ON

# THE HARMONY

OF THE

# COMPREHENSIBLE WORLD.

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*SAPERE AUDE.*

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LONDON:

1845.

# PREFACE.

An unprejudiced examination of the connexion between the different sciences, which are treated by practical philosophers as distinct departments of human knowledge, will lead to the conclusion, that they are all portions of one complete harmony, and that the end of each series of events in the great system of Nature is the beginning of another. No modern naturalist believes that botanical or zoological phenomena are independent of the laws of chemistry and physics, or that astronomical changes can be disconnected, in a compendious scheme of cause and effect, from those which depend upon the elective affinities of minute portions in each distinct heavenly body.

That a continuously *self-sustained development of gradually varied forms* prevails throughout Nature, is one of the hypotheses necessarily suggested by a belief in the existence of the perfect

harmony of her laws, not only in reference to zoology and botany, but to general physics, chemistry, astronomy, and every other branch of the mixed sciences; and it may be proved that this speculation about a *progressive development* may be extended to our most refined schemes of ontology and metaphysics.

The object of the following essays is to classify the evidence in support of such a doctrine, and to throw back the point of departure in the inquiry to our most elementary notions about primary substance, and the energetic or framing power of Nature. The proposed arrangement of the general argument commences with the attempt to investigate our most simple ideas, in regard to form and number, *in the abstract;* and proceeds to the application of the results of the analysis:—first, to general *physical* phenomena; secondly, to admitted *phrenological* and *psychological* facts, as regards the gradual development of mental faculties in animated bodies; thirdly, to those mysterious dogmas, which pervade the religious traditions of antiquity, but which are not inconsistent with an unprejudiced review of ancient and modern metaphysical opinions.

The whole scheme exhibits a connected system of mathematical, physical, physiological, metaphysical, and theological propositions, in which one omnipresent and unerring immaterial mind is con-

sidered the *universal* originating cause of the existence of every species or class of *individual* essence, be it inanimate or animated—material or spiritual. The inquiry induces a belief in the reality of a Supreme Creative energy, which is constantly engaged in promoting the *automatic* development of *successive series* of individual beings, whose qualities may at last hold some remote phrenological relation to those of the omnipresent Divine Intelligence, when their sensation and volition become more or less independent of the slavish instincts which are connected with mere physical necessity.

In the present volume the investigation does not advance beyond the domain of physics and elementary chemistry, and the first principles of physiology; in another, already prepared for the press, the argument is extended to those more recondite questions of psychology, which must be connected with every phrenological scheme of sensation and volition, and the generation of ideas.

The still more delicate subject of natural and metaphysical religion, in reference to the progressive development of mental faculties in created beings, and their capabilities of comprehending the mysteries of Superhuman Power, or of availing themselves of the highest gifts of a Divine Providence, is only cursorily hinted at in the second volume. In the existing condition of human

society, it would be rash to publish speculations which interfere with the conventional disinclination to examine the bearing of generally admitted facts upon such questions.

But no such scruples should be allowed to interpose between the soul-denying materialist, who believes himself to be the model of the whole macrocosm, or who makes his God the mere counterpart of his own limited intelligence,—and the more humble-minded searcher after truth, who is convinced, that there are mysteries in the universe far beyond the scope of human reason. Many modern naturalists, who establish physical limits to philosophical investigation, confine their inquiries to phenomena alone, and parade a pedantic horror of speculation upon the highest conceivable causes of such phenomena, while they endeavour to find an excuse for their *absolute* method of scepticism, by affirming that they do not meddle with metaphysics. Yet, they are always upon the frontier of metaphysical inquiry, when they talk of *ultimate* atoms. The assumption that these distinct atomic material individuals are realities, involves a necessity for the existence of interstices between them; the special conditions of such interstices are legitimate objects of physical meditation. It is is *physical* problem, whether these interstices are filled by matter, or are void, —whether the atoms are subject to change, or

are eternally the same,—and whether they are composed of the same substance as that which may fill up the interstices between them, or of some substance which is essentially different.

As materialists deal with physical forces in all physiological questions, they are inconsistent in dismissing these difficulties, under the pretence of their being metaphysical; and when they endeavour to depreciate the labours of others, who may be more speculative than themselves, their didactic mode of imposing limits to scientific inquiry, resembles that of the bigot in religion, whose denunciations against the liberty of thought are the constant theme of their own severe animadversions.

The professed metaphysician, who looks down with a mystical pity on the materialist, is equally unreasonable; and unless he condescend to examine the instincts of animals, and of his own race, in reference to the faculties of the mind, he is wholly disqualified from reasoning by analogy. In Hume's Essays, where he boldly enters into the most abstruse disquisitions upon abstract power, and cause and effect,—his ignorance of the first principles of natural science appears in the whole argument. But metaphysics and physics are inseparably connected. The human mind and its powers are dependent, to a greater or less extent, upon the matter which constitutes the nervous system of the human

body; and the *elementary* energies of matter must be in constant activity, as *mediate* causes of phenomena, whether the simplest law of chemical combination, or the most transcendental faculties of the *human* mind, be the subject of our investigation.

When we reason by analogy, we have *primâ facie* grounds for the assumption, that as the laws of nature exhibit an universal order and arrangement, which is precisely similar to a plan conceivable by a human mind, so far as our bounded intelligence is capable of understanding it,—there is something in common between our minds and the Universal Mind. And although we cannot comprehend the essential character of that all-presiding influence, we may infer that it is not the same thing as matter, because matter, in its totality, is subject to it.

But in our attempts to discover the physical causes of material phenomena, we arrive at last at the notion of individualised atomic forces, which may be regarded as constituent germs of the whole scheme of nature; and as it is possible to imagine a non-atomic condition of matter, which enables it to fill up the interstices between ultimate atoms, we are strictly within the limits of true philosophy, when we suppose the atom itself to be a generated entity, having a temporal beginning and an end, in relation to its form, to its every quality, and indeed

to its individual being, without thereby assuming that the substance out of which it is composed, was not a pre-existing material applied to such a purpose. This hypothesis, however, cannot be suggested without giving rise to the inquiry of whether the *primary* substance does not occupy space universally ; the materialist, therefore, who halts when the interstices between atoms are the subject of inquiry, is incorrect in declaring that such a question is a metaphysical problem. The problem involved in the relations of matter to space, is one of physics ; and when we endeavour to account for the generation of the atom, we are still employed in the consideration of physical laws, although the attempt to connect the order of nature with *mind, as its cause,* leads us up to that stage of philosophy, which may be termed metaphysics in the ordinary phraseology of science.

The general term metaphysics is applicable to two distinct branches of scientific study,—the one being connected with an inquiry into the attributes, power, and subjection of mind in animated bodies, where the elements of physics and psychology must be regarded as intimately dependent on each other ;—the other having reference to those *ideas,* which are altogether independent of matter and of mere physical laws.

It is only in relation to our ideas of logical, metaphysical, and mathematical truths, that abstract

elements of the higher order can be considered apart from the physical phenomena which depend upon them. The *absolute* existence of these *model truths* is equally clear to our comprehension, whether they be connected with physics, or treated as pure abstractions. They should be analysed in their purely ideal character, before any attempt is made to reconcile our theological opinions with the observations of the naturalists: the more deeply we meditate upon them, the less likely shall we be to fall into errors like those of the savage, who believes that an eclipse of the Sun is the *immediate* act of the Supreme Being, or to attribute the existing form of any specific material individual (or of the first individuals in any specific series of animals or vegetables, which is continued by the automatic agency of their parents) to a sudden and *human-like* interposition of that One incomprehensible Disposer of events, who acts through the instrumentality of the instinctive aptitudes which he has attached to material substance. The whole scheme of Nature will then appear to be one well-connected system of cause and effect, the plan, and the maintaining energy of which depend *essentially* upon the intelligence and power of the Almighty.

Plato, in his "Parmenides," has entered more deeply into the transcendental metaphysics which lead to the study of the First Cause, than any other ancient or modern writer. The careful perusal of

that master treatise in dialectical reasoning, ought to convince the materialist, that there are stages on stages in the higher branches of philosophy where the human intelligence may exercise its phrenological powers without the guidance of phenomena, but with as legitimate and perfect a reliance upon the certain connexion of the arguments, as if it were dealing with physical experiments or physiological observations.

It is in such efforts to investigate the connexion of the ideas which are independent of physical sensation, that we discover proofs of the existence of an incorporeal world. By gradually advancing from the contemplation of matter and its instinctive laws, to that of the *one design* which pervades the entire system of Nature,—while we ponder upon abstract truths as a category still more sublime, because every principle can only be understood as an eternally-existing Ideal Essence, whose *absolute being* is necessary to the harmony of Nature,—we may at last attain the metaphysical limits between physics and the inexplicable mysteries which are connected with a purely spiritual condition of existence.

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The third of the following Essays was printed, but not published, in 1842, as a separate treatise. The second Essay, on the "Outlines of a Physical

Theory," was an appendix to that treatise on Numbers: but as the form in which it was printed, was inconvenient,—in consequence of the number of notes,—it has been entirely remodelled, and the greater portion of its notes have been embodied in the text.

During the interval a compendious work has made its appearance under the title of "Vestiges of the Natural History of the Creation." That very popular publication is not only remarkable for the grasp of mind which it exhibits, but for the skilful arrangement of information, communicated in language as appropriate as it is elegant; and its author has been successful in a well-sustained endeavour to direct public attention to some of the most interesting problems in Natural History. Although a fellow-labourer in the pursuit of the same object, the writer of the following Essays entertains no hope of meeting with the like success: his attempt to discover an elementary basis for the theory of "gradual development," which is so artistically delineated in the "Vestiges of Creation," has involved him in a succession of calculations and minute details upon form and number in the abstract. Even with respect to his physical hypothesis, where he endeavours to extend the theory to first principles in chemistry, he has found it necessary to adopt a method which may be tedious to those who, under the guidance of the

author of the "Vestiges," have commenced their survey of Nature, by meditating upon astronomical harmonies.

The general title prefixed to the present volume was selected in preference to one which might have appeared more simple and euphonious, but which would have been inaccurate. There is an incomprehensible as well as a comprehensible world. The "Universe" includes both one and the other: but to have termed this series of Essays a treatise "on the Harmony of the Universe," would have justly exposed the writer to the charge of arrogance. The *universe*, as a whole, is beyond human comprehension, whether it be considered metaphysically or theologically.

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THE reader is recommended to make the following corrections, more especially as regards the cyphers, before perusing the volume.

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## CORRIGENDA.

### FIRST ESSAY.

PAGE

xi. Fourth line from below, for "is," read "*in*."

xxxv. In note, sixth line from below, for "may deduced," read "may *be* deduced."

lix. Eighth line from below, for "collape," read "*collapse*."

lxi. Eleventh line from above, for "EH*b*," read "EHG."

### SECOND ESSAY.

lxxii. Fourth line from below, for "Boscovitz," read "*Boscovich*."

cxi. Thirteenth line from above, for "weight," read "*eight*."

cxvii. Thirteenth line from above, for "circle of latitude," read "*circle of its latitude*."

cxxx. Tenth line—and cl, fourteenth line from below, for "hypothecated," read "*hypotheticated*."

cxxxiii. Fifteenth line from bottom, dele "attraction and."

cccxiii. Fifteenth line from below, for "Johnstone," read "*Johnson*."

cccxxvii. Eleventh line from below, for "however *he* exalted," read "*however exalted*."

### THIRD ESSAY.

15. Last word in note, for "hyperbola," read "*ellipse*."

41. Second line from below, for "7 and 8," read "2 and 8."

56. Ninth line from below, for "or," read "*on*."

58. Fifteenth line from below, for "proceding," read "*proceeding*."

61. Thirteenth line from below, for "left," read "*right*."

64. Second line in note, for "next chapter," read "*next Essay*."

79. In upper circle of the septuple figure, *transpose* the cyphers 3 and 5.

126. In diagram, alter the second circle from below, in the left hand column, as follows.—

$$\text{For}\quad \begin{array}{c} 4 \\ | \\ 3-10-33 \\ | \\ 6 \end{array} \qquad \text{read} \qquad \begin{array}{c} 4 \\ | \\ 3-6-18 \\ | \\ 7 \end{array}$$

129. Thirteeth line from below, for $\frac{40}{143}$ read $\frac{40}{146}$.

### FOURTH ESSAY.

141. Thirteenth line from above, for "indicatives," read "*indicators*."

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Earth in the same manner as the Sun does; that is to say, by a direct, not by reflected influence: and their distance from us is so great, that any magnetic influence of theirs must be very weak, although we see them. Not so the effect of the planets, which from their size or proximity are able to cast a shadow on the Earth's surface.

The astral influence for which we are contending, is not that empirically-imagined power, which is called malignant or benign in astrological tradition, according to the star from whence it proceeds; but a physiological force of an uniform character, the relative conditions of which may depend on the bulk of the planet, the contraction of its atoms, and its varying distance from the heavenly body, with the surface of which it sympathises. It may be, that where the distance is very variable, as in the case of Mars, there is a more irregular agency at work than in that of Jupiter, where, although the bulk is greater, there is less variation in its distance from the Earth; but this may be scientifically explained. That the planets have a magnetic influence is incontestable, if the Moon be so endued; and that the two constant forces of gravitation in the Moon (one of which raises the tides, whilst the other occasions irregularities in the Earth's movements) are altogether different from this reflected and occasional magnetic influence, is evidence in favour of a distinction between the *magnetising* power of such a planet as Jupiter, and the interference of his *gravitating* force with the motions of our globe.

## SECTION XVI.

*On the origin of species, and the theory of their transmutation.*

GEOLOGISTS are almost unanimous in maintaining,

1st. That every species, genus, or family of plants and

animals has been formed or developed within an appreciable period; and

2ndly. That, as regards the appearance of both sorts of living beings (vegetables and animals), there has been a gradual development, in which the *direction* of the general progression exhibits a continuous tendency to improve:—the most modern species being a more complicated system of organization than any other which was developed previously.

But before geology furnished such decided inferential evidence in favour of the botanical or zoological systems being the manifestations of one general progression, anatomy had established the doctrine,—that existing plants or animals are the links of two great categories, in which certain leading principles of arrangement are dominant; and that the differences between the highest and lowest individuals in either of these departments of organic beings might be accounted for, when the intermediate links were examined. Some of these connecting species, however, are extinct; but subsequent geological discoveries supply the deficiency in many instances, by bringing to the test of ocular observation, the remains of plants or animals which were wanting to complete a series. Thus genera, and orders of animals supposed by the naturalists of the last century to be entirely distinct, are now connected in well-considered systems of classification by the remains of such extinct species as the Sivatherium. Newly discovered living animals (the Ornithorincus and others), have also contributed to fill up the voids in the older schemes. It may, therefore, be laid down as a general rule,—that throughout nature, there has been, and *still is*, a constant tendency to advance in the improving ratio from the simple to the complicated.

This conclusion is an important analogical argument in support of the opinion, that *species* of a genus hold the same general relation to each other, as that which exists

between *varieties* of a species; in other words, that the individuals of one species derive their origin from those of another, through the intervention of numerous intermediate races during a very long period; while the difference between the two species in question, is the result of a gradual succession of very slight changes in the organization of each race. This hypothesis may be extended to the annihilation of any *permanent* characteristics of genera, families, orders, or classes of animals and vegetables.

Should such a doctrine be correct, we are obliged in consistency to admit, that all the higher animals (man included) derived their origin from some lower and less complicated forms of animated material systems,—more especially if it be a general principle, that the progression is one of continuous improvement throughout the entire solar system. It is a further deduction from this premise, that there are as many chances in favour of the development of an animal organization, more perfect than that of the most highly gifted human creature, and of its existing on this globe at some future period,—as there are, or have already been, different genera or species of animal inhabitants upon its surface.

Thus the question of the *origin* of a species is resolved at last, by this method of reasoning, into the following problem:—

*How was the* first *individual of a succession generated, supposing it to have been the aboriginal ancestor of a continuously improving series of descendants?*

While we dispassionately investigate this subject, it may be satisfactory to review the arguments for and against the doctrine, that every species is capable of permanent change. There is no question in philosophy which has more engaged the attention of the first authorities in natural science, nor one upon which men of undoubted philosophical ability have been more divided.

Tiedemann is one of the naturalists who have discussed

it the most at length. In his treatise on "Human Physiology," he has published a compendious dissertation upon the parallelisms between living and inert or inorganic bodies. Not only does he support the doctrine of the gradual automatic progression of the animal and vegetable systems, and the improving transformations of simple species into those which are more complicated, and therefore more perfect; but he believes in the *spontaneous* generation of the lowest or most simple forms of an organic body.

He says, Book I. sec. xx. "If we extend our inquiries, we have to determine how organic substances, their different combinations, and living bodies, are formed in our planet. The solution of this problem is not to be aided by our experience; and when we endeavour to solve it, we are obliged to establish hypotheses, which may be more or less plausible; but they have not the value of certainties. We suppose,—either that organized bodies have existed upon the Earth from its commencement,—or, that organic substances and living bodies have been formed out of inorganic elements and substances, by the action of physical causes, under certain circumstances,—or that the substance of living bodies was originally contained in water, as primitive organic matter endued with the quality of assuming organic forms; that it has given birth to very simple organic bodies, varied by circumstances; and that these bodies have passed successively into more complicated forms, until, in consequence of the development of generative organs, and manifestations of other active functions, they were enabled to keep up the specific succession, by the faculty of generation."

He then says,—the first of these hypotheses (which assumes that organic bodies have existed upon the Earth from the first moment of its creation), is hostile to geological observation.

He objects to the second hypothesis,—which supposes that inorganic matter could become organic, because no observation justifies its adoption, as we have never witnessed any phenomenon capable of furnishing an analogical argument in its favour. He inclines to the third hypothesis,—that the substance of organic bodies existed primevally in water, as matter of a particular sort,—that it had "a *plastic faculty*, that is to say, the power of acquiring, by slow degrees, different simple forms of living bodies, when aided by the general influences of light, heat, perhaps of electricity, &c., and of their passing from such simple to more complicated forms, varying in accordance with the modifications of external influences, until at last each species acquired a durable character in consequence of the activity of its generative organs."

Now in reviewing this opinion to which he attaches himself, we cannot fail to observe the want of extension in his analysis of phenomena. In such recondite questions, it is impossible to avoid beginning in an hypothesis; he so begins: he commences, however, with the geological argument, which is undoubtedly most important: but he never inquires how water itself was formed; and he takes no notice of any astronomical question connected with the origin of the planetary body which we inhabit. As *water* is not a simple chemical substance, his self-imposed limitation, which makes *that* compound of oxygen and hydrogen the primeval medium, is the more extraordinary.

The consequence of this has been his adoption of a circumscribed *plastic* theory. Such a theory, so far as it goes, is supported by the phenomena both of physiology and geology, nor is it hostile to some chemical and astronomical theories. But if it be admitted, the same method of argument leads to the adoption of his second instead of his third supposition, or rather to that of the second and third as members of the same hypothesis,—

namely, that *inorganic matter, under certain circumstances, is so acted upon by a general* plastic *force, that it becomes organic.* If the progression of complication began long before any planet was in existence, the *first* comprehensible physical or chemical manifestation of action, is as much part of the progression, as the *transmutation* of the non-generating organised body into one capable of maintaining the species by generation, is; and there is an analogy between the force of the germ in the egg of a bird, and that of the original force which occasioned the development of each atom in the solar system.

Thus that potential or latent energy, which Tiedemann ascribes to organic matter suspended in water, according to his idea of "a beginning," and which, he believes, is capable of being at last developed as the active cause of vitality and of intellect itself,—is only a link in the chain of forces, which, according to our more extensive hypothesis, pervades the entire system of material activity.

In his twenty-fourth section, he says: "another circumstance favourable to the hypothesis of the gradual development of organic bodies, from the most simple to the most complicated, is the fact,—that all vegetable and animal bodies appear in their most simple forms at the moment of their generation, or when their germs advance to maturity; and that it is only by degrees that they acquire the complication of form peculiar to each species. To begin under simple conditions, and to advance towards those which are most complicated, is the general property of all symptoms of life, whether a single individual or the entire zoological world be the object considered."

These opinions in favour of the continuous improvement of successive generations, have been less adopted in England than in other parts of Europe. Our most eminent living geologists are inclined to believe, that each existing species is a distinct system, the first individuals of which

were created with the same forms, or nearly the same, as those which are its present characteristics.

Professor Buckland, who has done more to make geology popular in England than any other writer, says, in his *Bridgewater Treatise,* " In these most ancient conditions, both of land and water, geology refers us to a state of things incompatible with the existence of animal and vegetable life: and thus, on the evidence of natural phenomena, establishes the important fact, that we find a starting point, on this side of which, all forms, both of animal and vegetable beings, must have had a beginning. As in the consideration of other strata, we find abundant evidence in the *presence* of organic remains, in proof of the exercise of creative power, and wisdom, and goodness, attending the progress of life, through all its stages of advancement upon the surface of the globe; so from the absence of organic remains in the primary strata, we may derive an important argument, shewing that there was a point of time in the history of our planet (which no other researches but those of geology can possibly approach) antecedent to the beginning of either animal or vegetable life. This conclusion is the more important, because it has been the refuge of some speculative philosophers to refer the origin of existing organisations, either to an external succession of the same species, or to the formation of more recent from more ancient species, by successive developments, and thus to deny the existence of any first term in the infinite series of successions which this hypothesis assumes. Against this theory, no decisive evidence had been accessible, until the modern discoveries of geology had established two conclusions of the highest value in relation to this long-disputed question: the first proving that existing species have had a beginning; the second showing, that they were preceded by several other systems of animal and vegetable life, respecting each of

which it may no less be proved, that there was a time when their existence had not commenced: and that to these more ancient systems also the doctrine of eternal succession, both retrospective and prospective, is equally inapplicable."

Sir H. de la Beche supports the same doctrine, in one of the most interesting of his many excellent works, his *Geological Researches;* but he does not attempt to overturn the evidence in favour of the propositions,—that all the earlier species are extinct, and that the progression has been from the simple to the complicated.

In Mr. Murchison's valuable and splendid book on the Silurian region, he has given us details upon this subject which are of the greatest importance. He says (p. 582), "Each period of change, during which the surface of the planet was essentially modified, was also marked by the successive production and annihilation of certain races. This territory [his so-called Silurian region], when examined carefully and in all its parts, presents us with many examples of a perfect 'sequence' in the succession of the strata, and the progressive development of the zoological contents. Thus, certain species, whether endowed with powers to resist vicissitude, or living in those parts where few active causes of destruction were at work, continued to live through long epochs; while others of a higher structure passed away in comparatively short periods."

"There is, however, a phenomenon of the highest importance connected with the distribution of organic remains in the older strata, which has not been adverted to, namely, that the same forms of crustaceans, moluscs, and corals, are said to be found in rocks of the same age, not only in England, Norway, Russia, and various parts of Europe, but also in southern Africa, and even at the Falkland Islands, the very antipodes of Britain. This fact accords,

indeed, with what has been ascertained concerning the wide range of animal remains in deposits equivalent to our oolite and lias; for, in the Himalaya mountains, at Fernando Po, in the region north of the Cape of Good Hope, and in the run of Cutch, and other parts of Hindostan, fossils have been discovered, which, as far as the English naturalists who have seen them can determine, are undistinguishable from certain oolite and lias fossils of Europe.

"Another remarkable fact illustrating this point of inquiry is, that although the older fossiliferous strata often contain *vast quantities* of organic remains, *the number of species is much smaller* than in more recent deposits."

Again, in the 584th page, he adds: "We find that, in the ascending geological series, the quantity of species increases considerably as we approach the younger deposits, and that in proportion to this increase, their geographical distribution harmonizes more and more with that of existing Nature." His conclusion is: "If the existence of formations, so nearly universal as respects the surface of the globe, be admitted, it would seem to be a fair inference, that however we may explain it, there must have then prevailed a generally equable temperature."

But a still more important inference, as regards the question of progressive development, now under consideration, is, that the small number of different species and their universal diffusion during the older geological periods, accords perfectly with the general scheme of Lamarck and others, who contend, that the gradual tendencies to improve and assume new organic forms, ramify in various directions like the branches of a tree, and are divided and subdivided, each small twig holding an analogy to each species or variety of animal or vegetable.

Indeed there is scarcely any difference between modern geologists upon the existence of a *continuously improving* tendency of this description in the gradual development of

organic systems upon the surface of our globe. Mr. Lyell is almost alone in his opinion upon that point; and even he admits, that man, the most perfect animal, was the last formed, which admission obliges him to attempt the establishment of distinctions between the human race and other animals that are not altogether warranted by physiological argument.

D'Omalius D'Halloy, in his *Elémens de Géologie*, from section 755 to the end of the work, offers a theory of geological formation, beginning with the assumption that the whole matter of the earth was liquid. He argues upon *data* which are completely mechanical, and enters into a detailed speculation upon the gradual "coagulation" of its surface, and of the gradual loss of its heat by radiation. Sir H. de la Beche, in his geological researches, resorts to a similar method of getting rid of the heat, which, by the way, is inadmissible in our theory; but neither they, nor any other geologist holding these opinions about the disappearance of the heat, attempt to account for its origin.

D'Omalius D'Halloy enters upon the precise question now before us, in his 763rd section. He supposes that no animal could have lived in a very elevated temperature, and that *vitality* was not developed on all parts of the solid terrestrial surface at the same time,—but that animal and vegetable forms of matter were both at first made manifest under simple conditions of organization, wherever that surface was fit for their abode.

As to the succession of living beings, he says, sect. 765,

"The successive changes in the nature of the living beings which have inhabited the surface of this globe, induce us to examine whether there have been many creations,—or whether there have been merely partial distinctions occasioned by geographical causes,—or whether the re-productive process of Nature could have promoted the graduated succession of those different forms which we

observe in the layers of the Earth. The notion of a series of distinctly new creations is a perfectly gratuitous hypothesis, which is supported by no analogy in regard to phenomena that have occurred within the historical æra; and we are not justified in adopting similar hypotheses, unless it is impossible to explain the fact otherwise, which is not the case in the present instance.

"Undoubtedly a partial destruction of vegetable and animal beings has taken place on certain occasions: thus when the sea has covered an island or an entire continent, all its terrestrial animals must have been destroyed, and succeeded by marine animals; in the same way, as the contrary must have occurred when the bottom of the sea became dry land. We can also understand, that changes of temperature, or the multiplication of carnivorous animals and of the human race, would have occasioned the disappearance of certain species; but if the changes in living Nature had only occurred in this manner, it is a strange chance that in the lower strata we do not find the remains of beings which resemble existing species. It is a second and no less extraordinary chance that living beings should have been distributed upon the Earth's surface in groups presenting to our view systems of organization which, although based on the same general plan, should have all differed from each other to a greater or less extent, and should offer such a regular progression of complication as that which appears in the fossil of the successive layers of this globe's crust. It is a third and still more extraordinary chance, that the destruction should have progressively obliterated groups, which least resemble those now in existence,—that the countries in which we discover their remains should only have been inhabited by such groups, if the more modern were simultaneously in being,—that such groups should have been regularly and successively replaced by others having a greater affinity to living species,

to such an extent that when the deposition of the series of layers in any particular spot has not been interrupted, or when the changes of organic remains do not demonstrate that there has been an invasion of the sea in that locality, the changes occur in an almost imperceptible transition; and finally that we should find new forms at first accompanied by older ones, which soon disappear altogether and are not renewed.

"The hypothesis,—that these changes have been occasioned by a progressive improvement in the organic system accompanying the ordinary mode of generative reproduction,—may be attacked by persons who maintain, that existing species have a stability incompatible with such a gradual development. But however decided such a stability may seem, it cannot be called the *absolute* quality of a species; and if we examine the history of living beings in reference to the assumption, that the species to which they belong are incapable of being so changed, we shall find that very decided alterations of form do take place.

"Human interference, by augmenting, diminishing, or varying the nourishment of such beings, or by changing the temperature of the medium which they inhabit, has made single flowers double, has rendered fruit larger and more succulent, and has given to domestic animals such new and varied forms, that zoologists are obliged to group together, in the species *canis*, a collection of animals differing from each other to a greater extent than the fox does from the wolf.

"Changes of this sort occur without the interference of man, in consequence of changes of circumstances affecting living beings. The Spanish horses which have become wild in the burning *pampas*, or cold *paramos*, of South America, have produced two races, which are as different from each other, as the ass and the zebra. Even if we examine our own species, we find that the peculiar diet of

a nation, or certain family professions, give nations or families peculiar forms which are inherited. Now, it is evident that all these causes of change must be much less operative than those brought about by geological means. The external heat of this globe—the gradual diminution of this heat—the nature of the atmosphere in the older periods—the new gases which are constantly changing its composition at all times—the mineral nature of water, which undergoes continual alterations—all these causes must influence the vital action to an extent which we cannot appreciate, but which may be sufficient to account for progressive changes in the forms of the animals and vegetables of different periods."

Cuvier, in his *Discours sur les Revolutions du Globe*, argues at length against the transmutation of species; but as he bases his arguments upon the fact, that animals which have been preserved in the oldest Egyptian tombs, or are sculptured on the oldest monuments, do not differ from existing species, they will not have much weight with the naturalist, who considers four or five thousand years too short a period for the transmutation of a series from one specific form to another. Still Cuvier is one of the most decided supporters of the doctrine, that the whole zoological series exhibits a progressive system of improvement, not merely as regards existing species, but with reference to fossil remains of animals; upon which he founds his opinion, that the improvement in question has been continuous from the earliest geological era, although he believes that each such change of form required a new creation.

M. Boué, in his *Géologue Voyageur*, is hostile to the theory of there having been a progression of this sort from the simplest to the most perfect form of organic bodies. He says, "Generally speaking, the different creations either of vegetables or of animals, when considered *en*

*masse*, do not lead to the notion, that the most complicated were not produced until the most simple forms had been in existence."

He then goes on to say, "According to my idea, which is neither that of the Biblical school, nor that of Mr. Lyell, the creating forces of nature have been the same at all epochs, and are now what they were before man appeared upon the earth: but certain accessory circumstances were necessary to their energetic manifestation;—for instance, certain ambient *media*, certain quantities of different sorts of gases, certain intensities and activities of the electro-magnetic fluid, of light, &c."

"Now it is in conformity with this notion, that all classes of vegetables and animals, man included, would have been created during the earliest geological periods of nature, if the conditions of their respective organizations had allowed it: but the accessory circumstances being such, that the life of one or of many of these classes, was impossible; it follows, that all of them would not have appeared at the same time,—that some were only able to create themselves at certain epochs,—and that those that formed themselves the first, only had that advantage in consequence of special modifications suited to their respective present conditions. It was above all things necessary, that there should be a suitable medium. At present the medium is such, that the creative process is restricted to the lowest beings, namely, those which are intermediate between animals and vegetables, to certain genera of infusoria, and, perhaps, to intestinal worms."

It may be observed, however, that this hypothesis of M. Boué's, which exceeds Lamark's in boldness, deals in a general and vague way with intensities and activities, which is not allowable, when a theory is propounded, even discursively, in opposition to that of almost every brother geologist. The hostility of Mr. Lyell to the doctrine of a

continuously-improving progression is more measured in its language, and founded upon much more detailed observations. In truth, there is little or no difference between the theories of Mr. Lyell and M. Boué. Both these geologists are hostile to the doctrine, that the more perfect species have, generally, been preceded by the less perfect.

Mr. Lyell has not, like M. Boué, speculated upon the nature of the agency, by or through which the first individuals were developed; he offers long and very interesting remarks upon "the original introduction of species,"—"the changeable circumstances which constitute the stations of animals,"—"the influence of inorganic causes in changing the habitations of species,"—and "the extinction and creation of species;"—all which questions are examined in the 8th, 9th, 10th, and 11th chapters of the 3rd book of his "Principles of Geology."

His speculations on the appearance of new species are exceedingly guarded; for towards the close of the last of these chapters, after demonstrating that the *annual* new appearance, and *annual* annihilation of a single animal species, might only occasion the disappearance of one species of mammifer in forty thousand years,—he infers that in such countries as "England or France, periods of much greater duration must elapse, before it would be possible to authenticate the first appearance of one of the larger plants and animals, assuming the *annual* birth and death of one species to be the rate of vicissitude in the animal creation throughout the world."

"The observations of naturalists, upon living species, may," he says, "in the course of future centuries, accumulate positive data, from which an insight into the laws which govern this part of our terrestrial system may be derived; but, in the present deficiency of historical records, we have traced up the subject to that point where geological monuments alone are capable of leading us on

to the discovery of ulterior truths. To these, therefore, we must now appeal, carefully examining the strata of recent formation, wherein the remains of *living* species, both animal and vegetable, are known to occur. We must study these strata in strict reference to their chronological order as deduced from their superposition, and other relations. From these sources we may learn which of the species, now our contemporaries, have survived the greatest revolutions of the earth's surface; which of them have co-existed with the greatest number of animals and plants now extinct, and which have made their appearance only when the animate world had nearly attained its present condition. From such data we may be enabled to infer, whether species have been called into existence in succession, or all at one period; whether singly, or by groups simultaneously; whether the antiquity of man be as high as that of any of the inferior beings which now share the planet with him, or whether the human species is one of the most recent of the whole.

"To some of these questions we can even now return a satisfactory answer; and with regard to the rest, we have some data to guide conjecture, and to enable us to speculate with advantage: but it would be premature to anticipate such discussions until I have laid before the reader an ample body of materials amassed by the industry of modern geologists."

In the close of his 16th chapter of the same book, in which he advocates the recent origin of man, we find the following remarks: "I cannot conclude this chapter without recalling to the reader's mind a memorable passage written by Berkeley a century ago, in which he inferred, on grounds which may be termed strictly geological, the recent date of the creation of man. 'To any one,' says he, 'who considers that on digging into the earth, such quantities of shells, and in some places bones and horns of

animals, are found sound and entire after having lain there in all probability some thousands of years ; it should seem probable that guns, medals, and implements in metal or stone might have lasted entire, buried under ground forty or fifty thousand years, if the world had been so old. How comes it then to pass that no remains are found, no antiquities of those numerous ages preceding the Scripture accounts of time ; that no fragments of buildings, no public monuments, no intaglios, cameos, statues, basso-relievos, medals, inscriptions, utensils, or artificial works of any kind, are ever discovered, which may bear testimony to the existence of those mighty empires, those successions of monarchs, heroes, and demi-gods, for so many thousand years? Let us look forward and suppose ten or twenty thousand years to come, during which time we will suppose that plagues, famine, wars, and *earthquakes*, shall have made great havoc in the world ; is it not highly probable that at the end of such a period, pillars, vases, and statues now in being, of granite, or porphyry, or jasper, (stones of such hardness as we know them to have lasted two thousand years above ground, without any considerable alteration) would bear record of these and past ages? Or that some of our current coins might then be dug up, or old walls and the foundations of buildings show themselves, as well as the shells and stones of *the primeval world*, which are preserved down to our times.' "

After offering this extract from Berkeley, Mr. Lyell proceeds : " That many signs of the agency of man would have lasted at least as long as 'the shells of the primeval world,' had our race been so ancient, we may feel as fully persuaded as Berkeley ; and we may anticipate with confidence that many edifices and implements of human workmanship, and the skeletons of men, and casts of the human form, will continue to exist when a great part of the present mountains, continents, and seas, have disappeared.

Assuming the future duration of the planet to be indefinitely protracted, we can foresee no limit to the perpetuation of some of the memorials of man, which are continually entombed in the bowels of the earth or in the bed of the ocean, unless we carry forward our views to a period sufficient to allow the various causes of change, both igneous and aqueous, to remodel more than once the entire crust of the earth. *One* complete revolution will be inadequate to efface every monument of our existence ; for many works of art might enter again and again into the formation of successive eras, and escape obliteration, even though the very rocks in which they had been for ages imbedded were destroyed, just as pebbles included in the conglomerates of one epoch often contain the organised remains of beings which flourished during a prior era.

Yet it is no less true, as a late distinguished philosopher has declared, 'that none of the works of a mortal being can be eternal.' They are in the first place wrested from the hands of man, and lost as far as regards their subserviency to his use, by the instrumentality of those very causes which place them in situations where they are enabled to endure for indefinite periods. And even when they have been included in rocky strata, when they have been made to enter as it were into the solid frame-work of the globe itself, they must nevertheless eventually perish, for every year some portion of the Earth's crust is shattered by earthquakes or melted by volcanic fire, or ground to dust by the moving waters on the surface. 'The river of Lethe,' as Bacon eloquently remarks, 'runneth as well above ground as below.' "

This last paragraph evinces a reluctance to surrender the position which he maintains throughout his work. It is a decided argument in favour of the existence of a continuous improvement of the general organic system, that the most perfect animal should have been the most modern

formation. Mr. Lyell is too acute a reasoner not to perceive, that the new and sudden appearance of a species, if it be proved in any one case, must be in opposition to his leading principle; but neither he nor M. Boué venture to dispute that proposition as regards man. They are also both too well versed in general science, to insist upon the *previous perpetuity* of any species; every astronomical hypothesis, in connection with geology, militates against such an assumption.

Now it is evident, that if new species were suddenly developed at any period, there must either have been some sort of systematic regularity in the order of production, or there must have been none; but they both attribute to the immediate cause or causes of the creation of each species a much greater and more unusual power of production, if they imagine that there is not that inherent capability in the specific series of individuals to improve in organisation, during successive generations, which is only a part of the general progression existing throughout Nature. Mr. Lyell rejects that doctrine; but M. Boué supposes, that during the present epoch, the lowest animal forms only, are generated by inorganic forces, which supposition is perfectly in harmony with Lamarck's hypothesis.

Mr. Lyell's remarks upon the shortness of the historical period during which recorded observations can have been made, are so valid against the arguments of Cuvier, where that illustrious French naturalist opposes to the theory of the gradual transmutation of form, the observations of only four or five thousand years at most,—that it is unnecessary to insist further upon that point: but when we couple those remarks with his own admission, that man is the most modern animal,—with the almost universal geological opinion, that there has been a progression from the simple to the compound, as regards both animals and vegetables,—with his belief, and that of M. Boué, that

there have been such new appearances as that of the human race,—and with the observations about those changes in the form of some species, which create varieties, even within a century or two,—we are compelled to admit, that the theory of Lamarck seems the best supported, and the most consistent in itself, of all that have hitherto been published.

All the deductions from the observations which have been made upon *mule* races of animals and vegetables, only establish these facts;—namely, that unless the parents nearly resemble each other, *hybrids* cannot be produced; and that even when such unions are prolific, the offspring is usually, but not always, barren. But such facts are in harmony with the restrictive laws of Nature, which do not admit of an interference beyond certain limits with the *gradual* progressive tendency to change. The general principle of generation is, that the specific form is only to be altered by almost imperceptible degrees, and that the generating power, where there are distinct sexes, is to be mutually participated in by two individuals, as nearly resembling each other as is compatible with the difference of their sexes; the original and first manifestation of the power of reproduction belonging to single individuals, where there is no difference of sexes, as happens in the cases of the lowest animals, and of most plants.

But the very existence of *mules* is evidence in favour of the difference between species being one of degree; the mutual generating sympathy not being altogether destroyed, until the difference is very decided, and until their respective distances from their common ancestral type, points to a much longer interval than the few thousand years to which any human tradition refers. Where the difference between its parents is less decided, the reproductive faculty is lost in the offspring, as may be expected; but where the difference is still greater, there is no such offspring,

the object being to hinder the creation of a form which was not intended by the Divine Intelligence to be developed under such circumstances. The whole argument supports the notion of a progressive ramifying development, because some mules produced by parents between whom the specific difference is slight, are themselves productive; and it is a justifiable inference, that the divergent tendency which promoted that difference, was developed at a comparatively modern period.

Every terrestrial body composed of atoms must have a fixed and definite form, and every change which occurs within it must be the result of the changes of relation between its constituent molecules, or between them and molecules which belong to other bodies. Such changes take place ultimately *at some definite moment*, because it is one of the conditions of material changes, that they should be decided and distinguishable at least by inference. Thus the whole process of the growth of an animal, or vegetable, (although the period is not *visibly* broken into the ultimate divisions of time, during which its minute atomic changes occur, because these specific acts are not capable of being appreciated by our observation), is a great system of activity, having its beginning as a whole, but made up of systems within systems, each of which has also had its own beginning. Some of these subordinate systems are developed at one period of its existence, some at another; and one may be replaced by another during the activity of the general system, in a manner so harmonious, that their respective commencements and ends may be imperceptible; but the apparent melting of one process into another in most physiological changes which occur during the life of a plant or animal, leads to the erroneous conclusion, that there is no such decided and defined beginning and end of the subordinate processes.

The same semblance of *indefinite* affinity is offered to

our imagination, when we meditate upon the succession of the individuals which maintain the specific series. The prolific plant or animal begets its offspring; and that offspring in its turn produces the next generation, in an apparently unbroken continuity of action: but in this instance we can appreciate the beginning of the subordinate process, because there is a distinct and special physiological act which marks the limit. This is still more clearly defined, when the mechanical separation occurs at the moment of birth, if the child is not separated from its mother until it is perfect, or when the egg is laid by an oviparous animal; or when the processes of reproduction by gemmation, or scission, cause the disjunction of the parent and the offspring in the lowest animals. If La Place's astronomical hypothesis about the origin of the heavenly bodies be correct, the disjunction in that instance, must be a process which has its clearly defined beginning and end; although even then it is a process of a subordinate character, in reference to the whole solar system.

Hence we find, that throughout Nature there is evidence in favour of the whole scheme of activity being made up of subordinate processes, which are like orders, genera, and species of a class, each process being distinct *in relation to a period of time*, however short that period may be. Still there is always a maintenance of continuity in the activity, as regards the whole scheme, which is manifested in the distinct successive phenomena of those separate systems, which are its subordinates; and this implies the *universal prevalence of intervals.* Our atomic theory supposes, indeed, that the first comprehensible manifestation of motion is not only strictly limited *as to space,* but accompanied by intervals of activity and quiescence, succeeding each other with such a rapidity, that there are several hundred billions of intervals within the short period of a second;

so that every jerk or throb of the reciprocating polar forces in each atom, may have an appreciable duration, and therefore manifest a definite beginning and end, *in relation to time.*

Now if we apply these considerations to the subject before us, it seems contrary to the whole scheme of Nature,—when there is such a general and pervading tendency to change, throughout her great system, and when the manifestations of all activity may occur during such short periods,—that a *specific* series in the zoological, or vegetable world, should continue unchanged, as to organic forms and qualities.

Every moment of the existence of an individual plant, or animal, is marked by some organic change during its stages of growth, maturity, and decay; each change being reducible to definite subordinate changes in the relations of the molecules which compose its body. Geology demonstrates, that the genera, orders, and classes of organic beings are constantly succeeding each other; and most geologists admit, that the change is from the simple to the complicated. The analogy between terrestrial organic bodies and celestial bodies, is therefore equally in favour of a continuously improving development of animal faculties. Is it probable, that a *specific* series of plants or animals, is the only stationary system?

On the contrary, is it not more likely, that improvement occurs here as it does in the vegetables, which, generation after generation, have undergone the artificial process of cultivation, during a few thousand years, until their forms are completely altered, because Nature's more slow proceeding has been interfered with by man, in pursuance however of the beneficent intentions of a Providence which destined them for our nourishment?

The hypothesis, that a new creation was necessary to the manifestation of every new species, is in direct opposi-

tion to the principle, that all natural processes are brought about by a gradual development of forces, according to the most regular and well connected plan of continuous cause and effect. Each species is a distinct system, and so undoubtedly is each variety or individual of the species. It is true, that every individual must die sooner or later, and the same destiny of dissolution awaits every other body celestial or terrestrial: but the species *is a system, not a body;* and the death of the parent animal does not interfere with the maintenance of the series, in which its offspring become its substitute.

Much reliance has been placed upon the fact of the great differences between the fossil remains in layers of the Earth's surface, which are near each other; and many geologists have inferred, that their observations upon this point warrant the conclusion that there must have been a new creation. But do they take into account all the accidents which might have suddenly destroyed the vegetable and animal inhabitants of the region in question,—the length of time which may have intervened, before it was again inhabited,—the geographical difficulties which may have isolated that region during intervals of perhaps many thousand centuries,—and other circumstances, which may have kept it uninhabited, until a new irruption of the sea, or a new uprising of the land, may have again rendered it an unfit abode for the animals whose remains they expected to find in the layer in question?

On the other hand, the observations made upon successive strata, where the interruption has been less decided, exhibit the commencement and the end of the prevalence of a peculiar form; the gradual melting, as it were, of one form into another in consequence of a succession of such unimportant changes, that the remains would be called those of varieties of *existing* species, (more especially as regards the testacea) offer decided evidence in support of

the theory of a progressive improvement and change in the members of the same series. The progressive increase of the number of species, alluded to by Mr. Murchison, and the comparative paucity and general distribution of species in the strata of the older geological periods, are important facts bearing upon the question now under consideration.

Now viewing all that has been advanced by modern geologists, who admit that the progression does tend constantly towards a more complicated and higher order of organic formation,—by naturalists, who lay before us charts, tables, and schemes, of a regularly ascending or descending system of *existing* animals and vegetables,—by astronomers, who, like La Place, assume, that the heavenly bodies are subject to laws, which occasion their consolidation, disjunction, and gradual change from a gaseous or liquid state, into one, which makes them fit abodes for such beings as inhabit the surface of this Earth,—by chemists, who analyse various vegetable and animal substances, and logically infer, that their simple elementary particles must have existed in a less complicated connexion, when the Earth was not habitable by organic beings,—regarding all these considerations, it would be doing violence to reason, to suppose that a new creation of each species was to be inferred from the fact, that species exist or have existed upon the Earth, which offer evidence of a systematic and progressive development of animal or vegetable forms.

M. Boué's assumptions, that circumstances which were formerly adequate to the sudden development of such a complicated organisation as that of a human being, are inoperative now, and that the lowest zoophytical animals, only, are created in that mode at present,—are the strongest arguments in favour of the only *aboriginal* development of an organic system being that of the lowest and least

complicated animal or vegetable. Nor does it at all militate against the general theory of a continuous and progressive *spontaneous* improvement of an animal series, that it should contain in itself, from the beginning of its existence as a system, the germs of all those peculiarities, (faculties, instincts and reason, depending on organic structure) which are to be developed by degrees during a long course of innumerable ages. Such a *potential* quality, in the simplest animal form, is in itself not more wonderful, than that of the egg, which contains the rudiments of the splendid peacock's plumage,—or of the bulb which *every year* puts forth the brilliant flowers of a tulip or a lily, although, during the winter, its presence in the garden is not indicated by the appearance of a single leaf.

Every organic being is exposed to accidents, which may destroy it and all prospects of its progeny, and thus annihilate the series in that direction. Vast geological changes may sweep off many, if not all, the existing vegetables and animals of any given district on the surface of a planet: let us even assume, that an entire heavenly body may undergo a catastrophe which would destroy all its inhabitants, for such an occurrence is possible; and such events may have happened in districts of this globe. But it seems to be in the order of the great productive system of Nature, that the lowest animals are constantly generated by the aboriginal causes of their appearance; and some of them may be the ancestors of new series, which would advance improvingly, as preceding systems had advanced, until their descendants become equal in zoological rank to the highest animals which they had replaced.

There are districts upon the earth, in which it seems most probable, that this has occurred. The low condition of the aboriginal inhabitants of regions, where immigration from other countries has been prevented by their insulated position, and where the human race with their domestic-

ated dogs, pigs, and poultry, (and rats, the vermin of ships which have touched there), may have been the only superior animals, suggests that an incalculable number of ages must elapse, before the higher sort of animals would appear again in such parts of the world, if they were once destroyed. New Zealand, equalling Great Britain in size, was in this condition, when first discovered by Europeans.

Those marsupial animals, which belonging to the lowest strata, containing the remains of mammifers, (and which seem to have been the species of that family in which the mode of gestation is the least perfect), with some forms which constitute a link between mammifers and oviparous animals, are the present dominant aboriginal races of *mammalia* in Australia.

Geological observations, however, in both these countries, offer the same strata as those of the Asiatic continent: and one of the most reasonable modes of accounting for the absence of the higher animals, is, that the progression was checked at some very remote era by a great catastrophe, while the insulated position of the land in question, hindered immigration from countries which had not been so universally depopulated.

Another hypothesis, however, accounting for the peculiar zoological conditions of Australia, may be advanced on plausible grounds. There is evidence, which suggests that some portions of the earth are better calculated to hasten the progressive development of a species, than others. It has been shown, that mountainous regions have a decided influence upon the variation of the magnetic needle; and it accords with our general hypothesis, that in such regions the cause of the progressive improvement of organic systems, should be more potent, because the reciprocity of the terrestrial and astronomically produced magnetic influences, would be more energetic there, than in low lands, and more especially in low islands.

Hence we may speculate, that mountainous regions are favourable to the rapid advancement of the progression; and we may be inclined to agree with naturalists, who trace the origin of species to localities of that description, which are regarded in many botanical and zoological theories, as centres of a peculiar Flora, or a peculiar group of animals.

Even as regards the precocity of the human intellect in olden days, in Greece, Southern Italy, and Sicily, where the inhabitants surpassed the rest of our race in every branch of knowledge, although they were only indebted to themselves, if not for the rudiments of science, at least for the glory of having improved upon what they had acquired to a greater extent in a short interval, than has ever been witnessed in other regions of the earth,—we may attribute these superior mental qualities, in great part, to the mountainous character of the country, and to its happy temperature. In so doing, we may make every allowance for the political advantages of their living in small independent states (a circumstance which always elicits talent); for the same advantages in other countries have never occasioned such a development of the human faculties. This subject, however, will lead us far from the question immediately under consideration; it belongs to a dissertation upon the mental qualities of animated beings.

The doctrine which maintains, that every species has certain unchangeable characters, has been carried out to the extent of insisting upon the notion, that all members of a species descended originally from the same individual, or pair of individuals. Such was the opinion of Linnæus; and several learned men have defended it with great ability. But it is impossible to admit this postulate, in reference to the vegetable and animal world in general; it can never be substantiated by observation. Supposing, however, that so far as concerns the existing races of man-

kind, the doctrine were true, we are only led back by philological enquiries to the time of the deluge; but it does not settle the main question, as to whether all mankind, *before the deluge*, were the offspring of one pair, if it be proved that the survivors, at that time, were limited to one family, including three brothers, who are not said to have married their near relations.

There is one important argument against the proposition. It is almost universally admitted, that nothing tends more to deteriorate a race, than to allow near relations, and more particularly children of the same parents, to cohabit. All persons engaged in rearing cattle and horses, hinder such breeding in and in, as it is termed, when they can do so: the Mosaic and Christian dispensations agree in forbidding the practice, in reference to our own species. The higher the animal, the more likely is such a marriage to ensure a weak and unhealthy progeny; and Nature implants in the mind of the human race an indifference, which acts as a check upon desire between father and daughter, mother and son, or brother and sister, unless the mind be depraved. But it is one of the consequences of the doctrine which insists on all individuals of the same species having originated in a single pair, that although the first pair need not have been related, the second generation must have entirely consisted of brothers and sisters. In the lowest animals, and in the hermaphrodite plants only, is it a condition of the multiplication of the species, that the increase must have been promoted in this manner. This single consideration is stronger as a physiological argument against the doctrine of Linnæus, in regard to the human race, than all the traditional or philological evidence in its favour.

Let us now meditate upon the elementary question involved in the general consideration of our subject—namely

—the development of the *first* corporeal systems, which were the ancestors of any given species of vegetables and animals.

When the question of sudden physiological innovation is reduced to its first terms, all geological naturalists are its supporters; because the *new creations* of distinct species can only be phenomena of that description which have occurred at certain epochs, if *that* be the mode in which such new species were introduced ; while on the other hand, the first individuals of a *series* must have been originally formed without the intervention of any organic parent, if there be truth in the doctrine of a progressive improvement of the same series having been the cause of the complicated organization of the more perfect vegetables and animals. According to both schools, the physical condition of this planet was such, that *no organised beings could have been its inhabitants at some early period of its existence.*

It is evident, therefore, that those who maintain the doctrine of a progressive improvement of a series, have adopted an hypothesis which is more in conformity with the every-day phenomena of nature, than those who hold the opposite opinion, which is not justified by observation; for they, who believe that the sudden transformation of inorganic elements into so perfect and complicated a system as that of a human body, speculate upon a possibility, in support of which there is not the most remote analogical evidence ; but the universal appearance of *infusoria* of the lowest class, and of *intestinal worms*, under circumstances hostile to the supposition that they could have been produced by beings like themselves, offers direct evidence in favour of the theory of spontaneous generation.

Upon this subject, the opinions of Lamarck, who has written the most extensively upon the theory of the progressive improvement of a series, are more consistent with

a general scheme than those of Tiedemann; both these naturalists believe in an original spontaneous development of organic forms; but Tiedemann attributes the organic energy to the *inherent* force of a peculiar sort of matter, while Lamarck refers it to a progressive development of forces in matter which had been *previously inorganic.*

If we reflect on the difference between them, we find that it arises out of the reluctance of Tiedemann to extend his inquiries beyond a certain limit. Had he commenced with the astronomical hypothesis of La Place, he would have found a great difficulty in persuading himself, that one sort of matter in the nebulous Sun, when the size of that heavenly body equalled that of the orbit of Saturn, was *potentially* organic, while another sort was to remain for ever in an inorganic condition. It is much more in harmony with the general principles of one great scheme, to suppose that the progressive improvement is only one of *forces* or *tendencies,* which are gradually developed in *all* material substance, according to circumstances, when the first process of formation, that of the atom itself, has taken place.

The doctrine of those who believe, that every species is an aboriginal creation—is more consistent than that of Tiedemann—because, if it be once admitted, that the special qualities of matter are *absolute,* there may have been one sort of substance originally set aside for one species, and one for another; and this notion is that of Bonnet, who supposed that the *corporeal* or *material germs* of all prospective organic beings, have been in existence "from the beginning." Bonnet's psychology is really a system of materialism.

But if we believe, that the germs of all physical systems are the *potential* qualities of *incorporeal* forces, we are at once led back in our analysis to the first development of material form, and to the *individualisation* of a distinct portion

of the homogeneous material ether, and consequently to *the beginning of the formal world*, so far as regards that region of infinite space, which can be observed by the astronomer.

Tiedemann is decidedly of opinion that there is as marked a distinction between the organisation of the lowest vegetables and animals, as there is between inorganic and organic bodies; although in the lowest forms it is difficult to determine the distinction. Lamarck says, animals are *irritable*, but denies that plants have that property. Undoubtedly the distinguishing feature of an animal body is its attribute of a nervous system; but this may exist under such a mode of arrangement as to be altogether beyond the reach of our direct observation, and oblige us to infer from the effects, that one organic body is animated, while another is not endued with the principle of *sensation*. Tiedemann, however, lays it down as a maxim; "that as regards the chemical operation which accompanies life in both sorts of organic body, there is a continuous process of *disacidification* and a continuous production of combustibles in the vegetable; while in the animal there is an oxidising process which occasions a sort of combustion."

This distinction would be very important in a physical sense, if it could be applied to the lowest animals and vegetables. The differences between the highest sort of plants and all animals, except some of those beings which are called zoophytes, are clear and decided; and if it were not for the existence of such paradoxical creatures, there would be no doubt upon the subject. We must, however, bear in mind, that according to the general rules of a progressive system, *animated* life ought to have been first developed in its most simple mode of manifestation. What that *simplest* mode is, we may never know: but that it involves the phenomena of some *obscure sort of sensation*, is a justifiable inference; and this faculty is denied to the

most complicated and perfect vegetable. The question at issue is really one of metaphysics, for with the exception of Tiedemann's chemical test, (and that may not be available in some doubtful cases) we have no decided criterion: *locomotion* may not be the property of some animals; and although it is proved by microscopic observation, that many of those very minute animals which are grouped together as *infusoria*, have stomachs, and are nourished by fluids taken into that cavity, while all plants are nourished by absorption,—still external matter may be absorbed cutaneously, and thereby incorporated in animal systems, even as regards those of a higher grade of animals.

Again in many organic bodies, of whose animality there can be no doubt, there is no visible trace of a nervous system; but this does not preclude us from firmly believing, that they contain some material substance which answers the purpose of distinct nerves, although that substance may be undistinguishable by our powers of observation from the rest of the body. The whole argument, therefore, favours the opinion, that all animals differ from vegetables, in possessing *the animating principle*, but that, as the improving progression of the series advances, new material organs are developed, which first demonstrate the existence of that principle, because we observe the organs through which it acts, and is acted upon.

Nevertheless, there is every ground for the faith of the devout psychologist, that the perceiving, thinking soul, the "moi" of Cuvier, or the principle to which we allude,—is a really existing being, wholly independent of the action of the material body which it animates, and that its *special individuality is the same, whatever may be the mental organs or nervous material instruments of its intercourse with the atomic world.* In this respect it seems to be the metaphysical counterpart of the aboriginal, physically unaccount-

able, and incorporeal dual force, which, according to our theory, generated the atom itself. The only proof of the soul's existence is to be found in the simple *sentiment* of "being," which sentiment is *obvious* to one person and one only, the individual who feels it. That other animals are animated is but an inference, although an inference of the highest order.

The distinction, therefore, between animals and vegetables, as to their origin, is very important, because we stand in need of a different organisation, when such a faculty as that of the lowest imaginable *sensation* is to be produced. Vegetables, so far as their want of this faculty is concerned, are vastly inferior to animals. But life or vitality is a process common to both classes of organic beings.

Let us now consider the phenomena connected with the development of entozoa and parasitical bodies; for they suggest some of the strongest arguments in support of the theory of spontaneous generation.

## SECTION XVII.

*On the development of parasitical and intestinal organic bodies.*

THE general hypothesis about the reciprocity between magnetic bodies being the stimulating cause of the development of organic life, is supported by the phenomena of parasitical plants and animals.

Most species of vegetables and animals are liable to be infested by more than one species of parasite, which is itself capable of reproducing offspring, although the first appearance of the series is sometimes quite unaccountable; and the extraordinary circumstance connected with this branch of zoology is, that certain parasites only appear upon a certain plant or animal, while the appearance is further limited by certain parts of the body being infested by their own special varieties of the same sort of parasite.

Two species of louse are found on man; one of these is confined to the head, the other to other parts of his body: and children are most afflicted with the first, while elderly people suffer from the presence of the other, which occasions *phthiriasis*, one of the most formidable and disgusting diseases that can assail our race.

There is no mammifer or bird exempt from this annoyance. Fishes suffer seriously from it. Some insects, more especially the larger species of beetle, swarm with parasites peculiar to their race, and even those insects which are microscopic, will be found, under high magnifying powers, to be the prey of this disease.

When we reflect on the whole course of argument adopted in our essay, the production of parasitical plants and animals seems to be the necessary consequence of the general prevalence of certain laws; and it offers corroborative evidence in favour of the doctrine of progression. Parasitical insects infesting vertebrated animals, are of a higher order than those infusoria which we have supposed may be the progenitors of the most complicated animated forms of this globe; and this assumption might seem to militate against the theory, because *pediculi* and *acari* must have been generated spontaneously, as it is termed, instead of deriving their origin from less complicated organic forms. But the fact of their occupying a higher place in the animal scale is really in harmony with the uniformity of the whole scheme.

We have already supposed it to be a general law of Nature, that every distinct aggregate of atomic matter, is a magnet or magnetic system, capable of reciprocating with other magnetic bodies, and of thereby influencing the matter on their respective surfaces in such a manner, as to occasion the development of some new arrangement of the particles, corpuscules, or other portions of those surfaces. The formation of organic bodies has been attributed to

such a reciprocity of magnetic influence between this Earth and the Sun or Moon. Now it is only following out this doctrine, to attribute to each organic body so formed, a faculty of reciprocating magnetically with the Earth, Sun, or Moon, and of causing a new arrangement of the particles of or upon its own surface; and as every vegetable or animal in question is a higher or more complicated system than any aggregate of inorganic matter, the inference would be that the new production should be itself a more complicated system, than the original organic body produced by the magnetic reciprocity of two inorganic masses, —whether such masses were the Earth and the Sun, or the Earth and Moon, with its reflected magnetism.

Such a doctrine may appear the more startling, when it is remembered that according to the general theory of progression, the highest animal now on the Earth's surface must have derived its own ancestral origin from a lower or more simple organic form, than the parasite, which spontaneously burst into life upon its own body; but humiliating to our pride as this inference may appear to some, and absurd as it will undoubtedly be pronounced to be by others, it is an induction supported by the fact of man being the prey of animals with which he will be infested, if he neglects those acts of cleanliness which are enjoined by the oldest religious rites of antiquity, and by the practices of all civilised nations. It is not one of the least important results of civilisation, that as by constant care and attention we may in most instances free ourselves from these inconvenient accompaniments of inorganic matter attached to our persons, it should be considered shameful to allow them to be formed in consequence of our not removing the sort of dirt with which the skin of most savages is begrimed.

The law of nature, which forces us to be, unwillingly, the parents of vermin, is capable of being explained by meditation upon the continuous energy of the magnetic

force, if we once admit that such an energy is a stimulating cause of organic development. The pediculi and acari appear to hold the same relation to higher organic bodies capable of producing them, as that which the most simple infusoria hold to the surface of the earth; and it seems probable, that the comparative complication of the parasite's organisation is in a general degree proportioned to that of the animal which it infests.

Again, as regards vegetables, we may infer from observation, that there is a reciprocity between the terrestrial magnetic force and their own, which has a powerful influence in modifying the forms of certain animals which feed on their juices; but as the lowest plant is *physiologically* a more exalted system of complicated relations than a heavenly body is, it is possible that the reciprocity between plants and the Earth may promote the development of animal forms. At all events, we are justified in assuming that vegetable parasites may be thus developed in the first instance, although, like the pediculi, they have the generative faculty of reproduction.

The remark of Oviedo, that in certain equatorial regions of the Earth vermin of this description cease to infest sailors (a remark, however, which requires confirmation), may corroborate our general magnetic hypothesis, and tally with the observations of experienced navigators upon the variation of the intensity of the ordinary terrestrial magnetic force, which is weakest on the equator. But Oviedo's remark may apply to that meridian in the Atlantic, where the great circle of no variation cuts the equator; for there would not only be a weaker magnetic influence generally at that point, as being farthest from the poles of the Earth, but a nullity of any magnetic influence as regards the internal terrestrial nucleus of this globe.

Now, should it be proved that Oviedo is correct about the whole equatorial region, we are warranted in assuming

that the production, and perhaps the existence, of these parasites depends upon a reciprocity between the magnetic currents on a human body and those of the Earth,—the tendency to develope them increasing or diminishing with the relative intensity of the terrestrial magnetic forces on any given latitude. On the other hand, should it be found that the phenomenon only occurs on that part of the equator where there is no variation of the compass,—in other words, where the *minor* terrestrial magnetic force of the Earth's surface replaces the *major* force of its internal nucleus—the fact is confirmatory of our hypothesis. It may indeed be possible that wherever there is no variation of the compass, the development of parasites may be unimportant, if not absolutely null in every latitude: observations in America and Australia would decide that question.

But as it is assumed, that the reciprocity depends upon the joint influence of two magnetic bodies in this as in every other instance, the variation of the magnetic force of the animal body, which generates the parasite, must be taken into account, as well as that of the Earth. Not only are children peculiarly liable to be afflicted with worms in the intestines, and by lice on the head, but calves are subject to ringworms in the head, and lambs have lice in the same region, which are not common to these genera when full grown. The pediculus found on the body of a person advanced in life, must owe its origin to some cause connected with his having passed the period of adolescence or maturity.

With such data, we are induced to suppose that there is some magnetic force *in the child* which acts *internally* as regards its body, and *externally* upon its head; but that a change in this respect accompanies its growth, and is complete after a certain time of its life, when the intestinal worms incident to childhood, generally cease to appear, and the external development of parasites is no longer principally confined to the head of the human body.

May we not speculate upon a greater organic energy existing in the *growing* person than in the mature man? All the processes of nature are more rapid as regards the conversion of food into a portion of the animal body at that period. The brain advances with a rapidity which can only be appreciated by our consideration of the very early attainment of mental powers observable in children, and of their acquiring the rudiments of language; not merely being able to call perceptible objects by their right names, but to catch the terms of abstract ideas and sentiments almost as soon as they can speak,—a faculty which is manifested much more slowly afterwards, in learning new languages, even when such sentiments are connected in their minds with words of their native tongue.

Anatomists find the brain at the seventh or eighth year of life as large as it will ever be; a most important fact in relation to the faculties of the child, and leading to the inference that although its structure improves afterwards, the *cerebrum* increases more rapidly during those first few years than any other part of the body does. Here then is a cause of magnetic energy adequate to the occasion; and it should be remembered, that the cerebrum is peculiarly the organ which develops magnetism in its most transcendent character, because there is no result of physiological action so elevated as that which generates ideas.

Thus, independently of the general superiority of the organic force in a growing child over that of a person who has ceased to grow, there is a special distinction as regards the growth of that internal portion of its body, outside which the parasitical animal peculiarly observed in children, is believed to be formed according to the laws of *heterogenesis*. The same mode of reasoning is applicable in a minor degree to the production of worms in the child's intestinal canal.

Again, when we search for the cause of the general

development of the other sort of pediculus, rarely found on children, and if found on them, always to be accounted for by their having been in contact with elderly persons so affected,—we may speculate upon an opposite cause, *the diminution of the vital force.* All organic bodies are liable to be the prey of parasites, when they grow old. Trees suffer in this way as well as animals; and when either the plant or animal is enfeebled by disease, the maladies of this description become more serious. An inferior nourishment of mature organic forms will also produce them, or render such bodies subject to an invasion of mosses, lichens, acari, and pediculi, which are generated elsewhere. The same may be observed as regards portions of a dead body or a dead tree; and many animal productions, such as decomposing cheese, soon swarm with tribes of living creatures.

Hence it appears, that in this process there is a manifestation of a general natural energy, incidental to the comparative force of the vital force in every animal and vegetable form of matter;—that the pediculus, for instance, is generated spontaneously by the human body, when that body is *positively* magnetic in relation to the Earth, as well as when it is *negatively* so;—that during the period of maturity there may be a balance between these two opposite conditions of the relation, when the parasite-producing energy is entirely or almost inert;—that there is a specific difference between the pediculus of the head and that of other parts of the body;—and that we find in this explanation of the phenomena, a confirmation of the general hypothesis, that in every case of spontaneous generation, the fixed starting point of the new progression depends upon the stage of the original progression already attained by the vegetable or animal which generates the parasite in question.

The prevalence of the tendency in *living* bodies, whether

they be vegetable or animal, to produce parasites, is not so evidently useful (as part of the general scheme of the organic world) as when the same process occurs in the decomposing substances of portions of a dead body, or in animal or vegetable excrementitious matter; for then, *useless* organic substance is rendered available in the great laboratory of vital operations, and new series of organic beings are thereby introduced into the world. But such occurrences take place in accordance with general laws, to which all organic bodies are subject. Peculiar generative forces, which are only active under certain conditions, must be developed in obedience to a higher system, than that of any animal. The *positive* intensity of the magnetism of the *growing* body (in the case of the child) in relation to that of the Earth, may elicit the parasitical development at that moment, while the relatively *negative* state of that of the *declining* body of the old man may promote an analogous phenomenon at a later period of life. The convenience or inconvenience of the human creature is disregarded by Nature, when such considerations might interfere with her general rules.

The climax of *convenience* to any individual of the human race, thus subject to the laws of *heterogenesis*, is the middle period of his life; the child must undergo the annoyance in a minor degree, and is less under its influence, as he approaches maturity. The old man, on the contrary, in this as in all other diseases, is again brought into subjection to physical causes of *decay*, which assail organic structures in obedience to the general operation of natural agents, when the complicated energy of his vital powers begins to give way; and he is thus forewarned of the approach of a period when the system of his own body will be used by an unerring Providence as the medium of development of a new and lower order of organic beings,

some of whose remote descendants may be gradually advanced, at last, to a specific form as perfect as his own.

Still, although the organic matter of higher animals during their lives is brought under subjection to the laws which develop lower animals; there may be a new starting point, as regards the development of the parasite which is called into existence by their influence. The pediculi and fungi, which may be produced by *heterogenesis*, are higher organic beings than the lower sorts of infusoria and byssi, from which the higher animals themselves may have descended, through a succession of innumerable generations.

Such a scheme of organisation is perfectly harmonious, when we remember that every animal capable of having sentiments or perceptions, may be the parent of three distinct classes of objects,—the *parasites*, which it develops unconsciously and automatically; *the progeny*, in which the maintenance of *its own species* is ensured; and the *ideas* which are created by its mental powers.

As regards the first class, there is an analogy between the Earth and the vegetable or animal which produces the parasite: if a reciprocity between two heavenly bodies be necessary to the development of any organic system of either of these heavenly bodies,—a similar relation between an *organic* body and the Earth may promote that of the parasite. This, however, is a more complicated operation: the animal thus called into life is of a higher class than that produced by the reciprocity between two *inorganic* bodies; one of the reciprocating aggregates is itself an *organic* system. Still the process would be completely physical in both cases.

The second class of generative phenomena is intimately connected with it, when the reproduction of the species takes place by scission or gemmation, and the parent body

gives birth to animals nearly resembling itself, by being divided into parts, or developing and throwing off young ones from the surface of its body, as shoots are sent forth from the growing tree. Observations enable us to trace up the improvement of the generative process through all the various changes of method, which appear in the zoological system. If our series of observations be made in the descending direction, we find that each lower grade of animal has a faculty of reproduction, which denotes an increasing simplicity of process, until those of scission and gemmation appear to be as mechanical as that of spontaneous generation itself.

The mental creation of *ideas* in the animal mind, may, in like manner, be said to hold an analogy to the vital process of maintaining the specific series, or to the gradual development of organs in the embryo, and *growing* organic being after its birth; and if we believe that the growth of the organs of the nervous system is connected with a magnetic influence of the *reflected* solar rays, we find the analogy complete. The reciprocities between inorganic portions of the *same* heavenly body,—between *two* heavenly bodies,—and between *three* heavenly bodies, through the instrumentality of such an operation as lunar reflection,—seem to hold the relations of causes to the effects of *chemical*, of *vital*, and of *phrenological* activities respectively, as regards aggregates of matter upon the surface of the Earth. The progressive improvement in the development of the great magnetic scheme coincides with the progression of every animal function, including that of reproduction itself.

Finally, we may remark, that vegetables were obviously made for the convenience of animals; but that unless we search for some ulterior object which is more important than the existence of lower animals, the unity of the great

scheme of Nature will appear broken. As a member of an *unchanging* specific series, an earthworm is but a sad type of animality; and the precarious existence of most of the lower animals carries with it no object of future interest;—the rapine and cruelty which pervade the whole animal world, might at first lead us to suppose that a capricious demon had disported himself in the work of animal creation, not that Divine beneficence had applied the abstract truths of physics to a great end, worthy of its own transcendent mind.

But when we believe that the existence of the lowest animal is a *necessary* stage in the development of a continuously improving animal series, and that in accordance with the unerring progression of those physical conditions, *to which, for some reason beyond our comprehension, the entire animal world is subject,* the manifestation of the higher animals must be preceded by that of the lowest, in order that such incorporeal ideas as those of human reason should be made manifest,—we discover an argument in favour of the doctrine, that the corporeal form of every animal embodies a manifestation of an improving system, both as regards the whole series, and the individual. The most highly-gifted human philosopher must individually have gone through the gradual changes of an embryo state, of infancy, of childhood, and of adolescence: and such a progressive improvement of the individual, which no one can gainsay, may hold an analogy to the gradual improvement of a specific series. Where it is to end, and when the series is to terminate, we know not; but the analogy suggests that every animal, whatever may be its grade in the ascending scale, is a physical instrument in the great plan, *having for its ultimate object some glorious manifestation of mind, even when mind is still dependent upon material organisation.*

That the animal series is fated to end at last, is an

inference deducible, according to the strictest rules of logic, from the almost universally-admitted postulate, that as regards every animated creature on this globe, it must have had a beginning; but that man is the highest possible animal, or the *ne plus ultra* of material organisation, would be too bold a speculation for any naturalist. In many respects we are but mechanical agents in the vast plan of Nature,—exposed, it is true, to less suffering than other animals, but still exposed to suffering, in consequence of the prevalence of physical laws. Our bodies are not formed for the purpose of our being murdered and then devoured, as almost every individual of a domestic race of animals is by ourselves; but we are often the victims of injustice and oppression, of physical violence and misery, in consequence of the injustice of our fellow-men.

Still the progression gradually tends to improvement in these, as well as in all other respects. The social institutions of civilization have gradually lessened the suffering of the mass of mankind: although in this instance there is an occasional retrogression, as the pages of history will show, the secular improvement of the human race has been sometimes retarded, but it has never been wholly checked. Tradition preserves the account of two great periods of degradation: it seems probable that the ancient Egyptians, or Chaldeans, were in possession of knowledge which can only be traced to certain opinions, that survived the scientific methods by which they were attained. No recorded astronomical schemes will account for their nearly knowing the precise distance between the Earth and the Moon; yet the doctrine upon that subject handed down to us by the Greeks, and borrowed from the East, is wonderfully correct. Why science declined in the earliest periods, is not mentioned in history: the Chaldeans and Egyptians may have only retained astronomical traditions, which

were preserved when the deluge overwhelmed the countries from which the founders of those nations originally came. Scientific men may have been destroyed by that catastrophe; but physical truths, which had become popular opinions, may have been preserved in the recollection of those who were less learned. Other causes of the decline of science may have prevailed, during a subsequent period.

Again, the Greeks obtained a high position in philosophy, and their histories enable us to trace their rapid advance in knowledge; but the destruction of the Roman Empire, and the inroads of the barbarians of the North, will account for the existence of the dark ages, as they are most appropriately termed. We are living in a third stage of scientific improvement, and our successors may be exposed to the retrogressive influence of some physical, political, or moral cause of deterioration in this respect. But the *secular* continuousness of the mean advance of human knowledge has always been in operation, notwithstanding these alternations and retarding circumstances. Some information obtained by philosophical meditation has always survived such catastrophes, and afforded a new and advanced starting point for the philosophers of future ages.

In concluding the dissertation upon the origin of species it is necessary to repeat that questions of a theological character have been carefully avoided, and that all surmises about pure psychology have been purposely kept out of this essay on physics. The existence of an *animating principle*, or of an individual *personal* basis of sensation in each animal, has been assumed as a postulate, in the same way as that of an aboriginal homogeneous material substance, or of the individual forces which give it forms and qualities, have been. Yet, we may assume without further argument, that there is some future compensation to each individual animal, in the great scheme of Na-

ture, for the service which it performs, and for the suffering which it must undergo, in consequence of its subjection to the physical laws of that system,—where the misery of one animal is necessary to the nourishment and pleasure of another, and where the general plan of the improvement of man himself is amenable to conditions, which apportioned fewer advantages to those of his own species, who existed in earlier ages than to the majority of the inhabitants of the civilised world at present.

Physically considered, every animal, man included, is a mere instrument in the hands of Nature, destined to keep up and improve the great series of Beings, of which he is a constituent member; and as each individual is liable to destruction, not only as regards himself, but with respect to the future prospect of having any offspring (for infants *must*, and mature animals *may*, die without progeny), this attention to the general principle is so arranged, that the suffering of each animal may be of no advantage to himself, or the maintenance of the species. The annihilation of an individual may be that of a series; and out of millions of lower animals which are called into being, by *heterogenesis* or *homogenesis*, one being only may contribute to the maintenance of the great system of continuous improvement.

Hence it follows, that in reference to physical laws, there is a providential calculation of what we call chances, which does not take into account the interests of the individual, but treats it, as if its body were a mere chemical aggregate, when the great object of progression is in contemplation. That object may undoubtedly be, and we believe it is, the future manifestation of corporeal individuality under such conditions of phrenological power, and social advantages, that the end may seem to justify the means. Still, in the mode of attaining this end, there is a disregard for the suffering of animals, which is at variance with our purest notions of benevolence, although scientific economists may

endeavour to apologise for it by alleging general convenience as a justification. Natural religion, however, inculcates different doctrines; and our instincts of charity and kindness rebel against such a justification.

The paradox is only to be explained by the supposition, that the passing physical world of subserviency to material laws, is not the only world; and that whatever be their temporary and passing state of being *here*, all *animating* principles belong to the same immortal category of essences, as those incorporeal forces of Nature, and that homogeneous ethereal matter, which are *aboriginal* elements in our physical scheme.

## SECTION XVIII.

*General remarks on Phrenology and Animal Magnetism.*

THE two popular branches of physiological science, under which all the mental faculties may be considered, are phrenology and animal magnetism: both are divisions of the same general class, and they are so connected, that a critical examination of the one involves that of the other.

The study both of human and comparative physiology induces the opinion, that the origin of the nervous forces of animals is to be found in three distinct sets of organs, —those of the sympathetic nerves in which the ganglionic system prevails,—those of the spinal chord and its appurtenances, some of which are also ganglionic,—and those of cerebrum and cerebellum.

The ganglionic centres of the sympathetic system,—the whole spinal chord,—and the brain, generally consist of two distinct sorts of substances. The sort which is always internal, has a white appearance, and the other, which is cortical or external, is of a grey colour. Most physiologists look upon the grey substance as the seat or