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with it the most eloquent art-literature of any tongue, have all recently sprung into existence in our motherland. All honor to those generous spirits that have produced this,—and honor to the nation that so wisely expends its wealth! A noble example for America! England also throws open to the competition of the world plans for her public buildings and monuments. Mistakes and defects there have been, but an honest desire for amendment and to promote the intellectual growth of the nation now characterizes her pioneers in this cause. And what progress! Between 1823 and 1850, in the Museum alone, there have been expended $10,000,000. Within twelve years, $450,000 have been expended on the National Gallery for pictures, and yet its largest accession of treasures is by gifts and bequests. Lately, beside the Pisani Veronese bought for $70,000, eight other paintings have been purchased at a cost of $50,000. In 1858, $36,000 were given for the choice of twenty, of the early Italian schools, from the Lombardi Gallery at Florence,—not masterpieces, but simply characteristic specimens, more or less restored. The average cost of late acquisitions has been about $6,000 each. In 1858, there were 823,000 visitors to both branches of the National Gallery. Who can estimate not alone the pleasure and instruction afforded by such an institution to its million of annual visitors, but the ideas and inspiration thence born, destined to grow and fructify to the glory and good of the nation? At present there are seventy-seven schools of art in England, attended by 68,000 students. In 1859, they and kindred institutions received a public grant of nearly $450,000. The appropriation for the British Museum alone, for 1860, is £77,452.

To the Louvre Louis XVIII. added one hundred and eleven pictures, at a cost of about $132,000; Charles X., twenty-four, at $12,000; Louis Philippe, fifty-three, at $14,500; and Napoleon III., thus far, thirty paintings, costing $200,000, one of which, the Murillo, cost $125,000. Russia is following in the same path. Italy, Greece, and Egypt, by stringent regulations, are making it yearly more difficult for any precious work to leave their shores. If, therefore, America is ever to follow in the same path, she must soon bestir herself, or she will have nothing but barren fields to glean from.

DARWIN ON THE ORIGIN OF SPECIES.

Novelties are enticing to most people: to us they are simply annoying. We cling to a long-accepted theory, just as we cling to an old suit of clothes. A new theory, like a new pair of breeches, ("The Atlantic" still affects the older type of nether garment,) is sure to have hard-fitting places; or even when no particular fault can be found with the article, it oppresses with a sense of general discomfort. New notions and new styles worry us, till we get well used to them, which is only by slow degrees.

Wherefore, in Galileo's time, we might have helped to proscribe, or to burn—had he been stubborn enough to warrant cremation—even the great pioneer of inductive research; although, when we had fairly recovered our composure, and had leisurely excogitated the matter, we might have come to conclude that the new doctrine was better than the old one, after all, at least for those who had nothing to unlearn.

Such being our habitual state of mind, it may well be believed that the perusal

of the new book "On the Origin of Species by Means of Natural Selection" left an uncomfortable impression, in spite of its plausible and winning ways. We were not wholly unprepared for it, as many of our contemporaries seem to have been. The scientific reading in which we indulge as a relaxation from severer studies had raised dim forebodings. Investigations about the succession of species in time, and their actual geographical distribution over the earth's surface, were leading up from all sides and in various ways to the question of their origin. Now and then we encountered a sentence, like Professor Owen's "axiom of the continuous operation of the ordained becoming of living things," which haunted us like an apparition. For, dim as our conception must needs be as to what such oracular and grandiloquent phrases might really mean, we felt confident that they presaged no good to old beliefs. Foreseeing, yet deprecating, the coming time of trouble, we still hoped, that, with some repairs and make-shifts, the old views might last out our days. *Après nous le déluge.* Still, not to lag behind the rest of the world, we read the book in which the new theory is promulgated. We took it up, like our neighbors, and, as was natural, in a somewhat captious frame of mind.

Well, we found no cause of quarrel with the first chapter. Here the author takes us directly to the barn-yard and the kitchen-garden. Like an honorable rural member of our General Court, who sat silent until, near the close of a long session, a bill requiring all swine at large to wear pokes was introduced, when he claimed the privilege of addressing the house, on the proper ground that he had been "brought up among the pigs, and knew all about them,"—so we were brought up among cows and cabbages; and the lowing of cattle, the cackling of hens, and the cooing of pigeons were sounds native and pleasant to our ears. So "Variation under Domestication" dealt with familiar subjects in a natural way, and gently introduced "Variation under Nature," which seemed likely enough. Then follows "Struggle for Existence,"—a principle which we experimentally know to be true and cogent,—bringing the comfortable assurance, that man, even upon Leviathan Hobbes's theory of society, is no worse than the rest of creation, since all Nature is at war, one species with another, and the nearer kindred the more internecine,—bringing in thousand-fold confirmation and extension of the Malthusian doctrine, that population tends far to outrun means of subsistence throughout the animal and vegetable world, and has to be kept down by sharp preventive checks; so that not more than one of a hundred or a thousand of the individuals whose existence is so wonderfully and so sedulously provided for ever comes to anything, under ordinary circumstances; so the lucky and the strong must prevail, and the weaker and ill-favored must perish;—and then follows, as naturally as one sheep follows another, the chapter on "Natural Selection," Darwin's *cheval de bataille*, which is very much the Napoleonic doctrine, that Providence favors the strongest battalions,—that, since many more individuals are born than can possibly survive, those individuals and those variations which possess any advantage, however slight, over the rest, are in the long run sure to survive, to propagate, and to occupy the limited field, to the exclusion or destruction of the weaker brethren. All this we pondered, and could not much object to. In fact, we began to contract a liking for a system which at the outset illustrates the advantages of good breeding, and which makes the most "of every creature's best."

Could we "let by-gones be by-gones," and, beginning now, go on improving and diversifying for the future by natural selection,—could we even take up the theory at the introduction of the actually existing species, we should be well content, and so perhaps would most naturalists be. It is by no means difficult to believe that varieties are incipient or possible species, when we see what trouble naturalists, especially botanists, have to distinguish between them,—one regard-

ing as a true species what another regards as a variety; when the progress of knowledge increases, rather than diminishes, the number of doubtful instances; and when there is less agreement than ever among naturalists as to what the basis is in Nature upon which our idea of species reposes, or how the word is practically to be defined. Indeed, when we consider the endless disputes of naturalists and ethnologists over the human races, as to whether they belong to one species or to more, and if to more, whether to three, or five, or fifty, we can hardly help fancying that both may be right, — or rather, that the unihumanitarians would have been right several thousand years ago, and the multihumanitarians will be a few thousand years later; while at present the safe thing to say is, that, probably, there is some truth on both sides. "Natural selection," Darwin remarks, "leads to divergence of character; for more living beings can be supported on the same area the more they diverge in structure, habits, and constitution," (a principle which, by the way, is paralleled and illustrated by the diversification of human labor,) and also leads to much extinction of intermediate or unimproved forms. Now, though this divergence may "steadily tend to increase," yet this is evidently a slow process in Nature, and liable to much counteraction wherever man does not interpose, and so not likely to work much harm for the future. And if natural selection, with artificial to help it, will produce better animals and better men than the present, and fit them better to "the conditions of existence," why, let it work, say we, to the top of its bent. There is still room enough for improvement. Only let us hope that it always works for good: if not, the divergent lines on Darwin's diagram of transmutation made easy ominously show what small deviations from the straight path may come to in the end.

The prospect of the future, accordingly, is on the whole pleasant and encouraging. It is only the backward glance, the gaze up the long vista of the past, that reveals anything alarming. Here the lines converge as they recede into the geological ages, and point to conclusions which, upon the theory, are inevitable, but by no means welcome. The very first step backwards makes the Negro and the Hottentot our blood-relations; — not that reason or Scripture objects to that, though pride may. The next suggests a closer association of our ancestors of the olden time with "our poor relations" of the quadrumanous family than we like to acknowledge. Fortunately, however, — even if we must account for him scientifically, — man with his two feet stands upon a foundation of his own. Intermediate links between the *Bimana* and the *Quadrumana* are lacking altogether; so that, put the genealogy of the brutes upon what footing you will, the four-handed races will not serve for our forerunners; — at least, not until some monkey, live or fossil, is producible with great-toes, instead of thumbs, upon his nether extremities; or until some lucky geologist turns up the bones of his ancestor and prototype in France or England, who was so busy "napping the chuckie-stanes" and chipping out flint knives and arrow-heads in the time of the drift, very many ages ago, — before the British Channel existed, says Lyell,* — and until these men of the olden time are shown to have worn their great-toes in a divergent and thumb-like fashion. That would be evidence indeed: but until some testimony of the sort is produced, we must needs believe in the separate and special creation of man, however it may have been with the lower animals and with plants.

No doubt, the full development and symmetry of Darwin's hypothesis strongly suggest the evolution of the human no less than the lower animal races out of some simple primordial animal, — that all are equally "lineal descendants of some few beings which lived long be-

* Vide *Proceedings of the British Association for the Advancement of Science*, 1859, and London *Athenæum*, passim. It appears to be conceded that these "celts" or stone knives are artificial productions, and of the age of the mammoth, the fossil rhinoceros, etc.

fore the first bed of the Silurian system was deposited." But, as the author speaks disrespectfully of spontaneous generation, and accepts a supernatural beginning of life on earth, in some form or forms of being which included potentially all that have since existed and are yet to be, he is thereby not warranted to extend his inferences beyond the evidence or the fair probability. There seems as great likelihood that one special origination should be followed by another upon fitting occasion, (such as the introduction of man,) as that one form should be transmuted into another upon fitting occasion, as, for instance, in the succession of species which differ from each other only in some details. To compare small things with great in a homely illustration: man alters from time to time his instruments or machines, as new circumstances or conditions may require and his wit suggest. Minor alterations and improvements he adds to the machine he possesses: he adapts a new rig or a new rudder to an old boat: this answers to *variation*. If boats could engender, the variations would doubtless be propagated, like those of domestic cattle. In course of time the old ones would be worn out or wrecked; the best sorts would be chosen for each particular use, and further improved upon, and so the primordial boat be developed into the scow, the skiff, the sloop, and other species of water-craft,— the very diversification, as well as the successive improvements, entailing the disappearance of many intermediate forms, less adapted to any one particular purpose; wherefore these go slowly out of use, and become extinct species: this is *natural selection*. Now let a great and important advance be made, like that of steam-navigation: here, though the engine might be added to the old vessel, yet the wiser and therefore the actual way is to make a new vessel on a modified plan: this may answer to *specific creation*. Anyhow, the one does not necessarily exclude the other. Variation and natural selection may play their part, and so may specific creation also. Why not?

This leads us to ask for the reasons which call for this new theory of transmutation. The beginning of things must needs lie in obscurity, beyond the bounds of proof, though within those of conjecture or of analogical inference. Why not hold fast to the customary view, that all species were directly, instead of indirectly, created after their respective kinds, as we now behold them,— and that in a manner which, passing our comprehension, we intuitively refer to the supernatural? Why this continual striving after "the unattained and dim," —these anxious endeavors, especially of late years, by naturalists and philosophers of various schools and different tendencies, to penetrate what one of them calls "the mystery of mysteries," the origin of species? To this, in general, sufficient answer may be found in the activity of the human intellect, "the delirious yet divine desire to know," stimulated as it has been by its own success in unveiling the laws and processes of inorganic Nature,— in the fact that the principal triumphs of our age in physical science have consisted in tracing connections where none were known before, in reducing heterogeneous phenomena to a common cause or origin, in a manner quite analogous to that of the reduction of supposed independently originated species to a common ultimate origin,— thus, and in various other ways, largely and legitimately extending the domain of secondary causes. Surely the scientific mind of an age which contemplates the solar system as evolved from a common, revolving, fluid mass,— which, through experimental research, has come to regard light, heat, electricity, magnetism, chemical affinity, and mechanical power as varieties or derivative and convertible forms of one force, instead of independent species,— which has brought the so-called elementary kinds of matter, such as the metals, into kindred groups, and raised the question, whether the members of each group may not be mere varieties of one species, —and which speculates steadily in the direction of the ultimate unity of matter,

of a sort of prototype or simple element which may be to the ordinary species of matter what the *protozoa* or component cells of an organism are to the higher sorts of animals and plants, — the mind of such an age cannot be expected to let the old belief about species pass unquestioned. It will raise the question, how the diverse sorts of plants and animals came to be as they are and where they are, and will allow that the whole inquiry transcends its powers only when all endeavors have failed. Granting the origin to be supernatural, or miraculous even, will not arrest the inquiry. All real origination, the philosophers will say, is supernatural; their very question is, whether we have yet gone back to the origin, and can affirm that the present forms of plants and animals are the primordial, the miraculously created ones. And even if they admit that, they will still inquire into the order of the phenomena, into the form of the miracle. You might as well expect the child to grow up content with what it is told about the advent of its infant brother. Indeed, to learn that the new-comer is the gift of God, far from lulling inquiry, only stimulates speculation as to how the precious gift was bestowed. That questioning child is father to the man, — is philosopher in short-clothes.

Since, then, questions about the origin of species will be raised, and have been raised, — and since the theorizings, however different in particulars, all proceed upon the notion that one species of plant or animal is somehow derived from another, that the different sorts which now flourish are lineal (or unlineal) descendants of other and earlier sorts, — it now concerns us to ask, What are the grounds in Nature, the admitted facts, which suggest hypotheses of derivation, in some shape or other? Reasons there must be, and plausible ones, for the persistent recurrence of theories upon this genetic basis. A study of Darwin's book, and a general glance at the present state of the natural sciences, enable us to gather the following as perhaps the most suggestive and influential. We can only enumerate them here, without much indication of their particular bearing. There is, —

1. The general fact of variability; — the patent fact, that all species vary more or less; that domesticated plants and animals, being in conditions favorable to the production and preservation of varieties, are apt to vary widely; and that by interbreeding, any variety may be fixed into a race, that is, into a variety which comes true from seed. Many such races, it is allowed, differ from each other in structure and appearance as widely as do many admitted species; and it is practically very difficult, perhaps impossible, to draw a clear line between races and species. Witness the human races, for instance. Wild species also vary, perhaps about as widely as those of domestication, though in different ways. Some of them appear to vary little, others moderately, others immoderately, to the great bewilderment of systematic botanists and zoologists, and their increasing disagreement as to whether various forms shall be held to be original species or marked varieties. Moreover, the degree to which the descendants of the same stock, varying in different directions, may at length diverge is unknown. All we know is, that varieties are themselves variable, and that very diverse forms have been educed from one stock.

2. Species of the same genus are not distinguished from each other by equal amounts of difference. There is diversity in this respect analogous to that of the varieties of a polymorphous species, some of them slight, others extreme. And in large genera the unequal resemblance shows itself in the clustering of the species around several types or central species, like satellites around their respective planets. Obviously suggestive this of the hypothesis that they were satellites, not thrown off by revolution, like the moons of Jupiter, Saturn, and our own solitary moon, but gradually and peacefully detached by divergent variation. That such closely related species may be only varieties of higher grade, earlier origin, or

more favored evolution, is not a very violent supposition. Anyhow, it was a supposition sure to be made.

3. The actual geographical distribution of species upon the earth's surface tends to suggest the same notion. For, as a general thing, all or most of the species of a peculiar genus or other type are grouped in the same country, or occupy continuous, proximate, or accessible areas. So well does this rule hold, so general is the implication that kindred species are or were associated geographically, that most trustworthy naturalists, quite free from hypotheses of transmutation, are constantly inferring former geographical continuity between parts of the world now widely disjoined, in order to account thereby for the generic similarities among their inhabitants. Yet no scientific explanation has been offered to account for the geographical association of kindred species, except the hypothesis of a common origin.

4. Here the fact of the antiquity of creation, and in particular of the present kinds of the earth's inhabitants, or of a large part of them, comes in to rebut the objection, that there has not been time enough for any marked diversification of living things through divergent variation, — not time enough for varieties to have diverged into what we call species.

So long as the existing species of plants and animals were thought to have originated a few thousand years ago and without predecessors, there was no room for a theory of derivation of one sort from another, nor time enough even to account for the establishment of the races which are generally believed to have diverged from a common stock. Not that five or six thousand years was a short allowance for this; but because some of our familiar domesticated varieties of grain, of fowls, and of other animals, were pictured and mummified by the old Egyptians more than half that number of years ago, if not much earlier. Indeed, perhaps the strongest argument for the original plurality of human species was drawn from the identification of some of the present races of men upon these early historical monuments and records.

But this very extension of the current chronology, if we may rely upon the archæologists, removes the difficulty by opening up a longer vista. So does the discovery in Europe of remains and implements of pre-historic races of men to whom the use of metals was unknown, — men of the *stone age*, as the Scandinavian archæologists designate them. And now, "axes and knives of flint, evidently wrought by human skill, are found in beds of the drift at Amiens, (also in other places, both in France and England,) associated with the bones of extinct species of animals." These implements, indeed, were noticed twenty years ago; at a place in Suffolk they have been exhumed from time to time for more than a century; but the full confirmation, the recognition of the age of the deposit in which the implements occur, their abundance, and the appreciation of their bearings upon most interesting questions, belong to the present time. To complete the connection of these primitive people with the fossil ages, the French geologists, we are told, have now "found these axes in Picardy associated with remains of *Elephas primigenius*, *Rhinoceros tichorhinus*, *Equus fossilis*, and an extinct species of *Bos*."* In plain language, these workers in flint lived in the time of the mammoth, of a rhinoceros now extinct, and along with horses and cattle unlike any now existing, — specifically different, as naturalists say, from those with which man is now associated. Their connection with existing human races may perhaps be traced through the intervening people of the stone age, who were succeeded by the people of the bronze age, and these by workers in iron.† Now, various evidence carries back the existence of many

* See Correspondence of M. Nicklès, in *American Journal of Science and Arts*, for March, 1860.

† See Morlet, *Some General Views on Archæology*, in *American Journal of Science and Arts*, for January, 1860, translated from *Bulletin de la Société Vaudoise*, 1859.

of the present lower species of animals, and probably of a larger number of plants, to the same drift period. All agree that this was very many thousand years ago. Agassiz tells us that the same species of polyps which are now building coral walls around the present peninsula of Florida actually made that peninsula, and have been building there for centuries which must be reckoned by thousands.

5. The overlapping of existing and extinct species, and the seemingly gradual transition of the life of the drift period into that of the present, may be turned to the same account. Mammoths, mastodons, and Irish elks, now extinct, must have lived down to human, if not almost to historic times. Perhaps the last dodo did not long outlive his huge New Zealand kindred. The auroch, once the companion of mammoths, still survives, but apparently owes his present and precarious existence to man's care. Now, nothing that we know of forbids the hypothesis that some new species have been independently and supernaturally created within the period which other species have survived. It may even be believed that man was created in the days of the mammoth, became extinct, and was recreated at a later date. But why not say the same of the auroch, contemporary both of the old man and of the new? Still it is more natural, if not inevitable, to infer, that, if the aurochs of that olden time were the ancestors of the aurochs of the Lithuanian forests, so likewise were the men of that age — if men they were — the ancestors of the present human races. Then, whoever concludes that these primitive makers of rude flint axes and knives were the ancestors of the better workmen of the succeeding stone age, and these again of the succeeding artificers in brass and iron, will also be likely to suppose that the *Equus* and *Bos* of that time were the remote progenitors of our own horses and cattle. In all candor we must at least concede that such considerations suggest a genetic descent from the drift period down to the present, and allow time enough — if time is of any account — for variation and natural selection to work out some appreciable results in the way of divergence into races or even into so-called species. Whatever might have been thought, when geological time was supposed to be separated from the present era by a clear line, it is certain that a gradual replacement of old forms by new ones is strongly suggestive of some mode of origination which may still be operative. When species, like individuals, were found to die out one by one, and apparently to come in one by one, a theory for what Owen sonorously calls "the continuous operation of the ordained becoming of living things" could not be far off.

That all such theories should take the form of a derivation of the new from the old seems to be inevitable, perhaps from our inability to conceive of any other line of secondary causes, in this connection. Owen himself is apparently in travail with some transmutation theory of his own conceiving, which may yet see the light, although Darwin's came first to the birth. Different as the two theories will probably be in particulars, they cannot fail to exhibit that fundamental resemblance in this respect which betokens a community of origin, a common foundation on the general facts and the obvious suggestions of modern science. Indeed,— to turn the point of a taking simile directed against Darwin, — the difference between the Darwinian and the Owenian hypotheses may, after all, be only that between homœopathic and heroic doses of the same drug.

If theories of derivation could only stop here, content with explaining the diversification and succession of species between the tertiary period and the present time, through natural agencies or secondary causes still in operation, we fancy they would not be generally or violently objected to by the *savans* of the present day. But it is hard, if not impossible, to find a stopping-place. Some of the facts or accepted conclusions already referred to, and several others, of a more general character, which must be taken into the

account, impel the theory onward with accumulated force. *Vires* (not to say *virus*) *acquirit eundo.* The theory hitches on wonderfully well to Lyell's uniformitarian theory in geology, — that the thing that has been is the thing that is and shall be, — that the natural operations now going on will account for all geological changes in a quiet and easy way, only give them time enough, so connecting the present and the proximate with the farthest past by almost imperceptible gradations, — a view which finds large and increasing, if not general, acceptance in physical geology, and of which Darwin's theory is the natural complement.

So the Darwinian theory, once getting a foothold, marches boldly on, follows the supposed near ancestors of our present species farther and yet farther back into the dim past, and ends with an analogical inference which "makes the whole world kin." As we said at the beginning, this upshot discomposes us. Several features of the theory have an uncanny look. They may prove to be innocent: but their first aspect is suspicious, and high authorities pronounce the whole thing to be positively mischievous.

In this dilemma we are going to take advice. Following the bent of our prejudices, and hoping to fortify these by new and strong arguments, we are going now to read the principal reviews which undertake to demolish the theory; — with what result our readers shall be duly informed.

Meanwhile, we call attention to the fact, that the Appletons have just brought out a second and revised edition of Mr. Darwin's book, with numerous corrections, important additions, and a preface, all prepared by the author for this edition, in advance of a new English edition.

VANITY (1).

(ON A PICTURE OF HERODIAS'S DAUGHTER BY LUINI.)

Alas, Salome! Could'st thou know
How great man is, — how great thou art, —
What destined worlds of weal or woe
Lurk in the shallowest human heart, —

From thee thy vanities would drop,
Like lusts in noble anger spurned
By one who finds, beyond all hope,
The passion of his youth returned.

Ah, sun-bright face, whose brittle smile
Is cold as sunbeams flashed on ice!
Ah, lips how sweet, yet hard the while!
Ah, soul too barren even for vice!

Mirror of Vanity! Those eyes
No beam the less around them shed,
Albeit in that red scarf there lies
The Dancer's meed, — the Prophet's head.

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Grant that in armor firm and strong,
Whilst pealing still Life's battle-song,
And struggling, manful, 'gainst the wrong,

Thy soldier, who would fight to win
No crown of dross, no bays of sin,
May fall amidst the foremost din

Of Truth's grand conflict, blest by Thee, —
And even though Death should conquer, see
How false, how brief his victory!

DARWIN ON THE ORIGIN OF SPECIES.

[Continued.]

"I CAN entertain no doubt, after the most deliberate study and dispassionate judgment of which I am capable, that the view which most naturalists entertain, and which I formerly entertained, — namely, that each species has been independently created, — is erroneous. I am fully convinced that species are not immutable; but that those belonging to what are called the same genera are lineal descendants of some other and generally extinct species, in the same manner as the acknowledged varieties of any one species are the descendants of that species. Furthermore, I am convinced that Natural Selection has been the main, but not exclusive means of modification."

This is the kernel of the new theory, the Darwinian creed, as recited at the close of the introduction to the remarkable book under consideration. The questions, "What will he do with it?" and "How far will he carry it?" the author answers at the close of the volume: "I cannot doubt that the theory of descent with modification embraces all the members of the same class." Furthermore, "I believe that all animals have descended from at most only four or five progenitors, and plants from an equal or lesser number." Seeing that analogy as strongly suggests a further step in the same direction, while he protests that "analogy may be a deceitful guide," yet he follows its inexorable leading to the inference that "probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed." *

In the first extract we have the thin end of the wedge driven a little way; in the last, the wedge is driven home.

We have already (in the preceding number) sketched some of the reasons suggestive of such a theory of derivation of species, — reasons which give it plausibility, and even no small probability, as applied to our actual world and to changes occurring since the latest tertiary period. We are well pleased at this mo-

* P. 484, Engl. ed. In the new American edition, (*Vide* Supplement, pp. 431, 432,) the principal analogies which suggest the extreme view are referred to, and the remark is appended, — "But this inference is chiefly grounded on analogy, and it is immaterial whether or not it be accepted. The case is different with the members of each great class, as the Vertebrata or Articulata; for here we have in the laws of homology, embryology, etc., some distinct evidence that all have descended from a single primordial parent."

ment to find that the conclusions we were arriving at in this respect are sustained by the very high authority and impartial judgment of Pictet, the Swiss palæontologist. In his review of Darwin's book,* — much the fairest and most admirable opposing one that has yet appeared, — he freely accepts that *ensemble* of natural operations which Darwin impersonates under the now familiar name of Natural Selection, allows that the exposition throughout the first chapters seems "*à la fois prudent et fort*," and is disposed to accept the whole argument in its foundations, that is, so far as it relates to what is now going on, or has taken place in the present geological period, — which period he carries back through the diluvial epoch to the borders of the tertiary.† Pictet accordingly admits that the theory will very well account for the origination by divergence of nearly related species, whether within the present period or in remoter geological times: a very natural view for him to take; since he appears to have reached and published, several years ago, the pregnant conclusion, that there most probably was some material connection between the closely related species of two successive faunas, and that the numerous close species, whose limits are so difficult to determine, were not all created distinct and independent. But while accepting, or ready to accept, the basis of Darwin's theory, and all its legitimate direct inferences, he rejects the ultimate conclusions, brings some weighty arguments to bear against them, and is evidently convinced that he can draw a clear line between the sound inferences, which he favors, and the unsound or unwarranted theoretical deductions, which he rejects. We hope he can.

This raises the question, Why does Darwin press his theory to these extreme conclusions? Why do all hypotheses of derivation converge so inevitably to one ultimate point? Having already considered some of the reasons which suggest or support the theory at its outset, — which may carry it as far as such sound and experienced naturalists as Pictet allow that it may be true, — perhaps as far as Darwin himself unfolds it in the introductory proposition cited at the beginning of this article, — we may now inquire after the motives which impel the theorist so much farther. Here proofs, in the proper sense of the word, are not to be had. We are beyond the region of demonstration, and have only probabilities to consider. What are these probabilities? What work will this hypothesis do to establish a claim to be adopted in its completeness? Why should a theory which may plausibly enough account for the *diversification* of the species of each special type or genus, be expanded into a general system for the *origination* or successive diversification of all species, and all special types or forms, from four or five remote primordial forms, or perhaps from one? We accept the theory of gravitation because it explains all the facts we know, and bears all the tests that we can put it to. We incline to accept the nebular hypothesis, for similar reasons; not because it is proved, — thus far it is wholly incapable of proof, — but because it is a natural theoretical deduction from accepted physical laws, is thoroughly congruous with the facts, and because its assumption serves to connect and harmonize these into one probable and consistent whole. Can the derivative hypothesis be maintained and carried out into a system on similar grounds? If so, however unproved, it would appear to be a tenable hypothesis, which is all that its author ought now to claim. Such hypotheses as from the conditions of the case can neither be proved nor disproved by direct evidence or experiment are to be tested only indirectly, and therefore imperfectly, by trying their power to harmonize the known facts, and to account for what is otherwise unaccountable. So the question comes to this

* In *Bibliothèque Universelle de Genève*, Mars, 1860.

† This we learn from his very interesting article, *De la Question de l'Homme Fossile*, in the same (March) number of the *Bibliothèque Universelle*.

What will an hypothesis of the derivation of species explain which the opposing view leaves unexplained?

Questions these which ought to be entertained before we take up the arguments which have been advanced against this theory. We can only glance at some of the considerations which Darwin adduces, or will be sure to adduce in the future and fuller exposition which is promised. To display them in such wise as to indoctrinate the unscientific reader would require a volume. Merely to refer to them in the most general terms would suffice for those familiar with scientific matters, but would scarcely enlighten those who are not. Wherefore let these trust the impartial Pictet, who freely admits, that, "in the absence of sufficient direct proofs to justify the possibility of his hypothesis, Mr. Darwin relies upon indirect proofs, the bearing of which is real and incontestable"; who concedes that "his theory accords very well with the great facts of comparative anatomy and zoölogy,—comes in admirably to explain unity of composition of organisms, also to explain rudimentary and representative organs, and the natural series of genera and species,—equally corresponds with many palæontological data,—agrees well with the specific resemblances which exist between two successive faunas, with the parallelism which is sometimes observed between the series of palæontological succession and of embryonal development," etc.; and finally, although he does not accept the theory in these results, he allows that "it appears to offer the best means of explaining the manner in which organized beings were produced in epochs anterior to our own."

What more than this could be said for such an hypothesis? Here, probably, is its charm, and its strong hold upon the speculative mind. Unproven though it be, and cumbered *primâ facie* with cumulative improbabilities as it proceeds, yet it singularly accords with great classes of facts otherwise insulated and enigmatic, and explains many things which are thus far utterly inexplicable upon any other scientific assumption.

We have said (p. 116) that Darwin's hypothesis is the natural complement to Lyell's uniformitarian theory in physical geology. It is for the organic world what that popular view is for the inorganic; and the accepters of the latter stand in a position from which to regard the former in the most favorable light. Wherefore the rumor that the cautious Lyell himself has adopted the Darwinian hypothesis need not surprise us. The two views are made for each other, and, like the two counterpart pictures for the stereoscope, when brought together, combine into one apparently solid whole.

If we allow, with Pictet, that Darwin's theory will very well serve for all that concerns the present epoch of the world's history,—an epoch which this renowned palæontologist regards as including the diluvial or quaternary period,—then Darwin's first and foremost need in his onward course is a practicable road from this into and through the tertiary period, the intervening region between the comparatively near and the far remote past. Here Lyell's doctrine paves the way, by showing that in the physical geology there is no general or absolute break between the two, probably no greater between the latest tertiary and the quaternary period than between the latter and the present time. So far, the Lyellian view is, we suppose, generally concurred in. Now as to the organic world, it is largely admitted that numerous tertiary species have continued down into the quaternary, and many of them to the present time. A goodly percentage of the earlier and nearly half of the later tertiary mollusca, according to Des Hayes, Lyell, and, if we mistake not, Bronn, still live. This identification, however, is now questioned by a naturalist of the very highest authority. But, in its bearings on the new theory, the point here turns not upon absolute identity so much as upon close resemblance. For those who, with Agassiz, doubt the specific identity in any

of these cases, and those who say, with Pictet, that "the later tertiary deposits contain in general the *débris* of species *very nearly related* to those which still exist, belonging to the same genera, but specifically different," may also agree with Pictet that the nearly related species of successive faunas must or may have had "a material connection." Now the only material connection that we have an idea of in such a case is a genealogical one. And the supposition of a genealogical connection is surely not unnatural in such cases, — is demonstrably the natural one as respects all those tertiary species which experienced naturalists have pronounced to be identical with existing ones, but which others now deem distinct. For to identify the two is the same thing as to conclude the one to be the ancestors of the other. No doubt there are differences between the tertiary and the present individuals, differences equally noted by both classes of naturalists, but differently estimated. By the one these are deemed quite compatible, by the other incompatible, with community of origin. But who can tell us what amount of difference is compatible with community of origin? This is the very question at issue, and one to be settled by observation alone. Who would have thought that the peach and the nectarine came from one stock? But, this being proved, is it now very improbable that both were derived from the almond, or from some common amygdaline progenitor? Who would have thought that the cabbage, cauliflower, broccoli, kale, and kohlrabi are derivatives of one species, and rape or colza, turnip, and probably rutabaga, of another species? And who that is convinced of this can long undoubtingly hold the original distinctness of turnips from cabbages as an article of faith? On scientific grounds may not a primordial cabbage or rape be assumed as the ancestor of all the cabbage races, on much the same ground that we assume a common ancestry for the diversified human races? If all our breeds of cattle came from one stock, why not this stock from the auroch, which has had all the time between the diluvial and the historic periods in which to set off a variation perhaps no greater than the difference between some sorts of cattle?

That considerable differences are often discernible between tertiary individuals and their supposed descendants of the present day affords no argument against Darwin's theory, as has been rashly thought, but is decidedly in its favor. If the identification were so perfect that no more differences were observable between the tertiary and the recent shells than between various individuals of either, then Darwin's opponents, who argue the immutability of species from the ibises and cats preserved by the ancient Egyptians being just like those of the present day, could triumphantly add a few hundred thousand years more to the length of the experiment and to the force of their argument. As the facts stand, it appears, that, while some tertiary forms are essentially undistinguishable from existing ones, others are the same with a difference, which is judged not to be specific or aboriginal, and yet others show somewhat greater differences, such as are scientifically expressed by calling them marked varieties, or else doubtful species; while others, differing a little more, are confidently termed distinct, but nearly related species. Now is not all this a question of degree, of mere gradation of difference? Is it at all likely that these several gradations came to be established in two totally different ways, — some of them (though naturalists can't agree which) through natural variation, or other secondary cause, and some by original creation, without secondary cause? We have seen that the judicious Pictet answers such questions as Darwin would have him do, in affirming, that, in all probability, the nearly related species of two successive faunas were materially connected, and that contemporaneous species, similarly resembling each other, were not all created so, but have become so. This is equivalent to saying that species (using the term as all natu-

ralists do and must continue to employ the word) have only a relative, not an absolute fixity; that differences fully equivalent to what are held to be specific may arise in the course of time, so that one species may at length be naturally replaced by another species a good deal like it, or may be diversified through variation or otherwise into two, three, or more species, or forms as different as species. This concedes all that Darwin has a right to ask, all that he can directly infer from evidence. We must add that it affords a *locus standi*, more or less tenable, for inferring more.

Here another geological consideration comes in to help on this inference. The species of the later tertiary period for the most part not only resembled those of our days, many of them so closely as to suggest an absolute continuity, but also occupied in general the same regions that their relatives occupy now. The same may be said, though less specially, of the earlier tertiary and of the later secondary; but there is less and less localization of forms as we recede, yet some localization even in palæozoic times. While in the secondary period one is struck with the similarity of forms and the identity of many of the species which flourished apparently at the same time in all or in the most widely separated parts of the world, in the tertiary epoch, on the contrary, along with the increasing specialization of climates and their approximation to the present state, we find abundant evidence of increasing localization of orders, genera, and species; and this localization strikingly accords with the present geographical distribution of the same groups of species. Where the imputed forefathers lived, their relatives and supposed descendants now flourish. All the actual classes of the animal and vegetable kingdoms were represented in the tertiary faunas and floras, and in nearly the same proportions and the same diversities as at present. The faunas of what is now Europe, Asia, America, and Australia differed from each other much as they now differ: in fact,—according to Adolphe Brongniart, whose statements we here condense,*—the inhabitants of these different regions appear for the most part to have acquired, before the close of the tertiary period, the characters which essentially distinguish their existing faunas. The eastern continent had then, as now, its great pachyderms, elephants, rhinoceros, and hippopotamus; South America its armadillos, sloths, and ant-eaters; Australia a crowd of marsupials; and the very strange birds of New Zealand had predecessors of similar strangeness. Everywhere the same geographical distribution as now, with a difference in the particular area, as respects the northern portion of the continents, answering to a warmer climate then than ours, such as allowed species of hippopotamus, rhinoceros, and elephant to range even to the regions now inhabited by the reindeer and the musk-ox, and with the serious disturbing intervention of the glacial period within a comparatively recent time. Let it be noted, also, that those tertiary species which have continued with little change down to our days are the marine animals of the lower grades, especially mollusca. Their low organization, moderate sensibility, and the simple conditions of an existence in a medium like the ocean, not subject to great variation and incapable of sudden change, may well account for their continuance; while, on the other hand, the more intense, however gradual, climatic vicissitudes on land, which have driven all tropical and subtropical forms out of the higher latitudes and assigned to them their actual limits, would be almost sure to extinguish such huge and unwieldy animals as mastodons, mammoths, and the like, whose power of enduring altered circumstances must have been small.

This general replacement of the tertiary species of a country by others so much like them is a noteworthy fact. The hypothesis of the independent creation of all species, irrespective of their antecedents, leaves this fact just as mys-

* In *Comptes Rendus, Acad. des Sciences*, Févr. 2, 1857.

terious as is creation itself; that of derivation undertakes to account for it. Whether it satisfactorily does so or not, it must be allowed that the facts well accord with that assumption.

The same may be said of another conclusion, namely, that the geological succession of animals and plants appears to correspond in a general way with their relative standing or rank in a natural system of classification. It seems clear, that, though no one of the *grand types* of the animal kingdom can be traced back farther than the rest, yet the lower *classes* long preceded the higher; that there has been on the whole a steady progression within each class and order; and that the highest plants and animals have appeared only in relatively modern times. It is only, however, in a broad sense that this generalization is now thought to hold good. It encounters many apparent exceptions and sundry real ones. So far as the rule holds, all is as it should be upon an hypothesis of derivation.

The rule has its exceptions. But, curiously enough, the most striking class of exceptions, if such they be, seems to us even more favorable to the doctrine of derivation than is the general rule of a pure and simple ascending gradation. We refer to what Agassiz calls prophetic and synthetic types; for which the former name may suffice, as the difference between the two is evanescent.

"It has been noticed," writes our great zoölogist, "that certain types, which are frequently prominent among the representatives of past ages, combine in their structure peculiarities which at later periods are only observed separately in different, distinct types. Sauroid fishes before reptiles, Pterodactyles before birds, Ichthyosauri before dolphins, etc. There are entire families, of nearly every class of animals, which in the state of their perfect development exemplify such prophetic relations. . . . The sauroid fishes of the past geological ages are an example of this kind. These fishes, which preceded the appearance of reptiles, present a combination of ichthyic and reptilian characters not to be found in the true members of this class, which form its bulk at present. The Pterodactyles, which preceded the class of birds, and the Ichthyosauri, which preceded the Cetacea, are other examples of such prophetic types."*

Now these reptile-like fishes, of which gar-pikes are the living representatives, though of earlier appearance, are admittedly of higher rank than common fishes. They dominated until reptiles appeared, when they mostly gave place to — or, as the derivationists will insist, were resolved by divergent variation and natural selection into — common fishes, destitute of reptilian characters, and saurian reptiles, the intermediate grades, which, according to a familiar piscine saying, are "neither fish, flesh, nor good red-herring," being eliminated and extinguished by natural consequence of the struggle for existence which Darwin so aptly portrays. And so, perhaps, of the other prophetic types. Here type and antitype correspond. If these are true prophecies, we need not wonder that some who read them in Agassiz's book will read their fulfilment in Darwin's.

Note also, in this connection, that, along with a wonderful persistence of type, with change of species, genera, orders, etc., from formation to formation, no species and no higher group which has once unequivocally died out ever afterwards reappears. Why is this, but that the link of generation has been sundered? Why, on the hypothesis of independent originations, were not failing species re-created, either identically or with a difference, in regions eminently adapted to their well-being? To take a striking case. That no part of the world now offers more suitable conditions for wild horses and cattle than the Pampas and other plains of South America is shown by the facility with which they have there run

* Agassiz, *Contributions: Essay on Classification*, p. 117, where, we may be permitted to note, the word "Crustacea" is by a typographical error printed in place of *Cetacea*.

wild and enormously multiplied, since introduced from the Old World not long ago. There was no wild American stock. Yet in the times of the Mastodon and Megatherium, at the dawn of the present period, wild horses and cattle — the former certainly very much like the existing horse — roamed over those plains in abundance. On the principle of original and direct created adaptation of species to climate and other conditions, why were these types not reproduced, when, after the colder intervening era, those regions became again eminently adapted to such animals? Why, but because, by their complete extinction in South America, the line of descent was here utterly broken? Upon the ordinary hypothesis, there is no scientific explanation possible of this series of facts, and of many others like them. Upon the new hypothesis, "the succession of the same types of structure within the same areas during the later geological periods ceases to be mysterious, and is simply explained by inheritance." Their cessation is failure of issue.

Along with these considerations the fact (alluded to on p. 114) should be remembered, that, as a general thing, related species of the present age are geographically associated. The larger part of the plants, and still more of the animals, of each separate country are peculiar to it; and, as most species now flourish over the graves of their by-gone relatives of former ages, so they now dwell among or accessibly near their kindred species.

Here also comes in that general "parallelism between the order of succession of animals and plants in geological times, and the gradation among their living representatives" from low to highly organized, from simple and general to complex and specialized forms; also "the parallelism between the order of succession of animals in geological times and the changes their living representatives undergo during their embryological growth," — as if the world were one prolonged gestation. Modern science has much insisted on this parallelism, and to a certain extent is allowed to have made it out. All these things, which conspire to prove that the ancient and the recent forms of life "are somehow intimately connected together in one grand system," equally conspire to suggest that the connection is one similar or analogous to generation. Surely no naturalist can be blamed for entering somewhat confidently upon a field of speculative inquiry which here opens so invitingly; nor need former premature endeavors and failures utterly dishearten him.

All these things, it may naturally be said, go to explain the order, not the mode, of the incoming of species. But they all do tend to bring out the generalization expressed by Mr. Wallace in the formula, that "every species has come into existence coincident both in time and space with preëxisting closely allied species." Not, however, that this is proved even of existing species as a matter of general fact. It is obviously impossible to *prove* anything of the kind. But we must concede that the known facts strongly suggest such an inference. And since species are only congeries of individuals, and every individual came into existence in consequence of preëxisting individuals of the same sort, so leading up to the individuals with which the species began, and since the only material sequence we know of among plants and animals is that from parent to progeny, the presumption becomes exceedingly strong that the connection of the incoming with the preëxisting species is a genealogical one.

Here, however, all depends upon the probability that Mr. Wallace's inference is really true. Certainly it is not yet generally accepted; but a strong current is setting towards its acceptance.

So long as universal cataclysms were in vogue, and all life upon the earth was thought to have been suddenly destroyed and renewed many times in succession, such a view could not be thought of. So the equivalent view maintained by Agassiz, and formerly, we believe, by

D'Orbigny, that, irrespectively of general and sudden catastrophes, or any known adequate physical cause, there has been a total depopulation at the close of each geological period or formation, say forty or fifty times, or more, followed by as many independent great acts of creation, at which alone have species been originated, and at each of which a vegetable and an animal kingdom were produced entire and complete, full-fledged, as flourishing, as wide-spread and populous, as varied and mutually adapted from the beginning as ever afterwards, — such a view, of course, supersedes all material connection between successive species, and removes even the association and geographical range of species entirely out of the domain of physical causes and of natural science. This is the extreme opposite of Wallace's and Darwin's view, and is quite as hypothetical. The nearly universal opinion, if we rightly gather it, manifestly is, that the replacement of the species of successive formations was not complete and simultaneous, but partial and successive; and that along the course of each epoch some species probably were introduced, and some, doubtless, became extinct. If all since the tertiary belongs to our present epoch, this is certainly true of it: if to two or more epochs, then the hypothesis of a total change is not true of them.

Geology makes huge demands upon time; and we regret to find that it has exhausted ours, — that what we meant for the briefest and most general sketch of some geological considerations in favor of Darwin's hypothesis has so extended as to leave no room for considering "the great facts of comparative anatomy and zoölogy" with which Darwin's theory "very well accords," nor for indicating how "it admirably serves for explaining the unity of composition of all organisms, the existence of representative and rudimentary organs, and the natural series which genera and species compose." Suffice it to say that these are the real strongholds of the new system on its theoretical side; that it goes far towards explaining both the physiological and the structural gradations and relations between the two kingdoms, and the arrangement of all their forms in groups subordinate to groups, all within a few great types; that it reads the riddle of abortive organs and of morphological conformity, of which no other theory has ever offered a scientific explanation, and supplies a ground for harmonizing the two fundamental ideas which naturalists and philosophers conceive to have ruled the organic world, though they could not reconcile them, namely: Adaptation to Purpose and the Conditions of Existence, and Unity of Type. To reconcile these two undeniable principles is a capital problem in the philosophy of natural history; and the hypothesis which consistently does so thereby secures a great advantage.

We all know that the arm and hand of a monkey, the foreleg and foot of a dog and of a horse, the wing of a bat, and the fin of a porpoise are fundamentally identical; that the long neck of the giraffe has the same and no more bones than the short one of the elephant; that the eggs of Surinam frogs hatch into tadpoles with as good tails for swimming as any of their kindred, although as tadpoles they never enter the water; that the Guinea-pig is furnished with incisor teeth which it never uses, as it sheds them before birth; that embryos of mammals and birds have branchial slits and arteries running in loops, in imitation or reminiscence of the arrangement which is permanent in fishes; and that thousands of animals and plants have rudimentary organs which, at least in numerous cases, are wholly useless to their possessors, etc., etc. Upon a derivative theory this morphological conformity is explained by community of descent; and it has not been explained in any other way.

Naturalists are constantly speaking of "related species," of the "affinity" of a genus or other group, and of "family resemblance," — vaguely conscious that these terms of kinship are something more than mere metaphors, but unaware of the grounds of their aptness. Mr. Dar-

win assures them that they have been talking derivative doctrine all their lives without knowing it.

If it is difficult and in some cases practically impossible to fix the limits of species, it is still more so to fix those of genera; and those of tribes and families are still less susceptible of exact natural circumscription. Intermediate forms occur, connecting one group with another in a manner sadly perplexing to systematists, except to those who have ceased to expect absolute limitations in Nature. All this blending could hardly fail to suggest a former material connection among allied forms, such as that which an hypothesis of derivation demands.

Here it would not be amiss to consider the general principle of gradation throughout organic Nature, — a principle which answers in a general way to the law of continuity in the inorganic world, or rather is so analogous to it that both may fairly be expressed by the Leibnitzian axiom, *Natura non agit saltatim.* As an axiom or philosophical principle, used to test modal laws or hypotheses, this in strictness belongs only to physics. In the investigation of Nature at large, at least in the organic world, nobody would undertake to apply this principle as a test of the validity of any theory or supposed law. But naturalists of enlarged views will not fail to infer the principle from the phenomena they investigate, — to perceive that the rule holds, under due qualifications and altered forms, throughout the realm of Nature; although we do not suppose that Nature in the organic world makes no distinct steps, but only short and serial steps, — not infinitely fine gradations, but no long leaps, or few of them.

To glance at a few illustrations out of many that present themselves. It would be thought that the distinction between the two organic kingdoms was broad and absolute. Plants and animals belong to two very different categories, fulfil opposite offices, and, as to the mass of them, are so unlike that the difficulty of the ordinary observer would be to find points of comparison. Without entering into details, which would fill an article, we may safely say that the difficulty with the naturalist is all the other way, — that all these broad differences vanish one by one as we approach the lower confines of the two kingdoms, and that no *absolute* distinction whatever is now known between them. It is quite possible that the same organism may be both vegetable and animal, or may be first the one and then the other. If some organisms may be said to be at first vegetables and then animals, others, like the spores and other reproductive bodies of many of the lower Algæ, may equally claim to have first a characteristically animal, and then an unequivocally vegetable existence. Nor is the gradation purely restricted to these simple organisms. It appears in general functions, as in that of reproduction, which is reducible to the same formula in both kingdoms, while it exhibits close approximations in the lower forms; also in a common or similar ground of sensibility in the lowest forms of both, a common faculty of effecting movements tending to a determinate end, traces of which pervade the vegetable kingdom, — while on the other hand, this indefinable principle, this vegetable *animula vagula, blandula*, graduates into the higher sensitiveness of the lower class of animals. Nor need we hesitate to recognize the fine gradations from simple sensitiveness and volition to the higher instinctive and other psychical manifestations of the higher brute animals. The gradation is undoubted, however we may explain it. Again, propagation is of one mode in the higher animals, of two in all plants; but vegetative propagation, by budding or offshoots, extends through the lower grades of animals. In both kingdoms there may be separation of the offshoots, or indifference in this respect, or continued and organic union with the parent stock; and this either with essential independence of the offshoots, or with a subordination of these to a common whole, or finally with such subordination and amalgamation, along with specialization

of function, that the same parts, which in other cases can be regarded only as progeny, in these become only members of an individual.

This leads to the question of individuality, a subject quite too large and too recondite for present discussion. The conclusion of the whole matter, however, is, that individuality — that very ground of *being* as distinguished from *thing* — is not attained in Nature at one leap. If anywhere truly exemplified in plants, it is only in the lowest and simplest, where the being is a structural unit, a single cell, memberless and organless, though organic, — the same thing as those cells of which all the more complex plants are built up, and with which every plant and (structurally) every animal began its development. In the ascending gradation of the vegetable kingdom individuality is, so to say, striven after, but never attained; in the lower animals it is striven after with greater, though incomplete success; it is realized only in animals of so high a rank that vegetative multiplication or offshoots are out of the question, where all parts are strictly members and nothing else, and all subordinated to a common nervous centre, — fully realized, perhaps, only in a conscious person.

So, also, the broad distinction between reproduction by seeds or ova and propagation by buds, though perfect in some of the lowest forms of life, becomes evanescent in others; and even the most absolute law we know in the physiology of genuine reproduction, that of sexual cooperation, has its exceptions in both kingdoms in parthenogenesis, to which in the vegetable kingdom a most curious series of gradations leads. In plants, likewise, a long and most finely graduated series of transitions leads from bisexual to unisexual blossoms; and so in various other respects. Everywhere we may perceive that Nature secures her ends, and makes her distinctions on the whole manifest and real, but everywhere without abrupt breaks. We need not wonder, therefore, that gradations between species and varieties should occur; the more so, since genera, tribes, and other groups into which the naturalist collocates species are far from being always absolutely limited in Nature, though they are necessarily represented to be so in systems. From the necessity of the case, the classifications of the naturalist abruptly define where Nature more or less blends. Our systems are nothing, if not definite. They are intended to express differences, and perhaps some of the coarser gradations. But this evinces, not their perfection, but their imperfection. Even the best of them are to the system of Nature what consecutive patches of the seven colors are to the rainbow.

Now the principle of gradation throughout organic Nature may, of course, be interpreted upon other assumptions than those of Darwin's hypothesis, — certainly upon quite other than those of materialistic philosophy, with which we ourselves have no sympathy. Still we conceive it not only possible, but probable, that this gradation, as it has its natural ground, may yet have its scientific explanation. In any case, there is no need to deny that the general facts correspond well with an hypothesis like Darwin's, which is built upon fine gradations.

We have contemplated quite long enough the general presumptions in favor of an hypothesis of the derivation of species. We cannot forget, however, while for the moment we overlook, the formidable difficulties which all hypotheses of this class have to encounter, and the serious implications which they seem to involve. We feel, moreover, that Darwin's particular hypothesis is exposed to some special objections. It requires no small strength of nerve steadily to conceive not only of the variation, but of the formation of the organs of an animal through cumulative variation and natural selection. Think of such an organ as the eye, that most perfect of optical instruments, as so produced in the lower animals and perfected in the higher! A friend of ours, who accepts the new doctrine, confesses that for a long while a cold chill came over him whenever he

thought of the eye. He has at length got over that stage of the complaint, and is now in the fever of belief, perchance to be succeeded by the sweating stage, during which sundry peccant humors may be eliminated from the system.

For ourselves, we dread the chill, and have some misgiving about the consequences of the reaction. We find ourselves in the "singular position" acknowledged by Pictet, — that is, confronted with a theory which, although it can really explain much, seems inadequate to the heavy task it so boldly assumes, but which, nevertheless, appears better fitted than any other that has been broached to explain, if it be possible to explain, somewhat of the manner in which organized beings may have arisen and succeeded each other. In this dilemma we might take advantage of Mr. Darwin's candid admission, that he by no means expects to convince old and experienced people, whose minds are stocked with a multitude of facts all viewed during a long course of years from the old point of view. This is nearly our case. So, owning no call to a larger faith than is expected of us, but not prepared to pronounce the whole hypothesis untenable, under such construction as we should put upon it, we naturally sought to attain a settled conviction through a perusal of several proffered refutations of the theory. At least, this course seemed to offer the readiest way of bringing to a head the various objections to which the theory is exposed. On several accounts some of these opposed reviews specially invite examination. We propose, accordingly, to conclude our task with an article upon "Darwin and his Reviewers."

REVIEWS AND LITERARY NOTICES.

Modern Painters. By J. Ruskin. Vol. V. Smith, Elder, & Co. London.

The completion of a work of the importance of the "Modern Painters," which has occupied in its production the thought and a large portion of the labor of fourteen years, is an event of more interest than it often falls to the lot of a book to excite; but when, as in this case, the result shows the development of an individual taste and critical ability entirely without peer in the history of art-letters, the value of the whole work is immensely enhanced by the time which its publication covers.

The first volume of "Modern Painters" was, as everybody will remember, one of the sensation-books of the time, and fell upon the public opinion of the day like a thunderbolt from the clear sky. Denying, and in many instances overthrowing, the received canons of criticism, and defying all the accepted authorities in it, the author excited the liveliest astonishment and the bitterest hostility of the professional critics in general, and at once divided the world of art, so far as his influence reached, into two parts: the one embracing most of the reverent and conservative minds, and by far the larger; the other, most of the enthusiastic, the radical, and earnest; but this, small in numbers at first, was increased, and still increases, by the force of those qualities of enthusiasm and earnestness, until now, in England, it embraces nearly all of the true and living art of our time. But that volume, professedly treating art with reference to its superficial attributes and for a special purpose, the redemption of a great and revered artist from unjust disparagement and undeserved neglect, touched in scarcely the least degree the vital questions of taste or art-production. It had no considerations of sentiment or discussion of principles to offer: it dealt with facts, and touched the simple truths of Nature with an enthusiastic fire and lucidness which were proof positive of the