several races, and partly to man breeding the pig for one sole purpose, namely, for the greatest amount of flesh and fat; so that selection has always tended toward one and the same end. With most domestic animals, the result of selection has been divergence of character, here it has been convergence." Divergence of character is solely caused by disproportionate development, and proportionate development in all the members of the species necessarily causes convergence of character; but disproportionate development may also induce convergence, as it has done in this case.

Degeneration has also been the means of the formation of breeds of cattle, as the niata cattle, and those distinguished by the complete suppression of the horns.

Tailless breeds of animals have been formed; among which may be mentioned the rumpless fowl, and tailless cats and dogs.

Ears in other animals have been reduced to mere vestiges.

Degeneration is also seen in the great deterioration in size of dogs. The turn-spit dog is manifestly a case of degeneration. Blumenbach remarks "that many dogs, such as the badger-dog, have a build so marked and appropriate for particular purposes, that I should find it difficult to persuade myself that this astonishing figure was an accidental consequence of degeneration." "But," says Darwin, "had Blumenbach reflected on the great principle of selection, he

would not have used the term degeneration, and he would not have been astonished that dogs and other animals should have become excellently adapted for the service of man." (Vol. II., page 220.) It is difficult to conceive why Darwin here ignores the fact of degeneration. The peculiar build of the badger-dog is not an accidental consequence of degeneration. But it is equally far removed from being the product solely of selection. Degeneration is not the less present because of the operation of selection. Could the two not act concurrently? It is clearly manifest that it is the joint action of degeneration and selection which accomplishes the appropriateness for particular purposes, and not either alone. Selection, in such a case as this, merely guides the course of degeneration. Unfavorable modifications occur, and such of them as best subserve the uses and purposes of man, he selects and preserves; the rest he rejects. Thus results the adaptation of these animals to the service of man.

With some fowls, the comb has been lost. The Sebright bantam, which is one of the greatest triumphs of selection, weighs hardly more than one pound, and has lost its hackles, sickle-tail feathers, and other secondary sexual characters.

The Porto Santo rabbit differs in size from the wild English rabbit, its progenitor, in the proportion of rather less than five to nine.

The crooked and shortened legs of the Ancon sheep of New England, frequently referred to by Darwin, also displayed the action of degeneration. This is a case which shows that disproportionate development in a single variety will produce divergence in the species, even when there is great proportionate development in the other varieties.

"With cultivated plants," says Darwin, "it is far from rare to find the petals, stamens, and pistils represented by mere rudiments, like those observed in natural species." (P. 316.) The Red Bush Alpine strawberry is destitute of stolons or runners. In the St. Valery apple, the stamens and corolla are reduced to a rudimentary state. It has, consequently, to be fertilized by artificial means. This is effected by the maidens of St. Valery, each of whom marks her fruit with a ribbon of a certain color, and fertilizes it with the pollen of adjacent trees.

Thus we have four processes of formation of varieties. 1st. The retention of the organism at each stage of reversion, accounting only for differences of size. 2d. The development of rudimentary organs and their apportionment among the several varieties. 3d. The development in different varieties of those parts which have been only partially suppressed under nature. 4th. The continuation under domestication of the process of degeneration commenced under nature.

Now, we conceive that, by showing the phenomena of variation to be conformable to the theory of degeneration and reversion, and by proving the unscientific nature of the assumption of evolution, we have fulfilled the promise made by us at the start. Even as the case now stands, the theory of special creations must commend itself to every truly scientific mind. But it is not our design to leave the subject a mere question of probabilities. It lies within our power to prove the doctrine of special creations to demonstration; to place our theory upon evidence beyond the reach of cavil.

To the mind of every reader accustomed to scientific habits of thought, it is clear that our next step

is to adduce proofs of our belief that the development of all the parts in every individual is necessary to perfection. In this direction we shall push the subject, and we now affirm that there is a typical structure—the sum of all the positive features of the species.

With a full appreciation of the magnitude and importance of the act, we advance the following definition of a species.

A species is a class of organisms, capable of indefinitely continued, fertile reproduction among each other, and endowed with the possession—either actual or potential—of character; the suppression, reduction, or disproportionate development of which is incompatible with a state of physiological integrity.

A HERO, OR A HEROINE?

CHAPTER VIII.

THE LION'S DEN.

DR. JAMES invited Margaret to visit "the shop," and one day, after returning a few calls in Scaling, she stopped, with her aunt, on their way home, at a plain brown house in the one street of Shellbeach. There were two square pieces of green, one on each side of the front door, shut in with a brown fence; the small door seemed quite covered up, for, besides a large shining knocker in the middle, there was above it a brass plate, on which was inscribed "Dr. James," in large letters. There also appeared a small bell on one side, and another opposite labelled "night-bell." Which of these advantages to improve, was at first rather a puzzle to Margaret; but her aunt settled the question by giving a smart pull to the right-hand bell, whence she concluded that the knocker, on which she had meditated an attack, was intended solely for unprofitable ornament.

A tall and thin young man, who had the appearance of having outgrown all his clothes, opened the door with a promptness which seemed to imply that he had been lying in wait for the favorable moment to pounce upon them, and which was a little startling to the ladies. He surveyed them both with interest, explained that the doctor was not at home, but was expected in, and proposed that they should walk into the parlor and wait. Having ushered them into that apartment, the youth discreetly withdrew.

"My dear aunt, what a forlorn room! And do you see the dust?"

Miss Spelman shook her head in a mournful manner, and proceeded to establish herself on a black horse-hair couch, (having first gently flapped it with her handkerchief,) while Margaret walked about from one thing to another, commenting and criticising.

"This is where he sits to write, I suppose. And if here isn't a family of three little kittens curled up in his arm-chair! I hope he won't mistake them for a cushion, that's all! What piles of books! Medicine, medicine, medicine! Oh! here is something of a different kind; poetry! who

THE IMMUTABILITY OF THE SPECIES.*

III.

No alleged factor of evolution is so capable of arresting the attention of a physiologist as correlation of growth. To this law we have before often incidentally alluded. But as we conceive that it furnishes strong confirmation of our views, it behooves us to extend to it a somewhat more lengthy treatment.

The current impression is, that every authenticated instance of variation is so much added to the probabilities of the evolution of the species; and that the refutation of Darwinism is rendered difficult just in proportion to the number of proofs of variability. It is natural, then, that Darwin should accord prominence to those factors which play a part in inducing modification. Conspicuous among these factors is cor-

* In the definition of a species, propounded in the last article, there occurred two mistakes. "Character" should have been characters; and the semicolon immediately following should have been absent.

relation, the nearest approximation to a law of all the colligations of facts involved in Darwinism.

Correlation is a bond, *nexus*, or connection subsisting between different growths. Owing to it, a modification seldom arises in any portion of the organism without involving a corresponding change in another part. It is often not a little difficult to determine which part first varies and induces the modification of the other. Frequently, characters simultaneously vary, and are apparently affected by some distinct cause. Correlation is an important subject for Darwin; for, owing to its operation, varieties seldom differ from each other by a single character alone. He declares that "all the parts of the organism are, to a certain extent, connected or correlated together," and that "of all the laws governing variability, that of correlation is the most important." Parts, however, differ greatly with respect to the strength of their connection. In some parts, the tie is ever manifesting itself; in others, it is seldom traceable. Each character, when developed, tends to stimulate the development of others. But, owing to adversity of conditions, or to being systematically suppressed by man, these correlated growths lose all ability to respond to this stimulus, and, in consequence, fail to develop.

We intended to adduce quite a number of facts from Darwin, in order to enable our readers clearly to understand the precise nature of correlation. But want of space forces us to change our mind. We do this with less reluctance, when we consider that those for whom this article is more especially written have already familiarized themselves with those facts.

All the phenomena of correlation show increase of growth corresponding to increase, and decrease corresponding to decrease. Now, the antithesis to correlation is compensation or balancement of growth. This alleged law, as applied to species under nature, was propounded by Goethe and Geoffroy St. Hilaire. It implies that the development of any one part is attended with the reduction or starvation of some other part. Not a little diversity of opinion exists respecting the validity of this law. Darwin inclines to believe that compensation occasionally occurs, but conceives that its importance has been overestimated.

We, however, are of opinion that there is really no such law. That correlation obtains, there is not the slightest doubt. The instances of correlation are innumerable; and every one of them is a disproof of the doctrine of compensation of growth. For the law of correlation is totally incompatible with the law of economy of growth. The latter, according to the hypothesis, makes decrease correspond to increase, and increase to decrease. The former entails the reverse. Both laws, then, cannot stand. One must, of necessity, fall. One must negative the other. Unquestionably, the stronger law is correlation. This law none can invalidate. It follows thence that there is no such law as that of compensation of growth.

The reader is now naturally desirous to know how we explain away the alleged cases of economy of growth. The explanation is, that they are merely manifestations of correlation. The reduction of the given parts is consequent, not, as alleged, upon the building up of some other parts, but upon the suppression or reduction of correlated parts. Strong confirmation of this view is given by the fact that seeming compensation of growth is more observable under nature than under domestication. As development

under nature is slow and occasional, we would expect to find, upon the theory of Goethe and St. Hilaire, very few instances of apparent balancement of growth. On the contrary, the instances are most numerous; which fact is strictly in accordance with our hypothesis. For where we find the conditions entailing the reduction of many parts, there must we also find the reduction of other parts, induced by correlation. These parts, then, being in close proximity with characters which neither the conditions nor correlation have affected, their suppression is naturally referred to compensation of growth. Under domestication, however, development is carried on rapidly and to a great extent. A very large number of characters is selected and developed. Here, then, we should look for the most striking manifestations of compensation of growth. But it is a fact, of which the significance is at once apparent, that, instead of meeting with the fulfilment of our expectations, the converse thrusts itself most obtrusively upon our attention. Nature here is most prodigal; giving growth for growth, and meeting the development of one feature with the corresponding development of another. The cases illustrating apparent balancement of growth are here exceptional. They bear a very insignificant proportion to those under nature. Hence we conclude that the law of compensation of growth never obtains, that its apparent manifestations are really due to the operation of the law of correlation.

But there are two classes of cases of which correlation is not an interpretation. The first is the instances in which the tie of correlation is in a measure broken by man's selection of one part, and by his systematic suppression of another. Darwin refers to these when he declares it "scarcely possible in most cases to distinguish between the supposed effects of such compensation of growth, and the effects of long-continued selection, which may at the same time lead to the augmentation of one part and the diminution of another."

The following is an example of the second class of cases: The Polish fowl is distinguished by the possession of a crest of feathers on the head. In consequence of its development, there arises a protuberance on the skull. This is due to correlation. But in the cock, the skull is so perforated with small holes that at any point a pin may be sunk to the brain. This is adduced as an instance of compensation of growth. But a rational explanation may readily be assigned. Darwin has shown that the crest of feathers is abnormal in the male, that it normally belongs to the female. The feature has been gained by the male by the somewhat mysterious law of the transmission of secondary sexual characters. The economy of growth may then be considered as abnormal, and may reasonably be attributed to the character not completely harmonizing with its fellows.

The facts of correlation meet with an exhaustive treatment at the hands of Darwin. Herbert Spencer, however, almost totally ignores them. Although they are seemingly most striking exemplifications of evolution, he passes with only an occasional incidental notice. What we conceive to be Mr. Spencer's reason for thus ignoring them, we will venture to give further on. But, while Darwin extends to the facts of correlation a full recognition, he is by no means over-desirous to ascertain their cause. Correlation is another of those laws which it pleases Darwin to consider as ultimate.

Now, the supposition that the correlated part has arisen by evolution,

involves the absurd conclusion that a centre of growth normally preëxists without a relative arrangement of parts. And on the evolution hypothesis, we are forced to believe that an evolved part is correlated to another part not yet in existence; that all the parts of the organism anticipate, as it were, the birth of the new feature, and so adjust themselves as to become immediately susceptible to its influence; and that, while the previous coördination of parts is destroyed, owing to the influence of the newborn feature ramifying throughout the whole organization, the organism is capable of immediately effecting a re-coördination. To assume for any organism such powers as these, is virtual hylozoism. The only escape for him who admits the evolution of variations, is to adopt the explanation furnished by the Duke of Argyll—that correlations are the *direct* manifestations of design.

This interpretation of the teleologist precludes all further argument. We, of course, concur in design. But we do not deem ourselves therefore bound to take for granted the validity of every argument adduced in proof thereof. We conceive that design can be proved by incontrovertible evidence, and that it can be shown to manifest itself in conformity to laws not merely empirical.

As for the ultra-evolutionist, if he were to cease regarding correlation as an ultimate fact, and if he were tc employ himself in placing an interpretation upon it, he would perceive that the tie of correlation is strongly suggestive of reversion, and that its phenomena completely negative the hypothesis of evolution.

On the hypothesis of reversion, correlation is perfectly explicable. The supposition of reversion necessarily involves the conclusion that all the features of the species coexisted in each individual, saving, of course, the characters peculiar to the opposite sex. The perfect organism, then, is a balance of all the parts. The parts are correlated to each other with respect to centres, and these centres are correlated to each other with respect to the axis or the aggregate. All the parts are mutually dependent. When a part is reduced, it tends to involve the reduction of its corresponding part. The centre of the parts is then weakened, and this weakening entails the weakening of the other centres, to which this center is correlated. The loss or suppression of even one part, then, manifestly disturbs the physiological balance—destroys the coördination of the parts. Under nature, many parts have been lost or reduced, and these have entailed the loss or reduction of others. When, under domestication, characters develop, owing to selection and favorable conditions, they concur with the different centres of growth to effect a return to the balance, and, in consequence, the correlated parts arise and assume their primordial relations to their correlatives and to the aggregate. When all the parts are developed, by correlation and otherwise, there result an equilibrium and a consequent perfect coördination. Correlation is the inseparable concomitant of coördination. Each implies the other. And this is the reason, we apprehend, why correlation is barely noticed by Mr. Spencer. He feared, we surmise, that a lengthy philosophical treatment of the subject would suggest the conception that correlated growth necessarily implied previously imperfect coördination.

In order to facilitate the reader's conception of our meaning, it may be well to adduce an analogy. Analogies between organic and inorganic nature, the advocates of evolution ever delight in. And as that of the

crystal has found especial favor in their sight, we will venture to use it. As we conceive that there are laws governing the organism, which are *sui generis*, we would request our readers to regard the analogy only as an illustration of our views, and not in the light of an argument.

In crystallization, the initial force involved in the deposition of the first molecule determines the form and shape of the crystal. This molecule is correlated, as it were, to the aggregate to be formed. It controls the whole formative process, with a view to the shape eventually to be attained. Otherwise, how are we to account for the due tempering and modification of the forces implied in the deposition of each of the atoms of the accretion? From the first, there must of necessity be but one normal process. But this correlation between the first molecule and the aggregate is not the correlation which we wish particularly to illustrate. The crystal having been fully formed, a couple of edges are truncated. The crystal is then placed in a solution similar to that in which it was formed. Now, the absence of these edges implies an abnormal distribution of the forces. This is manifest; for correlation, directly with the corresponding edges and indirectly with the aggregate, leads to the reproduction of the lost parts—a fact manifestly implying previously imperfect coördination, and a present equilibrium of all the parts, or due coördination. The parts reproduced assume their previous relations, and effect a return to the balance impaired by their truncation. It is hence clear that correlation implies coördination, and that coördination implies correlation. Correlation, then, is a necessary corollary from the hypothesis of due coördination, or proportionate development. It will be seen that, while it receives a clear, consistent, and rational interpretation upon the theory of reversion, it carries with it implications at variance with the hypothesis of evolution.

As our knowledge of crystallography is that of an amateur, these views respecting crystallization may be open to modification; though we are assured that they are not so in essentials.

The analogy of the crystal most happily illustrates our views of correlation. With equal felicity it illustrates the opposing views of the evolutionist and the reversionist, respecting the main points in the controversy.

Suppose three crystals, similar in shape, to have been formed in a solution. The truncation of six of the edges of each has, in some manner or other, been effected. With these edges thus reduced, the crystals are found by a person anxious to prove the theory of evolution. He places them in solutions similar to those in which they were formed. The development of the lost edges then ensues. But, instead of allowing them all to develop, only a single edge in each crystal is suffered to reproduce itself; and this edge is in each crystal a different one. This is done in order to render the crystals as unlike as possible. Practically, however, this would be not a little difficult to effect. Our friend, imbued with the inquiring spirit of the age, now seeks to ascertain the cause of the growth of the edges. In his observation of the phenomena of crystallization, he has noticed that the growth of an edge is often due to reproduction. But this fact he now finds it convenient to forget. He at last affects to believe himself forced to conclude that the growth of the edges is an ultimate fact; and, at the same time, refers the phenomenon to evolution, an explanation which has the strong recommendation of being a mere re-

statement of the phenomenon to be explained. He next observes that, in each crystal, a new angle develops in correspondence with the angle first developed. This gives him two characters peculiar to each crystal. Recognizing a new factor in the induced development of the last angle, he propounds the law of correlation, and affirms that it concurs with and subserves evolution. The three crystals, originally alike, are now widely distinct. These varieties of crystals, exclaims our friend with the proud and patronizing smile of conscious superiority, present differences almost equally great with those displayed by species. Given, then, an indefinite number of hours and the requisite conditions, and all the species of crystals can be shown to evolve one from another. You cannot assume a limit to the development of parts, otherwise than gratuitously. There cannot possibly be any such thing as the immutability of the species; for individuals vary, and the species is composed of those individuals. This argument of our friend cannot be invalidated, if we concede that the growth of the edges forming the peculiarities of the varieties is new growth, is evolution, and that it is not reproduction. But it is obvious that it is reproduction, or reversion back to the state which existed previous to the truncation of the edges. It is equally obvious that correlation, or the growth of the last edge in correspondence with that of the former, is merely a return to more perfect coördination. It is also manifest to every physicist, that the absence from each crystal of the four edges which constitute the peculiar characters of the other varieties implies an imperfect coördination of the remaining parts. In other words, their absence involves a departure from a state of chemical integrity. For there can be a normal distribution of the forces of a crystal only when all the angles and parts are present, and proportionately developed. The views of the evolutionist are therefore wholly erroneous. For the principles of physics preclude the possibility of the normal existence of more than one variety. The existence of a plurality of varieties of a species implies disproportionate development of some of the parts. With crystals, however, varieties may normally exist when their differences are merely those of size. But the only way in which the relations of the parts can normally be changed is by a totally new distribution of the forces; which would involve complete dissolution, a modification of the force originally implied in the deposition of the first molecule, and reintegration. Now, just as, in a crystal, the loss of any part involves a departure from a state of chemical integrity, so, in an organism, the reduction, suppression, or disproportionate development of any part involves a departure from a state of physiological integrity. In the perfect type alone are the relations of the different parts perfect. The only way in which these relations could be normally changed, is by complete dissolution and new creation.

Not a little prejudice exists against a perfect type. This prejudice is, in a measure, justifiable, owing to the vague and gratuitous manner in which the perfect type has been assumed. But it cannot reasonably be extended to the perfect type which we here assume. This, of ours, is an individual in which all the characters of the species are fully and proportionately developed. It is no Platonic idea; we assume it to prove it; and it is no more metaphysical than the assumption for a crystal of a specific shape, which, owing to perturbations of the forces of the solu-

tion, it has been incapable of attaining.

In "A Theory of Population," propounded in *The Westminster Review* for April, 1852, Mr. Herbert Spencer defines life as "the coördination of actions." This definition is, equally with his others, exceedingly felicitous in every respect but one. It is not a definition of life, as it purports to be, but merely a definition of the conditions of life. In a note on page 74 of his *Principles of Biology*, wherein he repels the imputation of being a disciple of Comte, he declares that the conditions *constitute* existence. Recognizing the fact that the *onus probandi* rests upon him, he presents phenomena in an aspect which at first gives not a little plausibility to his view. But these phenomena derive all their significance from the circumstance that Mr. Spencer's readers concur in the conception of the evolution of variations. When this conception is demurred to, his arguments lose all their force. The theory of reversion negatives the validity of his premises; and the hypothesis of the conditions constituting existence is then sustained by no proof greater than that of gratuitous assertion.

But, whatever may be the diversity of opinion respecting the truth of Mr. Spencer's definition of life, there is none, at least between him and us, on the subject that "the coördination of actions" is a definition of the conditions of life. On this point both he and we are fully agreed. His belief that the definition is more than that which we concede, is a matter immaterial in connection with the argument immediately to be adduced. We wish now to observe which theory consists more with the definition, the theory of evolution or that of reversion.

The coördination of actions is the attribute which characterizes all organisms. All the parts of each organism must work in concert. "If one of them does too much or too little—that is, if the coördination be imperfect—the life is disturbed; and if one of them ceases to act—that is, if the coördination be destroyed—the life is destroyed." These remarks of Mr. Spencer more particularly refer to the *vegetative system;* but, as he shows, they are, with little modification, applicable to the *animal system.* He says:

> "How completely the several attributes of animal life come within the definition, we shall see on going through them *seriatim.*
>
> "Thus, *strength* results from the coördination of actions; for it is produced by the simultaneous contraction of many muscles, and many fibres of each muscle; and the strength is great in proportion to the number of these acting together; that is, in proportion to the coördination. *Swiftness*, also, depending partly on strength, but requiring, also, the rapid alternation of movements, equally comes under the expression; seeing that, other things equal, the more quickly sequent actions can be made to follow each other, the more completely are they coördinated. So, too, is it with *agility;* the power of a chamois to spring from crag to crag implies accurate coördination in the movements of different muscles, and a due subordination of them to the perceptions."

On page 61 of his *Principles of Biology*, he further assures us "that arrest of coördination is death, and that imperfect coördination is disease."

A superficial view of Mr. Spencer's definition would involve the inference that, upon the evolution hypothesis, only one of two things is possible. Either there is an ever-continuing imperfect coördination, or there is an always perfect coördination. As parts subserve actions, the perfect coördination of the latter must be dependent upon the perfect coördination of the former. Now, evolution implies a constant change. In fact, according to the hypothesis, constant change

is the only normal state. The variation of parts, then, would entail their imperfect coördination, and, consequently, the imperfect coördination of their actions; for the only conceivable way in which the imperfect coördination of actions is possible, is by a change in the parts subserving those actions. As variations, then, are ever occurring, imperfect coördination must always exist.

The following is the alternative view. The evolutionist might assume an ability in each organism to effect, on the occurrence of each variation, a re-coördination. This view manifestly admits only of perfect coördination. But the advocate of evolution may avoid these absurd conclusions by affirming, as he has tacitly done, that, while the organism is capable of coördinating any number of characters, imperfect coördination may ensue by a too sudden change in any part or parts. This is the issue which we desired to produce, the decision of which will, we conceive, legitimately preclude further argument. The question is, Is the organism capable of coördinating any number of characters? or, are all the characters of the species alone susceptible of coördination? The reader will perceive that the latter is a mere recurrence of our proposition that the proportionate development of all the parts is necessary to perfection, and that the absence of any part is deleterious to the organism. If we prove this, we shall have completely disproved the evolution hypothesis.

There is a fact adduced by Darwin which places the validity of our theory beyond all doubt, and which is, at the same time, grossly at variance with the conception of evolution. The fact to which we allude is, that good results from crossing. Observing this result, Darwin propounds a general law of nature, that all organic beings are benefited by an occasional cross. This law he employs as a somewhat important factor of evolution, and essays to harmonize it with his theory. In this attempt he succeeds. But mere congruity with a law is no proof of the validity of a theory, where that law is only an empirical one. Of this every person conversant with science is aware. It is equally well known, however, that when a theory is shown to accord with a law; to furnish an explanation of it; and to resolve it into a higher law, thus changing it from an empirical into a derivative law; proof conclusive and incontrovertible has been adduced. If the reader has not already mentally anticipated our argument, it remains for us to prove that the theory of reversion fulfils these requirements.

Our theory manifestly implies that the more proportionate the development, the greater is the approach to perfection. It also implies that the more characters of the species there are in each variety, the nearer is the approximation to perfect coördination. It is apparent at a glance, then, that crossing furnishes a crucial test of the truth of our views. For most varieties are distinguished from each other by the possession of positive features. The presence of the peculiar character of one variety, of course, implies its absence in the others. Each variety possesses a character or characters which the others lack, and lacks what the others peculiarly possess. When, then, two such varieties cross, good must of necessity accrue to their offspring. For, in the formation of the latter, each variety supplies a deficiency of the other. Could a reason be more obvious? or could proof of a view be more conclusive? So conclusive is it, we conceive, that were

any other result consequent on crossing, such a circumstance would be at variance with our theory.

Of the fact that good results from crossing, not a doubt can reasonably be entertained. Darwin, so far from questioning the fact, is its most strenuous advocate. But upon his conception, it is crossing *per se* which produces the favorable effects. In other words, this is another of Darwin's ultimate laws. Being purely empirical, the general law of nature which he assumes, fails utterly to explain the cause of the variations in the quantity of the effects. The crossing of pigeons, for instance, is attended by the greatest gain in constitutional vigor, while comparatively little good results from the crossing of the varieties of the horse, sheep, or cow. On our doctrine, the explanation is clear. The many widely distinct varieties of the pigeon necessarily imply great disproportionate development of each. They are, then, extremely susceptible of improvement. The races of the horse, sheep, and cow, on the other hand, approximate, as we have seen, to proportionate development. There is, therefore, much less room for improvement. Strikingly in harmony with this interpretation is the fact that, with pigeons, the more highly bred the crossed varieties are, the greater is the gain from a cross. Equally congruous is the fact that the more highly bred the breeds of the horse, cow, and sheep are, the less is the gain. The reason is, careful and select breeding produces increased divergence of character with pigeons; but with horses, sheep, and cattle it induces increased convergence. The former become widely distinct, while the latter converge in character. All the characters are developed in each variety of the latter; but in the former different characters are developed in different varieties. While, then, coördination in the horse, sheep, and cow advances toward perfection, coördination in the pigeon is rendered more imperfect by careful breeding. Each variety of the pigeon possesses a character which, when joined with those of another variety, will entail a great advance toward due coördination. This concurrence is effected by crossing, and the result is, as one would be led to expect upon our doctrine, great beneficial effects. With the horse, sheep, and cow the effects of a cross between varieties are less marked, owing to less imperfect previous coördination.

In noting the advantage accruing to crossed offspring, we have particularly referred to gain in constitutional vigor. We have occasion now to speak of gain in fertility. Seeing that hybrids—the product of a cross between species—are invariably sterile, it is clear that, if the conception that varieties are incipient species is a valid one, we are bound to expect that the more marked, distinct, and widely divergent varieties are, the greater will be their sterility. The mere circumstance that such an effect is not observable, goes far to invalidate the conception. What, then, must the inference be when an effect diametrically opposite to that necessitated by the conception is shown to result—when increased fertility is seen to follow crossing, and when this increased fertility is observed to be directly proportionate to divergence of character? Such results would, we apprehend, negative completely the hypothesis of evolution, and would conclusively confirm our view, that the beneficial effects are owing to the disproportionate development which a multiplicity of widely distinct varieties necessarily implies. These results we have, and they are indisputable. For the fact that crossing induces increased fertility, and

that this increased fertility is directly proportionate to divergence of character, is so well known that it is scarcely necessary to adduce proofs from Darwin in support of it. But that the least shadow of a doubt may not remain, we will quote a few of Darwin's remarks on the subject.

Constant reference to crossing may be found in any portion of his late work. But a somewhat lengthy chapter is devoted exclusively to this subject and to close interbreeding. In the conclusion of this chapter (p. 142, vol. ii.) he says:

"In the early part of this chapter it was shown that the crossing of distinct forms, whether closely or distantly allied, gives increased size and constitutional vigor, and, except in the case of crossed species, increased fertility to the offspring. The evidence rests on the universal testimony of breeders. . . . . Although animals of pure blood will obviously be deteriorated by crossing, as far as their characteristic qualities are concerned, there seems to be no exception to the rule that advantages of the kind just mentioned are thus gained even when there has not been any previous close interbreeding. The rule applies to all animals, *even to cattle and sheep*, which can long resist breeding in-and-in between the nearest blood relations. It applies to individuals of the same sub-variety, but of distinct families, to varieties or races, to sub-species, as well as to quite distinct species.

"In this latter case, however, while size, vigor, precocity, and hardiness are, with rare exceptions, gained, fertility, in a greater or less degree, is lost; but the gain cannot be exclusively attributed to the principle of compensation; for there is no close parallelism between the increased size and vigor of the offspring and their sterility. Moreover, it has been clearly proved that mongrels which are perfectly fertile gain these same advantages, as well as sterile hybrids."

On page 174, he reiterates these statements, which place the subject of increased fertility beyond all doubt.

Now, it is clear that Darwin's being necessitated particularly to note that the rule that advantage results from crossing obtains even in the cases of cattle and sheep, implies that comparatively little good accrues to the offspring from the crossing of the breeds of either of those animals. This shows, as the varieties of the sheep and cow are convergent in character, that the less divergent the varieties the less is the good attendant on crossing. The converse, that the more divergent the varieties the greater the good, is plainly seen in the case of the pigeon, of which the varieties are manifestly and confessedly the most divergent. The following assertions are unequivocal proof of our view:

"All the domestic races pair readily together, and, what is equally important, their mongrel offspring are perfectly fertile. To ascertain this fact, I made many experiments, which are given in the note below; and recently Mr. Tegetmeier has made similar experiments with the same result. The accurate Neumeister asserts that when dovecots are crossed with pigeons of any other breed the mongrels are extremely fertile and hardy. MM. Boitard and Corbie affirm, after their great experience, *that with crossed pigeons, the more distinct the breeds, the more productive are their mongrel offspring.*" (Page 236, vol i., American edition.)

Mere mention of crossing in connection with our theory would, we conceive, suffice. But if any doubts have been entertained of the conclusiveness of the proofs furnished by the law, or of the competency of the theory of reversion to account for the good resulting from crossing, they are now surely dissipated by the evidence adduced from Darwin. The law of crossing which we propound is no ultimate law. It fulfils every requirement of a derivative law. The good which flows from crossing varies in degree in different animals, as is well known. This is quite explicable upon our theory; and the amount of good accruing to the offspring from the union of two given varieties, is even susceptible of prevision. Crossing *per se* does not produce the increased good; it is attributable to the lack of full

and proportionate development. Of course, for increased good to result, each of the crossed animals must contribute to the formation of the offspring a part or parts which the other lacks. We have, then, given what Darwin's law, being purely empirical, is utterly incompetent to do—a rational and consistent interpretation of the variations in the quantity of the effects. Logic requires no greater proofs of a theory than those which we have here adduced.

Darwin has informed us, in his late invaluable work, that crossing induces the appearance of new characters. Great stress is laid upon this fact by several writers, and some of them, among whom Pallas is conspicuous, have even gone so far as to ascribe variability exclusively to crossing. The theory of reversion furnishes a rational explanation of the appearance of these characters. We do not allude merely to the fact that their reversion is more probable than their evolution; for Darwin inclines to this opinion rather than to the contrary one. On page 264, vol. ii., after demurring to the conception that variability is solely induced by crossing, he says:

"Nevertheless, it is probable that the crossing of two forms, when one or both have long been domesticated or cultivated, adds to the variability of the offspring, independently of the commingling of the characters derived from the two parent forms; and this implies that new characters actually arise. But we must not forget the facts advanced in the thirteenth chapter, which clearly prove that the act of crossing often leads to the reappearance or reversion of long-lost characters; and in most cases, it would be impossible to distinguish between the reappearance of ancient characters and the first appearance of new characters. Practically, whether new or old, they would be new to the breed in which they reappeared."

But there is another factor subserving evolution, to which we particularly allude. This is correlation, which we have seen reason to conclude exists, not only between different growths, but also between different centres of growth. Now, when a cross ensues, the offspring generally acquires from each parent a character or characters which the other lacks. The union of these characters strengthens the centres to which they are joined, and also all the centres of which the related parts are developed. By correlation, the centre to which these centres are most closely allied becomes more firmly established. The more firm establishment of this centre, then, induces the development of its formerly connected parts. These parts are the characters consequent upon crossing.

If, as we maintain, the proofs furnished by crossing are conclusive, then the phenomena of close interbreeding must be proofs amounting to demonstration. For the law of close interbreeding, which is the converse of that of crossing, also holds good; is, if possible, more in accordance with the theory of reversion; is also susceptible of resolution into the law of proportionate development; and, being a derivative law upon our theory, fully accounts for all the variations in the quantity of the effects. The different data, moreover, esteemed so mutually inconsistent, of those who concur in and of those who demur to Darwin's law of close interbreeding, can be shown, by the light furnished by the hypothesis of proportionate development, to be perfectly congruous. If we can prove, then, that our law of close interbreeding, founded upon the facts furnished by Darwin, is capable of all this, we shall have fulfilled our promise to place our theory beyond the reach of cavil.

As has been more than once asserted, our views necessitate the conclusion that a multiplicity of divergent varieties implies the loss in each of

what constitute the peculiar characteristics of the others. The circumstance that some few varieties are distinguished by the possession of negative features, but slightly modifies this conclusion. Now, it is clear to the comprehension of every one who is likely to have followed us this far, that, as the loss of any part or character is deleterious, the pairing of the members of a variety would tend to aggravate the evil consequent on the absence of the peculiar characters of the other varieties.

Quite in harmony with this view is the following assertion, one of a vast number of a similar kind made by Darwin: "The consequences of close interbreeding, carried on for too long a time, are, as is generally believed, loss of size, constitutional vigor, and fertility, sometimes accompanied by a tendency to malformation." (Page 115, vol. ii.)

Now, according to our theory, the evil effects of close interbreeding must be proportionate to the divergence of character; or, rather, to the disproportionate development which divergence involves. Darwin admits that different species of animals are differently affected by the same degree of interbreeding. Among species of which the varieties are divergent, the pigeon and fowl are preëminently conspicuous. Here, then, we must look for the greatest evil effects from the interbreeding of the members of the varieties. The facts fail not to realize our anticipations. No writers have expressed so strong a conviction of the impossibility of long-continued interbreeding as Sir J. Sebright and Andrew Knight, who have paid the most attention to the breeding of the fowl and pigeon. Darwin gives us, as the result of his wide experience and extensive research, the following opinion:

"Evidence of the evil effects of close interbreeding can most readily be acquired in the case of animals, such as fowls, pigeons, etc., which propagate quickly, and, from being kept in the same place, are exposed to the same conditions. Now, I have inquired of very many breeders of these birds, and I have hitherto not met with a single man who was not thoroughly convinced that an occasional cross with another strain of the same sub-variety was absolutely necessary. Most breeders of highly improved or fancy birds value their own strain, and are most unwilling, at the risk, in their opinion, of deterioration, to make a cross. The purchase of a first-rate bird of another strain is expensive, and exchanges are troublesome; yet all breeders, as far as I can hear, excepting those who keep large stocks at different places for the sake of crossing, are driven after a time to take this step." (P. 117, vol. ii.)

And again, on page 125, he says: "With pigeons, breeders are unanimous, as previously stated, that it is absolutely indispensable, notwithstanding the trouble and expense thus caused, occasionally, to cross their much-prized birds with individuals of another strain, but belonging, of course, to the same variety." He then dwells at some length upon the great delicacy of constitution entailed by the close interbreeding of nearly-related pigeons, and mentions a circumstance for which the reason is at once obvious upon our theory. He says, "It deserves notice that, when large size is one of the desired characters, as with pouters, the evil effects of close interbreeding are much sooner perceived than when small birds, such as short-faced tumblers, are desired."

"In the case of the *fowl*," says Darwin, "a whole array of authorities could be given against too close interbreeding." (P. 124, vol. ii.) Following this assertion is mention of the great sterility of bantams, induced by close interbreeding. He assures us that he has seen silver bantams almost as barren as hybrids. The Sebright bantam is destitute of hackles and sickle tail-feathers. This in-

volves disproportionate development; and that the evil is attributable to this, Darwin virtually admits when he says, on page 101, that the loss of fertility is to be ascribed "either to long-continued, close interbreeding, or to an innate tendency to sterility correlated with the absence of hackles and sickle tail-feathers."

Of all the phenomena attendant upon close interbreeding, we know of none which so strikingly confirms our view as the following curious case. It is a most delicate exemplification of our doctrine. "Mr. Hewitt says that with these bantams the sterility of the male stands, with rare exceptions, in the closest relation with their loss of certain secondary male characters;" he adds, "I have noticed, as a general rule, that even the slightest deviation from feminine character in the tail of the male Sebright —say the elongation *by only half an inch* of the two principal tail-feathers —brings with it improved probability of increased fertility." (Pp. 124.) The full significance of this singular fact the reader will at once appreciate. For the cause of the phenomenon is obvious. The increased probability of fertility, consequent on the growth of the secondary sexual characters, is owing to the induced return to proportionate development.

Darwin says, "There is reason to believe, and this was the opinion of that most experienced observer, Sir J. Sebright, that the evil effects of close interbreeding may be checked by the related individuals being separated during a few generations and exposed to different conditions of life." (Pp. 115.) Now, different conditions are, as we have seen, favorable to the development of different parts. Exposure, then, to conditions other than those to which their brothers are subjected, would lead to the growth or strengthening of certain parts in the separated animals. Interbreeding between members of the two lots of animals would, in consequence, be equivalent to crossing. The check to the evil effects is to be attributed to a slight dissimilarity of structure.

These quotations from Darwin place beyond doubt the fact that the greatest evil effects flow from the close interbreeding of fowls and pigeons. It now remains for us to show that, in animals which are comparatively proportionately developed, the evil effects are very small. It must be observed that it does not rest with us to show a total absence of evil. For no animals are, in all respects, proportionately developed. Our very ability to discriminate between different breeds necessarily implies the disproportionate development of all but one of them; that is, when their differences are not merely those of size. With cows, want of proportion is often caused by blind conformity in certain breeds to certain standards. Thus, when a breed acquires a reputation, all its points are faithfully preserved, as if the preservation intact of the existing condition of all the features was a *sine qua non* of the animal's good quality; and this occurs even when some of the features are shockingly out of proportion, or greatly reduced. If one breed were fully and proportionately developed, the others could be distinguished from it only by negative features.

Of the close interbreeding of the cow Darwin says:

"With *cattle* there can be no doubt that extremely close interbreeding may be long carried on, advantageously with respect to external characters and with no manifestly apparent evil as far as constitution is concerned. The same remark is applicable to sheep. Whether these animals have been rendered less susceptible than others to this evil, in order to permit them to live in herds —a habit which leads the old and vigorous

males to expel all intruders, and in consequence often to pair with their own daughters—I will not pretend to decide. The case of Bakewell's longhorns, which were closely interbred for a long period, has often been quoted; yet Youatt says the breed 'had acquired a delicacy of constitution inconsistent with common management,' and 'the propagation of the species was not always certain.' But the shorthorns offer the most striking case of close interbreeding; for instance, the famous bull Favorite (who was himself the offspring of a half-brother and sister from Foljambe) was matched with his own daughter, granddaughter, and great-granddaughter; so that the produce of this last union, or the great-great-granddaughter, had fifteen sixteenths, or 93·75 per cent, of the blood of Favorite in her veins. This cow was matched with the bull Wellington, having 62.5 per cent of Favorite blood in his veins, and produced Clarissa; Clarissa was matched with the bull Lancaster, having 68.75 of the same blood, and she yielded valuable offspring. Nevertheless, Collings, who reared these animals, and was a strong advocate for close interbreeding, once crossed his stock with a Galloway, and the cows from this cross realized the highest prices. Bates's herd was esteemed the most celebrated in the world. For thirteen years he bred most closely in-and-in; but during the next seventeen years, though he had the most exalted notion of the value of his own stock, he thrice infused fresh blood into his herd; it is said that he did this, not to improve the form of his animals, but on account of their lessened fertility. Mr. Bates's own view, as given by a celebrated breeder, was, that 'to breed in-and-in from a bad stock was ruin and devastation; yet that the practice may be safely allowed within certain limits when the parents so related are descended from first-rate animals.' We thus see that there has been extremely close interbreeding with shorthorns; but Nathusius, after the most careful study of their pedigrees, says that he can find no instance of a breeder who has strictly followed this practice during his whole life. From this study and his own experience, he concludes that close interbreeding is necessary to ennoble the stock; but that in effecting this the greatest care is necessary on account of the tendency to infertility and weakness. It may be added that another high authority asserts that many more calves are born cripples from shorthorns than from any other and less closely interbred races of cattle." (Pp. 117, 118, vol. ii.)

This last phenomenon is doubtless due to correlation between the legs and the small development of the horns.

Now, these remarks of Mr. Darwin unequivocally show that extremely long-continued close interbreeding is possible with cattle. They also acquaint us with the fact that, although this may long be carried on, evil at length begins to manifest itself. This is easily explained. A small want of proportion in the animals interbred entails evil, but evil too small in amount to be capable of manifesting itself at once. But continued exacerbations, consequent on frequent pairing with related individuals possessing an evil identical in kind, so augments the evil as eventually to involve its display.

If further proof of the possibility of the long-continued interbreeding of cattle is needed, it may be found on page 44 of *The Westminster Review* for July, 1863. This review is the stronghold of Darwinism. The writer of the article to which we refer says, that "Dr. Child gives the pedigree of the celebrated bull Comet and of some other animals, bred with a degree of closeness such as no one who has not studied the subject would believe possible. In one of these cases, the same animal appears as the sire in *four* successive generations." So striking is the pedigree of Comet, that the writer cannot refrain from inserting it.

The sheep is another animal in which there is an approximation to proportionate development. Let us see, then, if our doctrine equally obtains in this case. Before going further, we may request the reader to call to mind Darwin's assurance that his remark, "that extremely close interbreeding may be long carried on with cattle," is equally applicable to sheep.

On page 119, vol. ii., he remarks that,

"With *sheep* there has often been long-continued close interbreeding within the limits of the same flock; but whether the nearest relations have been matched so frequently as in the case of shorthorn cattle, I do not know. The Messrs. Brown, during fifty years, have never infused fresh blood into their excellent flock of Leicesters. Since 1810, Mr. Barford has acted on the same principle with the Foscote flock. He asserts that half a century of experience has convinced him that when two nearly-related individuals are quite sound in constitution, in-and-in breeding does not induce degeneracy; but he adds that he 'does not pride himself on breeding from the nearest affinities.' In France, the Naz flock has been bred for sixty years without the introduction of a single strange ram."

In connection with this subject *The Westminster Review* says that,

"M. Beaudouin, in a memoir to be found in the *Comptes Rendus* of August 5th, 1862, gives some very interesting particulars of a flock of merino sheep bred in-and-in, for a period of two and twenty years, without a single cross, and with perfectly successful results, there being no sign of decreased fertility, and the breed having in other respects improved."

Of all animals, the horse is manifestly the most proportionately developed. In him all the parts maintain, to a great extent, the due proportions. Our doctrine, then, leads us to expect that, in this case, little evil results from close interbreeding. We would be greatly surprised that the horse was not the most striking instance of the possibility of long-continued in-and-in breeding, were we not conscious of the fact that a great portion of the evil eventually resulting from close interbreeding is attributable to augmentation of the diseases to which the horse is singularly susceptible. The following is the only evidence we shall adduce in the case of the horse; but it "is clear and decisive":

"Mr. J. H. Walsh, well known, under the *nom de plume* of Stonehenge, as an authority upon sporting matters, says distinctly, in his recent work, that nearly all our thorough-bred horses are bred in-and-in." (*Vide West. Rev.* for July, 1863, p. 44.)

"Writers upon sporting matters are pretty generally agreed that no horse either bears fatigue so well or recovers from its effects so soon as the thorough-bred, and it is a subject upon which such writers are the best of all authorities. Thus, 'Nimrod' concludes a comparison between the thorough-bred and the half-bred hunter in the following words: 'As for his powers of endurance under equal sufferings, they doubtless would exceed those of the 'cock-tail,' and being by his nature what is termed a better doer in the stable, he is sooner at his work again than the others. *Indeed, there is scarcely a limit to the work of full-bred hunters* of good form and constitution and temper; and yet these, as we have seen, are almost all close bred." (*Ibid.* p. 45.)

The mention of "good form" is a fact of significance; for the current conception of symmetry is, in the case of the horse, a safer criterion of proportionate development than in the case of any other animal.

In all the discussions on close interbreeding, no case meets with such frequent mention as that of the pig. Those who endeavor to gainsay the conclusion that evil is attendant on in-and-in breeding, signally fail to invalidate the fact that pigs die out altogether after being bred in-and-in for several generations. Those persons are the exceptions, however, who consider the fact as questionable. On page 121, vol. ii., Darwin says, "With *pigs* there is more unanimity among breeders on the evil effects of close interbreeding than, perhaps, with any other large animal." He then gives quite a number of facts, which we will not quote, as they are indisputable.

Close interbreeding being attended, in pigs, by evil effects is, at first sight, at variance with our doctrine. For, not only does utility guide the selection of pigs, but they are, as Darwin has informed us, the most striking instance of convergence of character.

We have seen the greatest evil effects of in-and-in breeding in those species in which selection is guided by fancy, and of which the varieties were the most divergent in character. A superficial consideration, then, would lead one to expect that, where the converse obtained—where utility was the motive in selection, and where the varieties were convergent in character—interbreeding would entail little or no evil effects. But the incongruity between the facts and the doctrine is only apparent, not real. There is presence of evil effects, because, in this case, the motive of utility and convergence of character also involve disproportionate development. Disproportionate development is the only never-failing criterion. In our last article we showed that, while divergence of character is solely caused by disproportionate development, convergence of character may be induced by either proportionate or disproportionate development. We further showed that the pig's convergence of character is caused by disproportionate development, and that the pig has many characters either wholly or partially suppressed. Its coat of bristles is greatly diminished, and its tusks are wholly reduced. Owing to a misguided policy, its legs are of the smallest possible size, and, by correlation, the front of the head is remarkably short and concave. Being, then, thus disproportionately developed, the pig, of all large animals, must be, upon our doctrine, the most susceptible of evil from close interbreeding. Allow the legs to be of proportionate size, and a marked decrease in the evil entailed by interbreeding will be observable. So impressed are we with the idea of the truth of our doctrine, that we will stake its validity upon the result, confident that, in doing so, we venture nothing.

That the cause assigned for the lessened fertility and delicacy of constitution of pigs is a true one, is placed beyond all doubt by the fact that, with those members of the species of which but little care is taken, there is comparatively very little evil entailed by close interbreeding. The reason lies in the circumstance that, in these animals, the legs are far more proportionately developed than in well-bred pigs; and that there is absent the shortness and concavity of the front of the head. The more well-bred the animals, the greater are the injurious effects of in-and-in breeding. This fact needs not proof; it is too well known. Care in breeding pigs almost invariably induces the small development of the legs and of the front of the head. A case somewhat analogous is presented by the fowl and pigeon. With them, the more careful the selection, the greater are the evil effects of interbreeding. With cattle, sheep, and horses, however, good breeding is a condition *sine qua non* of their exemption from the evil generally consequent on close interbreeding. Why care should be attended by different results in different species, is at first not clear. But this is the explanation. In fowls and pigeons, care in the formation of varieties induces greater disproportionate development by augmenting the divergence of character. In cattle, sheep, and horses, on the contrary, care, by inducing greater convergence, causes increased proportionate development. This convergence, be it remembered, is attributable to a cause other than that which creates the convergence of character of the breeds of well-bred pigs.

We incline to believe that the extremely small amount of evil attendant on reduced size never manifests itself by close interbreeding. That some evil, though inappreciably small, does result from reduced size, may

reasonably be inferred from the fact that, where animals disproportionately developed are crossed, increase in size follows, and that, where those animals are closely interbred, decrease in size results.

We are assured that there are cases in which crossing, instead of resulting in good, induces evil effects. Darwin says he has not met with any well-established case, with animals, in which this occurs. Now, our theory contemplates such evil effects under the following circumstances. The varieties crossed must each be distinguished from other varieties by a negative feature. In addition to this, they must lack features in common. The evil resulting would then be attributable to the same cause which induces the evil consequent on close interbreeding.

It is now clear that these phenomena of crossing and close interbreeding tell a tale the direct converse and refutation of that which Darwin would have us believe. They are manifestly, grossly, absolutely, and irreconcilably at variance with the doctrine of evolution. They show conclusively that no divergence of character is normally possible; that all the characters of the species are alone susceptible of perfect coördination; that the exclusive possession of any positive character by any variety is to the detriment of the other varieties; that the possession of any negative feature is deleterious to the organism; and that there can normally exist but one variety—the perfect type, that variety in which all the positive features are fully and proportionately developed. These conclusions cannot be gainsaid; for they irresistibly force themselves upon one by observation of the phenomena of crossing and close interbreeding, furnished by Darwin.

We have now propounded a counter-theory and a refutation of Darwinism. In doing so, we have introduced no new factors. We have used only those with which Darwin has furnished us. There are, however, three factors recognized by Darwin which we have eliminated. These are an innate tendency in organisms to vary, evolution, and the law of compensation of growth. Of these, the first is confessedly unscientific; the second, irrespective of the well-founded doubt as to whether it obtains or not, must share in the same discredit which is accorded to the first; and the third is viewed with distrust even by Darwin himself. The factors, however, which we have retained must be conceded to be immeasurably more amenable to the canons of scientific research, upon the theory of reversion, than when they are adduced to subserve the hypothesis of evolution. In our treatment of them they have fulfilled the highest requirements of logic. Take, for example, the four principal laws involved in the controversy—variation, correlation, crossing, and close interbreeding. These we found ultimate or empirical laws, and left them derivative laws. The law of variation we resolved into the law of reversion; and the laws of correlation, crossing, and close interbreeding we resolved into the law of proportionate development. Now, it is not possible for a theory to be capable of all this, and yet to be false. If the laws upon which we based our theory were merely empirical, a doubt of its validity might reasonably be entertained. But, as the case stands, it cannot.

But—may exclaim a tyro who affects a love for science, and whose conception of biology is limited to protoplasm and cells—assuming that the hypothesis of reversion is vastly more conformable to the phenomena of variation than the hypothesis of evolution, yet your theory fails to supply

the greatest requirement of biologic science. It fails to satisfy our yearnings after a knowledge of the development of the species. Darwin starts with cells, the lowest congregations of organic matter. Because he does this his theory is, at least philosophically, the more scientific.

But, even in this respect, our theory is more philosophical than that of Darwin. Darwin assumes three or four cells, and intrusts spontaneity or chance with the development of the species. We assume, not "a myriad supernatural impulses" going to the formation of each species, not the creation of each species in its maturity, but one cell alone for each species, (or, perhaps, one cell for each sex of each species.) For evidence of the fact that the assumption of a multiplicity of cells is more philosophical than the assumption of only three or four, we appeal to an article in the *North American Review* for October, 1868, entitled "Philosophical Biology," of which the writer is a professed Darwinian, and to G. H. Lewes's articles in the *Fortnightly Review*. Given, then, these cells, we intrust the development of the species, not to spontaneity or chance, but to the operation of laws similar to those obtaining in the crystal. The forces implied in the creation, formation, or existence of each cell determine, as in the case of the crystal, the whole form and structure of the species. The process of development is that predetermined, from which no departure is normally possible. Time, however, is an unimportant element. This kind of evolution of the species we concede. That which we deny is the evolution of the species one from another.

In conclusion, we cannot refrain from stating that our views are quite consistent with a high admiration of the great ingenuity and vast research displayed by Mr. Darwin. His desire to be frank and candid none can gainsay. For the ability of Mr. Spencer, who is somewhat less candid, but immeasurably more so than the petty retailers of his conceptions, we have the deepest respect. His exquisitely constructed mind we ever delight to study. Both Mr. Darwin and Mr. Spencer have rendered great services to the cause of science. And we must in candor admit that the British "infidels" generally present their theories in a form which admits of their eventual confirmation, or their eventual refutation. As we are confident that their refutation will follow whenever they are really at variance with religion, we anticipate with pleasure many a warm but amicable controversy within the next half-century.