Notices of New Books.

1. *The Origin of Species, by means of Natural Selection; or, the Preservation of Favoured Races in the Struggle for Life.* By Charles Darwin, M.A., F.R.S., &c. Third Edition. 538 pp., 8vo. London: John Murray, Albemarle Street. March, 1861. Price 14*s.*

2. *Natural Selection not inconsistent with Natural Theology; or, a Free Examination of Darwin's Treatise on the Origin of Species, and of its American Reviewers.* Reprinted from the 'Atlantic Monthly' for July, August and October, 1860. By Asa Gray, M.D., Fisher Professor of Natural History in Harvard University. A Pamphlet of 55 pp., large 8vo. London: Trübner & Co., Paternoster Row. Boston: Trickner & Fields. 1861.

3. *On the Origin of Species by means of Organic Affinity.* By H. Freke, A.B., M.D., T.C.D. 135 pp., large 8vo. London: Longman & Co., Paternoster Row. 1861.

4. *Species not Transmutable, nor the Result of Secondary Causes; being a Critical Examination of Mr. Darwin's book intituled 'Origin and Variation of Species.'* By C. R. Bree, M.D., F.L.S. 256 pp., 8vo. London: Groombridge & Sons, 5, Paternoster Row. September, 1860. Price 3*s.* 6*d.*

An Editor professing to keep up a record of the current literature of his subject, owes his readers some apology for omitting for so many months the notice of Mr. Darwin's volume on the 'Origin of Species.' The first edition has now been before the public some time, and has probably ere this been perused by most of the readers of the 'Zoologist.' The difficulty of doing anything like justice either to the subject or the author of the work, within the ordinary dimensions of a review, has influenced us in withholding a notice up to the present time; but the great interest it has awakened in the mind of the scientific public, and the extensive controversy that has arisen out of it, including several voluminous publications and reviews expressing a variety of sentiments, and a rejoinder to some of the objectors in Mr. Darwin's third edition, demand that we should remain silent no longer.

To attempt to give a full exposition of the controversy is beyond our limits; the difficulty of epitomising such a closely-connected

work, which is in itself but an abridgment of a larger unpublished work, has made us keep silent so long; and in now taking up our pen we feel profoundly the difficulty we are under in attempting to criticize any of Mr. Darwin's views; but, with the amount of detail in which he has advanced them, we cannot do this in a periodical magazine, and must therefore attempt little more than a brief summary of the four books before us, keeping any views we may have formed on their subject as much in the back ground as possible. They are singularly diverse in character. Mr. Darwin's book, considering the nature of the subject, is remarkably concise and readable, without the slightest attempt at ornamentation or elegance, beyond what the easy expression of an overflowing power of thought naturally possesses. The author, moreover, has that rare qualification of being able to think and write upon more than one phase of his subject: no difficulties that strike him are slurred over; each one is fairly and boldly met; entire chapters are devoted to self-imposed objections to the theories advanced: indeed, the whole work has more the character of an equally-balanced controversy than the pleading of an author on behalf of his subject. Criticism is thus disarmed, and the critic feels he can do little more than feebly reiterate what the author has said either for or against himself. We cannot feel, in reading Dr. Bree's work, that he fully appreciates the quality of his antagonist, or treats him fairly. Dr. Bree's style is very florid and elegant; but we think he unwisely sacrifices closeness and exactness of thought and expression—which are so fascinating in Mr. Darwin—for a sort of elegant flippancy, which, in dealing with the subject, is painful, as it is out of place. The following sentence, at page 151, will explain our objection:—"I do not think I need say one word in refutation of an hypothesis which I might simply designate profane; but I will leave the matter to the cool reflection of those who may read a statement which shocks and outrages every proper feeling, as much as it does violence to our reason and common sense." There is a general want of close accuracy throughout the whole book; and as an example we may notice Dr. Bree's carelessness in entirely misquoting the title of the work he is reviewing.

Again, Dr. Bree states, at page 189, reiterates over and over again, and implies it by the title of his work, that Mr. Darwin believes in the transmutability of one highly-developed form to another, which is an unfair inference from the very distinct theory (however great its falsity) of the common origin of widely-differing highly-developed forms from some vastly-distant and more elementary progenitor.

We disagree with the deductions Mr. Darwin draws, but should nevertheless like to see him fairly treated. We cannot admit that Dr. Bree does this, or goes the right way to work successfully to gainsay the issues of the argument; here and there he twitches at a weak thread, without, however, doing much damage to Mr. Darwin's elaborately-woven fabric.

Dr. Asa Gray's pamphlet is a graceful summing up of the arguments *pro* and *con* Natural Selection, in favour of the views enunciated by Mr. Darwin. He also takes up a further stage of the question, which the author of the 'Origin of Species' passes by almost unnoticed, and endeavours to prove the compatibility of the development of species by natural selection with final cause and design.

Dr. Freke's little book differs widely from any of the others, both in its matter and style. After Mr. Darwin's clearness and Dr. Bree's eloquence it reads most stiffly. Parentheses, here and there, are all very well and admissible, as a means of avoiding an extra sentence, but under any circumstances are merely a licensed deviation from grammatical expression, and when too freely indulged in become very objectionable. Dr. Freke throughout his book is painfully parenthetical, and every now and then, in endeavouring to express too much with a few words, loses himself in a whirlpool of parentheses. An idea expressed by two or three sets of parentheses, fitting into each other, must be lost to an ordinary reader, and involves the use of a greater number of words than good common-place English. Italics may also, now and then, be used to define the exact point of a sentence; but when every third or fourth word, or bit of a word, is written in Italics, this *finesse* of expression may easily be mistaken for pedantry. Dr. Freke considers himself a supporter of Mr. Darwin's deductions, but on different grounds: he appears to believe that species have been gradually developed from one primordial form, under laws of organic affinity somewhat parallel to those laws of chemical affinity defining the individual character and composition of inorganic compounds.

Mr. Darwin's volume, now published, is merely the abstract of a larger work, the author informs us, in his Preface, he has been occupied upon since his return from the voyage of the exploring ship 'Beagle,' and promises to complete it in two or three years. By it we are to be supplied with the details of the facts, forming the basis of his theory, he has been patiently accumulating and reflecting upon for more than twenty years.

To express Mr. Darwin's views in a few words :—From certain facts he observed regarding the distribution of the inhabitants of South America, and the relations of the present to the past inhabitants of that continent, he has been led through a course of observation and reflection, to the conclusion that organic bodies now individualized under the term species were not independently created, but are the descendants of a few much simpler forms, modified and multiplied under circumstances parallel with those now existing; that there has been no break between the present and the geological epoch during which the organic forms with which we are now surrounded were in process of manufacture; that this advancement and modification indirectly result from the power of organic reproduction being vastly in excess of the means of sustenance, which, in the resulting competition for existence, give variations from the normal type, having any profitable quality in the economy of life, the advantage both as to existence and power of reproduction; the quality of variability being inherited, and the steps of improved variation accumulated, through several generations, produce as a result the multiplication and advancement of species. Intermediate links, or those that are too nearly resembling their brethren to settle down into distinct arenas of nature, strive with them for the mastery, the weaker becoming extinguished, those that remain appropriating subdivisions of the district of nature occupied by their common parent, according to their new gradations of habit and functions; and the special qualities of each, being reacted upon by their specialized habits of life, become intensified, first into specific differences, and subsequently, by throwing off series upon series of varying descendants, take higher rank in what Mr. Darwin says is the genealogical order of nature.

The matter of the work, consisting of fourteen chapters, seems to be naturally separable into three divisions — 1st, direct evidence in favour of the theory; 2nd, collateral or constructive evidence; 3rd, the difficulties of the theory. Chapter II., on variation under nature; Chapter X., on the geological succession of organic beings; part of Chapters XI. and XII., on geographical distribution, and the affinity of the productions of the same continent; and Chapter XIII., on the mutual affinities of organic beings, deal with *primâ facie* evidence. Chapter I., on variation under domestication; Chapter III., on the struggle for existence; Chapter IV., on natural selection; and Chapter V., on the laws of variation, relate to less direct evidence, and the assumed active processes connected with the elimination of species. Chapters VI., VII., VIII. and IX., and part of Chapters XI. and XII.,

relating to instinct, hybridism, the imperfection of the geological record, and anomalies in geographical distribution, relate more particularly to the discussion of difficulties and their attempted explanation.

With reference to those facts which Mr. Darwin considers afford him natural evidence in favour of the gradual multiplication and progression of organized beings: Chapter II. relates to the variability of species, as observed under a state of nature, as individual differences determined by peculiarities of habitat, instanced in dwarfed plants on alpine summits, and the quantity and quality of fur of animals having a wide range determined by temperature, and the dwarfed condition of certain shells in the brackish waters of the Baltic; also individual differences under identical circumstances, as individual variations in the plumage of certain birds, the want of uniformity in the muscles of the individual larvæ of certain insects.

Again: the difficulties naturalists have met with in defining the characters which distinguish a species from a variety he says imply that they are but different degrees of the same kind of difference, and that, the consanguinity between varieties and their parent species being acknowledged, genealogical relationship between kindred species, and again between the higher grades of classification, is fairly implied. At page 53 (third edition) Mr. Darwin says, "Certainly no clear line of demarcation has yet been drawn between species and sub-species, *i. e.*, the forms which in the opinion of some naturalists come very near to, but do not arrive at the rank of species; or, again, between sub-species and well-marked varieties, or between lesser varieties. and individual differences. These differences blend into each other in an insensible series, and the series impresses the mind with an actual passage." Again: that the kind of relationships existing between varieties and their acknowledged parent species has, in each natural series, a striking parallel resemblance to the relationship subsisting between the species and the higher grades of classification; for the number of the varieties of a species is generally proportionate to the size of its genus, each species of large genera having a greater number of varieties than each species of small genera, exhibiting a parallel relationship between the affinity of the variety to its species with that of the species to its genus, implying in the resemblance an inherited property: and that allied species once held the same relationship to some common progenitor that varieties now do to each of their acknowledged parent species.

At page 57 (third edition) is stated, "From looking at species only as strongly-marked and well-formed varieties, I was led to anticipate

that the species of large genera, in each country, would oftener present varieties than the species of the smaller genera; for wherever many closely-related species (*i.e.* species of the same genus) have been formed, many varieties or incipient species ought, as a general rule, to be now forming; where many large trees grow, we may expect to find saplings; where many species of a genus have been formed, through variation, circumstances have been favourable to variation, and hence we might expect that the circumstances might still be favourable to variation. On the other hand, if we look at each species as a special act of creation, there is no apparent reason why more varieties should occur in a group having many species than in one having few."

From the gradations of affinity between the species of the successive geological formations, more especially evident in the gradual and even increase upwards in the proportion of existing to extinct species of the tertiary deposits; from the extinction of species never to reappear, but to be replaced with an allied form more advanced in organization; from the progressive divergence in character between recent members of a group, as compared with its species during the geological period; and from the geological succession of the same types within the same geographical areas, implying the inherited relationship of the successive species within those districts; Mr. Darwin implies the genealogical succession of organized beings through the several geological periods, in preference to their being the result of a series of distinct acts of creation. On this subject Mr. Darwin says, at page 368 (third edition): — "Mr. Clift, many years ago, showed that the fossil mammals of the Australian caves were closely allied to the living mammals of that continent. In South America a similar relationship is manifest, even to an uneducated eye, in the gigantic pieces of armour, like those of the armadillo, found in several parts of La Plata; and Professor Owen has shown, in the most striking manner, that most of the fossil mammals buried there in such numbers are related to South American types. This relationship is more clearly seen in the wonderful collection of fossil bones made by MM. Lund and Clausen in the caves of Brazil. I was so much impressed with these facts that I strongly insisted, in 1839 and 1845, in this law of the succession of types,—in this wonderful relationship, on the same continent, between the dead and the living. Professor Owen has subsequently extended the same generalizations to the mammals of the Old World. We see the same law in this author's restorations of the extinct and gigantic birds of New

Zealand; we see it also in the birds of the caves of Brazil. Mr. Woodward has shown that the same law holds good with sea-shells, but from the wide distribution of most genera of mollusks it is not well displayed by them. Other cases should be added, as the relations between the living and extinct land shells of Madeira, and between the extinct and living shells of the Aralo-Caspian Sea. Now, what does this remarkable law of the succession of the same types within the same areas mean? He would be a bold man who, after comparing the present climate of Australia and of parts of South America under the same latitude, would attempt to account on the one hand by dissimilarity of physical conditions for the dissimilarity of the inhabitants of these two continents, and on the other hand by similarity of conditions for the uniformity of the same types in each during the late tertiary periods. Nor can it be pretended that it is an immutable law that Marsupials should have been solely or chiefly produced in Australia, or that Edentata and other American types should have been solely produced in South America; for we know that Europe, in ancient times, was peopled by numerous marsupials; and I have shown in the publications above alluded to, that in America the law of distribution of terrestrial mammals was widely different from what it now is. North America formerly partook strongly of the southern half of the continent, and the southern half was formerly more closely allied than it now is to the northern half. In a similar manner we know, from Falconer and Cautley's discoveries, that Northern India was formerly more closely related, in its mammals, to Africa than it is at the present time. Analogous facts could be given in relation to the distribution of marine animals."

These facts are very startling, and would be still more so if the relationship upon which Mr. Darwin lays so much stress could be traced through any extent of contiguous geological formations. Most of the examples adduced refer to the upper tertiary and post-tertiary beds, and only support contiguity of descent with existing species. So far, indeed, it is but fair, on Mr. Darwin's own assumption, to take the evidence he brings forward, respecting Europe being peopled in ancient times by marsupials which are now limited to Australia, as implying a break in the genealogical thread; for if marsupials did not exist in Australia during the age they peopled Europe, we have a strong plea for assuming the subsequent special creation of the modern Australian kangaroo and its allies; and if the far isolated continents of Europe and Australia were contemporaneously peopled with marsupials, it affords a striking exception to the evidence in support of

the limitations of special types to special geographical areas. Again: the pachydermatous monsters of tertiary Europe have no recent representatives on that continent; but this perhaps might be fairly accounted for on Mr. Darwin's theory of extinction through climatal fluctuations; and we might expect to find their nearest allied descendants driven down to warmer latitudes of the same continent, as plants were, according to Mr. Darwin, during the glacial period; but it is a fact worthy of note that America possesses in its tapir a much nearer ally to the extinct Dinotherium of Europe than any recent species on the old continent.

Mr. Darwin admits the imperfection of his evidence; of the evidence, if it were perfect, as it stands, presenting grave objections; but says that the geological record is imperfect, does not contain a complete record of the succession of organic life; that the average circumstances attending the deposition of the geological strata were such as to render a complete record impossible, and that our acquaintance with this imperfect record is infinitely small, but that the broken scraps of complete evidence we here and there get give us the warrant for assuming the missing links.

Dr. Bree will not admit this,—will not allow Mr. Darwin an era of life in which to perfect his fauna as we find it at the apparent dawn of geological life, or unrecorded periods in which to graduate transitions in organic structure which here and there stagger him with their abruptness. He demands that the geological record as it stands must be taken as complete evidence, and that the sudden changes it here and there displays, in the past history of organic life, are utterly incompatible with Mr. Darwin's theory.

The next division of natural evidence upon which Mr. Darwin rests is that supplied by the phenomena of the distribution of plants and animals, treated of in Chapters XI. and XII. Chapter XI. commences, "In considering the distribution of organic beings over the face of the globe, the first great fact that strikes us is that neither the similarity nor dissimilarity of the inhabitants of various regions can be accounted for by their climatal and other physical conditions. Of late almost every author who has studied the subject has come to this conclusion." The facts specially noted are—the arbitrary character, as regards physical conditions, of the distribution of genera and species along the same zones of latitude; the affinity of the productions of the same continent, and the distribution of species as being mainly dependant on geographical peculiarity, especially as to geographical barriers to free migration, defining the range of species,

as for example small islands, far isolated from continents, being destitute of mammals and batrachians, incapable of migration across any extent of sea; the great difference oftentimes observable in the marine floras and faunas of closely-contiguous districts, separated by lofty and contiguous mountain ranges, deserts or even large rivers, acting as barriers to free migration; and the great differences in the marine floras and faunas of some closely-contiguous seas that are separated by barriers of land, preventing free intermigration; again, in the affinity of the productions of the same continent or sea, though the species themselves are distinct at different periods and stations, as implying not only genealogical relationship, but an uninterrupted existence, within the district, for a length of time sufficient for the development of the allied species from a common parentage. Chapter XI. contains also some interesting details respecting the means of the geographical dispersal of species; but this we shall again refer to when we consider the part of Mr. Darwin's work relating to his explanation of difficulties. Chapter XII., on the mutual relation of organic beings, aims at assigning community of descent as the cause of common points of resemblance, the different degrees of resemblance represented by the terms variety, species, genus and class, representing various parallel degrees of consanguinity. Mr. Darwin says that these different grades are difference of measure, not of kind; that the amount of difference recognised as necessary to define these different groups is arbitrary, and various in different parts of the organic kingdoms, and resembling the unequal amounts of difference that would be observable between the multiplied descendants of large and small families; and that the genealogical relationship between species and their subordinate varieties being a known fact, and that the relationship between species and the higher grades of classification being the same in kind, their nearness of consanguinity in proportion to their resemblance is implied,—that adaptive qualities, or those dependant on, and influenced by, habits of life, are not such as naturalists find most useful in classification; and this, Mr. Darwin says, is because they have been similarly influenced in unrelated families, instancing the community of habits and external appearance between the mouse and the shrew, the resemblance of the whale to a fish, and the external resemblance in the habits of unrelated genera of plants growing in similar situations,—and that it is a general rule that the less any part of the organisation is connected with special habits, the more important it becomes in classification, implying that there is a hidden bond of union between organisms, independently of the places they

hold (whether by special creation or otherwise) in the economy of nature; and this Mr. Darwin deduces is genealogical relationship. The distinction endeavoured to be defined between "special" and "adaptive" characters suggests the question as to where they are to be separated. Mr. Darwin carries us back to a time of indefinite organic simplicity, and by this theory of external influence all advances from it would, in the first instance, be by adaptive steps; and if there is any inherent difference between "special" and "adaptive," the one valuable as characterising a distinct genealogical line, and the other comparatively valueless, we have something to go by in trying to ascertain when the divergence of species, by means of adaptive modification, commenced. To what extent would Mr. Darwin use these "special" characters in classification? If they are really distinguishable from adaptive, to be used in a distinct sense for the purpose of classification, surely the characters of the organic prototypes, which cannot be obscured by the least taint of the adaptive character, ought to be sufficiently clear to save him from the vague speculations expressed in his concluding chapter, as to whether animals and plants have descended from, at most, four or five progenitors, or whether the two grand divisions have descended from a common prototype. What grounds has he for assuming that certain characters, selected for the purpose of classification, are *special*, when he tells us that every quality by which organic beings advanced from the simple prototypes was developed, by the impress of external circumstances, upon its possessor?

Morphology, or the unity of type in the construction of allied groups, or the resemblance to each other in the general plan of their organisation, though the functions of the homologous parts are dissimilar, is enlisted by Mr. Darwin in favour of his theory of genealogical relationship, and the modification of a part to suit various special purposes. At page 466 (third edition), he says:—"Nothing can be more hopeless than to explain this similarity of pattern in members of the same class by utility, or the doctrine of final causes; the hopelessness of the attempt has been expressly admitted by Owen, in his most interesting work on the nature of limbs. On the ordinary view of the independent creation of each being we can only say so it is—that it has so pleased the Creator to construct each animal and plant. The explanation is manifest on the theory of the natural selection of successive slight modifications, each modification being profitable, in some way or other, to the modified form."

There is a bearing of the fact of the correlationship of plants which

must here be noticed. Let us exchange Mr. Darwin's term "correlation of growth" for "correlation of organization," and we think we attain to the means of accounting for such phenomena (as the uniformity of model in the construction of limbs in different vetebrate animals) as appear to Mr. Darwin to support his theory of genealogical affinity. Do we not find numberless instances of correlation of character when it cannot have depended upon blood relationships, such as associated characters of trifling importance running parallel in genera that are most distantly separated? Take, for instance, remarkable peculiarities of colour; as the tendency of a particular shade of blue, in a number of unrelated genera of plants, to vary with a peculiar and exactly uniform shade of pink flowers; and a peculiar reddish brown and yellow being associated in several unrelated genera, as Calceolaria and many of the Leguminosæ.

The relationship borne by one part of an organism to another part is a fact of wide application, for the works of God are all fairly and beautifully proportioned; and correlated properties (as relation in the form of the head to the form of the legs) are no more unaccountable, or inconsistent with special creation, than that an architect with an eye to beauty should make the different parts of his several buildings proportionate. If it exist in such trifling details as those just cited, where correlation of growth through genealogical affinity is out of the question, it is not unreasonable to suppose that the uniformity of model, upon which the more important parts are formed, is the result of special creation working out a consistent proportion of the integral parts.

If browns and yellows are consistent colours in unrelated genera of plants, and long heads and long limbs consistent in unrelated genera of animals, we may fairly carry the principle a step further, and say that the arrangement of bones forming a head is consistent with the arrangement of bones forming a limb. So that, on the bare fact of the correlation of parts, we ought to expect that the existence of a leg is consistent with the existence of a head, and all gradations of relation consistent, from this abstract fact down to those delicate relations between the proportions of these organs which Mr. Darwin notices; and the differences in a series of heads would imply a series of limbs separated by corresponding measures of difference, and apparently forming a related series, though really, in them, individual resemblances totally unconnected with each other. Again: unless all organic beings had been designed without any common resemblances, we must necessarily expect, on the principle of correlation of parts,

that any organic property, being common to several organisms, would involve community of character in some other parts; these, again, would involve other points of resemblance, and so on and on, till we get that exquisitely complex system of resemblances which co-exist within each organic kingdom.

The grounds upon which Mr. Darwin examines the phenomena of Embryology, as bearing on his theory, is the assumption that, at whatever age any variation would first appear in the parent, it would tend to reappear at a corresponding age in the offspring; and as a modification by external influences in the struggle for existence cannot take place in the fœtal or early stages of life, he expects to find in the embryo and young animal an epitome of the being as it existed unmodified by external influences. He says that there is no valid reason in the economy of life why the fœtus should not be developed with all the elaborations of the parent, but, assuming the existing organic beings have multiplied and diverged in character from simpler types, he sees in the simplicity of the fœtus a resemblance to those simpler types. He expects to find in it the absence of characters which have since specialized the improved forms to particular spheres of existence, and the existence perhaps of a few characters, which would be obliterated by disuse, in the multiplied descendants, occupying individually more limited functions. Here and there it is expected that the fœtus will reveal bonds of old relationship, which in the adult have been obliterated by the development of characters distinguishing more special functions, *e.g.*, the occasional appearance of faint bars and shoulder stripes in the foal of the horse and of the ass reveal, he says, their common origin with the zebra, and the much closer resemblance of the spotted young of the blackbird and ouzel to the thrush than when matured implies modern divergence in character from some ancient common progenitor; again, that the faint bars noticeable in the young cub of the lion point to its community of descent with the tiger and cat, the more individual characters of the genera intensified on maturity having been produced by the divided progeny of some older type filling more special places in the circle of organic life. In animals, as the horse, dog and pigeon, where the breeds are very various, the differences characterising them are less strikingly developed in the young animal than the adult, pointing, on the principle before mentioned, to the nearer resemblance of the parents before they had assumed the fully-developed characters of their respective breeds. Mr. Darwin says, at page 438 (first edition):—"The embryo of distinct animals within the same class are often strikingly similar; a better

proof of this cannot be given than a circumstance mentioned by Agassiz, namely, that having forgotten to ticket the embryo of some vertebrate animal, he cannot now tell whether it be that of a mammal, bird or reptile. The vermiform larvæ of moths, flies, beetles, &c., resemble each other much more closely than do the mature insects. We occasionally, though rarely, see something of this kind in plants; thus the embryonic leaves of Ulex or furze, and the first leaves of the Phyllodineous Acacias, are pinnate, or divided like the ordinary leaves of the Leguminosæ.

Mr. Darwin looks upon rudimentary or functionless members as either retrospectively or progressively implying progress,—little pages in the history of individual species, parallel with the phenomena of the extinction and first development of individuals as members of groups. Some rudimentary organs are those that have become functionless by disuse, and others may be the elementary stages of future developments not yet entered upon their allotted functions; otherwise it would be impossible to account for their existence as the result of natural selection taking at advantage of *profitable* variations. At page 488 (third edition) Mr. Darwin says:—"Rudimentary organs may be compared with the letters of a word still retained in the spelling but become useless in the pronunciation, but which serve as a clew in seeking for its derivation. On the view of descent with modification, we may conclude that the existence of organs in a rudimentary, imperfect and useless condition, or quite absorbed, far from presenting a strange difficulty, as they assuredly do on the ordinary doctrine of creation, might even have been anticipated, and can be accounted for by the laws of inheritance." At page 452:—"The wing of the penguin is of high service and acts as a fin, and may therefore represent the nascent state of the wings of birds; not that I believe this to be the case; it is more probably a reduced organ modified by a new function. The wing of the Apteryx is useless, and is truly rudimentary. The mammary gland of the Ornithorhynchus may perhaps be considered, in comparison with the udder of a cow, as in a nascent state." At page 453:—"It is an important fact that rudimentary organs, as teeth in the upper jaws of whales and ruminants, can often be detected in the embryo, but afterwards wholly disappear. It is also, I believe, of universal rule that a rudimentary part or organ is of greater size, relatively to the adjoining part of the embryo, than in the adult; so that the organ in its early stage is less rudimentary, or even cannot be said to be in any degree rudimentary." Bearing in mind Mr. Darwin's theory, that the embryo is a sort of epitome of the

animal's ancestors, would point to a former more perfect condition of the now absorbed organ.

The next class of evidence Mr. Darwin dwells upon relates to the assumed processes of change by which the conditions we see around us have been brought about. The progress of change in species, under a state of nature, in relation to our idea of time, having been, on Mr. Darwin's theory, so infinitely slow, he says we must not expect it to be appreciable by our observation; it rests, therefore, rather on implied than historical evidence. In Chapter I. he fills up the gap with a catalogue of facts bearing on the actual progress of variation observed under domestication. Here we have not only the result, but, knowing in most cases the condition of the originals of our domestic productions, their state under domestication gives us a positive evidence of a certain amount of change. A kind of artificially-produced plasticity of character, of both animals and plants that have been domesticated, must be admitted; but whether this, which is certainly proportionate to the artificial circumstances, has any relation to "variation under nature," seems scarcely implied. Mr. Darwin tells us that seedlings from the same fruit, and young of the same litter, sometimes differ considerably from each other, though the young and the parents have apparently been exposed to the same conditions of life; that the change of habit, under domestication, may influence the relative proportions of the body, *e. g.*, "I find in the domestic duck that the bones of the wing weigh less, and the bones of the leg more, in proportion to the whole skeleton, than do the bones of the wild duck; and I presume that this change may be safely attributed to the domestic duck walking more and flying less than its wild parent;" that the artificially-produced variation of one part of an animal is frequently accompanied by a change in another part not directly influenced, on a principle Mr. Darwin calls correlation of growth, or relation in the characters of isolated members, *e. g.*, "breeders believe that long limbs are almost always accompanied by an elongated head; pigeons with short beaks have small feet, and those with long beaks long feet; hairless dogs have imperfect teeth; long-haired and coarse-haired animals, long or many horns," implying that the impress of circumstances upon a particular function may also involve the modification of other parts of the individual. The extent of the fact of variation under domestication receives a strong illustration in the widely-different breeds of most of our domestic animals and plants, which are supposed to have descended from single wild stocks; and Mr. Darwin says that it illustrates a similar principle he

believes to be at work under a state of nature, the prime mover of which is the struggle for existence treated of in Chapter III, on the reproductive powers being in excess of the necessities for keeping up animal and vegetable population, involving the destruction of a large proportion of the individuals that are brought into existence. In illustration of this Mr. Darwin says, at page 67 (third edition):—"There is no exception to the rule that every organic being naturally increases at so high a rate that, if not destroyed, the earth would soon be peopled by the progeny of a single pair. Even slow-breeding man has doubled in twenty-five years, and at this rate in a few thousand years there would literally not be standing room for his progeny. Linneus has calculated that if an annual plant produced only two seeds—and there is no plant so unproductive as this—and their seedlings next year produced two seeds, and so on, in thirty years there would be a million plants. The elephant is reckoned the slowest breeder of all known animals, and I have taken some pains to calculate its probable *minimum* rate of natural increase; it would be under the mark to assume that it breeds when thirty years old, and goes on breeding till ninety years old, bringing forth three pairs of young in this interval. If this be so at the end of the fifth century, there would be alive fifteen millions of elephants, descended from the first pair." Mr. Darwin asks,—Then who is to die and who is to live of this excessive progeny? Nature replies,—If they differ, the weakest must give way. Mr. Darwin says, on the principle of "variation under nature" they do differ; some are a little worse and some a little better than their parents; and that the weakest must die, and the strongest and best live and become the parents of the next generation, which inherits not only the advantageous quality by which its parents obtained the mastery, but an increased measure of that advantage, for the descendants not only inherit thequality of the variation, but also the property of variability, and so on and on, till this particular quality becomes intensified, and the property of a numerous race, who, as soon as they become too numerous for their particular sphere, again split up on some little advantageous variations, which in their turn become the characteristic properties of each section of the divided race. The first thoughts that this theory of the production of species by these infinitely small steps of variation suggest are,—How is it that we get any individuality in the character of species? and how is it that species do not merge into each other by almost insensible gradations? If this property of variability is an inherent principle, and may be not merely an occasional accident, but the property, in

different measure, of any individual, how is it that every organic individual around us does not bear the impress of the process of change, and repudiate specific clanship? To account for this Mr. Darwin introduces several principles — "the struggle for existence," just referred to; "variation under nature;" "natural selection;" "extinction;" "divergence of character;" and "correlation of growth." These are all treated of under several distinct heads, but they appear so intimately connected that in the following short summary we must consider them together. First, then, the struggle for existence is the generation of a greater number of individuals than can be supported; and this, again, is parallel with the production of a greater number of species than the divided functions of nature are ordained for. Then comes the assumed fact of variation under nature, deduced from the evidence of variation under domestication. Variation under nature is primarily the slight difference of individuals, parallel also with the slight difference of sets of individuals. Slight differences involving slight advantages in the struggle for existence, some must give way; these advantages, however infinitely slight, turn the scale in favour of the possessors. Then follows extinction on the death of the weaker individuals, and parallel with it also, in a variety of grades, the extinction of sets of individuals, or specific groups, by stronger sets of individuals encroaching upon them. Divergence of character, or the production of individuality in species, results in the struggle for existence taking place, as it were in separate little groups, by the most closely related individuals striving for an identical part of the sphere of nature; and as the individuals having the character suiting them for that sphere most strongly developed would obviously gain the mastery, the less characteristic individuals of each little group of competition will be extinguished, and the conquerors consequently be placed in a more isolated position. Then, the different groups will perhaps vary in their power of reproduction and persistency, and as they extend will encroach upon and compete with each other, some becoming extinguished, and others of stronger power will thus become still further isolated, and, again dividing and subdividing by newly-developed grades of character, fill a disproportionate share of the arena of nature; and thus Mr. Darwin accounts for the apparent want of symmetry in the measures of difference separating genera and species.

The theory is certainly very plausible, and presents an easy means of accounting for the irregular grades of difference observable in the organic series. The general completeness of the series, and the apparently irregular gaps that here and there occur, impress the mind

with the idea of imperfection, and imperfection is not compatible with our notions of creation as delivered from the hands of the Creator.

Without at all agreeing with Mr. Darwin, we would suggest that the history of man upon the earth seems to be parallel with what he supposes has gone before us, race struggling with race, some getting the mastery, the stronger extinguishing the weaker; then, culminating, and perhaps becoming unwieldly by their size, and trying to include too great a diversity of compounds, break up into distinct nations, isolated from each other by some peculiar character (as instanced in the recent severance of the United States) which, though of advantage to them separately, was incompatible in association. Each of the young nations, at first, fill different spheres; increase, multiply; and as they may be of unequal strength, the more powerful outrun the others; the weakest are wholly extinguished, and those of middle power, too weak to multiply and too strong to die, go dwindling on from age to age as feeble communities, bringing down to posterity antiquated characters which have been quite lost in the subdivisions of the more vigorous races into "modern nations," but to be wholly cut off only when the dominant races take unusual strides in advance of them. Every step in these changes would tend to some kind of improvement, as no new quality could become dominant that did not confer some advantage on its possessor; the feeble and small-numbered races of the world, termed aboriginal, would bear a sort of analogy to those brute genera, as the Ornithorhynchus, Apteryx, Dodo, &c., which have become or are becoming extinct; and a parallelism might even be drawn between the monumental remains of extinct nations and the fossilized ancestors (if such they be) of organic life.

Now, it must be admitted that there are many striking points of resemblance between these facts and what Mr. Darwin says he has observed in the past history of organic life; but we can scarcely admit that the parallel resemblance is the result of genealogical affinity between the brute creation and the human species; and if a special creation is admitted for man, with his many points of sympathy with the laws of lower organic life, the probability of special creation lower in the scale of nature is at once admitted. However slightingly Mr. Darwin may speak of "plans of creation" we do see general parallelisms and a sympathy of design running through the whole system of creation, not only between the different divisions of organic nature, but in things which are necessarily disconnected; and we ask whether the resemblances occurring within the organic kingdoms may not be attributable to this same uniformity of design rather than genealogical

relationship. Classification, or the subordination of group to group, is a general and vastly-extensive natural law. There is not a single principle in organic classification that Mr. Darwin enlists as favourable to his theory that is not strikingly paralleled in some unrelated part of creation; for instance, the analogy between the system of arrangement of the heavenly bodies,—satellites grouped round planets, planets round the suns, and, again, suns or stars round some common centre into nebulous groups,—and that subordination of group to group, in organic classification, which he attributes to blood relationship.

Then, again, the unequal amounts of differences separating species, which Mr. Darwin attributes to the secondary cause of extinction, is most strikingly paralleled in the mineral kingdom, where such a process could not take place; here we have group subordinate to group, and the unequal amount of difference between different groups and the individuals of different groups, just as in the organic kingdoms; indeed, if Mr. Darwin could believe he was dealing with plants or animals instead of inactive mineral elements, he could weave them into a genealogical series more remarkably consistent than the blood affinities he asumes exist in the organic kingdoms, not merely by arbitrary measures of resemblance, but, as every chemist knows, by the most complex and exquisitely perfect series of correlated affinities. With reference to inorganic classification, and the unequal amounts of difference distinguishing the sixty or seventy elements, the grouping together of the alkalies is most striking. If they were plants or animals Mr. Darwin would surely say that they were very recently descended from some common parent, and that they ought not to be ranked higher than varieties; and if the extremes of dissimilarity in the elements were linked together by the same slight amounts of difference, it would require several thousand individuals to perfect the series. Again: arsenic and antimony are associated by an extraordinary number of common properties, and, as compared with these close affinities, there are, as in the organic kingdoms, isolated individuals—as carbon, nitrogen and silex—which might be aptly compared to the Ornithorhynchus and Apteryx of the organic series. Then, again, there are little *groups* of elements, as that including iodine, bromine, chlorine and fluorine, with their individuals closely related, but collectively isolated in character from the other elements and other groups, as the alkalies, alkaline earths and true earths, which are more easily associated into a related series. There are also kinds of resemblances which may be compared to collateral relationship, as between the heavy and the light metals in the affinities of baryum to

lead. The metals can also be subdivided into a number of natural groups, defined by correlated affinities, as that including the metals resembling platina, and the group of metals having oxides with acid properties; in fact, the affinities and correlationships of all the elements are endless, and to outward resemblance they possess more common blood than either of the organic kingdoms. There is another unconnected parallelism which must here be noticed, the resemblance in the kinds of properties existing within the two organic kingdoms. Mr. Darwin may perhaps attribute them to genealogical relationship, as he claims the possibility of the common origin of animals and vegetables; but it would be obviously necessary, on his theory, that any organs or functions, common to the two kingdoms through affinity, should have been developed by the process of natural selection before their divergence. One of the many common properties shared by the two kingdoms is that wonderful and mysterious phenomenon, sexuality. Now all naturalists, even those that assume their community in their lowest forms, admit that the animal and vegetable kingdoms diverge long before the sexual element appears; that is, that a large series of plants and animals, far above the stage in which the animal and vegetable kingdoms are possibly identical, are asexual; so that, even admitting, for the sake of argument, that plants and animals have gradually progressed from a common origin, sexuality in plants and sexuality in animals are genealogically independent, and affords another striking example of unrelated analogy. A somewhat similar case presents itself in the abortive teat in the male mammal; here is an organ utterly functionless, and if it is not an aborted once useful organ it cannot have been developed by natural selection; it cannot be an aborted organ resulting from the separation of the sexes, because sexuality, or the distinction between male and female, appears much lower in the scale of creation than the teat-bearing mammal, and the teat, as an organ of nutrition concomitant with parturition, would, on the principle of natural selection, have been perfected in the one sex only.

Mr. Darwin refers to an apparent difficulty somewhat parallel with the above, and we notice it to show how easily we may be misled in assuming certain points of organization as the gradual effects of use for particular purposes. We refer to the composition of the skull out of *distinct bones*, apparently for the purpose of its temporary contraction in parturition. Such may be the case, but not as the result of gradual modification by use; for we find them represented by corresponding marks, when the growth of bone takes place, in

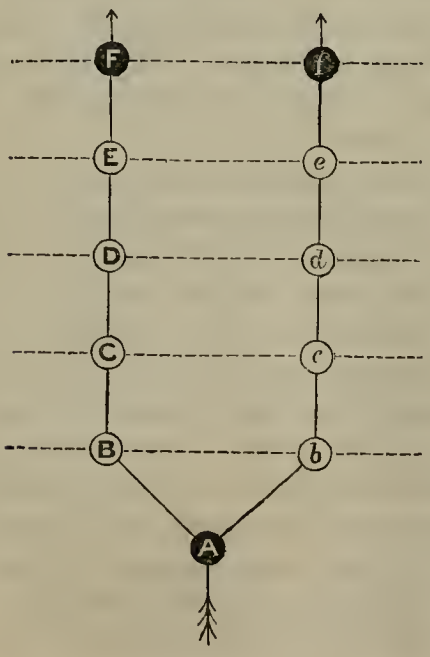
the skulls of oviparous Vertebrata, the elasticity of the skulls of which would be objectless; and in them it cannot have been the inherited evidence of an aborted function previously matured, by natural selection, in a viviparous race, which, being higher in the scale of organization, on the theory of natural progression would be developed from and subsequently to the oviparous. They must, then, clearly be considered as one of the numerous examples of unrelated resemblances and "unity of type," upon which we are led to doubt that common resemblances are dependant on genealogical relationships. A great difficulty, in attributing progress of organization as the result of the gradual modification and advancement of organs, through certain slight variations giving their possessors advantages over their fellows, exists in the fact that small measures of improvement of many organs, or anything short of their immediate perfection, would confer no advantages on their possessors. How, for example, could mammiferous nutrition have been perfected by short stages? The young mammal requires a certain amount of nourishment for its existence, and it is obvious it could not live during the imperfected stages of the organs of supply; so that, however rapid the strides of improvement might be, the extinction of the improved progeny would at once prevent the results of the improvements being accumulated and realized; and it is impossible to fancy a process of generation intermediate between the oviparous and viviparous, to account for the gradual adaptation of the young to suit the gradual perfection of the milk-producing organs.

In the competitive struggle for existence individuals having the greatest natural stamina, and the usually accompanying reproductive energy, would certainly have the advantage; and would not these qualities compete with and extinguish all other deviations from the normal condition? Now, as a general rule, we think it must be assumed that no marked deviation from the normal standard takes place without some sacrifice of reproductive energy, either in animals or plants; and, parallel with this, the strongest individuals have always the characteristic points of the genus or species most strongly developed; for instance, who would think of taking a small and weakly specimen—the leaf of a young seedling, or the first-developed small frond of a fern—to describe the characteristic features of the species from? Have we not, therefore, on this principle, a natural provision for perpetuating the individuality of species, by giving the most normal individuals the advantage in the struggle for existence?

Artificial variations from the normal type, as domestic varieties, have generally less stamina and power of persistence than their native parent; for example, the most artificial forms of florists' flowers, or those that are most "highly bred" (independently of the question of sterile double flowers, through the abortion of the reproductive organs), produce less seed, and are altogether more difficult to propagate, than the less artificial varieties. This is especially evident to the cultivators of the fancy varieties of the scarlet Pelargonium; the "golden chain," "flower of the day," "Alma," and other highly-bred fancy varieties being much less easy to strike and keep alive than the common scarlet, more closely resembling the original species. Again: breeders of stock know how frequently their efforts to produce certain artificial qualities are frustrated by the individuals leading to them ceasing to breed. If this holds good with variations under nature — and the two, according to Mr. Darwin, are parallel, for he illustrates variation under nature by facts of variation under domestication—the tendency must certainly be to the perpetuation of the species in its most normal descendants; and a principle is established that variations, as a rule, do not tend to the well-being of the possessors, or give them any advantage in the struggle for existence. The fact has a variety of bearings: take, for example, the case of the colour of certain animals resembling the colour of their habitats, which most naturalists agree is a provision to guard them from the too easy assaults of their predatory neighbours; any deviation from the normal colour — as a little lighter or a little darker tint, or the presence even of a white feather—would surely mark them as the first to be assailed by animals of prey, and tend to perpetuate the dominion of the usual colour of fur or plumage.

The greatest difficulty we see in Mr. Darwin's theory is the disposal of the infinite number of intermediate forms which must necessarily be the result of the production of species by small steps of variation; it must be by some absolute law, for those cases in which a want of definition between species occur are so few that they at once present themselves to us as exceptional, and we must look for an almost universally pervading operation tending to the extinction of intermediate forms. Mr. Darwin tells us that not only the variation but the property of variation is inherited, and if this be true why should it be set in motion through a number of generations sufficient to accumulate the amount of difference dividing species and then utterly cease? It commences with an individual variation, is prolonged by means of slight individual variations, every individual partaking of the property

in some measure; then, without the slightest reason, stands still, and is not prolonged in the slightest degree through succeeding descendants; otherwise there would be the perpetual obliteration of species going on before us, through the deviation of every individual and its descendants, in every variety of measure, from the original type. We cannot assume even that the correspondence in character of cotemporary individuals is the result of absolutely parallel amounts of the same kind of variation going on in distinct lines of descent, for as its result is accumulatory, and the original type might be throwing off variations through a length of time, the different ages at which we should view the evenly varying descendants would present different measures of the ever accumulating variation and an apparent difference in the cotemporary descendants, according to their antiquity; on the other hand, if the principle of variation was inherited unequally, the infinitely complex variety in the kinds and measures of difference that must result in the descendants would be utterly inconsistent with the amount of individuality existing in species. The process of extinction by which Mr. Darwin gets rid of these infinite series of intermediate forms must depend not in their possessing any abstract quality of being intermediate, but in standing at a disadvantage in reproductive and constitutional energy. The question at once presents itself to us, Has this, even on Mr. Darwin's theory, invariably been correlated with the differences in measure of the characters separating species, or, in other words, has every variation of structure or habit been connected with relative power of dominion over the form from which it has been derived?—for the assumed fact of variations tending to specific characters, *conferring a dominant advantage over their inferior ancestors*, is the very essence of the argument.



Referring to the annexed diagram, let F and *f* represent two species, and B, C, D and E, and *b*, *c*, *d* and *e* the extinct steps of variation that have led to them from some common parent, A, or the two

intermediate lines of species that have become extinct now on the theory of advancement. It is somewhat plausible to assume that the less useful ancestral forms have, in a regular progressive series, been replaced by their improved progeny, A by B, B by C, C by D, D by E, and E by F; but supposing we find the ancestor A, or its unaltered descendants, still existing by the side of F and *f*,—and this is a case abundantly and variously illustrated by the cotemporary existence of organic beings of different degrees of organization,—we must assume, first, that B had not a dominant advantage over A, or it would have extinguished A, and yet that it could bequeath to C a dominant advantage over itself, parallel with the improved variation, which it did not inherit with its own improved variation from A; and, again, as we progress upwards towards D and E, that the little steps of advantage accompanying the little steps of variation could individually effect the extermination of the successive steps of variation without, in any measure of their accumulation or divergence, summing up an advantage over A. Then here we clearly establish the fact that dominant advantage, or power of success in the struggle for existence, has not an exact relation to other variations; for instance, that those differences of structure upon which genera and species are based might go on accumulating without that condition so absolutely essential to Mr. Darwin's argument, that their power of dominion is correspondingly increased; nay, some of the earlier forms may even retain, as in the case of A, a slight measure of dominant advantage over its otherwise advanced progeny; for we cannot reflect on the coexistence of organisms of different height in the scale of nature without being convinced of the fact, however securely those low in the scale may have been saved by divergence of character from extinction in recent competition with the higher, that there was a time at which they must, on the theory of progression, have conquered forms genealogically and structurally in advance of them, for they have outlived every gradation of the assumed links connecting them with higher organizations.

It is difficult for the mind to picture the infinitely varied result of Mr. Darwin's theory in the non-coincident operation of variation in structure, and variation in power of dominion, as it must of necessity involve every variety of gradation of character between organisms; but in viewing the question as a matter of experience we do not see this, nor a measure of it sufficient to account for the gradual mutation of species.

It is impossible, also, to imagine that such slight differences of dominant power as must of necessity separate the slight steps of

variation could influence any appreciable advantage in the struggle for existence. Do we not see every grade of specific difference filling its special place, and varieties, species and genera, of every variety of difference, associating their individuals, and yet all live and multiply? Those varieties which are obviously varieties and separated by the smallest measures of difference, and would, therefore, Mr. Darwin tells us, be involved in the closest competition, are generally found associated with their nearly allied species of identical habits, as many of the closely resembling Veronicas. Linaria spuria and L. Elatine, which are perhaps more closely resembling each other than any two other species of the genus, occur more frequently together than separately; and again, different genera, of largely different character and power of persistence and reproduction, are closely associated without engaging in that mutually extirpating struggle upon which Mr. Darwin's theory of progression so much depends. How very few plants can be said to occupy the ground so densely (as in a dense agricultural crop), through a great reproductive power, as, by their close proximity, to limit their further extension! and, moreover, when mutual extirpation does take place, it in is the earliest stages of development, before the individuals could be subjected to those mutually acting modifications of character which Mr. Darwin says have been the steps leading to specific differences. Again: in the animal kingdom many parts of the globe seem insufficiently stocked, or, in other words, the vegetation would easily support a more extensive herbivorous life, which would afford food and the consequent power of increase and extended dominion to carnivorous races. Take, for example, the prairies of S. America, where the great bulk of vegetation suitable for the support of herbivorous life year after year decays; now the animals that are sustained by it can scarcely be said to be competing with each other for the means of subsistence, for we see in the rapid increase of the domestic horse, introduced in the sixteenth century by the Spaniards, that the inherent power of the prairies in supporting animal life was not nearly made available by its native inhabitants; so that, there at least, we ought to find, in full life, those intermediate grades which Mr. Darwin tells us are extirpated where the means of support are limited. Assuming even that the power of stamina, reproduction and persistency is exactly correlated with all these differences constituting species, it is impossible to realize that such infinitely small points of advantage accompanying the infinitely small steps of variation can, in their separate power, have any influence in Mr. Darwin's 'Battle of Life;' we instinctively feel that each would live and find

a suitable place in the circle of creation, as the human family forms in the social scale an infinity of indefinable grades, each unmolested by its neighbour.

The influence that the wide dispersal of the individuals of a species would have in counteracting the effect of competition and extinction, in weeding out the continual production of intermediate forms, is another point that should be considered with reference to Mr. Darwin's argument in explanation of the individuality of species. Competition can only take place between the individuals of a species where there is actual association. In the case of animals the regions of competition will be wide in proportion to their means of ranging, and the theory might hold good to a practical extent, for as the weaker individuals were being reduced by improved variations there would be no difficulty in supposing that the stronger could soon occupy by migration the whole geographical range of the species, and thus quite outstrip their inferior progenitors. But with plants this uniform interchanging competition could not take place, because there is not continual intermigration. Suppose, for example, the case of any common plant distributed throughout the whole of England or Europe, as Athyrium Filix-fœmina, and admit in all its fulness Mr. Darwin's theory of variation, that the Athyrium is continually throwing off slightly varying descendants, and that the improved forms are supplanting their inferior progenitors. Now there must be some limit to the range within which these circles of competition take place, for no one would be bold enough to say that the different grades of variation of a species growing in Devonshire are competing with the different grades of variation of the same species growing in Norfolk, or, taking a larger view, that the individuals growing in Spain are competing with those growing in Russia; indeed, not only is there every grade of variation, but there must be every gradation in competition, proportionate to geographical severance, and we ought certainly to find every gradation of result and the very process of the individualization of species thereby neutralized; for instance, supposing an improved variation is thrown off in Norfolk, the individuals in Devonshire would be none the worse for this, unless the improved form could exterminate its normal progenitor where it originated, and gradually spread to Devonshire; another variation may be thrown off in Devonshire, and retained within a distinct range of competition to the Norfolk district, and thus several forms might be preserved from extinction, for unless every improved step of variation could extend itself *over the whole geographical range of the*

species, it is obvious that the consecutive extinction of the whole of the individuals of every step of variation could not take place.

Great and more important variations will have a more extensive power of dominion than smaller variations, therefore their range and circle of competition will be more extensive. Small variations will have a small proportion of power over their progenitors, and a correspondingly small power of ranging, which will thus tend to their isolation and preserve them from competition involving their extinction, for, as the measures of improved variations are arbitrary, it is quite probable that many might have just enough power to keep themselves ahead of their progenitors and preserve themselves from extinction by them, without having a great power of spreading; indeed, as Mr. Darwin's steps of variation under nature are so infinitely small, so small as to be undiscernible in their separate amount, it is most probable that this nice balance would be preserved, and thus the slightest gradations of difference be perpetuated.

It is impossible to deny the infinite variety in the grades of variation, or the infinite variety in the grades of competition, resulting from the operation of Mr. Darwin's theory; and these, being as it were multiplied into each other, would, even admitting the operation of "extinction," produce a complexity of result utterly inconsistent with the amount of individuality observable in species.

The difficulties of the theory that have presented themselves to Mr. Darwin, and their attempted explanation, are treated of in Chapters VI., VII., VIII. and IX., and part of Chapters XI. and XII. The most prominent obstacle that strikes him is that which we have already referred to, *viz.*, the absence of the intermediate links representing the gradations of variation by which specific differences have been produced, which he accounts for by the extinction of the consecutive forms being concurrent with the production of each fresh grade of improvement: he says that there would be no great production of individuals separated by small measures of difference and advantage, and that it would not be until each specific difference had been accumulated into a decided advantage upon some point that it would become decidedly dominant; thus it is that the individuals of varieties are generally fewer and have a more restricted range than those of species. Species, if we understand Mr. Darwin aright, are stages in the process of variation where it has so far accumulated as to give the possessors a sort of dominant era in the struggle for existence. The imperfection of the geological record, our imperfect acquaintance with that record, and the fewness of the individuals of the intermediate links compared

with those of the perfected species, are the causes assigned for the absence of geological evidence of the gradation of one specific form into a higher.

Another difficulty cited by Mr. Darwin is the existence in a particular group of species adapted to fill places in the economy of nature, for which the group in its entirety was not designed; for instance, the adaptation of the bat for flight, though its nearest allies have all terrestrial habits, and the aquatic Carnivoræ, structurally allied to animals of totally distinct habits, present difficulties in the way of community of descent, because of the apparent impossibility of the existence of the animal in an intermediate state, and of the improbability of natural selection leading to characters and habits inconsistent with those habits which have tended to the well-being of the group. Mr. Darwin meets the difficulty by citing sundry cases of species possessing extended diversity of habits and small measures of organic modification to suit those habits,—of animals of structures apparently adapted to particular habits filling a distinct position in the economy of nature; for instance, a species of woodpecker, which is obviously adapted by its character for climbing trees and licking out insects with its long tongue from the crevices of the bark, existing in the treeless American prairies,—of the Musula vison of North America, which has webbed feet, and resembles the otter in its fur, short legs and long tail, which in summer preys on fish, but during the frozen winter preys like other polecats or mice and other land animals,—of the family of squirrels, with every intermediate grade of character, from a merely flattened tail to the flying squirrels, having their tail and limbs united by a broad expanse of membrane,—of a flying Lemur, with such a fully developed similar membrane, as to have been at one time mistaken for a bat,—of the loggerheaded duck, whose wings do not fulfil the ordinary functions, but are used as propelling fins in the water, and as a kind of front legs on the land,—of the grebes with feet intermediate in character between the normal type of webbed feet and the feet of land birds,—of the ostrich, whose wings are only used as sails,—and of the Apteryx, where the wings are utterly functionless; all which instances are looked upon by Mr. Darwin as incipient stages that might ultimately be developed into those greater differences of habit and "adaptive" structure which so widely divide some organic classes without disassociating them as natural groups.

The difficulty of attributing the formation of organs of no apparent influence in the well-being of its possessors, as the result of natural selection, affects the question doubly; first, there would be no apparent

inducement for their preservation and development; and, secondly, supposing they might have a small proportionate influence in the course of natural selection,—that a line of development following the formation of any more important organ would certainly obliterate it. These objections Mr. Darwin meets by assuming that many functionless organs may be either members in an incipient state of formation, not yet fulfilling their allotted functions, or those that have passed out of use and become aborted, and also as there is an evident relation in the development of distinct parts of an organic structure (as in the proportion of head to limbs before instanced) that the modification and formation of some useful organ, by the active process of natural selection, may, on the principle of correlation of growth, influence a parallel but functionless development of some other part.

The limited evidence of the formation of organs of great complexity, as the eye, by natural selection, from parallel organs of simpler and scarcely related structure, is another difficulty; but although the gradated series of links connecting them is incomplete, Mr. Darwin says that the possibility of its entire completeness is implied by the existence of little isolated parts of the complete series gradating upwards in almost every point in the scale of animal organization; that the principle of extinction is accountable for the breaks in the series, and, as soft organs cannot be preserved in a fossilized state, that the geological eras might otherwise afford evidence of more complete gradations.

Highly remarkable special organs of unusual character, being common to two widely distinct genera—for instance, a peculiar arrangement of the pollen-grains, similar in Orchis and Asclepias—would throw doubt on community of structure being necessarily the result of blood relationship; but Mr. Darwin considers such cases as attributable to natural selection working, in distinct courses towards a similar result, for the good of the possessors, "in the same way as two men have independently hit on the very same invention."

As a means of accounting for the formation of some complex organs by the process of natural selection, Mr. Darwin supposes the possibility of the transition of functions, *i.e.*, that an organ may be developed to a certain stage for a particular function, then perform some supplementary function which may for a time accompany the normal function, and, by gradual use, ultimately become the dominant and only function, the use for which the organ in its early stage was constructed being entirely obliterated. At page 210 (third edition), Mr. Darwin says:—"The illustration of the swim-bladder in fishes is a good one, because

it shows us clearly the highly important fact that an organ originally constructed for one purpose, namely, flotation, may be converted into one for a wholly different use, namely, respiration; the swim-bladder has also been worked as an accessory to the auditory organs of certain fish, or, for I do not know which view is now generally held, a part of the auditory apparatus has been worked in as a complement to the swim-bladder. All physiologists admit that the swim-bladder is homologous or ideally similar in position and structure with the lungs of the higher vertebrate animals; hence there seems to be no extreme difficulty in believing that natural selection has actually converted a swim-bladder into a lung or organ used exclusively for respiration." This explanation, however necessary, implies, in the early stage of the process, the multiplication of functions in a particular part, which is diametrically opposed to the theory of advance and complexity of structure being the result of natural selection by the specialization of particular functions to particular organs. It is in the more lowly organized beings that we find a multiplication of functions condensed on a single organ, and a retrogressive process seems to be implied when more functions are applied to an organ than those for which it was designed.

Another difficulty Mr. Darwin discusses is that presented by the apparent fact of certain organs having been ordained in relation to other organic beings, implying sympathy of design; for instance, the stings of venomous animals as a means of defence. The production of the sting of the bee by natural selection presents a further difficulty, because its exercise involves the death of its possessor, for as its production can therefore confer no dominant advantage upon its owner we should be inclined to view it as a preordained function in relation to the species assailed by it. At page 221 (third edition) Mr. Darwin says:—"Natural selection will never produce in a being anything injurious to itself, for natural selection acts solely by and for the good of each. No organ will be formed, as Paley has remarked, for the purpose of causing pain or for doing an injury to its possessor. If a fair balance be struck between the good and the evil caused by each part, each will be found on the whole advantageous; after the lapse of time, under changing conditions of life, if any part comes to be injurious it will be modified, or if it be not so the being will become extinct, as myriads have become extinct."

The subject of instinct, treated of in Chapter VII., is discussed as a difficulty, for it is not easy to imagine how those qualities which have such a kindred resemblance to mental power and reflection can have

been developed and improved by processes which are assumed as the means of organic modification. Mr. Darwin appears to look upon instinct as parallel with any other quality essential to the existence of the possessor, and like any mere physical advantage has been gradually developed by the process of natural selection. Referring to the instincts of the honey bee, the individual which would construct its cells of the greatest capacity, with the least amount of material, would have an advantage over its fellows in storing honey for the winter, and the power of manufacturing the beautifully perfected hexagonal construction might therefore be gradually developed by the accumulated inheritance of that half-mental experience we call instinct, through those individuals that have become dominant from attaining to the most perfect economy in the construction of the comb. If we look upon instinct as merely the inherited experience of bygone generations it may perhaps be admitted into the same category as the more strictly physical qualities, which Mr. Darwin tells us have been developed by natural selection; he even enlists the existence of some instincts as favourable to his theory, and says that those common to the widely isolated species of the same genera distinctly point to genealogical affinity.

Another grave difficulty in the way of the theory of natural selection occurs in the fact of the production, by some insects, of neuter, sterile casts, or particular groups of isolated individuals, distinct in structure and habits from the ordinary line of generation. It seems almost impossible that these can have been produced by gradual modification, because they leave no inheritance to gradually accumulate the deviation from the generating line, and, furthermore, the whole amount of difference *is* accumulated in a single generation, but Mr. Darwin says, on the assumption that these sterile casts are of advantage to the social economy of the species, the individuals tending to produce them would become dominant and gradually accumulate the property of generating the completely sterile neuter casts.

The alleged fact of the fertility of the hybrids produced by the crossing of varieties, and the sterility of those produced by the crossing of species, would imply two serious difficulties; first, an essential difference between varieties and species, which Mr. Darwin says is one only of measure; and secondly, a natural provision for the maintenance of the individuality of species. Chapter VIII., on the subject of hybridism, is principally devoted to questioning the force of the evidence that has been adduced in favour of an absolute difference between the fertility of the offspring of crossed varieties and crossed

species; Mr. Darwin admits the fact as one of measure, accountable, he says, from those organic forms classified as varieties having closer affinity than those distinguished as species. The evidence he disputes, he says, is full of anomalies and difficulties, and has a false amount of weight given it from the fact of the reputed phenomenon having been erroneously used to define what forms are to be called species and what varieties. The production of fertile offspring from two distinct forms, whether they be species or varieties, is exceedingly arbitrary: in some genera individuals widely differing can be crossed to produce fertile progeny; in others the forms more closely resembling each other produce perfectly sterile progeny. The species or varieties of some genera are more easy to get first crosses from than others; and yet the progeny are less fertile than from those which are more difficult to obtain as first crosses. Again: the ease with which first crosses may be obtained between two species depends on which is employed as the male and which the female; or, in other words, two species do not always produce reciprocal crosses with equal facility; *e.g.*, the male of A and female of B may more readily breed and produce fertile progeny than the male of B and female of A. There are some species that are more easily fertilized by the pollen of another and distinct species than by their own pollen. Looking at all these anomalous facts, and the great difficulty with which they beset the subject of hybridism, Mr. Darwin does not consider that the balance of evidence in favour of the increased fertility of the offspring of crossed varieties over those of crossed species is greater than can be justly accounted for by the closer organic resemblance between varieties than between species. We know that there is some limit to the diversity of organic forms that will produce fertile progeny, and we are justified in expecting to find the measure of sterility proportionate to the measure of difference.

The last difficulty Mr. Darwin discusses (Chapter XI.) is the fact of certain apparent exceptions to the very general law, so essential to his theory, that the area inhabited by a species is continuous; for if the same species occupied isolated parts of the world, between which migration was impracticable, we should be driven to the inevitable alternative, either that they were derived from distinct centres of creation, or "the improbable assumption that species identically the same had been derived, by the process of natural selection, from parents specifically distinct."

The most prominent examples of isolation are of alpine species being common to the summits of mountain ranges widely separated

by extensive temperate and tropical lowlands, across which the migration of cold-loving species could not, under ordinary circumstances, take place; the wide distribution of fresh-water animal and vegetable species occurring at distant stations separated by impassable barriers of land, and the occurrence of terrestrial species common to islands and mainlands separated by hundreds of miles of open sea acting as a barrier to free inter-migration: all such cases Mr. Darwin looks upon as exceptional to a generally-pervading law, that the individuals of a species have a contiguous range, and considers that they can be accounted for by occasional and accidental means of dispersal; for instance, by variations that have taken place in the level of the earth's surface, altering the form and relative contiguity of continents and islands, by which once-existing roads of migration have been obliterated; by ocean currents effecting the distribution of seeds and plants; by migratory birds carrying with them, over hundreds of miles of open sea, undigested seeds; by wading birds conveying and distributing, by simple adhesion to their feet, the young of small fresh-water mollusks, and seeds of fresh-water plants; by gradual changes of temperature on the earth's surface, as evidenced in the once-existing glacial condition of present temperate regions, causing the migration, northward and southward, of species to and from various zones of latitude.

The occurrence of identical alpine species on widely separated mountain ranges, Mr. Darwin suggests must have been effected by this process during the glacial period, the alpine species then spreading over the lowlands having been exterminated and replaced by temperate species on the returning warmth, except where they would be able to recede northward and up the higher mountains to suitable temperatures. We cannot, however, avoid the conclusion that the tropics must have undergone a corresponding diminution of temperature with the more northern zones, and would probably, when central Europe was ice-bound with glaciers, not have been warmer than our present temperate regions, inevitably causing the utter extermination of all animals and plants that were dependant on tropical heat for their existence, and necessitating a fresh special creation to meet the altered condition of the earth's surface on the return of warmth after the glacial period.

In reading the first thirteen chapters of Mr. Darwin's work, we must confess that, however widely we dissent from his conclusions, we go hand in hand with him in weighing the various phases of the question, and our most perfect confidence in his sincerity assures us that he is striving after truth, and that, with all openness and honesty, he is fairly

considering every difficulty that has occurred to him. In Chapter XIV., however, we seem merely to get a faint glimmer of what is passing in his mind. The reader has been gradually prepared for something beyond the conclusions that are previously stated, and we begin to wonder whether man's origin, the question inevitably suggested to every reader of 'The Origin of Species,' has been thought over by Mr. Darwin with the same amount of detail as the origin of brute species. We hope we do him no injustice in saying that there are several passages in Chapter XIV. which seem to hint at something which he dares not openly avow, and point at conclusions which may not be candidly stated. In his retrospective glances he knows not how far to press his theory, and in applying it prospectively there is an equally unsatisfactory indecision,—a quality of which the rest of the work is so characteristically void that we cannot help feeling it is intentional, and that he is shrinking from the open assertion of convictions which appear to clash with Revelation. At p. 523 (third edition) he says, "In the distant future I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mutual power and capacity by gradation; light will be thrown on the origin of man and his history. * * * * * When I view *all beings* not as special creations, but as the lineal descendants of some few beings which lived long before the first bed of the Silurian system was deposited, they seem to me to become ennobled. Judging from the past we may safely infer that *not one* living species will transmit its unaltered likeness to distant futurity. * * * * * *As all the living forms of life are the lineal descendants of those which lived long before the Silurian epoch*, we may feel certain that the ordinary succession of generation has never once been broken, and *that no cataclysm has desolated the whole world.* Hence we may look with some confidence to a secure future of equally inappreciable length; and, as natural selection acts solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection."

We must confess these passages pain us, because we believe their thoughtful author must have considered their bearing upon Revelation. It is one thing to avoid carping at apparent scientific inaccuracies of the Scriptures and another to carelessly pass by and ignore all reference to Revelation. Everything like detail appears here to be scrupulously avoided; monkeys and gorillas are unaccountably passed by without notice; and notwithstanding Mr. Darwin leads us by inference to conclude that he considers the human species

is genealogically allied to brute life, he escapes the responsibility of clashing with Revelation by expressing his views in broad intangible generalizations, and makes a kind of sentimental theology do duty for Revelation, which his theory so unequivocally opposes. Does Mr. Darwin consider his theory of the origin of species consistent with the Scriptures? or is the question of its consistency a matter of indifference to him?

Dr. Asa Gray says that natural selection is compatible with natural theology; this is merely a truism, for who doubts that a religion built up of natural evidences is compatible with natural evidences? and if natural selection is a fact in Dr. Gray's estimation, his natural theology will of course be based upon it. We want, however, to know whether Dr. Gray and his followers are satisfied with "Natural Theology" as a substitute for the revealed will of God, and whether he considers that the weight of Revelation, which has been submitted to us simply for the acceptance of our faith, is to be valued according to its correspondence with the ever-fluctuating and conflicting views and experience of men of science?

Revelation must either be accepted or rejected by us *in toto:* there is no middle course. It is not to be pruned and docked according to our fancy and supposed experience, and then its mutilated remains honoured out of a conventional sense of propriety. If it cannot be accepted with every detail as it has been delivered to us it must be openly ignored altogether, and its honest denial is better than its qualified acceptance by those who ape it by "Natural Theology."

With regard to the theory of the progressive mental advancement of the human race, hinted at in Chapter XIV., history affords little evidence to encourage it; a high intellectual condition is peculiarly the property of individuals, and, beyond a certain point, affords little advantage in the human struggle for existence and power of dominion. An unusual degree of intellectual endowment pervading a large proportion of a nation has, unaccountable as it may appear, invariably been the prelude to the nation's downfall. Rome and Greece gradually attained to this "acquirement of mental power" in an eminent degree, but beyond a certain point it was not a quality which profited the possessors in the power of dominion, for, as we know, they had to give way to their more barbarous conquerors, and their intellectual perfection was thus lost as a hereditary quality.

Nations and races may differ in their intellectual qualities, but we never see intellectual advancement go on in an uninterrupted career. The different nations and races of the world are continually fluctuating

in the progressive element, first advancing, then declining and becoming extinguished; these fluctuations, being dependant on a variety of qualities unconnected with intellect in its highest sense, deny the means of its hereditary accumulation for the collective advancement of the human race: even admitting the abstract theory of advancement, there would be a number of qualities at work competing for the line of progression; those benefitting man as an animal, in his sensual prosperity and power of existence and reproduction, would probably compete with and cancel the line of mere intellectual advancement; for, beyond a certain point, we know that the two are not correlated, and that in the ordinary economy of life a man of medium intellectual power is just as successful, accumulates just as much money, and leaves behind him as many children to populate the world, as the most brilliant genius.

God has ordained certain proportions of the social scale as essential to the well-being of a community, and whenever that proportion is unbalanced (as it soon would be on Mr. Darwin's theory of intellectual advancement) we see its effects in the decay and ultimate obliteration of nations.

The fresh conviction we have received from the perusal of 'The Origin of Species' is that there is a measure of truth in Mr. Darwin's deductions, that genealogical relationship between species is here and there true to a limited extent,—just to that extent to which naturalists are puzzled in discriminating forms which rank below what are universally acknowledged as good species.

The great bulk of varieties have so obviously an affinity for certain species that we instinctively acknowledge their genealogical relationship, and the great bulk of species have such strong individual characters that we are impressed with the opposite conviction concerning them; that here and there there are doubtful forms that are difficult to decide upon must be readily admitted, but the proportion of these doubtful forms is so infinitely small that it at once denies our using them as the means by which to graduate the identity of species with varieties; for if specific differences and the differences separating varieties were only in measure we certainly should find a regular gradation between the kinds of differences separating individual varieties and the kinds of differences separating individual species, or at all events a fair proportion of the forms of intermediate degree.