

7. *On 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. London: John Murray, Albemarle Street, 1859.
8. *On the Classification and Geographical Distribution of the Mammalia*; being the Lecture on Sir Robert Reade's Foundation, delivered before the University of Cambridge, in the Senate House, May 10. 1859. To which is added an Appendix "on the Gorilla," and "on the Extinction and Transmutation of Species." By RICHARD OWEN, F.R.S., Reade's Lecturer in the University of Cambridge, &c. &c. London: John W. Parker & Son, West Strand, 1859.
9. *History of the Old Covenant*; from the German of J. H. KURTZ, D.D., Professor of Theology at Dorpat. Vol. I. Edinburgh: T. & T. Clark, 1859.
10. *The Book of Genesis in Hebrew, with a Critically Revised Text, various Readings, and Grammatical and Critical Notes.* By CHARLES HENRY HAMILTON WRIGHT, B.A., of Trinity College, Dublin. London: Williams & Norgate, 1859.
11. *Commentary on the Pentateuch.* Translated from the German of Otto Von Gerlach. By Rev. HENRY DOWNING, Incumbent of St Mary's, Kingswinford. Edinburgh: T. & T. Clark, 1860.
12. *The Natural History Review, and Quarterly Journal of Science.* London: Williams & Norgate, January 1860.

"Who is he," asks Bentley in one of his characteristic sermons, "so abandoned to sottish credulity, as to think that a clod of earth in a sack may ever, by eternal shaking, receive the fabric of a man's body?" Sottish credulity! Our great master in criticism puts the case strongly. In his charitable respect for human nature,—and his severe experience in Old Trinity, had taught him that man has many more sides than one—he in his best vein of indignant irony, discards the most remote suspicion of any one in the wide world, and especially any man of polite learning, turning towards the light of common observation the sottishly credulous side of atheistic materialism.

Richard Bentley, however, shrewd almost to a proverb as he was in the detection of ignorance and fraudulent pretence in questions of classical and antiquarian interest, had but imperfectly inquired into and inadequately discriminated the manifold possibilities of a credulity, in some respects more sottish, than the expectation of producing even an idiot—not to mention a philosopher—by any concussion, however smart, of clods in a sack.

"The highest mind," remarks an ingenious, though rather

inscrutable, German philosopher, "is an anatomised or dismembered mesmerism, each member whereof has been constituted independent in itself." A somewhat novel mode of deciphering the mysteries of anthropology, and likely, at first sight, to induce in ordinary minds some little perplexity and doubt, the reader may perhaps innocently conclude. A rather hasty and precipitate judgment is this, however. Any little obscurity that may be felt will, doubtless, be instantly and for ever dispelled by the announcement by the same ingenious naturalist, that "the liver is the soul in a state of sleep," "the brain is the soul active and awakening;" that "theology is arithmetic personified," and that "God is a rotating globe." And such propositions are the growths of a highly gifted mind—the germs of a philosophy that is alleged to have taken root among philosophers—and were serenely and confidently published to the world! Surely Dean Swift must have rather seriously miscalculated the courage of some naturalists, at least when he remarked, "How shall any man who hath a genius for history undertake such a work with spirit, when he considers that in an age or two he shall hardly be understood without an interpreter."

It will, however, be neither an innocent mistake as to the activity and duration of mischievous opinions, nor candid as regards the scientific men of Germany, to suppose that the doctrines of Oken are merely a part of the inoperative history of knowledge in our own country. Greatly modified in form, and clothed in language, in some measure, compatible with the sobriety and decorum of thought presented by the more reverential spirit of the English people, the spirit and ideas of pantheistic atheism are, as shall be more distinctly explained hereafter, from time to time, more or less directly, influencing the speculations and tone of a portion of the scientific mind among us.

At present, however, we are more immediately desirous to invite the attention of the reader to a peculiarly cheering testimony borne to the reality of man's highest relations and responsibilities, by the most distinguished of all the naturalists of the present age. Towards the close of Professor Owen's lecture in the Senate House at Cambridge, in May last, there is the following passage:—

"The supreme work of Creation has been accomplished that you might possess a body—the sole erect—of all animal bodies the most free, and for what?—for the service of the soul. Strive to realise the conditions of the possession of this wondrous structure. Think what it may become,—the Temple of the Holy Ghost. Defile it not."

Most memorable words assuredly, alike in their meaning and moral spirit! Prophetic, as may be earnestly hoped, of a purer era in the combined activities of the divines and naturalists of the world, they cannot fail more immediately to encourage the heart of many a humble labourer in the scientific field, whose services are already, in no mean degree, fragrant with the sacred perfumes of God's altar. Counsels so ripe in wisdom and so boldly spoken to an auditory so greatly eminent in social position and intellectual culture, will be thankfully welcomed by every sincere friend of truth and goodness.

It is not merely that they furnish emphatic evidence of the fact that the blind and debasing figments of the Priestleys and Belshams of a former age, who were not ashamed to avow that "man consists of one uniform substance, the object of the senses," are authoritatively repudiated by the calm voice of rigid scientific thought. They also, as we fondly believe, strongly tend to hasten on the blessed advent of the time when an anthropology as ethically mischievous as it was philosophically meagre and inadequate—but towards which, about five-and-thirty years ago, not a few of the more active students of natural science were too favourably disposed—shall, through the diffusion of sounder views, have become impossible as an element in any influential public opinion.

Nor do we confine our grateful acceptance of Professor Owen's counsels within these limits merely, wide and important though they be. Vindicating the just claims of matter, as a divine creation, to a more thoughtful estimate than is implied in the too prevailing suspicion of its inherent corruption and necessary vileness, he, at the same time, in taking for granted the trustworthiness of man's intellect as an organ of truth within the proper limits of the argument for the divine existence, makes his *Natural Theology*, so far as it goes, the sacred forerunner and herald of the revealed truth, that in the present and everlasting indwelling of the Holy Ghost in man's complex but unique nature is the gracious and sublime accomplishment of all truth.

But, as already indicated above, other and opposite views, active alike in effort and influence, to a certain extent prevail in this country. Several strong currents of opinion, moving at higher or lower depths in the thoughts of naturalists, all of which are more or less prejudicial to the legitimate claims of supersensuous and divine truth, in relation to the arrangement and purposes of matter, are from time to time evincing their existence in novel aspects of old and customary errors.

Special pleading by means of partial instances of fully accredited laws, together with a large, and, not uncommonly, rather clumsy application of negative evidence, forms a prime feature

in the discussion of too many questions that demand for their solid solution the widest compass of investigation with the most chastened statement of results. As nothing is, at any time, easier or more frequent than for imperfectly grounded inquirers in natural science, to lose themselves in almost utter helplessness amidst a vast and ever-enlarging labyrinth of details, so few things are more ominous of evil than the efforts of one and other of our many accomplished theorists, who, in striving after the attainment of higher uniformities of expression with a view to the explanation of exceptional facts, lose sight of palpable realities amidst the obscurity and vagueness of an isolated logic. In reference to this point, the following sagacious words of the late Archdeacon Hare, have a wide and instructive application:—"When nothing more than the mere faculty of reasoning, Reason is most fallible, as is proved by the myriads of abortions and misgrowths which swarm in the history of philosophy and science. This its fallibility does not arise merely or mainly from slips of inaccuracy; though such blunders also, at any link in a chain of argument, render the whole chain brittle and untenable. Reason has erred still more from its neglect of those corrections and adjustments which must be introduced at every step, before logical inferences can become scientific inductions; and from its precipitance in building up systems, by arbitrarily impressing its own forms on outward objects, instead of searching laboriously among the multitude of those forms for such as will suit them."

In using the space now allotted to us, it is intended to essay an estimate of the prevailing aspects of Natural Science in its present relations to certain fundamental interests of Natural Theology and the divine claims of the Mosaic record, advertent occasionally, on the one side, to some recent speculations of an adverse character, and, on the other, producing from the large mass of accumulated facts, a few of the more significant and serviceable testimonies of a friendly and corroborative kind.

That results of a highly instructive and beneficial nature may be acquired from an exact and conscientious review of the correlative influences of natural and sacred science, is a proposition too obvious to require a minute or prolonged exposition. Out of place it never can be to assert directly and positively the value of a just conception of the argument of Final Causes, or to associate in an intelligible method the more recent evidences supplied, more especially by organic phenomena, of its logical validity and material extent. Too late it never can be to enliven and illustrate that argument in its hold on the heart as well as the understanding, by such fresh and cogent appeals to the imaginative faculty as are

suggested by the detection of novel and unexpected facts in organic structures and functions. It must ever be seasonable and serviceable, by the aid of the many luminous testimonies to the fact that the postulate of a personal intelligence in creation is strictly demanded by the primary conditions of man's intelligent study of its manifold products, to preserve in sharpest outline the broad and irreconcilable distinction between the theory of a living Creator and the dreamy hypothesis of the solution of all the various forms of existence by the chaotic menstruum of Pantheism. Nor at any time, and especially not now, will it be regarded by those who love the lively oracles of God, and have been taught from above to revere the divine law so picturesquely expressed by the ancient prophet in the words, "The thing was true, though the time appointed was long," a work of supererogation, to assert from time to time, that the Mosaic record cannot be divested of its essential character of a divinely revealed history either by a silent avoidance of its claims, or a fanatical opposition to its reconcileableness with the disclosures of cosmographic or ethnological science.

The first point to which, in the prosecution of our present task, we solicit the reader's attention is, that in some popular speculations in natural science of more immediate and vital interest to the theologian an *explicit* assumption of Theism is neutralised by an *implicit* Atheism.

Œcumenius, in his commentary on the Second Epistle of John, thus describes the Atheist—"ὁ ἕξω τῆς ἐντολῆς τοῦ Ἐυαγγελίου Ἰδους, ἄθεος ἑαυτον ἀποσχοινίσας τοῦ ἔχειν Θεον." This, of course, is no valid definition of Atheism. It nevertheless embodies its essential and characteristic element as a practical creed. It is emphatically significant of that dialectic *animus*, which is peculiar to the advocates of the tenet of the merely natural in contrast to the miraculous in creation. The ἀποσχοινισίς—the tacit, though active, exclusion of the supernatural agency of a personal Jehovah from the primordial origin and successive transmission of vital species,—can alone explain the fact of an avowed Theism being associated with conclusions and results no less logically impure than morally antagonistic. We speak here, of course, merely of recorded opinions, to the true nature of which we shall have occasion, ere we conclude, of more specially adverting. Men themselves, as considered apart from their formal principles, and especially their scientific dogmas, may be morally better than any one article, or all the articles of their creed taken together, it being unhappily by no means uncommon for scientific inquirers to embark in speculations, not knowing in what region of limbo and disaster an iron-handed logic may compel them eventually to land.

History, it is sometimes said, though with no great originality, has manifold practical applications. And this in a certain sense cannot be doubted. At the same time practical men, whose claims to some small share of still surviving modesty are legitimate, are occasionally disposed, more especially when gravely pondering the marvellous repetition, at distant intervals of time, of grave errors,—a circumstance emphatically noticed by Aristotle in his *Meteorologica*,—to question their own special fitness for attaining to any certain results. There are theories, for example, of world-building, that having been given after the prolonged elaboration of years by their authors to their fellow-men, some twenty-five or thirty centuries ago, and having had some measure of acceptance for a season, among the leaders of national thought and opinion, then passed away their small ingredients of truth, which were insufficient to keep afloat the greater weight of error by which they were incrustated, being absorbed for onward transmission by some more novel and popular system. Has the written story of such philosophical pastimes of folly ever since kept the wide world awake to the perilous hazard of misinterpreting facts, or vainly attempting to secure abiding results of knowledge by methods of inquiry and inference long since proved to be illustriously chimerical in principle, and of the most futile application? And, more especially in reference to such theories of nature, as while apparently based on a theistic principle, are moulded and overruled by a tacit atheism, have the naturalists of the present time nothing to learn from the blind and barren results of ancient speculation? Had history repudiated the function of rendering the reasonings of a past age serviceable as a safe guide amidst the quicksands of modern theories, when a naturalist of no mean reputation recently employed the following ominous words—“Throughout whole classes various structures are found on the same pattern, and at an Embryonic age the species closely resemble each other, Therefore I cannot doubt that the theory of descent with modification embraces all the members of the same class. I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number.

“Analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype. But analogy may be a doubtful guide. Nevertheless, all living beings have much in common, in their chemical composition, their germinal vesicles, their cellular structure, and their laws of growth and reproduction. We see this even in so trifling a circumstance as that the same poison often similarly affects plants and animals; or that the poison secreted by the gall-fly produces monstrous growths on

the wild rose or oak tree. Therefore I should infer from analogy that all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed."

In every exposition, however, of what is known by the name of "development," as opposed to the doctrine of a miraculous creation of species, as in every discussion of the transmutation of species, which is merely a more plausible modification of the former, with which the reader may be familiar, it is deserving of special remark that the postulate of creation, as an idea generically distinct from generation, seems to be more or less openly avowed. Anaxagoras, in like manner, twenty-three centuries ago, sought to transmute preceding cosmogonies into a better and happier shape than was at all compatible with the genius of a hard and naked atheism. He sought to introduce a higher name. He aimed at the display of a more plausible and prevailing symbol. He adopted the *Noûs*, or the regulative faculty of intelligence, as a higher and more consistently comprehensive cause of the various phenomena of matter, with their disposing forces. He, nevertheless, at the same time excluded from his theory the element of creation. Repudiating the ideas of his Ionic predecessors, who accepted matter as the efficient cause of all things, he, in common with them, believed in the eternal existence of a chaos, the rudiments of which were, in his view, reproduced in time, by the energy of the cognitive principle, in the forms and organisms of which the world now consists.

Is it not, then, eminently instructive when, as at the present day, voices of no dubious import in natural science are heard pronouncing, with a very peculiar emphasis, the terms "creation," "development," and "transformation," as if the conceptions ordinarily denoted by them were logically comprehensible by any intelligible scheme of Theism, to know that Socrates or Plato, in the mantle of "the old man eloquent," charges Anaxagoras with giving an atheistical tendency to his age?

"Having at one time," says Socrates, "heard an individual reading from a book, written, as he said, by Anaxagoras, and setting forth that intelligence disposes and produces all things (*ὡς ἄρα νοῦς ἔστιν ὁ διακοσμῶν τε καὶ πάντων αἰτίας*), I was delighted with this cause. It, moreover, seemed to be in a manner right that thought should be of all things the cause; and so I concluded, if such is the case, that all things would be disposed of and arranged by the ruling mind as is best. . . . From this wonderful hope, however, I was soon cast down, when, in my more familiar acquaintance with his

writings, I perceived that this man makes no use of mind, nor ascribes any causes to the arrangements of all things (*ὁρῶ ἄνδρα τῷ μὲν νῷ οὐδὲν χηρῶμενον οὐδε τινος αἰτίας ἐπαιτιώμενον εἰς τὸ διακοσμεῖν τὰ πράγματα*), but air, ether, and water, and many other things equally irrational."

But in vain does the history of opinions invite attention to such pregnant criticism of philosophic beliefs in past times, if the inherent seminal weakness of a Theism,—which though more or less explicitly avowed is at the same time silently yet organically tainted with the moral virus of Atheism,—does not, even at first sight, appear.

It will of course be admitted, with all the promptitude of a grateful intelligence, on the part of the philosophic naturalist, that natural phenomena; alike organic and inorganic, will, in proportion as scientific methods of treating them attain to higher degrees of ideal simplicity and force, be, within certain limits of thought, more accurately understood and prove more serviceable to man. The gases, fires, and fluids (*ἀερες τε καὶ αἰθέρες καὶ ὕδατα*) of an earlier time, casting off all crude disguises and "ill-favoured visors," become, in obedience to a more acute and dominant analysis, much more than the mere alphabet of higher knowledge. In proportion, also, as data and appropriate formulæ accumulate, the faculties of the inquirer submit almost unconsciously to more advanced forms of scientific discipline and control. More enlarged thoughts of the vital connections of the concrete and the abstract, as the ministers of daily advantage to man in his probationary life here, are almost spontaneously occurring to the patient student of dead matter. In like manner also, the visionary, though far from meaningless or un instructive, and in some respects deeply plaintive mythology, that was considered in ancient times equal to the interpretation of organic nature, when,—

"The mass
Of Nature's lives and wonders pulsed tenfold,
To feel the sun-rise and its glories old,"—

has been, after the manifold reactionary theories of centuries, long superseded by more credible and consistent views, not only of the characteristic momenta of animal and vegetable life, but also of their congenial conditions.

Are there, then, not some cogent reasons for disappointment and painful surprise, on the part of the thoughtful and discreet student of nature, who has been instructed, not only as to the logical value of duly discerned facts, but also in regard to the ethical import of the lessons of history, and who has especially been led to expect in theoretical naturalists a progressive insight into the strictly scientific account of the origin of

organisms, when he meets with the following extract of a work published so lately as the close of 1859 ?

“On the view,” remarks Mr Darwin in his recent volume ‘On the Origin of Species,’ from which we have already quoted, “that species are only strongly marked and permanent varieties, and that each species first existed as a variety, we can see why it is that no line of demarcation can be drawn between species, commonly supposed to have been produced by special acts of creation, and varieties which are acknowledged to have been produced by secondary laws.”

And that this opinion of Mr Darwin’s differs in no essential respects from that of the author or authors of the “Vestiges of Creation,” the reader will easily see from the following sentences contained in the latter work.

“Organic beings came not at once, as they might have been expected to do if produced by some special act on the part of the Deity. . . . They came in a long succession in the order of progressive organization.”

And that both extracts are as antagonistic to sound views of the philosophy of nature as to the oft-repeated instructions of history from the very earliest to the most recent times, will, it is hoped, be apparent from the following observations which, though not perhaps strictly expository of the enfeebling effect of a pantheistic feeling in some minds on the Theistic argument, may contribute to an exposure of its insufficient results in relation to the origin of organic beings.

The question immediately raised by Mr Darwin is obviously this. Admitting the evident fact of variations in animals and plants, is there any good evidence of so wide a departure, even in the domesticated state of organic life, from a common central type or idea as to warrant the inference that all did not originally descend from common stocks? In the young, for example, of the common hare (*Lepus timidus*), the eyes and ears are perfect, the body is covered with fur, and the limbs are fit for locomotion. In the rabbit (*Lepus cuniculus*) on the contrary, there is the converse of each of these facts. Again, in the red deer (*Cervus Elaphus*), the female is gravid eight months, and produces one at a birth, while the roe (*Cervus capreolus*), is gravid only five months, and produces two at a birth. But, in all these cases, illustrative of every varying condition of life, domestic and wild, and admitting of varieties more or less extensive, the same definite adherence to one specific idea is maintained. Nor in examining the fossil remains of these respective members of the families Leporidae and Cervidae, does anything in their osseous structure at all deviate from the type of the living animals. On the contrary the evidences of a permanent adherence to it are manifest.

“The most common fossil remains,” remarks Professor Owen in his “British Fossil Mammals and Birds,” “of the deer tribe, are those which cannot be satisfactorily distinguished from the same parts in the species *Cervus Elephas*, which most abounded in the forests of England until the sixteenth century, and which still enjoys a kind of life, by virtue of strict protecting laws in the mountains of Scotland. The oldest stratum in Britain, yielding evidence of a *Cervus* of the species of the red deer, is the Red Crag at Newbourne. More conclusive evidence of the specific character of this sized deer, is afforded by antlers as well as teeth and bones, and these attest the existence of the *Cervus Elephas*, through intermediate formations, as the new freshwater pliocene and the mammoth silt of ossiferous caves up to the growth of existing turbaries and peat-bogs. . . . Similar fragments of shed antlers of the red deer, associated with others referable to the *Megaceros* and the great *Strongyloceros* have been found in Kent’s Hole at Torquay ; they all shew the effects of gnawing, and indicate that all the three species of deer coexisted in England with the *Hyæna*, and other extinct carnivora at that remote period.”

And the only exception, which however is more apparent than real, to the specific identity also, in remote and recent periods, of the roe, the hare, and the rabbit, is in the case of the hare. Of its fossil remains as discovered both in the cave at Kirkdale, and in Kent’s Hole, the Professor states :—

“The fossil lower jaws which I have examined have presented a somewhat shorter interspace between the molars and incisors, than in the common hare of this country, with the same properties and dimensions, and the same sized teeth ; whereby it would appear that the hare of the caves had a rather shorter head, and resembled in that respect the variety or species to which the name of *Lepus Hibernicus* has been given, and which has also stouter limbs than our English hare. I cannot detect any difference between the fossil hare and the Irish hare in the forms and proportions of the bones of the extremities.”

Nor in vindicating the doctrine of specific identity as prevailing throughout great changes, in condition and vast successions in time, is it possible to overlook the fact that, by the marked steadfastness of the most ancient genera of organisms that occur in a fossil state, a forcible presumption against specific transmutations is presented to the mind. For let the definition of species be what it may, so long as an objective reality is assumed as the ultimate and essential basis in all definitions, or in other words, in so far as the logical definition of a term, by which mere words in relation to notions are more clearly understood, is not confounded with the real determination of the contents of a notion, or the elucidation of the relation of notions to things, it is impossible without denying the validity or falsifying the lessons of geological history to refuse an assent

to the fact of permanent generic types in organic structure and habits.

In illustration of these remarks on the persistent character of generic and specific identity in union with instances of variation, in so far as that identity is traceable by us, we invite the attention of the reader to two extracts from German writers, limiting our own criticism of them to a few connecting sentences. The one is taken from Spring's treatise on the "Ideas of Genus, Species, and Variety in Natural History." The other is from Burmeister's "Zoonomische Briefe."

"The idea of the species," according to Spring, "is never fully expressed by a single individual; it can only be exhausted by the aggregate of all the individuals existent in all places and times. Every discrepancy between individuals is a more or less full development of the idea of the species produced by external influences; and the common opinion is erroneous which regards those discrepancies (the varieties) as deviations from and not as contained in the idea of the species. They belong universally to the idea of the species, in which they are expressed as regards their possible existence. For the same reason they are not accidental, as others say; for, given the possibility in the idea of the species, then, by necessary consequence, certain external conditions will produce certain alterations or degrees of development."

If, then, a separate origin and distinctness of race, discriminated by a constant transmission of some essential and fixed element in structure and function—and this seems to be all in the way of the definition of a species that is now called for—is a marked feature in the Tertiaries, does not a generic similarity of type in vital organisms, based, of course, on more superficial and general characters and pervading widely divided geological eras of anterior date, supply something more than merely negative evidence against the theory of transmutation as explanatory of phenomena at any period in the history of nature, and a special auxiliary to the doctrine of a universal specific identity during the ages more immediately preceding the historic period?

"The study," observes Burmeister, "of the formation of Corals at the epochs anterior to history, or, should another mode of expression be preferred, in pre-Adanitic times, is a subject most profoundly interesting to the geologist. It discovers to him the amazing activity of these small creatures on the largest scale, proving at the same time the entire agreement of organization between the most ancient polyps and those in being at the present time. In all times, when we revert to the most distant antiquity of the globe, there have been polyps in our terrestrial seas, at least as long as organic life has existed in the earth. It is corals that furnish the most ancient evidence that this earth was inhabited long before the larger animals came into being. The entire structure and habits of these antique

corals agree completely with those now living. We find, indeed, in the most ancient formation, genera which, though distinct from, yet closely resemble those of the present day; but even at that distant period all the existing families were represented."

But as further illustrative of the compatibility of permanency in specific character with a wide range of varieties, or in other words the capability of a central type's allowing of its essential appearance in manifold aspects, we may glance at one or more of our native plants and animals. In looking, for example, at the specific characters, the peculiar habitats, and the geographical distribution of the Common Erythræa (*Erythræa Centaurium*), it is obvious, that while varying much in the size and breadth of its foliage and flowers, and at first sight leading to the conclusion that even six or seven species have been included in it, on a more accurate comparison, the latter will be seen to run into one another so much, that no precise limits can be assigned to them. Why, then, should any one who acknowledges the fact of unity in nature as the comprehension and reconciliation of a plurality in forms and relations refuse to allow, for example, that the Large-flowered, the Common, the Broad-leaved, and the Linear,—the most prominent forms of the Erythræa,—are descended from one stock, having a positive existence in nature, and which will also come true from seed? Or what reason can be alleged against the entire consistency of the *Mustela Putorius*, as a permanent species, with the varieties springing from the crossing of the Albino (*M. Furo*) with the dark individuals with which the latter is known to breed freely?

But, in still further elucidation of this point, the following extracts from Dr Williamson's valuable work on the Foraminifera will doubtless be welcomed by the reader:—

"In 1847 I ventured to publish my monograph on the British species of the genus *Lagena*, basing my classification on a principle of which Montague, Maton, and Rackett, and Fichtel, and Moll had already obtained faint glimpses, viz., that amongst the Foraminifera, the widest variations of form and aspect were compatible with specific identity. Hence I united numerous varieties hitherto regarded as specifically distinct. . . . What amount of variation is compatible with specific unity, is perhaps the most important inquiry now engaging the attention of philosophic zoologists; and the reply to this query must be the common postulate of many philosophical syllogisms. No satisfactory response to the question has yet been given, even by the higher organisms; still less by those diversified inferior creatures whose histories present so much that is anomalous and obscure. It is from among these latter, in all probability, that the most important materials for solving the problem must finally be drawn; but these are precisely the objects whose history is most difficult to read, from the impossibility of tracing their infinitesimal germs through

all their conditions of life and development. . . . I have observed that we can detect a few stray gleams illumining this obscure subject. The existence of some definite relationship between the outward forms of successive generations is indicated by the frequent prevalence of special varieties in particular localities. Thus the remarkable variety of Polymorphina, represented in fig. 149, prevails at Southport, in Lancashire, and also near the Eddystone lighthouse, and Plymouth Sound; the probability is, that in each locality these examples are the common products of some ancestral individuals, amongst which acquired peculiarities of contour have been hereditarily transmitted. Be that as it may, the study of specimens, both from our own coasts and foreign stations, satisfies me that there exists among the Foraminifera, a strong tendency to the perpetuation of certain unvarying types of form; and the similar occurrence of many existing varieties in a fossil state demonstrates that this tendency has operated through countless ages. But side by side with this disposition to constancy of form, we have the opposite one to endless differentiation. Whence do these diverse tendencies originate, and what circumstances are essential to their free operation?"

"In another part of this volume (pp. 19 and 20), I have called attention to the specimens represented by figures 32 a, 41 a, and 49), as indicating the existence of spontaneous fission amongst the soft animals of the Foraminifera. In each of these examples there appears to have been an abortive attempt at division of the uncalcified germ, which attempt the premature supervention of the calcifying process has arrested. Whenever such specimens occur, *it invariably happens that the two halves of the twin organism belong to the same variety or type.* It is fair to conclude that if the spontaneous fission had not been arrested, but the germ had affected its division into two parts prior to calcification, both of these, when calcified, would have retained their identity of form, just as they have done when linked together. Whether these germs were merely unimpregnated gemmiferous products, or whether they have resulted from the union of a sperm-cell, cannot now be determined, though probably both these processes will ultimately be demonstrated to exist among the Rhizopoda. The former of these is merely a modification of true spontaneous fissions, being but a small portion of the organism pinched off, in the place of its being divided into two nearly equal halves. The specimens just referred to indicate that *fission tends to repetition of identical types and not to differentiation*; hence I am disposed to believe that the origin of varieties of Foraminifera must not be sought amongst non-sexual fissiparous products, any more than a florist would seek corresponding varieties amongst the slips and cuttings from older plants. Analogy renders it probable that some equivalents for true ova exist amongst these creatures; if so, we might expect the tendency to differentiation commencing amongst these ova, just as new varieties of flowers result from varied potentialities hidden within the different seeds of individual plants. This hypothesis is perfectly compatible with the fact that the same individual Foraminifer often undergoes important changes in its progress

to maturity, the newer segments differing from the older ones; we must here carefully distinguish between true primary variations and those merely dependent on age and unequal development. The tendency to such ultimate differentiation in each individual resided potentially in each primary embryo; but this tendency must be distinguished from the variations between different individuals, *the sum of which variables, whether potential or actual, constitute the characteristics of the species, distinguishing it from all other species.*"

Nor in identifying the doctrine of Theism with the distinct creation—as opposed to natural development in every form—and enduring identity of species in all ages, may the more prominent objections to the main result or the methods of its accomplishment be overlooked.

Is it alleged that miraculous agency in producing distinct forms of plants and animals, as sharply contrasted to natural generation, is obviously unnecessary as an element in the true notion of the divine existence, or of the adequate definition of the primordial creation of the world? In so far as our argument is concerned—while inclined to a strong recoil from all such attenuations of the doctrine of a Creator, as would seem to assume that the human faculties can competently deal with the work of Creation as if it were a question regarding the maximum or minimum of divine energy in its performance—we have no special call to combat this position. Our present question does not refer to the separate ideas essential to the formal construction of the lowest possible notion of creative agency. It is not a speculative question merely that is now to be answered; on the contrary, in a great measure, it is practical, viz.—Is not a higher, because more comprehensive conception of God than what embraces merely intelligence in union with power,—and no more than this seems to be implied in the most reputable Theistic system of the supporters either of development or transmutation,—absolutely necessary to the protection of the speculative mind of the naturalist against the noxious moral influences of the atheistic spirit. In other words, will the *Noûs* patronised by Anaxagoras rescue the soul of any one, who is involved in speculations about laws and forces, from practically becoming something more than passively atheistic? is a question to which none but a negative reply seems possible.

Nor does this practical view tend either to invalidate the strictly logical character of the doctrine of the divine existence, or to the intermingling of any merely subjective element with the data in external nature on which it rests. On the contrary, it cannot fail to promote its more lively and robust assertion. It is in the recognition of the moral perfections of God—that of his living personality—that living man, in the

intelligent study of creation and the application of a sound logic in vindicating the doctrine of final causes, will realise the sources of his strength and security. This train of reflection, however, we will not prosecute farther, having, since entering into it, fortunately met with the following apposite passage in Dr Ogilvie's "Master Builder's Plan:"—

"Yet—strange to say—neither in Oken, by whose penetrating intellect were laid the foundations of the science of typical forms, nor in some of those who, since his time, have most successfully prosecuted it, did the principle they unfolded awaken any recognition of the moral attributes of God. Immersed in dreamy pantheism, they could regard him only as the animating principle of the universe, or lower still, simply as a necessary existence, manifesting itself by a continual succession of phenomenon, like a great panorama ever unrolling. But the reproach which has in consequence attached to such investigations is most unfounded; for so long as the truth of the divine personality is firmly grasped, the evidences of unity of organisation, instead of militating against the free agency of God, tend greatly to elevate our conceptions of His power and wisdom. We then see that in His works a greater problem is solved than the mere adaptation of means to ends, for this, without losing any of its completeness, is combined with a certain harmony and uniformity in the means themselves. We see the Almighty Creator, for the manifestation of His glory or other wise purposes, subjecting himself, as it were, to laws,—restricting himself, so to speak, in the choice of the mechanism of His work, that the power and wisdom which bring it to perfection all the same, may be the more apparent."

It is not, however, the conclusion merely that is objected to in this argument of specific identity as opposed to the transmutation of species. In the method or evidence of its attainment essential weakness is alleged to exist. At page 279 of his "Origin of Species," Mr Darwin remarks:—

"In the sixth chapter, I enumerated the chief objections which might be justly urged against the views maintained in this volume. Most of them have now been discussed. One, namely, the distinctness of specific forms and their not being blended together by innumerable transitional links is a very obvious difficulty. I assigned reasons why such links do not commonly occur at the present day, under the circumstances most favourable for their presence, namely, on an extensive and continuous area with graduated physical conditions. I endeavoured to shew that the life of each species depends in a more important manner on the presence of other already defined organic forms than on climate, and, therefore, that the really governing conditions of life do not graduate away quite insensibly like heat or moisture. I endeavoured, also, to shew that intermediate varieties, from existing in lesser numbers than the forms which they connect, will generally be beaten out and exterminated

during the course of further modification and improvement. The main cause, however, of innumerable intermediate links not now occurring everywhere throughout nature depends on the very process of natural selection, through which new varieties continually take the places of, and exterminate their parent forms. But just in proportion as this process of extermination has acted on an enormous scale, so must the number of intermediate varieties, which have formerly existed on the earth, be truly enormous. Why, then, is not every geological formation and stratum full of such intermediate links. Geology, assuredly, does not reveal any such finely graduated organic chain; and this perhaps is the most obvious and gravest objection which can be urged against my theory. The explanation lies, as I believe, in the extreme imperfection of the geological record."

A remarkable passage this! On it, however, as a whole, no minute or prolonged criticism is desirable, especially as something like a dim feeling of insecurity seems to have been at work in the author's mind in the moment of inditing it. And what is less an object either of envy or praise than that peculiarly nervous state of reflection that is induced by the suspicion that a favourite theory in both frame-work and bottom is irretrievably going to pieces? "If you strike a solid body," says Bacon, "that is brittle, it breaketh not only where the immediate force is, but breaketh all about into shivers and fritters." How much more will a speculation such as Mr Darwin's, having in it so little of what is solid, as compared with its large amount of visionary assumptions, either in his use of its materials, or by virtue of its cementing power, "break all about into shivers and fritters," no greater shock being sustained by it than what may be accounted for by the tremors of its author's uneasy thoughts?

Deserving however, of special attention is Mr Darwin's mode of accounting for the absence of transitional links among species in the geological record. He ascribes his own defective proofs to the extreme imperfection in the stony registers. The entries in the venerable journals of ancient nature have no report to make in his favour. He may not bribe them into silence, because they cannot but speak out in unimpassioned antagonism to his darling dream. Therefore, he alleges that full many a page of organisms that, doubtless, should have borne witness to the validity of that dream, has, in some inexplicable way, by some unaccountable agency, been torn out of its proper place, and gone disastrously amissing. In short, the great archives of the geological ages are hopelessly and intractably perverse and stupid.

Is it not, however, an instructive circumstance, that in so far as the history of organic nature in pre-historic eras can be interpreted, its lessons uniformly inculcate the doctrine of

permanency in types of structure, that where the traces of species disappear in one age, they are never repeated in any other succeeding it, a certain limitation of existence being assigned to each peculiar form, and especially that in comparing the more ancient with the more recent formations, the organic series of phenomena is equally conspicuous by an increase in the number of species, and also by an identical correspondence in many of them to such as presently exist? The explanation accordingly, supposing it consistent with facts, in which Mr Darwin takes refuge from his misgivings, is virtually an appeal from our knowledge, which is adverse to his whole theory, to our ignorance, which, if it suggest any presumptions at all in connection with that theory, must obviously increase the general improbabilities on which it rests. And this is an appeal which, of course, he cannot expect to be allowed, unless he adopt the peculiar philosophy, broadly hinted at in the poet's remonstrance,

"As if 'tis nothing worth, that lies concealed,
And science is not science till revealed."

But is it true, we may now ask, that there is any such great imperfection in the geological record as will suit the purpose of Mr Darwin? Are there any such blanks in the fossiliferous deposits, in so far as they are known, at all warranting the assertion that the information afforded by them regarding their vital phenomena is materially defective?

That great imperfections of various kinds may be expected in geological history,—that no articulate reply to many interesting questions regarding the forms and conditions of ancient life can be given by the most accomplished naturalists, —and that no theory in regard to the grouping and succession of vital phenomena will be so entirely satisfactory as to leave out no exceptions are propositions of no greater originality in conception than one of visionary Burnet's most obvious remarks, that, "for theoretical learning and sciences, there is nothing yet complete." At the same time, it cannot but be equally obvious to any one who will carefully estimate the precise use intended by Mr Darwin's averment of imperfection, that, while making every fair deduction from our confidence in the certainties of geological discoveries, as being of comparatively recent origin, and, by their vast and rapid accumulation of facts, presenting peculiar hindrances to adequate explanation, no such blanks occur in the order of strata, either as regards general collocation or special superposition, throughout the globe, as affords the least presumption in favour of Mr Darwin's view. Go wherever the geologist may, he meets with a most instructive uniformity of arrangement in the order of geological structure, the missing links of any

series in one district or country being supplied by their representatives in another.

But on this point we will not enlarge ; nor on the doctrine in aid of which Mr Darwin has summoned the negations of geology, can we dwell longer. We will merely take the benefit of the following remarks of Professor Owen :—

“ As to the successions, or coming in of new species, one might speculate on the gradual modifiability of the individual ; on the tendency of certain varieties to survive local changes, and thus progressively diverge from an older type ; on the production and fertility of monstrous offspring ; on the possibility, for example, of a variety of auk being occasionally hatched with a somewhat longer winglet, and a dwarfed stature ; on the probability of such a variety better adapting itself to the changing climate, or other conditions, than the old type—of such an origin of *Alca torda*, e. g. ; but to what purpose ? Past experience of the chance aims of human fancy, unchecked and unguided by observed facts, shews how they have ever glanced away from the gold centre of truth.”

How consolatory to the hearts of such as are alive to the scientific validity and higher relations of natural theology, amidst the confusions of thought that from time to time arise from the premature use of facts but imperfectly discerned, and especially from impure analogies, to realise the harmony subsisting between the instinctive modes of sanctified reason in men but little skilled in the interpretation of intricate phenomena, and the serene judgments of a highly-trained and vigorous intelligence. Amidst the strange doctrines in regard to the origin of life that now and again unexpectedly issue from what is regarded by many—perhaps too superstitiously—as the peculiar haunt and region of mature thought in the explanation of nature,—doctrines that, when adequately tested, are found to be almost identical with the cosmogonies so pungently derided in the ancient satirist's lampoon,

Ἐρέβους δ' ἐν ἀπέργοσι κόλποις,

Τίκτηι πρῶτιστον ὑπηνέμιον, Νύξ ἢ μελανόπτερος ὦον,

how cheering to listen to words such as these of Britain's greatest anatomist, which are not more lofty in their wisdom than exemplary by their humility !

It would, however, be in no small degree unworthy of any friend of truth, and a marked violation of that candour and justice to which Mr Darwin is, as an accomplished and beneficial naturalist, peculiarly entitled, were the foregoing strictures given to the reader without any reference to the many valuable features of his recent work on the “ Origin of Species.” The most remarkable fact, indeed, connected with his book is, that while abounding in numerous illustrations of special adaptations and the doctrine of final causes, as co-extensive

with the ever-widening compass of natural history, he should be the advocate of a doctrine so utterly at variance with the fact of creative agency in the production of specific forms of animal and plant life. This is deeply to be regretted, for the author's sake, and because of the injury done to truth. And all the more, that there are few books in natural science, of recent production,—and no one, we believe, will question the fact of the marked fertility of the present day in the publication of works auxiliary to natural theology,—that may, to a larger extent, be laid under contribution for lively and apposite illustrations of design in creation.

To such of our readers as may not have seen Mr Darwin's work, the following extracts may be acceptable:—

“I am tempted,” says Mr Darwin at page 73, “to give one more instance shewing how plants and animals, most remote in the scale of nature, are bound together by a web of complex relations. I shall hereafter have occasion to shew that the exotic *Lobelia fulgens*, in this part of England, is never visited by insects, and consequently, from its peculiar structure, never can set a seed. Many of our orchidaceous plants absolutely require the visits of moths to remove their pollen masses, and thus to fertilise them. I have also reason to believe that humble bees are indispensable to the fertilisation of heart's-ease (*Viola Tricolor*), for other bees do not visit this flower. From experiments which I have tried, I have found that the visits of bees, if not indispensable, are at least highly beneficial to the fertilisation of our clovers; but humble bees alone visit the common red clover (*Trifolium pratense*), as other bees cannot reach the nectar. Hence I have very little doubt that if the whole genus of humble bees become extinct or very rare in England, the heart's-ease and red clover would become very rare, or wholly disappear. The number of humble bees in any district depends in a great degree on the number of field mice, which destroy their combs and nests; and Mr H. Newman, who has long attended to the habits of humble bees, believes that “more than two-thirds of them are thus destroyed all over England.” Now, the number of mice is largely dependent, as every one knows, on the number of cats; and Mr Newman says, “Near villages and small towns I have found the nests of humble bees more numerous than elsewhere, which I attribute to the number of cats that destroy the mice.” Hence it is quite credible that the presence of a feline animal in large numbers in a district might determine, through the intervention first of mice and then of bees, the frequency of certain flowers in that district.”

Nor are we to conclude from Mr Darwin's theory that he does not, in his volume, recognise the principle of final causes. At page 216 we meet with the following passage:—

“It is now commonly admitted that the more immediate and final cause of the cuckoo's instinct is, that she lays her eggs not daily,

but at intervals of two or three days, so that if she were to make her own nest and sit on her own eggs, those first laid would have to be left for some time unincubated, or there would be eggs and young birds of different ages in the same nest. If this were the case, the process of laying and hatching might be inconveniently long, more especially as she has to migrate at a very early period, and the first hatched young would probably have to be fed by the male alone. But the American is in this predicament; for she makes her own nest and has eggs and young successively hatched all at the same time."

It is impossible, however, even after the most favourable view that may be taken of the author's more reverential sentiments and words, his explicit mention of a Creator, and the many vivid illustrations of the adaptations of special means to special ends in nature, to avoid the painful inference, as regards the general scope and bearings of his volume, of its being but a slight modification of the doctrine of that book of most mischievous conception and mysterious parentage—the "Vestiges of the Natural History of Creation." In both the salient features of the crude imaginings of Anaxagoras are reproduced. Tested by the rules of logic, creation in time, viewed as a special agency of a living God, is necessary neither to the validity of their original data, nor the consistency of their speculations. Both are most easily construed on the assumption of an incomprehensible activity of matter from all eternity. Not only in referring to a Creator do they extemporise, merely for the occasion, an unknown God, but they suggest the impossibility of a real God ever being known to man. In parting with Mr Darwin, we cannot but express a feeling of deep sadness and regret. How much better for the sacred cause of truth—how much more worthy of his scientific name, if using the "fairly tales of science and the long result of time," in child-like deference to the authority of the great I AM, he had spoken to the world in words like those of Richard Owen, in the Senate House of Cambridge. Of permanent injury, however, as the result of this or similar works, none at all deeply read in the past history of scientific thought will entertain any serious apprehension. In the noble words of Galileo, the friends of truth at all times can say, "Quin ipsa philosophia talibus edisputationibus non nisi beneficium recipit. Nam si vera proponit homo ingeniosus veritatisque amans, nova ad eam accessio fiet; sin falsa, refutatione eorum priores tanto magis stabiliuntur."

But another topic of rather anxious interest to the theologian, emerging in connection with the large growth of difficult questions in natural science, is the frequent tendency to *theoretical exaggeration* in the vindication of the plan and method

of creation. And this tendency—no less hazardous in its results than irrational in its spirit—may be detected both in some ingenious conjectures, such as Mr Gosse's prochronism, in imaginary reconciliation of the geology of the rocks with the Mosaic genesis of natural phenomena, and also in such an extension of the doctrine of typical forms as oversteps its basis in facts, and therefore proves so much in excess of the true limits of natural types, as virtually to neutralise some of the most serviceable portions of the argument.

At present the attention of the reader is invited to a few strictures on what appears to be a manifest discrepancy in logic between actual phenomena and their general expression in the unity of a type. We purposely defer any discussion of Mr Gosse's argument, until we can embrace it in a more general inquiry into the geological value of the Mosaic record.

The *status questionis* in the matter of typical forms in creation, appears to us to be this. In studying individual phenomena, *e. g.*, the wallflower or common *Arabis* of our gardens—the blue tit among birds, or the familiar *Vanessa Urticæ* among *Lepidoptera*—the fifteen-spined stickle-back of our sea-ward rivulets, or the common shore crab—do we not discover a certain relation to some general type or types, which have constantly pervaded all natural organisms, and which contain within them in a potential form, the various modifications of structure and function, which are necessary to fit them for their respective conditions in living nature. In other words, is it not evident, on a comprehensive and exact view of the works of creation, in so far as man can know them, that in the idea of one general plan or method is to be found the most adequate explanation of the existence and relations of individual facts and organs?

In an affirmation of this sovereign and controlling unity is the highest expression of natural science, viewed as a part of philosophy. In this great thought is the most mature wisdom of the ripest naturalists of the day. It is, for example, in its recognition that Dr Carpenter has thus expressed himself:—

“In the several tribes of organised beings we have not a mere aggregation of individuals, each formed upon an independent model, and presenting a type of structure peculiar to itself; but that we may trace through each assemblage a conformity to a general plan, which may be expressed in an ‘archetype’ or ideal model, and of which every modification has reference either to the peculiar conditions under which the race is destined to exist, or to its relation to other beings. Of those special modifications, again, the most important themselves present a conformity to a plan of less generality; those next in order to a plan of still more limited extent, and so on, until we reach those which are peculiar to the individual itself. This

is, in fact, the philosophical expression of the whole science of classification."

On this conception of an order or system—a general scheme or method of agency in creation—viewed as a result of inductive reason, together with the obvious fitness of certain means to accomplish certain ends, the science of natural theology primarily rests. In the light of their organic union the dark spectral shapes of chance and blind necessity disappear. At their sovereign bidding the multitudinous forms of individual existence, in submitting to the laws of human thought, not only assume a vital harmony of arrangement, but become in their many obvious relations the outward symbols of pre-determining intelligence and wisdom. In their due study, man, conscious of design, as a primary law of his own spirit, is enabled to detect them as the witnesses to himself of the presence and agency of the living and true God,

" Who instructs the Brutes to scent
All changes of the element,
Whose wisdom fixed the scale
Of Natures, for our wants provides
By higher, sometimes humbler, guides,
When lights of reason fail."

Some rather unhappy misconceptions, however, of the true nature of this unity in creation, and the suitable method of knowing it, are sometimes observable in the theistic arguments both of divines and naturalists. The object of contemplation is, in some degree, denuded of its essential character, in consequence of a serious mistake in regard to the observer's legitimate and successful point of inquiry.

In the conscious unity of our own minds is the source of our expectation of unity, not only in the works of our fellow-men, but also and especially in the divine workmanship. In looking on a piece of mechanism, *e. g.*, a reaping-machine or a microscope, we unconsciously assume that its framer, in ordering and adjusting its several parts towards a definite end, was guided by a first principle of unity in his own mind. And, in like manner, with no less certainty, though it may be in certain cases with much less definite knowledge of the elementary constituents of objects, we assume that, as in the creation of every inorganic form, there is a chemical whole, so in every animal and plant there is a unity of structure and function. In the common foxglove, for example, no two bells of which are precisely the same, either in shape or colour—or in the edible crab, in which every segment of the breast-plate differs in some degree from another—or in the almost ceaselessly varying notes of the song of the missel-thrush—we feel—at the same time that we may be entirely incompetent to explain the

grounds of the conviction—that there is unity. Nor can it be otherwise.

“Unity,” remarks Dr Macvicar, in his profound *Treatise on Human Nature*, “is the very key-stone of a reflective nature; unity is, as it were, the very foundation of its structure. . . . But not the analysis of the conception of self-directive power only, thus giving unity as one of the conditions indispensable to the existence of such a power, attests the fact of unity, as a leading attributive of the self-directive principle. There are many other arguments for it; and among these we cannot regard as a trivial one, the fact of the existence of the idea of unity in the human mind itself, holding that conspicuous place in consciousness which it does. That the idea exists, I presume no unsophisticated mind will dispute. Now, whence can the soul have got such an idea? Not a single object in the outward, which any of the five senses could name, manifests a true unity. It cannot be from outward nature that this idea is derived. The soul, therefore, must have it from herself. The soul herself must be the fountain of the idea of unity, its object, and its archetype. Yes; and so she is. And this explains why the idea exists so fully in the soul, as it plainly does. She carries it about with her every where; and among all objects, be what they may, which are presented to her, her main intellectual engagement consists in seeking for unity.”

And in like manner, Archdeacon Hare has expressed himself in the following noble passage:—

“The principle, I said, which leads and compels us to seek for unity in all the objects of our contemplation, notwithstanding the diversity, and multiplicity, and contrariety wherewith they assail us, is the unity of our consciousness, in which our Divine Maker mirrored the unity of His own being. Accordingly, it is only so far as we retain this true unity in ourselves, that we can succeed in discovering a living unity without us. That there must be an essential pervading all God’s works, is implied indeed in the very fact of their being his works. Even in man’s works, in the works of the same man, there is a unity, whereby they reveal the mind they sprang from; though, as in all men there is more or less of disorder and distraction, the harmony in all has been marred and is incomplete. In a far higher degree, then, there must be a unity running through all the works of Him, who is essentially, and entirely, and indivisibly, and eternally One. But this true unity we cannot make out, unless we gain sight of its principle, unless we have hold of the only clue, with the aid of which we can explore the multitudinous chambers in the endless labyrinth of the universe,—unless we can trace back the countless streams of life to their one primary source in the wisdom and goodness of their Author. Cut off from this source, they seem unconnected, vagrant, often opposite. Hence there are two main causes, through the combined operation of which we are apt to miss unity; and no man has ever lived over

whom these two causes have not both of them exercised continually more or less sway. Both of them are the results of that separation from God, of that depravation of the Divine idea in man, which took place at the fall; unless it would be more correct to say that they are both parts of that very act through which man fell."

It is not, however, man's expectation of unity in nature that we have had in view in making these quotations, so much as the hints incidentally supplied by them on the important question as to the adequate method of its realisation.

Do we then err in believing that the likelihood of attaining to the discovery of that unity of creation that we naturally expect will greatly depend on the logical idea we may have antecedently formed of the generic character of that unity itself?—or are we mistaken in supposing that, in allowing one's self to theorise at all on that point, no small risk is incurred of entailing on subsequent inquiries an injurious influence?

Now, it may help in some measure, to elucidating these queries, if we state that, within the last few weeks, according to a newspaper report of the proceedings of a scientific society, the geometrical relations of trees and their elements, as determined by the goniometer, have again become the subject of grave discussion with certain theoretical naturalists. The typical form of precise figure in extension is alleged to pervade the vegetable kingdom, so that, altogether irrespective of every special end that may be subserved by the operation of chemical, physiological, and vital forces, and of their general combination in promoting one or other ultimate end, a geometrical unity is supposed to be *un fait accompli*. But where is the evidence of this? In standing beneath an elm or oak in the "leafy month of June," and gazing upward among its verdant mysteries of intricate foliage and complex branching, that display an almost endless variety in colour and outline, who is ever conscious of being disturbed by any thing like a departure from unity, unless recalling the fiction of a geometrical type, he is also constrained to recall the rather mischievous story of the Scottish engineer's renowned facilities of triangulation in "easing any angle" that was likely to prove obstinate and troublesome?

All such speculations originate, in our opinion, in ingenious and peculiarly ductile error. It is assumed that a *certain kind* of unity in nature, together with man's consciousness of that special unity, is a final cause; but, on the contrary, is not all unity the natural effect of the outward expression of the simplicity of the Divine mind, which, instead of confining itself to one or other unifying form in the phenomena of creation, as if

there were not innumerable methods of revealing the oneness of the infinite Creator, is constantly unfolding its all-sufficient fertility in reconciling contrasts, in educing the like from the unlike, and while ever responding to man's consciousness of unity, leaving him with still higher aspirations of knowing it more fully in the patient study of the infinite variety and glorious *integrity* (we use the term literally) of natural phenomena. Of this every day's increasing knowledge continues to furnish the most ample evidence. At the same time, while in man's sovereign consciousness is the evidence of his being a moral unit—one entire being, he is also aware of being formed of “similitude in dissimilitude, and dissimilitude in similitude,” of parts like and unlike, contrasted and conformed, and is thereby divinely taught to exercise caution in receiving stereotyped theories of the Plan of Creation, which some men, while making confession of their own ignorance, seem ready to confine within the narrow limits of certain categories, every one of which is more or less open to serious debate, if not prompt and peremptory denial.

In further illustration of the need of vigilance in scrutinising all such imposing schemes of interpretation as have been already referred to, as well as of exemplifying the wholesome nature of that method of investigating the unity of nature of which we have spoken, the commonly received notion of the relationship between plants and the climate in which they live may be adduced.

At first sight, the inference of a peculiar climate as deducible from the prevalence of certain plants, seems to have been not only probable but certain. If asserted as a general law or typical form, it seems entitled to claim as high a position in the categories of a General Plan of nature as has been awarded by some writers to the idea of Number or Colour. And, accordingly, confiding in this relationship between climate and plants, important conclusions drawn from a consideration of *fossil* plants, have been generally entertained in regard to climatal alterations equally great in extent and influence in previous conditions of the surface of the earth.

“Before drawing conclusions,” remarks Professor Balfour, “as to the climate or physical condition of the globe at different geological epochs, the botanist must be well informed as to the vegetation of different countries, as to the soils and localities in which certain plants grow, whether on land or in the sea, or in lakes, in dry and marshy ground, in valleys or on mountains, or in estuaries, in hot, temperate, or cold regions. It is only by a careful consideration of all these particulars that any correct inferences can be drawn as to the condition of the globe.”

And in the views set forth by the learned professor, in

these well chosen and careful words, the student who has been duly disciplined in the methods of a cautious induction cannot but fully concur. How easily, however, may such views be exaggerated, more especially if the humble path of a strictly inductive inquiry be forsaken for the more ambitious course of concussing nature into an artificial support of some special theory of unity!

To use the apposite words of Professor Harvey, in an exceedingly able review of Alphonse de Candolle's *Geographie Botanique, Raisonnée*, in the *Natural History Review*, "many persons suppose that the presence or absence of such and such forms of vegetation is a certain indication of a precise climate, as if each plant individually were a sort of natural thermometer. This incorrect notion has been perhaps chiefly mischievous in reference to the obscure regions of fossil botany, where certain climates have been hastily assumed to have existed in certain localities at a former epoch, because certain forms are found fossilised in the strata. Thus, because *Zamias* are now found at the Cape of Good Hope, in New Holland, and in the table-land of Mexico, and because fossils of kindred structure are imbedded in the strata of England, and of other northern countries, it has been assumed that the England of the Zamian era must have had a similarly hot and dry climate to that of Southern Africa, or of Western Australia, where these forms of vegetation are now common. The inference, however, is a very vague one, resting on a very narrow basis, as will be evident when we examine a little more carefully the climates where the Cycadeæ are now found. We shall then discover, that though none inhabit a very cold country, yet the range of climate, especially as regards humidity, over which the order is distributed, is very extensive, some species growing in the moist jungles of tropical India, others in the low islands of the Pacific archipelagos, besides those more familiar forms which we have from the arid regions of the Cape and Australia. It would be impossible to tell, from the mere inspection of a modern Cycadeous stem and foliage, whether they had grown in a tropical or extra-tropical climate; and it must be just as hazardous to pronounce on the nature of the climate which nourished Cycadeæ in the earlier eras of our planet. It would be as reasonable to judge from the finding of fossil *acorns* or oak-logs that such indicated a climate in the regions where they occurred similar to that of Modern England. But in this hasty assumption we should lose sight of the fact that the genus *Quercus* has a wide distribution in tropical as well as in temperate and cold latitudes, species being found from very high latitudes on the American continent nearly to the equator, and occurring on

the mountains and table-lands of tropical India, and of the islands of Java. Were the species of oak now existing in Java fossilised there, leaving no descendants, some future geologists, knowing the oak only as a form of vegetation of cold or temperate climates, might draw, from its presence in the strata of Java, a very false inference respecting the early climate of that tropical island.

“That a plant does not indicate a particular climate in a manner analogous to a thermometer or hygrometer, must be evident to any one at all acquainted with the powers of endurance which certain species display, and the feebleness of endurance equally obvious in other species; so that each species of plant has, in some degree, its own *charter*, one enjoying more extensive privileges than another. Nor, until we have ascertained the facts regarding species by particular observations, can we with certainty foretell what will be the effect of change of climate upon them. What would be more natural than to suppose that all the plants spontaneous at the Cape of Good Hope, supposing they occurred at a tolerably uniform elevation above the sea, would be influenced by change of climate in a like degree? Their native climate is a very remarkable one—remarkable for the intensity and amount of solar light throughout the year; for rapid changes of temperature, and for the very unequal distribution of moisture at different seasons. We should expect among them a common feeling—so to say—on their removal to this country; and such, to a certain extent, is the case. But the exceptions are very numerous; for while some—such as the Heaths and Pelargoniums—flourish and actually improve in the artificial climates of our greenhouses, others—as many of the bulbs—are with difficulty induced to blossom, and rapidly degenerate.

“As might be expected, most Cape plants require the protection of glass in winter; but to this there are many remarkable exceptions. The *Agapanthus* flowers freely in the south of Ireland, in the open ground, from year to year; and the *Tritomanthe* (hot-poker plant) is even still more hardy; for we have seen it raise its spike of scarlet uninjured from among the snow. Yet this plant is a native, not of high mountains or table-lands, but of the low plains at the Cape, where the thermometer may stand on a summer day in the ground, close to its roots, at a height of 130° to 160°. When we find such wide discrepancies as these among plants of the same region, we may well agree with our author in maintaining that the question of the relation of plants to climate is a very complicated one; and that we can only rightly understand by regarding plants as “living machines,” having a certain work to do, and struggling to perform it at all hazards, fighting under

difficulties against physical agencies. Beyond a minimum of light, heat, moisture, life ceases. With fair proportions of these (according to the wants of each individual species), it is maintained with vigour; and there are a thousand intermediate stages of excess or deficiency in which a struggle for existence is by the more hardy species maintained."

While, therefore, recognising the scientific value of man's instinctive expectations of an objective unity—the natural result of his own personal consciousness,—and the importance alike to his own well-being and the advancement of knowledge, of his actively endeavouring to realise that expectation, we cannot fail, if we would not repudiate the legitimate claims of natural science, to discriminate between the widely-different practical tendencies, on the one hand, of a theory of unity that is specially directed towards its own proximate verification in external phenomena, and on the other, of an instinctive belief, the verification of which in nature is not only, in its constant demands of the utmost caution, forbearance, and self-restraint in the inquirer, an important means of mental discipline, but is also the only reliable mode of ascertaining what the divine plan and order of nature really is.

In the language of Professor Tappan, "the conception of final causes, like other universal and necessary conceptions, accepts the observations of the senses as its condition and antecedent in time; but it can rest upon an idea of the reason alone as its constitutive element. Phenomena fleeting and apparently irregular and confused are grasped by this idea, and reduced to orderly and beautiful relations. And it is not only in fields of observation actually presented, that it arranges and composes phenomena, and reduces system; as a watchful and expectant eye, it is ever looking about to find phenomena that shall fall in with its own preconceptions. It is a necessary prophetic thought, which wanders through the universe. Where no observation can reach, it has full assurance there is design."

ART. IX.—*Leaders of the Reformation: Luther, Calvin, Latimer, Knox.* By JOHN TULLOCH, D.D., Principal and Primarius Professor of Theology, St Mary's College, St Andrews. W. Blackwood & Sons, Edinburgh and London. 1859. 8vo. Pp. 324.

THE Reformation from Popery in the sixteenth century was the greatest event, or series of events, that has occurred since the close of the Canon of Scripture; and the men who are