

worthy for Infinite Excellency to receive, he planned and executed the work of the sinner's redemption, and only fails of attaining universal salvation in it, from the perverse rejection of sinners, in whose behalf his own honor will not allow his power and grace to work any longer nor any further. In this broad sense, rectitude demands more than justice, more than benevolence; it is a goodness that contains them both, and demands that they both meet and embrace each other for what the Lord Jehovah sees in himself is due to himself. Thus sin was, and much sin and misery ever will be, because divine power must work under the guidance of divine rectitude.

ARTICLE III.

○ SCIENCE AND THE BIBLE.

A REVIEW OF "THE SIX DAYS OF CREATION" OF PROF. TAYLER LEWIS.¹

By James D. Dana, LL. D., Silliman Professor of Natural History, Yale College.

"THE heavens declare the glory of God, and the firmament showeth his handiwork." Thus spake the Psalmist in view of the revelation which God had made of himself in his works. With deeper emphasis may we now utter the same ascription of praise; for that revelation, as its records have been unfolded in these later days, has opened more and more glorious thoughts of the Almighty Architect, and appears as unfathomable in its truths, as God himself is infinite. The world in general is satisfied to see this glory as exhibited in form, color, magnitude, and other outside quali-

¹ *The Six Days of Creation, or the Scriptural Cosmology, with the Ancient Idea of Time-Worlds in distinction from Worlds in Space.* By Tayler Lewis, Professor of Greek in Union College. 12mo. pp. 407. Schenectady, 1855.

ties. The external attributes of existences have indeed been graciously made so transcendent in beauty and full of harmonies, that "he may run that readeth." But there are also revelations below the surface, open to those who will earnestly look for them. For God's hand was never outstretched to create, but beauty and wisdom appeared in every tracing; and, if seemingly wanting in the outer vestments, they are still profoundly exhibited through the structure beneath, in the ordering of the parts from which the externals are educed, and in the universal laws there contained; these are literally secrets of the Almighty, to be diligently "sought out of all them that have pleasure therein."

Who are they that are trying to open this book of revelation? 'Men of Science' they are sometimes called; 'Students of Nature' is their true position. Nearly all the world besides pass the revelation by unheeded, almost as if God were only the God of external nature, a maker of pretty forms, colors, and fragrances on a grand scale. Many even speak contemptuously of him, who, in the study of stones, insects, or worms, busies himself with endeavors to read those records of God's wisdom. In the style and spirit of the Atheist, they decry his pursuits, and strive to throw opprobrium on all of the sect. They may think better of some, who deal with worlds, and mountains, and large quadrupeds, perhaps; as if material size were a measure of truth with God. They seem not to know that the minutest living being is as much above a universe of dead worlds as life is superior to matter.

This unworthy spirit is mainly due to prejudice and ignorance. They say that science, after all its claims, is no nearer to explaining the ultimate nature of matter or of life, than centuries ago, and at the same time decry its "boasted" laws. And here is a fatal misconception of science. Has metaphysical or sacred Science yet explained the nature of God or spirit? or has any mind yet measured eternity? The ultimate nature of matter or of life is as much beyond all investigation. Science claims not to fathom it; is not so presumptuous as to hope for success, although examples are

at hand of this prying into mysteries among many writers on the second revelation. These subjects are neither within its bounds or aims. It seeks only to ascertain the laws which God has established in nature, or rather, the methods in which he is constantly working in the universe, his plan or system, ordained in infinite wisdom and sustained in infinite power. Man were presumptuous in his searchings, were he not made in the image of God. Thus endowed, if also teachable in spirit, he may read and understand, and reach onward in his knowledge to brighter and brighter revelations.

Newton, by a flash of his intellect, conceived of the law of gravitation; and as he, inquiringly, looked around and above, he everywhere found testimony that the conception was a fact, a comprehensive truth. At once, cycles and epicycles, and all the cobwebs of past ages vanished, and our planetary system and the vast universe stood forth in its majestic extent, the whole like a vision from on high. After the thousands of years that the world had existed, there was, at last, a correct apprehension of the actual relations in space of the heavenly bodies. He announced the law of attraction and its ratio, called it, for convenience, the law of gravitation; and by it, the great highways in the heavens have been traced. What before had been thought out, and thereupon received as true, proved to be wrong in fact and principle. But who will say that we do not now *know* the relations of the heavenly bodies, and the law of their motions? This law is as immutable as God's will, for it is his ordinance. Newton did not dream about the cause or nature of gravitation; he had read the law, and rejoiced in the revealed truth.

Crystallization opens to us other laws, no less comprehensive. All are familiar with the pretty geometrical forms of some crystals. But the observing eye sees the world full of crystals. When it snows, the heavens are showering down crystals, for every flake is a congeries of crystalline grains, and they are often in elegant symmetrical forms. When the waters freeze, they become a mass of crystals, only so

blended that we distinguish not their outlines. When seawater evaporates, it drops crystals freely; for every grain of salt that goes down, is itself a gem. A bar of iron is broken, and its whole texture proves to be an aggregation of crystal particles, showing the angular lines and cleavage of true crystallization. The granite of the hills is but a mountain of crystals; and every pudding-stone, although made of pebbles, has myriads of crystalline grains or fragments of crystals in and among those pebbles. Finally, the special fact first noted, develops into a general truth or law, that cohesion in the inorganic kingdom producing solidification, is actually crystallization; that we not merely see nature geometrizing, but matter in its profoundest quality governed by geometrical principles; and therefore that cohesion in solidification is not a sort of agglutination acting in all directions alike, which would be well enough for making spheres, but an axial or polar attraction, bringing out symmetrical forms according to fixed laws.

Examining further, more definite laws come out: each species or kind of substance, wherever found or however made, proves to have its distinct and constant fundamental crystalline form, so unvarying in angles and structure, although admitting of modifications by simple ratios, that it may be as easily known by it, as an animal by its form. These crystalline forms are cubes, square prisms, rhombic prisms either right or oblique, etc.; and in each case, the axes of the prisms, that is, their relative dimensions, admit of mathematical calculation.

Thus by widening our field of vision from the single fact to universal nature, we learn that molecules have their specific forms or dimensions, and cohesion in solids its mathematical basis. This fundamental quality of cohesion is sustained by every other characteristic of crystals: the hardness is different in the direction of *unequal* axes; so also the transparency, elasticity, conduction of heat, and refraction of light; and all in exact accordance with the law of symmetry in the crystal. Do we not see, here, that the very molecules, of which the universe is built, were modelled variously and

with precision by the hand of Deity? Looking deeper still, we learn that these molecules are not, like the blocks of an architect, squared and cornered for one place alone, but have their laws according to which they are adapted to numberless forms and structures. Gaining entrance to these inner temples of nature, we recognize, everywhere, the appointments of Him whose glories are infinite.

The chemist reads Nature in another of her departments: he watches the changes going on around him, and the changes which Nature, in her work, passes through in his laboratory. He thence learns not merely the absurdity of the ancient fancy that water, air, earth, and fire are elements, and not only that these are true elements, and that water is made of two, oxygen and hydrogen, and so each substance has its elemental constitution; but he goes further: he discovers, as his facts accumulate, that there is a law in these combinations; that oxygen and hydrogen, for example, unite only in certain ratios; that they exist in water in the ratio of 8 to 1 by weight; that, in another compound containing oxygen and iron, the ratio is 8 to 28; in another, containing oxygen and nitrogen, the ratio is 8 (oxygen) to 14 (nitrogen), or else, 8 to 28, 8 to 42, 8 to 56, 8 to 70, equivalent, in parts, to 1 : 1, 1 : 2, 1 : 3, 1 : 4, 1 : 5 parts; and so, throughout Nature, in compounds of all kinds, he ascertains that the elements have their definite combining ratios, and combining weights; and thence he learns to calculate, with the utmost precision, the constitutions of compounds.

Here then is a fundamental law of attraction, at the basis of chemistry, and upon it the science rests. It is a law of numbers and harmonic relations — the ordained will of God, which the chemical student has been enabled to apprehend, and is now endeavoring to follow out into all of its beautiful developments. No future research can revoke that will. The supposed elements may be resolved into others; but all matter, organic and inorganic, is constituted upon this law; and the law must stand, until the Being who said, "So let it be," reverses all Nature and his own enactment.

In the study of Light, the division of the beam into its

component colored rays, was a first fact; the different refrangibilities of those rays, a second. Then came the law that each color corresponds to a specific rate of vibration or of wave motion: the vibrations were measured; and finally, whatever the freaks of light, they were found to be explainable by the interferences and other inter-actions of just such rays with these specific rates of vibration. This established, science says: "sic Deus vult," and pays Him the homage due.

Thus we might go on with the departments of physical science, heat, magnetism, electricity, and others; and in all, it would appear, that science has reached immutable laws, simply by comparing one tracing in nature with another, and thus reading the hand-writing of God in his works. The attraction of gravitation, chemical attraction, cohesive attraction, light, heat, electricity, may yet be referred to some higher laws: they may be found to be but the workings of a common law, embracing the whole; and to this, science is tending. But in so doing, what are now laws will stand firm as laws under a more general law; what is knowledge will be knowledge still.

The laws in the kingdoms of life are of similar import, equally intelligible to the humble pupil of nature, and, if possible, more grand in their scope and relations.

The great universal law for all life Moses announced when speaking of the institution of the first life-kingdom, in the words: "which has seed in itself;" for this is the fundamental characteristic of living beings, as distinct from inorganic existence.

The evolution of the germ — in its essence, a simple memberless cellule — resulting in a successive individualization of parts: the more fundamental first; then, by degrees, leading on to the completed complex organism in all its details, is an exhibition of another grand law of the highest significance; one, in an important sense, typical of all progress.

The spiral line of development as the initial in evolution, and retained in its perfection in the spiral arrangement of leaves in plants, as well as in the parts of some animals, is

another grand law, which science has evolved from the mass of facts before us in the plant-kingdom. And this law has its more special announcements: follow the leaves, from one leaf (A) as a starting point around the stem, taking the course of the spiral, to another leaf (B) in the same vertical line with the first; and if there are 2 or 3 leaves in the spiral, the spiral goes around but once before reaching leaf B; if there are 5 leaves in the spiral, the spiral revolves 2 times before it reaches leaf B; if there are 8 leaves, it revolves 3 times; if 13 leaves, it revolves 5 times; if 21 leaves, 8 times; and so on, and the converse, by an inflexible rule. Placing the number of leaves above, and number of turns below, the following series expresses the relation: — $\frac{1}{1}$ $\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{5}$ $\frac{5}{8}$ $\frac{8}{13}$ $\frac{13}{21}$ etc. Now the last 8, the number of revolutions for a spiral of 21 leaves, is the sum of 5 and 3 of the two next preceding spirals in the series; and 21, of 13 and 8 of the same two preceding spirals. In this way the series extends on, in exact mathematical relation. Thus law rises above law, in God's plan, to mathematical harmonies; and when we shall establish the connection between the nature of growth and the production of such spirals, this will be still another law, not obliterating the former, but only opening a profounder view into the mysteries of creation.

In the animal kingdom also, there are laws above laws in a long progression. There are relations of structure or concurrent conditions that run through the kingdom as a whole; others for each class; others still of less profound character, but no less strict or beautiful, for each order, or family, or genus; and then in a species itself there are still other analogies between different parts, which are like higher tones in the grand system of harmonies. These science has partly studied out, and still she labors to comprehend them all.

As one example: after tracing the analogies of parts between the fore and hind limbs of a quadruped, it has gone on and shown that in the Divine plan, one system or type of structure is at the basis of the arm of man, the leg of the horse or lion, the wing of the bird, the paddle of the whale

and pectoral fin of the fish ; and so precisely, that the homologous bones may be traced, and the changes or obsolescence of this or that bone, as the type becomes adapted to its various purposes. There is in this unity of structure an expression of one single fundamental idea.

This kind of research has been further pursued, and it has been found that there is a like parallelism through the whole structure even to the relations of every bone in fishes, reptiles, birds, quadrupeds, and man ; so that there is one type at the basis of all.

Still deeper has investigation gone ; and now we know that in a single vertebra and its appendages, all the elements of the bony structure in these classes of animals are comprised, the repetition and modifications of a type-vertebra, with its accessories, producing all the various results.

Thus God throughout nature has evolved diversity out of unity, eliciting ten thousand concordances out of single profound enactments in His plan of creation.

These laws are universal truths, limited so far only as the range of objects to which they relate is limited. Thus any truth with regard to *life* which characterizes all living beings, is a law in the Science of Life. So as to the leaves of plants, any quality which is found to be a universal truth, as for instance their spiral arrangement, as explained, or their function of respiration, or their general structure, is a law in the Science of Plants. The chemical combination of elements in simple ratio and according to constant equivalents by weight, is another law or universal truth ; and the general truths relating to the dependence of chemical combinations on heat, light, or electricity, are other laws. The parallel relations of structure or homologies between all vertebrates, is another law, universal as regards the vertebrates ; and the other great groups have their corresponding laws. The reciprocal relations between the parts of an animal, due to the fact of type-structures, as between the hoof, leg, teeth, stomach, etc., through the structure, which is so exact, that a knowledge of one of these parts is equivalent to a knowledge of the general nature of all, is another law or universal truth.

Thus there are laws having reference to forces, motion, form, dimensions, general structure, functions, affinities of family, class, etc.; homological type-relations; reciprocal relations between the parts of a structure; development or growth, whether organic or inorganic. And such facts or conditions may be considered also with reference to one another, and afford still other laws; or specially with regard to forces or influences of any kind; and in this line are mainly what we call causalities. They may all be of various grades of generality; and they may be reduced in some instances to mathematical expressions, in which last case we reach nearest to the prototype enactments of Divinity.

Such laws are literally announcements of concordances in nature. They are not in any sense phenomena, but expressions of the relations of phenomena. They proceed from the oneness of system in the universe. They may rise above one another, in a grand series, and all still be true as laws; for they are exhibitions of the lines of truth which run through nature, all emanating from the will of the Supreme Architect.

In electricity, magnetism, and some related departments, the term *fluid* is commonly used, but only as a help in the expression of general truths. The science is not in the fluid, nor is the idea of a fluid a part of the science. The science consists of enunciations of general relations observed, and general methods of action or change; that is, the comprehensive facts or truths which research has developed.

The illustrations which have been given are sufficient to make clear the true goal of science, that toward which it has been moving with unceasing progress since man turned from excursions of fancy, and became an earnest and faithful learner at the footstool of his Maker. Nature, to such a one, is not a mere collection of things, of trees, and rocks, and animals, and man, but of living activities harmonious in plan and action.

These explanations may, to some, seem trite or out of place; and they would be actually so, were there not lamentable ignorance where we have a right to look for knowledge.

The work cited at the head of this Article, is an example to the point. Knowing something of the position and standing of the author, we had opened the book to receive therefrom such light as learning could give on the word of God in Genesis. We found much truth, well expressed and argued, with some philosophical notions as to causalities and phenomena, and much arrogance and error. We had heard that the author sustained the conclusions arrived at by geologists regarding the days of Genesis; and found the conclusions, indeed, but accompanied with sneers at geology and all science, which betokened a mind unfit for research. We found, too, a loose use of the Sacred Record, and a limited comprehension of the grandeur of its truths, which no less surprised us.

On the subject of facts and laws in nature, the author gives us early an exhibition of the depth of his philosophy. In a note on pages 38, 39, he explains his views with some detail. He writes out the mathematical expression :

$$P \quad p_1 \quad p_2 \quad p_3 \quad p_4 \quad p_5 \quad \dots \quad p_n \quad \dots \quad X.$$

as a series representing a higher and higher stage of causation from the fact or directly observed phenomenon P, to X the initial or most remote "act, fact, or energy;" and observes that, on attaining a knowledge of p_2 , a higher energy or causality than p_1 , p_1 then becomes *phenomenal* or a *manifestation*, and so on; so that P, p_1 , p_2 , p_3 , etc., all below p_n are phenomenal to p_n , if that be a known "fact, act, or energy." After thus explaining himself, and adding other illustrations, he says : —

"Making an application of such views to science generally, we might say, the n th terms at the present stage of discovery are to be found in such words as *gravitation*, *magnetism*, *crystallization*, *elasticity*, etc. These do yet stand for *energies* or *causalities*, because there has not yet been discovered that still more remote energy of which they are *manifestations*, and which when discovered will convert them all into *phenomena*, that is, *make them appear*."

Hence, in opposition to all that has been said, knowledge is *not* knowledge. Since science is necessarily finite, and therefore its results cannot reach nearer to X than p_n , *ergo*, not only its present laws, but all the future may develop,

are ephemeral, fated, to the last one, or all but the last, to become "phenomena" in the progress of learning; one charnel-house for the whole, "cycles," "epicycles," "magnetisms," "gravities," "elephants," "turtles," etc. A hopeless prospect ahead for those who reason from or about nature; and we wonder when Professor Lewis was propounding his laws with regard to nature, in the following pages of his work, he did not fear lest they might, hereafter, be doomed to a place by the side of the "elephants."

That we may not appear to misrepresent him, we cite further:

Page 220: "Science may boast as she pleases, but according to her own most vaunted law, she can only trace the footsteps of a present or once-passing causation;" as if the laws of matter and of all existence were as mutable as the changing seasons.

In the same spirit, he speaks of the progress of science (p. 180), rendering "childish and obsolete all the doctrines and all the language in which she now so proudly boasts."

After a very cutting rebuke for the "savans of the nineteenth century." (p. 107), he observes that "the language of science, when it fails or has become obsolete, exhibits always the appearance of childish folly and pretence;" and then, after a few sentences, goes off as follows:

"Science has indeed enlarged our field of thought, and for this we will be thankful to God, and to scientific men. But what is it after all, that she has given us, or can give us, but a knowledge of phenomena, appearances? What are her boasted laws but generalizations of such phenomena ever resolving themselves into some one great fact that *seems* to be an original energy, whilst evermore the application of a stronger lens to our analytical telescope resolves such seeming primal force into an *appearance*, a manifestation of something still more remote, which, in this way, and in this way alone, reveals its presence to our senses. Thus the course of human science has ever been the substitution of one set of conceptions for another. Firmaments have given place to concentric spheres, spheres to empyreans, empyreans to cycles and epicycles, epicycles to vortices, vortices to gravities and fluids ever demanding for the theoretic imagination other fluids as the only conditions on which their action could be made conceivable."

The error of our profound author is plain enough after the remarks which have been made. The connection, in the same category, of ancient dreams with discovered laws,

laws deduced by science after experiencing the vanity of man's imaginings and turning to God's works as a sure fountain of knowledge, is certainly remarkable as a specimen of learning; and it abounds on other pages. We hardly know to what to refer the blindness that cannot see the wide gulf between "vortices" and "gravities."

On p. 170, again, he remarks on the "ever-increasing darkness of science," "unaided by any higher beams," not aware that science is itself an emanation from the Source of light. On page 110, he says well of the Book of God, though in the same perverse tone about science: "This grand Old Book of God still stands, and will continue to stand, though science and philosophy are ever changing their countenances and passing away."

Once more, we quote a forcible illustration, which presents his views in few words: "We may smile," he says, "at the old quackish story of the earth's standing on the back of the elephant, and the elephant standing on the head of a tortoise, etc.; but in our gravities, our magnetisms, our series of fluids, ever requiring other fluids to explain their motions, we have only introduced a new set of modern equivalents."

There is much more of the same sort. At first, this slashing away at science excited amusement, reminding us of the contest between Sancho and the windmill: but then, pain, that an infidel philosophy should have emanated from such a source. This placing in antagonism God's word and his works, or the results of the study of his works, is only fitted to make the young scout the former; for they know the latter has its great truths, having the best of all evidence.

Had the author simply condemned the false that is mixed with science, or the atheism that substitutes force or nature for God, it would have been well. But notwithstanding an occasional admission of good accomplished, he reprobates science in its foundation and essence, and also all who dare to believe,—very much, indeed, in the spirit of the Cardinals who judged Galileo.

But science is still alive; her progress is sure; and in her

readings of God's works, His word is daily finding support, fuller elucidation, and increasing sublimity.

In this attack upon science, which is a sort of by-play quite unessential to the object of the work, geology of course gets double share. And, strange to say, the author is at the same time sustaining essentially the conclusions of geologists. He adopts and proves, on exegetical grounds, that the days of Genesis were long periods of time, and speaks quite freely of the æons and æons, saying that the "feeling of the vast, the indefinite, the unmeasured, once received into the soul [in the opening period], is carried naturally through all the other periods" (p. 96); and, at first, we gathered that he and geologists were agreed. But when all seemed to be flowing on smoothly, suddenly the geologist gets an unmannerly rap for taking too much time. It would seem to be a trivial fault in a case where all is acknowledged to be so "indefinite," and where the periods are periods in the work of a Being who has existed from eternity; and especially since, if we go back even "billions of years" for each day, we get no nearer to the beginning of that eternity. But still it is not pardoned. The author thinks it gives too much time to the age of "Fungi and sea-weeds;" indeed, he says: "it is very strange that fungi, at least some fungi, should exist at all" (p. 172). He is not aware that geology accords somewhat with his notion; for it finds no Fungi whatever until the later periods of the globe. He does not anywhere mention the exact length of time which, consistently with divine wisdom, the periods could have occupied. But, although objecting so decidedly to a long age of Fungi, he thinks that a state of "huge nebulosity," "with an absence of solidity and cohesion," might have been continued "for millions and millions of years" (p. 60). Again (p. 398), he remarks, with some temper (alluding to geologists and the Bible), as follows: "Neither does the Bible mean what you, in your little science and still less Biblical learning, would ascribe to it. Your stale caricatures belong neither to its prose nor its poetry: they are alike alien to its letter and its spirit."

The author exhibits a constant fear lest geology should

teach something, and that thereby a belief, based on truth from such a source (he has it — “on Buckland, Lyell, or Hugh Miller”), should be substituted for a belief grounded on the Scriptures, which would be, he says, “a wretched self-deception;” — lamentable, indeed, if we should admit of help from God’s works in understanding His writings!

In another place, he says of geology (p. 98): “Infidel as her spirit often is,” she is “driven, more and more, to acknowledge the mixture of the natural and supernatural in the production of the earth:” very much, we think, as a current is driven by the boat it carries; for geology first proved that “the natural” was involved in creation, and, with a rare exception, has always admitted the supernatural; and she has finally drawn off exegesis so completely into the same course that some, like Prof. Lewis, as they are hurried on by the current, exclaim in great glee over their wonderful progress, and, in remarkable self-complacency, look down frowning upon the current that they imagine is trying to keep up with them.

As to infidel geology — the science which, almost alone, put down the pantheistic “Vestiges of Creation” and its “development theory,” was geology. Not a geologist, in his writings, has supported the work; and the facts proving successive creations, in past time, instead of evolutions of species from species, have been uniformly regarded as conclusive against that theory. Yet our author admits that “a development theory, in the sense of species from species, may be as pious as any other,” and may, possibly, have been true. He needs the bit of science to curb his fancy.

The work is remarkable for the confident air with which it brings forward principles that cautious science is slow to utter, thus dictating to nature in the true style of the old philosophy, while, at the same time, not adopting, or “caring” to recognize, any results established by geology or the other sciences. But it is useless to enter into further details.

We come now to the special subject of the work, “the six days of creation, or a Scriptural cosmology.” We will first give briefly the general course of doctrine in the volume.

The six days are six periods, "indefinite, vast;" still, he says, not so long as "very flippantly and very ignorantly" asserted by geologists.

Creation, in the very beginning of beginnings, was a creation out of nothing. But Moses probably did not mean a real *bona fide* beginning either in the first or second verse of Genesis. The words of our author are (p. 45): "whatever may be believed, in respect to this first origination of matter, whether of the earth or of all worlds, there is good reason for doubting whether it is actually meant to be set forth either in the beginning or in any other part of this account." He says of the primal or originating force, in, or constituting, nature, that it is not "the divine power continually energizing in space;" but that "it is a real entity distinct from God, which God has originated, and to which he has given an immanent existence of its own in space and time." This is "the great ultimate fact of facts in the physical world." (p. 47).

The formless and void earth was probably a "huge nebulosity," as just now cited. But "how it came in such a condition, no one can say; whether it was the result of a progress or a deterioration, we have no means of knowing, either from reason or revelation." The creation of Genesis, was no creation, even *ab initio*, but rather a fashioning in or upon matter previously existing, "a separating, a dividing, a clearing up, a bringing into order, an arranging of outward relations." The original matter may have had only "the dead force of cohesion;" but at "the beginning" to which Moses refers, there was added "an inward power, a separating, arranging, selecting, organic power," and this was "the beginning of life, although, as yet, exhibited only in the chemical aspect, rather than the higher modes in which it afterwards energized" (p. 65).

The first effect of the new life was the elimination of light" (p. 65). And as light succeeded to darkness, a finished work to time when the work was not begun, so by a natural figure, morning succeeded to evening, or light to night, "boker" to "ereb." Thus the first day passed.

Creation thus begun, was throughout, a *growth*, a *generation*, as *Genesis*, in Greek signifies. Accordingly (p. 114), "there are the days or periods of quickening, and then, supervening on them, a season or seasons of repose, in which physical law, the physical law both of the material and the sentient nature, carries on the processes thus begun, or thus renewed. As the *fœtus* grows in this *hidden world*, which the Psalmist compares to the lowest parts of the earth, there is doubtless a most important part performed by nature." The author, seeing himself on the verge of an abyss then adds: "yet if we would avoid the grossest materialism, we must conclude that there are some things, even in this seemingly *natural* process, which nature never could have done, — something to which all her chemistry and all her laws of physical life, could never have given the beginning of existence."

The *second* day was the "evolving from the yet semi-chaotic world, that we now call the atmosphere" (p. 104); "the origination and completion of that apparatus of physical law, or that physical state of things, be it scientifically whatever it may — for we do not yet know in all respects what it is — by which were produced the combined appearances of the clouds, the blue heavens, together with other *outward* revealing phenomena connected with, and representative of, such interior causality." The author in this connection afterwards apologizes for his indefiniteness by a fling at unfortunate science, observing (p. 105), that "the more scientific our statements, the more abstract and conceptionless are they, etc."

On the *third* day, dry land appears coming up out of the waters through natural causes. The consideration of the creation of vegetation is passed over to the *fifth* day.

On the *fourth* day, the sun, moon and stars, long before created, became visible to the earth, or "made their APPEARANCE in the firmament." The sun was perhaps now first brought into the same planetary system with the earth; or else a veil was removed; or it then first became luminous; or the matter of the sun did not before exist; or in some way, the sun became visible.

On these several points, Prof. Lewis says (p. 136): "Science is dumb, and revelation says nothing;" and again as to the establishment of the relation of the earth and the sun at that time, he remarks with equal confidence (p. 144): "science cannot say anything for or against such a view;" and again: "how can science say whether there was then any revolution of the earth upon its axis or not," and so on to a depth the reader can explore on page 145. Science seems to haunt the author like a horrible ghost, and his cudgel is always up. After all this and much more, he adds as follows, in which the remarks on vegetation are noteworthy:

"We may conclude that at this fourth period, partly contemporary with vegetation, and before the earliest dawn of animal life, the sun assumed towards our earth the state and form of a luminous body, and the adjustment of the shorter periodic seasons commenced All that we can say is, that at this period the solar system was lit up, the phosphorescent light which the earth may have possessed went out as the planet became more dense, the veil was taken from the central luminary, in order that now there might be not only light and warmth, which existed before, but such regulated diversities of them as would be required for the later vegetation as well as for the animal and human life" (pp. 147, 148).

Between the chapters on the fourth and fifth days, a discussion comes in again on the word *day*, and on time, and the uses of the sun, which it is unnecessary here to consider.

The *fifth* day is now taken up, when the author speaks of the creation of vegetation, and animals generally, exclusive of man. The expressions, "Let the waters bring forth," "Let the earth bring forth," are explained thus:

"In its general effect, [the general effect of the account by Moses,] and still more, in the conceptions which lie at the roots of its most important terms, it forces upon the mind the idea of a *nature in the earth* acting through a real dynamical process of its own, and in periods, which, whether longer or shorter, contain within themselves all the changes and successive stages which we find it impossible to dissociate from the thought of birth and growth. And this, too, of the animal as well as of the vegetable world" (pp. 211, 212).

Preparatory to this conclusion he had said (p. 200): "holding Nature thus to be, in some sense, a self-subsisting, self-

acting power," etc.; also, p. 199, "from the necessity of our laws of thinking, as well as from revelation, we say, that it [nature] is a power given originally by God. But, though thus originated, we can distinctly conceive of it as a nature, only when we regard it as in some manner left to itself and operating by its own laws or methods;" also, p. 204, "if we thus view Nature as a stream of causation governed by a certain law which not only regulates but limits its movements, then the *supernatural*, as its name imports, would be all *above nature*, in other words, that power of God which is employed 'according to the counsel of his own will' in originating, controlling, limiting, increasing, opposing, or terminating nature, whether it be the universal, or any particular or *partial nature*;" also, "it [the devout mind] loves to read how Nature, ever so obedient to her lord, is sometimes commanded to stand away from his presence."

After this, he observes that a development theory, of species from species, is pious enough, and Crosse's manufacture of *Acari* may be in harmony with law and gospel, provided the law have a divine origination; and in this provision the *naturalism* of the view escapes *atheism*.

The discussions which next follow, as to "what is meant by God's making the plant before it was in the earth," are not particularly edifying. The following chapter, on "the cyclical law of all natures," urges, that, from the analogy of day and night, summer and winter, life and death, sleep and activity, Nature has had its passivity and activity. The author "infers not only the *fact*, but the absolute *necessity* of repeated creative or supernatural acts; and this, not only to raise Nature, from time to time, to a higher degree, but to arouse and rescue her from that apparent death into which, when left to herself, she must ever fall" (p. 241). This is "the cyclical law of all natures." He quotes, approvingly (p. 243), the following thought from Plato's "strange myth," in the *Politicus*: "When God suffers Nature to take her course, all things tend to disorder, decay, and dissolution; when he resumes the helm, Nature moves on in her law of progress,

order comes again from disorder, growth from decay, and youth from age."

Finally, he comes to the *sixth* day, under which head, *having disposed of the quadrupeds in his remarks on the fifth day*, he speaks only of MAN. He thinks that possibly a perfect *primus homo* could have been made, by God, from the earth, like the animals (p. 247); but the record is against it, asserting that man was made in God's image, and therefore he admits that "the origin of man, as *man*, was special and peculiar;" by which he means, as he says, "his distinctive humanity, as separate from all that he has in common with the lower animals" (p. 248). He thinks, further, as follows:

"We are not much concerned about the mode of production of his material or merely physical organization. In regard to this, there is nothing in the expressions, 'He made,' or 'He created him,' or 'He made him from the earth,' which is at war with the idea of growth or development, during either a longer or shorter period. Ages might have been employed in bringing that material nature, through all the lower stages, up to the necessary degree of perfection for the higher use that was afterwards to be made of it. We do not say that the Bible teaches this; we do not think that any one would be warranted in putting any such interpretation upon it. There is, however, in itself, and aside from any question of interpretation, nothing monstrous or incredible in the idea that what had formerly been the residence of an irrational and grovelling tenant might now be selected as the abode of a higher life, might be fitted up in a manner corresponding to its new dignity, might be made to assume an erect heavenward position, whilst it takes on that beauty of face and form which would become the new intelligence, and indeed, be one of its necessary results."

In other words, a monkey may possibly have been curtailed behind and straightened up into a man.

The *seventh* day is regarded as now in progress and as including the period of spiritual existence beyond this life.

The prominent points, then, in the system are:

1. His personifying Nature, after Plato's notion; and, as a consequence, regarding her as, in a sense, "self-acting;" yet needing occasional supernatural acts, to rescue her from the decay or death to which she tends, and having alternately her time of rest and action.

2. Hence making mother earth to bring forth, through her

“parturitive powers” (p. 206), plants and animals, and even man, as far as his physical nature goes.

3. Admitting that matter is not eternal, but neglecting the obvious meaning of the phrase “In the beginning.”

4. Admitting that the higher forms of vegetation were not created before the sun.

5. Regarding the creation of the sun and moon as “phenomenal.”

6. Taking the days of Genesis to be indefinite periods.

7. Admitting the expression “evening and morning” to be metaphorical, and implying progress from the beginning to the full completion of a work, which, on the first day, was literally from darkness to light.

With regard to the last four points, geology can make little exception to Prof. Lewis’s conclusions.

On the first three, the author and the “Vestiges of Creation” are pretty well agreed, except that Professor Lewis is less consistent in his use of Nature; and besides, he admits the occasional need of the supernatural to wake Nature from her slumbers, arrest decay, and give new momentum to her activity.

But is this Scriptural cosmology? We fail to find it in Genesis or elsewhere in the Bible. Successive days of evening and morning are announced; but does this imply that God or Nature needed rest? We have been led, from God’s word as well as works, to conceive of Nature not only as God’s initial work, but his constant work, ever sustained, and never left to go alone; and therefore no more requiring rest than God himself; no more capable of self-acting obedience than as God’s own acts are obedient to himself. The world, in this sense, is full of God, though still not God; for these are only physical manifestations, which he ever continues, through the system he has established; while above all is a Moral Governor, a personal will supreme, which, by this system, which we call Nature, is working out physical, moral, and spiritual ends.

The successive phases or conditions in Nature may have, on such a ground, the character throughout of an evolution,

or the working of a single purpose, in all its lines of details, — as much so as in the opening flower. Yet this is so because God is infinite in power and wisdom, needs not to revise his plan or institute new principles; but, at the inception, saw the end and all the steps leading thereto, as a series or succession throughout perfect in law and harmony. In such a plan we have no right to say that God stands by to see Nature go alone; but that, unceasingly, he sustains and directs the glorious work by his power. We have not to conclude, in order to avoid materialism, that there are “some things” which Nature could never have done; for, in this view, there is nothing which, of itself, or in any sense as a self-existent activity, it can do.

This view, which shines forth from every page of the Bible, is as correctly a growth or Genesis, as that of Prof. Lewis; and all his argument, based on the progress of creation by periods, or on the meaning of the word *Genesis*, or of *φύσις* in Greek, or *natura* in Latin, or the alleged irrationality of any other view, does not go one step towards sustaining his peculiar notion of a huge self-acting something, now and then aroused to progress by God.

Although Prof. Lewis may not regard the fact, we observe that science does not suggest such a view of Nature.

The whole essence of physical Nature is expressed in a molecule; for molecular laws are the laws of physical Nature. The mere aggregation of molecules into stones or earth, however large the amount, does not give powers that are not contained in the minutest particles. Or, if many balls of such stones and earth are set afloat in space, they still do not make “Nature” with higher qualities than the molecular forces; and however great the effort of laboring Nature, we have no right to assume that those forces could make a living germ. The dirt of a laboratory had the misfortune to set afloat the idea of the creation of *Acari*, by Mr. Crosse. But science has yet no reason to deny that physical forces are physical forces.

In fact, life and physical or inorganic force are directly opposite in their tendencies. There are, in compounds, two

extremes : one, the inorganic and stable ; the other, the organic and unstable ; the former, the oxygen extreme ; the latter, the carbon extreme. In inorganic Nature, as oxygen is the element of strongest affinity, the tendency is mostly to combination with oxygen or an analogous change, and this occasions the speedy dissolution of the organic structure when life disappears, and continued interchanges until the stable oxyds are produced. In life, on the contrary, there is a constant rising in the scale ; that is, a movement in just the reverse direction, to compounds of carbon, hydrogen, and oxygen, or carbon, hydrogen, nitrogen, and oxygen, of greater and greater complexity ; the stem of the plant thus preceding the formation of the higher material of the flower ; or, in the animal, the albumen of the germ preceding the multiplied compounds of the structure and the highest of all compounds, as we believe it, the material of the brain. Inorganic and organic nature thus move in opposite directions.

Again, in inorganic Nature, increase of size is only accretion, and does nothing more than increase gravity. In the plant-kingdom of life, increase from the germ, besides increasing gravity, develops and sustains the organic structure, and produces a rising scale of chemical compositions. In the animal-kingdom, in addition to all the results just mentioned, there is a gradual development of mechanical force, from zero in the germ to its maximum in each species, besides also the force necessary to sustain the growth and functions of the individual, including mental action.

On scientific ground we should, therefore, conclude that physical force could not, by any metamorphosis or genesis, give rise to LIFE.

But again, suppose life to exist. This means simply living beings, as plants and animals, and implies conditions of chemical change, growth, and decay, in such beings. But we have no right to assert that any aggregation of such living beings, or amount of life, is capable of more than simply living and reproducing itself. The greatest possible result is accomplished when a living organism produces its like, in its young ; for it is a result precisely equivalent, in power, to the

parent itself; that is, the power at work. Let there be a universe of worlds, full of living beings, and we still have no authority, from science, to assert the existence of a principle of life actuating that universe, beyond what belongs severally to each living being in it.

A study of Nature gives us, therefore, no basis for the notion of a living universal nature, capable more or less completely of self-development. Suppose the world to be in its condition of inorganic progress; we have no scientific ground for supposing that it could pass to a higher state, possessing living beings, by any parturient powers within. Or if life exists; we still get no hint as to the evolution of the four Sub-kingdoms of animal life from a universal germ; nor as to the origin of the Class-types, Order,—Family,—or Genus-types, or those of Species, each of which is a distinct idea in the plan of creation.

Nature in fact pronounces such a theory of evolution false, absolutely false, as we observe more particularly on a following page. It also proves the Divinity to be present at every step in creation, in the ordering of the globe in each physical feature, as well as in the plan and evolution of the life-kingdoms. The perpetual presence of Mind, infinite in power, wisdom, and love, and ever-acting, is so manifest in the whole history of the past, that the pantheistic theory which makes Nature God, is much the least absurd of the two. It regards Nature more in accordance with the analogies of a being like man, in which mind is uninterruptedly immanent, instead of an entity only now and then roused by an external mind. From the pantheistic doctrine we rise to true theism, by recognizing that whatever perfections belong to Nature, must be in or of God, as his power and attributes, and in an infinite degree. Hence physical attributes do not constitute God: for if we reject the idea that a sense of justice, truth, and love is evinced by the physical world, still man has these moral qualities; and therefore they must be among the attributes of Deity. And in addition, man has over all a free will; and therefore this also, but in its infinitude, must be an attribute of the God of Nature. Such a

Deity is not Nature itself, which is only a plan in development, but a personal being above Nature, while ever *in nature* by his power and wisdom.

Our conclusion therefore is, that Nature, self-existent and self-propagating, now and then requiring a jog from the supernatural, may be an interesting myth, but cannot rise to the same point of view with Biblical truth or sound philosophy.

But let us pass on. We need better argument than Prof. Lewis has brought forward, to convince us that the phrase, "In the beginning," does not mean what it says. We have regarded the announcement, in the first verse, of creation out of nothing by the will of God, a will free, supreme, omnific, as the grand point distinguishing the Mosaic cosmogony from the Egyptian and all others; almost like the very hand itself of God on the first line of the new revelation. But he would have us suppose that matter was made at some earlier beginning; and perhaps had had its ups and downs, and finally was worked over at a new beginning announced in the first verse. It is true the Hebrew word used in this place for *create*, does not signify, necessarily, creation out of nothing. Yet such an inference cannot be resisted without doing violence to the spirit of the text, and the fundamental laws of human belief. We would ask Prof. Lewis, what Hebrew word he could substitute for the one used, that would convey the precise idea of creation out of nothing? When he has found such a one, his reasoning may then demand consideration. "In the beginning" refers directly to the existing "heavens and earth" mentioned in the following part of the verse; that is, the existing universe. We may suspect the existence of a previous universe that came to nought before this began; but it cannot be made a question of reasonable belief, or a basis for argument.

Some other points in Professor Lewis's cosmology (he will excuse us if we substitute his own name for the term "scriptural") demand from us a passing remark.

With singular inconsistency, Professor Lewis admits a "huge nebulosity" for the "formless and void" state of the earth, makes the progress mainly one by natural causes, and

then speaks contemptuously (p. 107) of nebular condensations, the very process required to evolve solidity from his nebulousness. He speaks of the power of cohesion in the nebulous matter as preceding chemical and other kinds of attraction, not knowing but that the existence of cohesion involves the existence of the rest.

Professor Lewis supposes that, on the third day, the world was finished so far as to have its seas and lands, mountains and valleys, and urges a general theory of evolutions; yet he thinks that this does not necessarily imply that, at that time, the central body, to which the earth is a satellite, was already in its place. The worlds, on such a view, were not evolved according to the analogy of embryogeny, by eliminating the systems and then their parts; but first the scattered parts, and then these, were afterwards put into systems. Science, as well as reason, most plainly teaches, that if any evolution-theory is to be adopted (and such our author aims at), the former is the true one.

In the Mosaic record it is said that, on the third day, dry land appeared; but nowhere does it announce, like our author, that the land was diversified with mountains and valleys: and neither does science.

It is remarkable, that, in a work on the six days of creation, the author's system should have led him so far away from the record, as to place under the fifth day, both his remarks on the creation of vegetation (the work of the third day), and all he has to say on the quadrupeds or mammalia (the work of the sixth). The convenience of his theory of *life from the waters and earth*, appears to have been, in part, the occasion of it. But is this reason sufficient, in a work entitled "The Six Days of Creation, or the Scriptural Cosmology," by an author who expresses great devotion to the Scriptures? — a work exegetical, profound, claiming to sift the Hebrew, and offered as a contribution to our Biblical literature? Can we be satisfied that the word of God has been sufficiently studied and apprehended, when not even a mention of the creation of quadrupeds is introduced into the chapter on the sixth day?

Besides this, the author doubts, on grounds he so contemns, —scientific grounds—whether the higher kinds of vegetation, if any, were created before the sun. He says: “For the development of these, if not for their origination, there is needed the orderly arrangement of the seasons and the regularly-adjusted light and heat of some great luminary.”

Moreover, he mentions no reason for the wonderful fact, that two so diverse creations as that of vegetation and the dividing the land from the seas took place in one day; nor for the equally marvellous fact, that the creation of quadrupeds took place on the same day with that of man.

On the creation of man, we have the crude speculations that have already been cited (p. 98), a miserable substitute for wisdom that comes from above.

Temptations to remark and criticism follow one, all through the pages of such a work; there is so much to complain of, in the author's philosophy, his exegesis, his ready way of making the Mosaic record literal or “phenomenal,” to suit his theory; his misapprehension of science, and denunciation of established truth. We therefore have had to cull sparingly, not to run to a tedious length.

Is it not a marvel that a learned Professor should accord, in his cosmogony, with the views of science in all their grander points, and yet lose no opportunity to denounce science: should adopt, with science, the idea of indefinite periods for days, and then pick a quarrel because geologists make the days, he thinks, too long; should build up a system out of Nature and natural causes, or what he supposes to be natural causes, and still abuse a science that also uses Nature and natural causes, and studies not to stretch those causes beyond what is warranted by direct observation; should attempt to grasp a subject that requires the highest knowledge of natural possibilities, without the least investigation as to what are the actual powers or capabilities of Nature? An honest doubt of the conclusions of geologists, in the mind of one who has not pursued the subject, is reasonable enough; but for such a one, in his acknowledged emptiness, to turn around and charge science or the students of Nature with flippancy and ignorance, is at least to prove

himself a subject meriting psychological investigation. Science, it is true, is so far conceptionless as to clip the wings of fancy in world-making; but it is not a fault that should send her to purgatory.

It can hardly be doubted by our readers that the "Cosmology" of Professor Lewis fails of exhibiting the spirit of the original. And we believe it will soon appear, if not so already, that it indicates no adequate comprehension of the philosophy or divine features of that record. It may be good Platonism; but it is, in our view, neither scriptural theism, nor true naturalism.

Having in our *first part* presented a general sketch of science, its aims and its laws, or the laws of Nature, as a basis of comparison with the opinions of Prof. Lewis, we have considered, in our *second part*, the "Cosmology" brought forward by him as an interpretation of Genesis. It now remains, as our *third part*, to mention those points in which science has thrown light on the Mosaic account; light which could have come from no other source. We pursue this method of meeting the views of Professor Lewis on the legitimate uses of science in Biblical interpretation, rather than that of direct argument and criticism.

As introductory, we would first offer a few thoughts on the authority of the Mosaic record, and then endeavor to correct some misunderstandings with respect to geology.

Since geology began to be a science, believers in the Sacred record have gradually divided off into four classes.

1. Those who hold, on exegetical grounds, that the account in Moses admits only of a strictly literal interpretation, and denounce all geological conclusions.

2. Those who take the same view of the record, but admit in the main the results of geological research, and regard the record as a myth, correct in making God the creator, and in the general notion of progress.

3. Those who adopt a liberal interpretation of the record as most consistent with its spirit and truth, and believe both the written word and the testimonies which are gathered from the study of Nature.

4. Those who adopt the liberal interpretation of the last, but with denunciations of geology, while at the same time accepting its main conclusions.

The truthfulness of the Mosaic record is admitted by all the classes here referred to, excepting the second. These, on the ground that the early part of Genesis bears evidence of being a collection of two or three distinct accounts, suppose that Moses adopted that particular ancient or traditional story which acknowledged God as the Creator; and they do not insist upon its being correct in details. It would at first seem as if this liberality of view were a consequence of a firm and well-defined belief in the deductions of science. This is so with some; but with many, it is just the other way: there is a vague opinion that geological facts cannot be set aside; and as the literal rendering of the Hebrew, in their view, is also inflexible, they consequently let the record go, — we can hardly say, as the least of two evils. They thus obtain a sufficient ground for rejecting all attempts to reconcile science and the Bible.

The fact, if it be a fact, that the account was a tradition which Moses adopted, would not necessarily prove it incorrect in any of its statements. The acts in creation had no human witness, and therefore the tradition either was originally from the Being who had before given man a living soul, or else it was only a human conception of world-evolution. If the former, it might still be, throughout, truthful; while at the same time we should naturally infer, in the case of such a tradition, that the exact literality might yield a little to research, provided the spirit of the whole were sustained. If the latter, then the whole is hardly better than a fable, except the grand pervading truth — God in creation. In this last case, the Divine signet is stamped on a false or suspicious document, and thus opens the Sacred Book — false not in mere drapery, for the account is peculiarly free from adjuncts or symbols, presenting a series of definite assertions as to the acts of the Deity himself. Admitting the account as thus untrustworthy, science becomes the only true record of the history of creation; and its facts should hence

have a vastly enhanced interest, especially to the religious world.

But we do not believe in this fabulous origin, as we show beyond. And if but little flexibility is allowed to the Hebrew by the exegetical student, the record will stand firm, sustained by Nature and the God of Nature. We call it flexibility; yet we have the authority of some learned Biblical scholars for concluding that the liberal rendering, required by science, is the only correct rendering of the original words of Moses. Our own faith in both records is the more confirmed, the deeper we pursue our investigations.

We cannot believe that Moses had a full comprehension of the events he narrates, any more than the Jewish prophets, of the spiritual kingdom of Christ which they foretold. The account is but an epitome of creation, in a few comprehensive enunciations. The details God had before inscribed in the earth itself; and science fulfils its end in reading those records and receiving the lessons they teach.

Accepting the account in Genesis as true, the seeming discrepancy between it and geology rests mainly here: geology holds, and has held from the first, that the progress of creation was mainly through secondary causes; for the existence of the science presupposes this. Moses, on the contrary, was thought to sustain the idea of a simple fiat for each step. Grant this first point to science, and what further conflict is there? *The question of the length of time*, it is replied. But not so; for if we may take the record as allowing more than six days of twenty-four hours, the Bible then places no limit to time. *The question of the days and periods*, it is replied again. But this is of little moment in comparison with the first principle granted. Those who admit the length of time and stand upon days of twenty-four hours, have to place geological time *before* the six days, and then assume a chaos and reordering of creation, on the six-day and fiat principle, after a previous creation that had operated for a long period through secondary causes. Others take the days as periods, and thus allow the required time, admitting that creation was one in progress, a grand whole,

instead of a *first* creation excepting man by one method, and a *second* with man by the other. This is now the remaining question between the theologians and geologists; for all the minor points, as to the exact interpretation, of each day, do not affect the general concordance or discordance of the Bible and science.

On this point, geology is now explicit in its decision, and indeed has long been so. It proves that there was no return to chaos, no great revolution, that creation was beyond doubt one in its progress. We know that some geologists have taken the other view. But it was only in the capacity of theologians and not as geologists. The Rev. Dr. Buckland, in placing the great events of geology between the first and second verses of the Mosaic account, did not pretend that there was a geological basis for such an hypothesis; and no writer since has ever brought forward the first fact in geology to support the idea of a rearrangement just before man;—not one solitary fact has ever been appealed to. The conclusion was on biblical grounds, and not in any sense on geological. The best that Buckland could say, when he wrote twenty-five years since, was, that geology did not absolutely disprove such an hypothesis; and that cannot be said now.

It is often asserted, in order to unsettle confidence in these particular teachings of geology, that geology is a changing science. In this connection, the remark conveys an erroneous impression. Geology is a progressing science, and all its progress tends to establish more firmly these two principles. (1) The slow progress of creation through secondary causes, as explained, and (2) the progress by periods analogous to the days of Genesis.¹

¹ The various uses of the word *day* in the Mosaic account of creation are not all mentioned by Prof. Lewis. *First*, in verse 5, the *light* in general is called day, the darkness, night. *Second*, in the same verse, *evening and morning* make the first day, before the sun appears. *Third*, verse 14, day stands for *twelve hours* or the period of daylight, as dependent on the sun. *Fourth*, same verse, in the phrase "days and seasons," day stands for a period of *twenty-four hours*. *Fifth* at the close of the account, in verse 4, of the second chapter, day means the *whole period of creation*. These uses are the same that we have in our own language.

What other points science in its present state establishes or elucidates, we shall now consider. The best views we have met with on the harmony between Science and the Bible, are those of Prof. ARNOLD GUYOT, a philosopher of enlarged comprehension of nature and a truly christian spirit; and the following interpretations of the sacred record are, in the main, such as we have gathered from personal intercourse with him.¹

The first thought that strikes the scientific reader is the evidence of Divinity, not merely in the first verse of the record, and the successive fiats, but in the whole order of creation. There is so much that the most recent readings of science have for the first time explained, that the idea of man as the author becomes utterly incomprehensible. By proving the record true, science pronounces it divine; for who could have correctly narrated the secrets of eternity but God himself?

Moreover, the order or arrangement is not a possible intellectual conception, although we grant to man, as we must, the intuition of a God. Man would very naturally have placed the creation of vegetation, one of the two kingdoms of life, after that of the sun, and next to that of the other kingdom of life, especially as the sunlight is so essential to growth; and the creation of quadrupeds he would as naturally have referred to the fifth day, leaving a whole day to man, the most glorious of all creations. Prof. Lewis, in making no allusion to the creation of quadrupeds on the sixth day, writes as if it were a mistake that this was not so done. Man, again, would never have separated the creation of light so far from that of the sun, to us the source of light; neither would he have conceived of the creation of the firmament, as that word is usually understood, and was under-

The meaning of the words "evening and morning" we believe to be correctly given by Prof. Lewis.

¹ The views of Prof. Guyot have been presented at some length in this journal by Rev. J. O. Means (numbers for January and April, 1855). They are here brought forward from a different point of view with other illustrations, and additional deductions from the science.

stood by the Jews, without the stars as part of its decoration.

Moreover, there is a sublimity and system in the arrangement, and a far-reaching prophecy, to which philosophy could not have attained, however instructed.

The creation, in the first place, consists, according to the record, of two great periods; the *first three* days constitute the *inorganic* history, the *last three* days, the *organic* history of the earth.

Each period begins with LIGHT; the *first*, light cosmical; the *second*, light to direct the days and seasons on the earth.

Each period ends in a day of two great works. *On the third day*, God *divided the land from the waters*; and he "saw that it was good." Then followed a work totally different, *the creation of vegetation*, the institution of a kingdom of life, a work more unlike that of the former half of the same day than those of any two whole days preceding; as much a new creation when expressed in a sea-weed, as in an oak or apple-tree. So, *on the sixth day*, God created *the quadrupeds* or Mammalia, and pronounced his work "good;" and as a second and far greater work of the day, totally new in its grandest element, he created MAN; and he then pronounced his creation "very good."

There is here no chance parallelism; for God neither in his word or works can be charged with accidental or unmeaning harmonies.

Vegetation, while for physical reasons a part of the creation of the third day, since its main end is physical, was also prophetic of the future, the true organic period, in which the progress of life was the grand characteristic. So again, man, while like other mammals in structure, even to the homologies of every bone and muscle, was endowed with a spiritual nature, which looked forward to another period, that of spiritual existence and immortality. Thus the last day of each great period included one work typical of the period, and the other, while essentially of the period, prophetic of the future.

Surely, philosophy never could have attained to such a

glorious scheme. What now are the special points which God's testimonies in nature have made clear?

I. *The progress of creation mainly through secondary causes.* Time was lengthened back by geology to ages unmeasured. This had before been suspected: geology made it positive knowledge.

II. *The fact that the days of Genesis were as many long periods,* the progression of physical changes and of living beings, being, on this principle, in harmony with the Bible record. The Infinite God worked not by man's time-piece, or by the roll of a ball in space, counting the twenty-four hours, but in his infinitude and eternity, he directed events through the passing ages as if those ages were but moments.

We may remark here, that science explains, and general history also, what we must understand by epochs or periods in history. We learn that the importance of an epoch is generally inversely as its length, or rather, has no necessary relation to length of time. Take the life of a plant, for example: there is the epoch of the stem, that of the flowering, that of the fruit; the first much the longest, and yet the least important in itself. Then, again, the incipient stages of an epoch, are deep in preceding time: the changes leading toward it are at work, and now and then an event strikingly betokens the coming age, and is in fact a characteristic of that age coming up through the darkness of earlier time, foretelling or announcing the future. All history is alike in this; geological history is full of it. An age is marked by its great features, by the cresting of some characteristic; while its limits—its beginning and end—may be, and usually are, indefinite. It is thus that vegetation in the organic division of time was prophetic of the period when life should be the glory of the world.

As to the actual length of periods, geology gives us no definite knowledge.

III. *The true principles or law of development or evolution in nature.* We observe, as Agassiz has well illustrated, that the development of a living being brings out the profounder distinctions and afterwards those more external. First, in the

growing germ or egg appears a character that enables us to note the class; then, that of the order; then, that of the tribe, family, genus, in succession; and finally, that distinguishing the species. It is an individualizing process. We have already alluded to this subject on a preceding page.

Taking the earth alone as an example, geology proves that it was, at one time, a fiery ball in space; and, of course, with no more distinction of parts than in a germ. Then, dry land and seas appear; but the land is of small extent and without its mountains, the waters are all salt, and the climate is one over the whole sphere, the tropics reaching to the poles, for the same tribes of plants covered all zones, even to Melville Island and Spitzbergen. At a much later period, the mountains begin to enlarge, the dry land to expand, and gradually, as time rolls on, a temperate climate settles about the poles; the tribes of animals also become more localized. Then, in the last age before man, the continents take their full breadth, the Alps and Pyrenees are born, and other mountains attain their majestic dimensions; the rivers consequently multiply and increase in magnitude and in their erosive power, and valleys are everywhere formed in great diversity of beauty; moreover, the zones of climate become nearly like our own, and every region of the globe has its peculiar Fauna and Flora and temperature. Finally, the features, and climates, and life, attain all their present variety, as man appears to take his place at the command of his Maker. Thus the earth's features and functions were gradually individualized. The subject is illustrated also in various details in the organic history of the globe, to which we briefly allude beyond.

IV. *The universe one, in system and origin.* Threads of light and attraction bind the universe in one, proving an essential unity in the nature and laws of matter. Attraction of gravitation is the fundamental force of matter; and since the law is, in fact and ratio, the same here as in remote space, we may with reason conclude that matter is everywhere essentially the same, now and from its first existence; for the present system of the universe would be annihilated by a change in this law, and therefore it was begun when the law

was established. Bodies possessed of cohesion, necessarily have gravitation ; and hence a general identity as regards attraction of cohesion is involved in the identity of gravitation. Light being dependent on vibrations, as science has shown, and these vibrations a result of molecular action, therefore, since precisely the same rate of vibrations and identical characteristics belong to the light of the stars, we have proof of the profoundest significance and of the most precise character, as to the identity of all matter in its general laws. Thus it is literally inscribed on nature that, CREATION IS ONE, GOD IS ONE, THE UNIVERSE ONE.

V. *Light necessarily the work of the first day—the signal of creation begun.* From the recent results of science we know that light is dependent not merely on molecular vibrations, but on vibrations of a certain requisite rate ; and also that it is produced only by molecular disturbance, action, or combination ; it is a result of chemical or molecular change, and is no independent entity. Without mutual molecular action there could be neither heat nor light. Matter in such an inactive, forceless state, would be literally dark, cold, dead. But let it then be endowed with intense attraction of different degrees or conditions, and it would produce light as the first effect of the mutual action begun.

The command "Let light be," was therefore the summons to activity in matter. The Spirit of God moved or brooded over the vast deep, an abyss of universal night, and light, as the initial phenomenon of matter in action, flashed instantly through space, at the fiat of Deity. Thus science, in its latest developments, declares as distinctly as the Bible, that "on the first day light was."

Light in its veriest universality, must have been the light created, as light is one and the universe one ; and not light about the earth, a little satellite to the sun.

VI. "*The beginning,*" the actual beginning. In the fact that light must have been the first phenomenon in creation begun, and that the universe is one in history, we have all needed evidence that Moses meant "in the beginning," where he so asserts.

"The heavens and the earth," as before stated, is obviously a comprehensive expression for all existence — then a lifeless existence in the extremest sense. The earth was not the earth in defined outline; for, if we may take our translation as correct (and Professor Lewis and others give it the preference), it was "without form, and void," actually formless, and merged in the great "deep," over which the Spirit of God afterwards brooded.

VII. *The earth gradually brought to a condition in which dry land and seas existed.* Geology, as we have observed, has taught that the earth was once in complete igneous fusion; and this would imply a heat at the surface equal at least to that of melted iron. Granting this, there are conditions of its waters and atmosphere, and of its rocky mass, which may be partly followed out; and when we know better than now all the effects of heat on the elements and their compounds, we may perhaps be able to write out the history of those times of chaos. It obviously involved a gaseous condition of the whole ocean, whose waters, if now placed evenly over the sphere, would make a layer averaging two miles in depth. From this state, there would have been a passage to successive stages of condensation, as the cooling went on. Finally, the waters would descend and envelop the surface; and afterwards, by unequal contractions of the still cooling earth, the dry land would have appeared.

As it would have required a temperature of at least 500 or 600 deg. Fahrenheit to have retained so much water in the state of vapor, the surface of the earth could not have been much below this, when the ocean descended to its place. It was still a highly heated earth and ocean, and the atmosphere must have been dense and murky with foul vapors. In Job there is a sublime description evidently of this period (38: 8—10). Jehovah says: "Who shut up the sea with doors . . . when I made the cloud the garment thereof and thick darkness a swaddling-band for it, and brake up for it my decreed place, and set bars and doors, and said, Hitherto shalt thou come and no farther, and here shall thy proud waves be stayed." From such a state, the earth gradually emerged,

that garment of cloud slowly dissipating. The tides and waves rolled around the sphere in ceaseless motion; and, however incredible it appears, we can point out the strata that were made by that ancient ocean. Geology has brought to light rocks of great thickness, without traces of fossils, and many of them crystalline, which belong to time preceding the creation of animals, after the descending of the waters to the surface. They are called the *Azoic* rocks, or rocks of the *Azoic* age, because no traces of animals occur in them. Geology proves, too, that before animal life began, large areas of these rocks were dry land, over North America from Labrador westward, and we may almost map out the "dry land" on this hemisphere, which is announced on the *third day*.¹

VIII. *Vegetation part of the physical creation.* The introduction of vegetation on the third day, was one of the mysterious facts in creation until the recent revelations of science. Now we know that the prime mission of vegetation is physical, the removal from the atmosphere of a deadly gas, carbonic acid, and the supply to it of one eminently a supporter of life, oxygen. This it accomplishes by the simple process of growth; upon this great end, its vital functions and structure are based; this single criterion distinguishes all plants from animals. Feeding animals and giving joy by its beauty to the human soul are only concomitant ends of vegetation.

Moses in announcing the creation of vegetation describes plants in general. But the institution of the plant-kingdom was the great event; and if plant-life came forth first in the sea-weed, it was still life, a new feature to the progressing world. According to the records in the rocks, vegetation was for a long age only sea-weeds; then in the coal-period,

¹ We have omitted any special reference to the *second day*, as neither geology nor general science, apart from astronomy and general reasoning, afford much aid in interpreting the account. The step of progress was one between that of light through universal space on the first day, and the separation of the lands and seas on the third. The event of the highest character in that interval, that marking a grand epoch in terrestrial time, was the elimination or separation of the earth itself from the "deep" or "waters," (admitted to mean "fluid" in its most extended sense). See Prof. Guyot's views on this subject, in the article in this journal, for April last, p. 327.

flowerless trees, along with the pine tribe (coniferæ) which are almost flowerless; and as the last age before man was about to open, trees of our common genera, oaks, elms, etc., and also the palms, began to diversify the earth's surface.

The proof from science of the existence of plants before animals is inferential, and still may be deemed satisfactory. Distinct fossils have not been found: all that ever existed in the azoic rocks having been obliterated. The arguments in the affirmative are as follows:

1. The existence of limestone rocks among the other beds, similar limestones in later ages having been of organic origin; also the occurrence of carbon in the shape of graphite, graphite being, in known cases, in rocks a result of the alteration of the carbon of plants.

2. The fact that the cooling earth would have been fitted for vegetable life for a long age before animals could have existed; the principle being exemplified everywhere that the earth was occupied at each period with the highest kinds of life the conditions allowed.

3. The fact that vegetation subserved an important purpose in the coal-period in ridding the atmosphere of carbonic acid for the subsequent introduction of land animals, suggests a valid reason for believing that the same great purpose, the true purpose of vegetation, was effected through the ocean before the *waters* were fitted for animal life.

4. Vegetation being directly or mediately the food of animals, it must have had a previous existence. The latter part of the azoic age in geology, we therefore regard as the age when the plant-kingdom was instituted, the latter half of the third day in Genesis. However short or long the epoch, it was one of the great steps of progress.

IX. *The creation of the sun on the fourth day.* By arguments already mentioned, based on the oneness of the universe in origin, the sun, moon and stars are shown to have had their places, when the earth was established. But through a prolonged period, as has been remarked, the earth was shrouded in its own vapors, and warm with its own heat, and there was therefore no sun or moon, days or

seasons. Whenever the sun first broke through the dense clouds, it was a day of joy to the world, standing out as one of the grand epochs in its history.

The sun is almost the heart and brain of the earth. It is the regulator of its motions, from the orbital movement in space, to the flow of its currents in the sea and air, the silent rise of vapors that fly with the winds to become the source of rivers over the land, and the still more profound action in the living growth of the plant and animal. It is no creator of life; but through its outflowing light, heat, and attraction, it keeps the whole world in living activity, doing vastly more than simply turning off days and seasons. Without the direct sunlight, there may be growth, as many productions of the sea and shady grounds prove. But were the sun's face perpetually veiled, far the greater part of living beings would dwindle and die. Many chemical actions in the laboratory are suspended by excluding light; and in the exquisite chemistry of living beings, this effect is everywhere marked: even the plants that happen to grow beneath the shade of a small tree or hedge in a garden evince, by their dwarfed size and unproductiveness, the power of the sun's rays, and the necessity of this orb to the organic period of the earth's history.

The sun therefore leads off, not only in fact, but with peculiar grandeur and aptness, the organic history of the globe.

Thus, at last, through modern scientific research, we learn that the appearance of light on the first day and of the sun on the fourth, an idea foreign to man's unaided conceptions, is as much in the volume of nature as that of sacred writ.

X. *The invertebrates, fishes, reptiles, and birds, the earlier animal creations.* Geology has opened out the fact, that the earliest animals and plants of the globe were wholly water species. There was a long *marine era*, the lands small, the seas nearly universal, the continents marked out it is true in their grand outline, but only partly emerged; the animals only the inhabitants of the seas, as molluscs, corals, and fishes.

This was followed by a *semi-marine*, or *amphibian era*, as

it may be called, when land-plants took possession of the dry land, producing in its earlier half the coal era : but still the continents were at least half the time more or less submerged. Reptiles and birds were then the dominant animal types.

As God has recorded in the rocks by the burial of these races in their successions, so he has written in His word. On the fifth day, He said : " Let the *waters* bring forth," by *waters* implying apparently the marine or amphibian character of the species of life ; and then, the account adds : " The waters brought forth *abundantly*," while the rocks testify also to swarming myriads in the seas. The species with few exceptions were oviparous. Prof. Bush shows that the " great whales " were as correctly *reptiles*, the same word *tannim* being used for *dragon* in Ezek. 29: 3, where the figure is drawn from the crocodile of the Nile ; also that the word for *fowl*, means rather *flying thing*, whether insect, bird, or flying reptile, all of which occur in this era. He says moreover that the clause in verse 20, translated " and fowl that may fly above the earth " may be as correctly translated *and let the fowl fly above the earth* ; so as to disconnect it from the clause, " Let the waters bring forth : " thus it stands in verse 22.

The harmony of geology with Genesis could not be more exact.

XI. *The creations of the tribes not simultaneous but successive, and occurring at many different times, after more or less complete exterminations.* The records in the rocks declare that these creations came not forth all at once, but in long progression. There was an Age when Molluscs (of which shell-fish, snails, and cuttle-fish are examples) were the dominant race, having as associates corals, crinoids, and trilobites. The earth, we may believe, was yet too warm, and the atmosphere too impure for more exalted forms. This was the *Silurian age* of geological science.

There was next an Age when Fishes first filled the seas, the *Devonian* of geology. Then another, when Amphibians (the inferior group of reptiles, including frogs and salaman-

ders, related to fishes in having gills when young) commenced, and land-plants were first in exuberant growth, the *Carboniferous age* (the land-plants, as stated, cleansing the atmosphere from carbonic acid for land animals). Then followed an Age in which true reptiles increased in numbers and diversity, by multiplied creations, until there were reptiles larger than whales in the water, immense leviathan reptiles on the land, and flying reptiles in the air, so that each of the elements was taken possession of by these scaly tribes. This was the *Reptilian age*. In its progress, reptiles passed their climax, and before its close, commenced their decline; the race, since then, has been a comparatively feeble one.

Moreover, in each of these Ages, there were many distinct creations succeeding to exterminations of previously existing life. Through the Silurian, Devonian, Carboniferous and Reptilian Ages in America, the fifth day of Genesis, *fifteen times* at least the seas were swept of their species, so that, in the rocky folios of the succeeding epoch, not a species of the former epoch occurs, or only half a dozen or so out of hundreds. After each, life was again reinstated by the Creative Hand, life in all the departments that had thus far been introduced to the globe, new mollusca, new corals, new crinoids, new trilobites; and if the Age of Fishes were in progress, new fishes also, and so on; making a complete creation for the time. Even in the Age of Fishes alone (the Devonian age), there were *four* such revolutions in America, with new creations throughout. Moreover, there were many partial destructions and restorations at other times. These exterminations can be proved, in many cases, to have been produced, either by the escape of heat, through fissures, from the earth's interior, or the elevation of the sea-bottom to dry land, or some convulsion in the earth's crust. They were, in general, connected with the earth's physical history.

Recapitulating the geological Ages mentioned, and adding those following, they are (naming them, as has been done by Agassiz, from the dominant type):

I. the Age of Mollusca, or the Silurian; II. the Age of Fishes, or the Devonian; III. the Age of Coal-plants and

Amphibians, or the Carboniferous ; IV. the Age of Reptiles, including the periods between the Coal and the Tertiary ; V. the Age of Mammals, or the Tertiary and Post-Tertiary ; VI. the Age of MAN. The progress of Vegetable Life affords : *first*, the Age of Algæ or Sea-weeds, corresponding to the Silurian and Devonian ; *second*, the Age of Flowerless Trees (Acrogens) and Coniferæ, or the age of Coal-Plants ; *third*, the Age of Dicotyledonous Plants, or our common trees (oaks, elms, etc.), beginning just before the age of Mammals.

XII. *A gradual elevation of the successive races involved in the gradual refrigeration of the earth, as also in its other steps of physical progress.* The whole plan of creation had evident reference to MAN as the end and crown of the Animal Kingdom, and to the present cool condition of the globe, as, therefore, its most exalted state. It is hence obvious, that progression in the earth from a warmer to a cooler condition, necessarily involved progression from the lower to the higher races, such as actually took place. This cooling, therefore, implied almost necessarily the complete extinction of some earlier races, fitted for earlier time, as well as of species. The whole fifth day (using the term in Genesis) until its later epochs, was a time of warm climate from the equator to the poles. Not a species of the thousands in those ages now exists. Species and genera appeared and disappeared as time moved on : the last trilobite lived in the Carboniferous seas, and the last *Lepidodendra* in the forests of the Carboniferous continents ; the last ammonite, flying reptile and swimming saurian existed in the Reptilian age, when molluscs as well as reptiles passed their prime, both as to numbers of individuals and rank of species. Even the fishes bear distinctly, in their bodies, the marks of the particular part of the fifth day in which they lived : for they first appear in the Devonian age with the spinal column elongated quite to the extremity of the upper lobe of the tail ; and afterwards it becomes less and less elongated until the middle of the Reptilian age, when, for the first time, species occur with the body cut off square behind, as in existing species ; moreover, the old type of tail disappears, and almost

completely too the Ganoid tribe of fishes, in which it was so striking a characteristic. Thus the world took its successive steps onward, towards the Golden Age, in the then distant future. The earlier races were of lower types, not because the Creative Hand was weak, but for the reason that the times, that is the temperature and condition of the globe, were just fitted, in each case, for the races produced, and the progress of the plan of creation, correspondingly, required it.

As between the hot equator and the frigid zones, tribes now have their limits in geographical distribution, so in geological time, between the warm Silurian age and the cool present, there was a localization of groups in time, a chronological distribution,—an increase and period of maximum at different epochs along the Ages. The Reptilian and Molluscan types attaining their maximum in the Reptilian age, are examples. A few genera reach from the very first dawn of life to the existing period: they are continuous lines, binding creation in one. This oneness also appears most strikingly in the fact that hardly a fragment of a fossil is taken from the oldest rocks that is not at once as well understood as if it were from an existing species.

The intervals of rest in "self-existent" nature, which Professor Lewis speaks of, are not in the records of the earth. The longest suspension of life in North America took place, as nearly as we can learn, between the Coal period and the Middle Reptilian. Moreover, the epochs of revolution in Europe and America were, in general, not contemporaneous; and this implies merely a non-contemporaneity in the convulsions or oscillations of the earth's crust in the two hemispheres.

XIII. *System of life-evolution.* The facts gathered from nature teach us :

1. That species have not been made out of species by any process of growth or development; for the transition-forms do not occur.

2. That the "original divine power" did not create a generic or universal germ from which all subordinate genera and species were developed; for, with any such system of

evolution, the Creator would have been incompetent to complete the creation begun; each revolution would have frustrated every new effort.

3. That the evolution or plan of progress, was by successive creations of species, in their full perfection. After every revolution, no imperfect or half-made forms occur; no back-step in creation; but a step forward, through new forms, more elevated in general than those of earlier time.

4. That the creation was not in a lineal series from the very lowest upward. The four sub-kingdoms of animal-life, the Radiate, Molluscan, Articulate, and Vertebrate, early appeared in some of their representatives; and the first three almost or quite together. The types are wholly independent, and are not connected lineally, either historically or zoologically; and this is a general principle with regard to subordinate groups. The earliest species of a class were often far from the very lowest, although among the inferior. The gigantic saurians appeared before turtles and serpents; trilobites were superior to many crustaceans afterwards created; and the fish that began the Vertebrata, were powerful species, even superior in attributes of life, though not in type, to some existing Amphibians.

5. That the creation of life was the unfolding of a plan, which involved distinct archetype enactments, and, subordinate to these, and in harmony with them, expressions of purposes or ideas of a less and less general character. The four sub-kingdoms of animal life were the four archetype enactments: they limited the development of the animal creation to these four directions; and every new group came forth in subordination to these established types. So the subordinate groupings, classes, tribes, etc., have the same relation to the groups under them.

6. That the development of the plan of creation, while by successive creations, was in accordance with the law of evolution, as Agassiz has explained, that is, progress from the simple to the complex, from comprehensive unity to multiplicity through successive individualizations. The institution of the Vertebrate type in the memberless fish, embraced in

its idea all those parts and organs, external and internal, which were afterwards brought out, and which have their highest individualization, in man; so that in the bony structure, for example, we may trace the homologies between the human skeleton and the primitive fish-type. The unfolding was, in some groups, a general rising in grade, until the time of maximum, as in the Reptilian type; but embraced expansions both upward and downward, that is, to superior and inferior tribes. In many cases, the original or earliest group was but little inferior to those of later date, and the progress was towards a purer expression of the type. Thus the earliest fishes had reptile teeth, a bony coat of mail, and other reptilian characteristics, foreshadowing the Reptile type afterwards introduced. In the unfolding of the type, the reptilian features were lost, the ancient race became almost wholly extinct, and gradually the fish type came out in its purity and full diversity. This is one of numerous examples of this kind.

The Molluscan type was unfolded, in all its grand divisions in the Silurian or Molluscan age. The Articulate type, on the contrary, appeared then only in the inferior water-species, crustaceans and worms; and gradually, as time moved on, one grand division after another was evolved, until the age of Man, the period of their greatest diversity. A reason for this difference consists in the fact that Articulates are, like Vertebrates, largely land species. Moreover, every new diversity of climate, soil, plant, or animal, enlarged the field for insect life.

7. That hypotheses as to the precise mode of creating a species are presumptuous. D'Orbigny, a distinguished geologist of France, in his *Geology* (1851, vol. II., p. 251), says well: "Quelle est la force créatrice qui a eu cette toute-puissance si extraordinaire? Ici nous devons confesser l'impossibilité complète dans laquelle nous trouvons de répondre à aucune de ces hautes questions. Il est des limites que l'esprit humain ne peut franchir, des circonstances où l'homme doit s'arrêter et se borner à admettre les faits qu'il ne peut expliquer."

XIV. *The revolution closing the Reptilian age in geology a universal one.* Although the catastrophes in the earth's history were seldom universal, that closing the Reptilian age swept both Europe and America alike, and, as far as we know, the whole earth. Its destruction of the life of the Cretaceous period (the last of the Reptilian age) was complete, with scarcely an exception. Thus geology and the Bible both mark the close of the *fifth day*. After such a devastation, the new creation began, that of Mammals or quadrupeds: not, be it understood, of Mammals alone, for all the lower tribes had their various representatives also, by the same creation, from molluscs and corals to fish and reptiles. All, by their new forms, express the character of the age. The climates of the earth, as this age of Mammals opened, were, for the first time, widely diversified; yet the facts show that they were not as cool as now, until the age had half elapsed.

XV. *The creation of Mammals introducing a new element into the world.* The type of animal life which began with this age, the *sixth day*, was that in which the earth was to reach its highest destiny. It was the full establishment of that special type of Vertebrates that was at last to be exalted by the endowment of a soul; that, in which the mutual dependence of the parent and young, indicated in the term *mammalia*, is its grand feature, the principal means, in this age of Man, of cultivating those affections which bind society together and man to his Maker. There is hence the highest beauty and philosophy in the Mosaic record, independent of its historical facts, in thus separating the Mammals from the other Vertebrates.

Some small insect-eating Mammals appeared in the age of Reptiles. They were few (four species have been found) and weak, in striking contrast with the huge Saurians that filled the seas, earth, and air in that age. They have been well called prophetic types, announcements, as has been already explained of the true age of Mammals next to open in its full grandeur. Such seeming exceptions are in fact

part of the system of progress, and afford no objection to the reality of the great Ages.

XVI. *Progress by revolutions, and by successive creations in the age of Mammals; but the revolutions diminishing in extent as the age of Man approached.* The age of Mammals had its revolutions like the Reptilian age and those preceding; but they become less and less general, and the continents more and more stable, and modern in outline and features. The *marine* and *amphibian eras* of the globe had passed; and this was the commencement of the *continental era*.

The quadrupeds did not all come forth together. Large and powerful Herbivorous species first take possession of the earth, with only a few small Carnivora. These pass away. Other Herbivora with a larger proportion of Carnivora next appear. These also are exterminated; and so with others. Then the Carnivora appear in vast numbers and power, and the Herbivora also abound. Moreover these races attain a magnitude and number far surpassing all that now exist, as much so indeed, on all the continents, North and South America, Europe, Asia, Africa, and Australia, as the old mastodon, twenty feet long and nine feet high, exceeds the modern buffalo. Such, according to geology, was the age of Mammals, when the brute species existed in their greatest magnificence, and brutal ferocity had free play; when dens of bears and hyenas, prowling tigers and lions far larger than any now existing, covered Britain and Europe. Mammoths and Mastodons wandered over the plains of North America, huge sloth-like Megatheria passed their sluggish lives on the pampas of South America, and elephantine Marsupials strolled about Australia.

XVII. *A dwindling of the race of Mammals as the age of Man approached.* As the Mammalian age draws to a close, the ancient Carnivora and Herbivora of that era all pass away, excepting, it is believed, a few that are useful to man. New creations of smaller size peopled the groves; the vegetation received accessions to its foliage, fruit-trees and flowers, and the seas brighter forms of water-life. This

we know from comparisons with the fossils of the preceding Mammalian age. There was, at this time, no chaotic upturning, but only the opening of creation to its fullest expansions: and so in Genesis, no new day is begun, it is still the *sixth day*.

The continents long before had had their marked characteristics: the Oriental (including Europe, Asia, and Africa) as the continent of *Carnivora*, the highest mammals; North America, of *Herbivora*, a tribe inferior to the Carnivora; South America, of the sloth and armadillo tribes (*Edentata*) still lower in rank; Australia, of the Kangaroo tribe or *Marsupials*, the lowest of all quadrupeds; for these were severally the characteristic races of the continents in the Mammalian age. As the age of Man opens, North and South America and Australia were still essentially the same in their tribes of Mammals, though with new and smaller species; there is no sign of progress. The Oriental lands, on the contrary, which had so prominently taken the lead in the age of Mammals, and even through the whole Reptilian age preceding,—since the species of animals in Europe as indicated by the fossils, were ten times more numerous than in North America,—may be said to have been marked out for the Eden of the world, ages previous to man's creation.

XVIII. *Man, the new creation.* In the living beings of former ages, there had been intelligence and a low grade of reason, affections as between the dam and her cub, and the joyousness of life and activity in the sporting tribes of the land. But there had been no living soul that could look beyond time to eternity, from the finite towards the infinite, from the world around to the world within and God above. This was the new creation, as new as when life began; a spiritual element as diverse from the life of the brute as life itself is diverse from inorganic existence.

The *first* great period of history, was the period of mere material existence and physical progress. Its beginning was far away in the dim indefinite past, when light announced the work of progress begun; and even beyond, in the forceless matter of preceding time; after many changes and

evolutions, it blossomed in the lands and seas and vegetation of the third day. The *second* great period was the period of life and organic progress. Its germs are traced in the vegetation of the former period; but the light of the sun first gave vigor to the growth, and after various developments progressing through long ages, it finally blossomed in the Mammals and man of the sixth day. The *third* great period is the more exalted period of spirit and spiritual progress; whose germs are even now expanding in the soul of man; but whose flowers and fruit will appear, only in time to come. The great evolutions of time are thus so closely in accordance with the evolutions in a living being, although all is by the direct power and wisdom of God as before explained, that we comprehend the system best in language recognizing the parallel relations and oneness of principle.

XIX. *Man the last creation: The day of rest.* Science has no evidence that any living species have been created since the appearance of man on the globe. All facts in nature accord with the Scripture record, that man was the last of the grand series. Ages and ages had rolled by, the world had, step by step, been fitted up, and life had passed through its long succession of forms, ever increasing in rank, until at last man stood up erect, fitted to subjugate the mightiest energies of nature, to read the records of infinite intelligence, to embrace a universe in his sympathies, and reciprocate the love of Heaven. Creation thus ended. God pronounced upon it his benediction and rested from all his work. Analogy with the other days of Genesis, in the light of geology, certainly would lead us to regard that seventh day, not as a simple twenty-four hours, but the period of rest still in progress.

The two records, the earlier revelation and the later, are thus one in their sublime enunciations of the history of creation. There is a like grandeur in the progress of the ages. They both contain conceptions infinitely beyond the reach of the human intellect, and bear equal evidence of their divine origin. The "grand old book of God still stands," and this

grand old earth, the more its leaves are turned over and pondered, the more will it sustain, enlighten, and illustrate the sacred word. The two are independent inscriptions, written in lines of light by the same Sun of righteousness; and the more deeply they are studied and loved for their truths, the higher may we rise towards the effulgence of their eternal source. The universe and the Bible are consecutive parts of one glorious volume; the *former* teaching of infinite harmonies, coming up from the deep past, and of man's relation through Nature to God; the *latter* of man's relation through his own soul to God, and of still loftier harmonies in the eternal future: the *first part*, telling not only of the wisdom and power of God, but also of man's exaltation, at the head of the kingdoms of life, the being towards whom, with prophetic eye, all nature was looking through the course of ages, preparing his earthly abode, arranging every ridge, and plain, and sea, and living thing, for his moral and intellectual advancement, and with so much beneficence that man, when he came to take possession of the domain, found everywhere lessons of love and adoration, and read in his own exaltation a hope, though a trembling hope, of immortality; the *second part*, after a chorus epitomizing the former revelation, pursues its closing thought, Man in his relation to his Maker, makes that hope of immortality sure, and points out the way of life, by which he may enter into everlasting communion with God his Creator and Redeemer. If students of nature fail of that way of life, it is not that science is evil, but man fallen.

ARTICLE VII.

©

SCIENCE AND THE BIBLE. NUMBER II.

WITH FURTHER REMARKS ON "THE SIX DAYS OF CREATION" OF PROF. TAYLER LEWIS.¹

By James D. Dana, LL. D., Silliman Professor of Natural History, Yale College.

"Is RELIGION, then, so false to God as to avert its face from science? Is the church willing to declare a divorce of this holy marriage tie? Can she afford to renounce the external proofs of a God having sympathy with man? Dare she excommunicate science, and answer, at the judgment, for the souls which are thus reluctantly compelled to infidelity? We reject the authority of the blind scribes and pharisees who have hidden themselves from the light of Heaven under such a darkness of bigotry. We claim our just rights and our share in the church. The man of science is a man, and knows sin as much as other men, and equally with other men he needs the salvation of the gospel. We acknowledge that the revelations of the physical world are addressed to the head, and do not minister to the wants of the heart; we acknowledge that science has no authority to interfere with the Scriptures and perplex the holy writ with forced and impossible constructions of language. This admission does not derogate from the dignity of science; and we claim that the sanctity of the Bible is equally undisturbed by the denial that it was endowed with authority over the truths of physical science. But we, nevertheless, as sons of men, claim our share in its messages of forgiveness, and will not be hindered of our inheritance by the unintelligible technicalities of sectarianism; as children, we kneel to the church and implore its sustenance, and entreat the constant aid and countenance of those great and good men who are its faithful servants and its surest support, whose presence and cheering

¹ Along with the work already mentioned, we here include the letter in reply to our review published in the last number of this Journal, page 471.

sympathies are a perpetual benediction, and among whom shine the brightest lights of science as well as of religion. Moreover, as scientific men, we need the Bible to strengthen and confirm our faith in a supreme intellectual Power, to assure us that we are not imposing our forms of thought upon a fortuitous combination of dislocated atoms, but that we may study His works humbly, hopefully, and trusting that the treasury is not yet exhausted, but that there is still left an infinite vein of spiritual ore to be worked by American intellect."

Such are the words, rather the devout thoughts of Science, as expressed by Prof. PEIRCE of Cambridge, in his Address, in 1854, before the American Association for the Advancement of Science; and there were few among his hearers on that occasion, who did not cordially respond to them. He spoke with earnestness; for, if there is any charge against science, fitted to stir the soul to its depths, it is that asserting the hostility of science and the Bible. The student of nature, accustomed to search for knowledge with a scrutiny and precision that has hardly a parallel in other departments of study, so as even to incur, at times, by his untiring labors among the merest minims of existence, the contempt of many a haughty intellectualist, can but look with indignation upon those who pronounce him faithless to the truth, and his studies at war with the sacred word. With such an exhibition of the Bible thrust upon him, its enmity with science insisted upon, if he is not so grounded in faith as to be sure his opponent is wrong in this hostility, he will feel forced to stand by nature, God's acknowledged work, *versus* the Bible, "the Book."

Prof. Lewis, by his sneers at science, which commence on the first page of his "Scriptural Cosmology," and stream out, as from a bitter fountain, all through the volume, has thus done a lasting injury to the cause of the Bible. However sacred his intentions, or excellent his private character (which we believe to be irreproachable), this is *one* of the ways in which *the influence of his work is infidel*.

But the uncertainties of science seem, to many minds, to authorize skepticism with regard to its results; and upon this subject some explanations may be instructive.

There are two modes of arriving at the philosophy of nature; and, correspondingly, there are two kinds of philosophers. The one is ever breeding "elephants" and "tortoises;"¹ the other, is "conceptionless," perhaps, but humble and believing. The one, in self-sufficiency, looks within for knowledge; the other, seeks to learn the true philosophy of nature from nature herself, God's appointed means. The one boldly assumes a position by the side of the Deity, and pronounces on the plans of the Creator, in the light of mind alone, as if sharing in the Divine omniscience; the other looks up reverently to the hand-writing of God in nature, and patiently endeavors to decipher the wondrous record. The one soars aloft, in dignified contempt of plodding science; and the other knows *that* to be the way of ignorance and folly.

In the remarks which follow, we propose to show, briefly, (1) how the finite mind of man is adapted to nature; (2) how nature is adapted to the finite mind; then to point out (3) the methods in which the mind studies nature, mentioning examples; (4) the certainty of error when mind ventures to theorize on matter, alone, without the guidance of nature; (5) the necessary limit to the excursions of the mind, and the consequences of attempting to pass that limit; and, finally (6), to consider the alleged infidel tendencies of science.

(1) The human mind, as has been often said, may mould material within its knowledge, or form new combinations; but it cannot rise even to a conception of a new principle in matter, or a new order of existences, or a new sense in the kingdom of life. Its appointed arena is the earth, and here alone can it gather strength for its upward flight. Being

¹ We quote from Prof. Lewis to explain this allusion to such as may not have read our former review. "We may smile," he says, "at the old quackish story of the earth's standing on the back of the elephant, and the elephant standing on the head of a tortoise, etc.; but in our gravities, our magnetisms, our series of fluids, ever requiring other fluids to explain their motions, we have only introduced a new set of modern equivalents."

made in the Divine image, it is fitted to study and comprehend the Divine laws, whether physical or moral.

Within the soul, as part of its nature or of this Divine image, there are certain principles which are a basis of all reasoning about nature: as that, leading to a recognition of a higher Power above, the infinite God, the Cause of causes; that, leading to a recognition of the relation of cause and effect in consecutive events; that, leading to a recognition of the truthfulness of the God of nature, demanding faith in return from his creatures; of the unity of nature, its oneness in plan as in Author, and thence the harmony of all laws, systems, or events in nature. And besides these, there is a recognition of the relations of units or numbers, from which has proceeded the whole fabric of mathematics; and an appreciation of harmonies in form, color, and sound, whence comes the sense of natural beauty in these several departments.

These intuitions and decisions do not characterize all minds alike. They are but germs or principles, which are active only when developed, and are seldom truthful in their operation, without large accessions of knowledge and freedom from moral obliquity. In the natural differences as to the appreciation of harmonies of sound, we learn the diversity that may exist in minds as to other qualities; the diversity, in this case, ranging from just above zero, to a height of perfection that responds instantly to all the intricacies of musical harmony without study or thought.

Only the most profound minds, or those of the highest grade, are so possessed with the idea of the unity of plan and profound harmonies in nature as thereby to be urged forward to a high range of philosophical discovery; and moreover, in these, the idea will be mainly a result of study and observation. Yet there are few that are not under the influence of this principle; few that do not recognize some system or relation in things and events around them. Lord Bacon, indeed, dwells upon the influence of this tendency to find harmonies or parallelisms among observed facts, under the name of "Idola Tribus" (Idols of the Tribe), remarking upon the "spirit of system" as one of the great sources of

error; and this it undoubtedly is. But while often an occasion of error, it was the same principle that penetrated the soul of Kepler, and led him through his long calculations to the great laws which bear his name.

(2) On the other side, nature is adapted to our finite minds, as we to nature. Her laws are expressed in simple, finite numbers, or ratios, and so are directly fitted to our comprehension, as observed by Professor Peirce in his address referred to above.

In music, the succession of tones is made through the simplest possible ratios in the number of vibrations,—the ratios of 1 : 1, 1 : 2, 2 : 3, etc. In crystals, the modifications of form are based on similar simple ratios between the axes, and the axes have specific dimensions. In the vibrations on which the phenomena of light depend, there are definite measurable lengths. In chemistry, substances have their unvarying combining weights, which we may ascertain by a simple process of weighing; and their combinations with one another take place in simple multiples of 1 : 1, 1 : 2, 2 : 3, etc. Plants grow by a law of spiral development, defined, with the same precision, in numbers. In all beauty or harmony of form, there are simple ratios; the features of the human face having ratios of 1 : 1, 1 : 2, etc.; all true curves in nature admitting of mathematical expressions; and those of the same animal or plant being an outflow or evolution of a single system, so that, even in the most unwieldy of beasts, there is the beauty of harmony in all outlines and structure.

Thus, whether we consider the kingdoms of life, the vibrations of air producing sound, or the vibrations evolving the colors of light, or regard the invisible constituents of matter, and, we might add, the spheres in space, there is everywhere a system of simple ratios and fixed dimensions; not merely a mathematical basis, but a *simple* mathematical basis. Nature is thus specially adapted to our finite minds.

It is hence plain that Nature is an intelligible minister appointed to lead us up to God, being a revelation of him in one range of his attributes, his power and wisdom, brought

down to our comprehension, as the Spirit, and the manifestation of the Divinity in Christ, are our means of rising to a knowledge of God in his holiness and love, and of man in his duty and destiny. Even nature, also, is radiant with God's love; for the earth's history evinces that man's welfare was regarded in the whole progress of creation; but Christ is the only expression of the infinite fulness of that love. In these two ways we gather strength, from the earth about us and God above, for the progress of the human soul.

While there is this kind of simplicity in the system of nature, its readings are more and more profound, as we pass beyond the more obvious phenomena, and rise, in our generalizations, to higher and higher principles: and just as we cannot, by searching, find out God, so we cannot fathom the depths of nature. There is an infinite range before us.

(3) To show that we do not claim too much for science, we will illustrate, briefly, its modes of research by reference to a few examples. It will appear that the methods employed are simple and truthful, being strictly readings from nature in accordance with the laws of mind; and that they reach onward towards truth instead of error: while pseudo-philosophy looks upon nature with reverted eyes, sees only its own vain imaginings, and tends necessarily to the false in its views of nature.

In investigating heat, for example, it is observed that matter changes size with change of temperature. Selecting some substance for experiment, we apply our measures — measures so improved by modern skill as to mark discrepancies of 100,000ths of an inch; we note the precise amount of expansion for given increments of temperature. Thus, after a while, we decipher one law by literally reading off the rates of expansion. Having made a scale of temperature, we next note, perhaps, the point of ebullition, or that temperature at which each substance passes to the state of vapor, and observe its constancy for each kind of liquid; and so read the facts that represent another law. The mind then makes comparison of the facts with one another and, as science advances, also with the chemical constitution of the

substances operated on, etc.; and so finds, as another lesson, a definite and simple relation between chemical constitution and the boiling points of compounds, — a profounder law.

Again, we note the amount of heat absorbed when substances pass from a liquid state to that of a vapor, or from a solid to a liquid; find the amount 1000 deg. F. in the former case, and 142 deg. in the latter, and observe that this heat absorbed (or given out in the reverse changes) does not vary the temperature of the substances undergoing the change. In this way we ascertain another law of heat, called the law of *latent heat*.

We observe again, making our measurements with extreme care, that *different* substances expand *unequally* with the same addition of heat; and, therefore, that there are specific differences between substances. In this way we read off what is called the *specific heat* of those substances, and, by comparing, arrive at its general law. The chemical philosopher, with this law and its details in mind, observes that there is a close relation between these specific heats and the combining weights of elements, so exact that one is directly deducible from the other. Thus he opens a new chapter in the chemistry of nature; or, rather, nature throws a flood of new light into his mind.

When searching out the constitution of matter, he simply divides the compound into its constituents, by processes carefully studied, and then weighs those constituents, having balances that will weigh to thousandths of a grain. By weighing in one case after another, and setting down the amounts, he reads, again, a grand truth, that the elements and their compounds have definite combining weights. Then, pursuing it farther, the law of simple ratios, in the combinations of each element, is deciphered.

The investigation of nature is thus carried on by applying our weights and measures, as much so as in measuring a piece of cloth or weighing a pound of lead; and the generalizations, called laws, are the results of comparisons among these measurements. The mind rises, through natural induction, from specific to comprehensive truths.

Another example, bringing out a few facts in the history of chemistry, will exhibit the contrast between this style of philosophy and that egotistic method which puts its own conceptions in place of nature.

Chemistry made its earliest beginnings as a science in the last century. Then man first commenced to read nature on the subject. There had been mingling of acids and salts, and much torturing of nature to wrench out impossibilities, or obtain chance-results. But until then, there had hardly been one who was willing patiently to find out the letters of the alphabet and seek for word after word until a sentence was deciphered.

One question came up about the middle of that century : Why magnesia or lime was sometimes caustic and sometimes not ? It was the subject of profound thought : mind went at it with vigor, and proved itself finite. Dr. Black took a given quantity, by weight, of the magnesia of the shops, not caustic, and heated it in a retort ; it became caustic, as usual, from the action of heat. He then weighed it, and found it had lost weight, showing that something had gone from it as a consequence of the heating, and here was a probable cause suggested ; something invisible, and therefore *gaseous*, had escaped. Thinking to obtain the gas, he tried an acid upon a portion of the original magnesia, and succeeded ; he called it *fixed air*, as it was air or gas fixed in the solid state, — a great truth for the age. This was the first knowledge of *carbonic acid*. Then, by simply collecting the gas, as it escaped during the heating of the magnesia, he obtained the same *fixed air*, and completed the chain of evidence. In this way a sure step was taken towards a knowledge of the cause of causticity, and real progress made in chemical science.

The change of the metal mercury to a black or red earthy substance in different processes, had long puzzled the alchemists, and was among the facts that suggested the idea of the transmutation of the metals. No mind among the many that had delved within their own precincts or indulged in hap-hazard observation, had solved the mystery. Priestley

took some of the *red precipitate of mercury* and exposed it to heat in a small flask, having made arrangements for collecting any vapor or gas that should pass off. Air, he says, was readily expelled, showing that the red mercury contained a gaseous ingredient in addition to mercury. He examined the air, found, to his surprise, "that a candle burned in it with a remarkably vigorous flame," and thus brought to light the gas *oxygen*. He obtained the same result with *red lead* and some other substances.

By similar searchings, Priestley made additional discoveries; experimented on the composition of the atmosphere and the respiration of plants; and, in this last research, first opened out to the world the grand fact, that vegetation, by contributing oxygen to the atmosphere, counterbalances the reverse influence of the respiration of animals. Bergman, Scheele, and others, added to these facts; and before the century closed, Lavoisier pointed out the true relations of oxygen to other elements, and its part in combustion, giving the science of chemistry its first distinct shape or system.

The world had had its millions and millions of minds for nearly fifty-eight hundred years, and conceptions respecting nature had followed conceptions; yet the efforts of human genius, in this line, had accomplished almost nothing. We see mind alone utterly impotent; but at once becoming mighty when taking nature (that is, God's display of himself in his works) as its guide and fountain of strength.

Thus, by readings of nature, chemistry continued its progress. Law rose into view beyond law. Electricity, magnetism, attraction, became terms representing systems of laws.

And it is clear, to the student of science, where research is still tending;—not to a demolition of these systems, but to simpler and wider enunciations, embracing the laws now known, as subordinate propositions or principles; NOT TO PROFOUNDER AND PROFOUNDER ERROR, NOR FROM ONE SPECIOUS ERROR TO ANOTHER; BUT, BY AN ELIMINATION OF ERROR, TO HIGHER AND HIGHER TRUTHS.

(4) The contrast between the kind of philosophers illustrated, and the "elephant" breeders of old or modern times,

is sufficiently obvious. The world owes more curses — if curses were ever right — to these pseudo-philosophers than to any other class of men that have existed. Yet we would be slow to blame, knowing the strong proclivity to such error in the human mind. Bergman, in the latter half of the last century, well observed: "A tendency to Cartesianism still exists; and, upon attentive consideration, it will not appear wonderful that the human mind should delight to indulge in this method; for, on the one hand, the way of experiment is expensive, troublesome, and tedious; all minds, therefore, are not capable of enduring it; many are without the proper instruments; others want the necessary dexterity: but the most universal defect is that of patience and perseverance, so that if the experiment does not at once succeed, it is abandoned in disgust. Man in his ordinary state seems, by nature, prone to indolence. On the other hand, the contemplative method favors the desire of knowledge. By pretending to unlock the secrets of nature with ease and expedition, it soothes the natural rage of explaining all things; and by supposing everything accessible to the human intellect, administers pleasing flattery to vanity and arrogance."

The chains thrown around the mind by this species of philosophy have been one of its most depressing means of bondage. At the time when the first aspirings of chemistry were about to make themselves apparent, in the seventeenth century, even a hundred years before Priestley wrote, a true theory of combustion was well nigh reached through the researches of Hooke and Mayow. But not long after, as the century drew towards its close, the hypothesis of *phlogiston* was ushered on the world by Beccher and Stahl of Germany. Offspring of aspiring mind, it haunted like a nightmare the opening science, blinding Priestley, Bergman, and others, to the true bearing of the facts they observed. And not till many an investigator had gone to nature for truth, and facts had been largely gathered in, to the help of the science, was the evil power destroyed and chemistry left free to expand.

The same disposition to give the fancy wings, is still ob-

structing progress. But light is so far let in upon science, and observers have so multiplied all over the civilized world, that the baneful influence is now comparatively short-lived, if not confined to its author. The reverence for truth, which the study of nature inspires, makes scientific men critics upon one another; and it is now well apprehended that there is a common court of appeal as to truth,—even nature herself. The written law is not more decisive in its judgments, than the law of God in his works; and it cannot be more faithfully regarded than the latter, by true students of nature. They know whereon they stand; and they rejoice in the light that is daily coming to their minds from the eternal source of all light.

Mind was long in the world in ignorance of the world. It lay dreaming of the deep unknown, taking only dim and lazy views into the darkness around. Latterly, it has broken loose from the case in which it was revolving upon itself. It has found that God's hand is outstretched to touch our blind eyes, and help us onward; that the way is strown with flowers, gushes with fountains of wisdom, and leads directly towards the eternal throne. By making use of the proffered means, mind has greatly enlarged its range, and that range is still extending.

(5) But there are remains of the old obscurity, profound depths, indeed, in which sight fails of distinct images; and the complete dissipation of this obscurity cannot be hoped for, although circle after circle may be gradually penetrated by science. This is a dream-land, into which mind may take its excursions; yet the true philosopher will think deeply, and speak cautiously.

To this dream-land, moreover, there is a limit, beyond which mind cannot go, even in its fancies; for, in making the attempt, it only turns back upon itself. The leadings of nature offer no aid to those who would pass the boundary. On the hither or finite side of that limit are the laws of matter, which mind is exploring; on the farther or infinite side, the essence of matter, out of the range of knowledge. On the finite side are the laws of mind; on the infinite,

spirit in its nature or essence. On the finite side, created things and laws of progress in creation; on the infinite, the mode of creating matter or the living germ or spirit, and their period of origin.

The beneficent Author of all things, through the way already mentioned, offers us help, it is true, in looking upward beyond the sphere of nature; but only along one line, and that for the soul rather than the intellect, — presenting to view the moral attributes of God instead of his creative power, teaching the spiritual relations of man rather than the spiritual essences of existence in general, and lighting the pathway to eternity instead of opening the spirit-world to our gaze.

We may, even now, go many stages on the way towards the boundary of knowledge; but only presumption will think to pass that boundary. Analogies from matter or corporeal existences have been appealed to in reasonings on spirit; but no satisfactory ground for faith in such reasonings can be shown, and not even a moderate degree of presumption in their favor. We may conceive of spiritual entities preceding material living forms, and thus believe we jump the line and comprehend creation the better. But it is a conclusion without premises, like the old "elephant;" a figment of the mind, and not a truth educed from any sure source of knowledge. Of those who talk of such entities, they alone are consistent with the laws of the mind who claim, like Swedenborg, to receive their views by direct Divine communication; and the defect in such a case is, that the claim is not substantiated. It is only a claim, and worth little as a basis for faith.

(6) Treatises on science of the present day touch but lightly upon the hypothetical, and draw a broad line between ascertained laws and suspected truth. FARADAY, of England, is one of the faithful students of nature, ever interrogating, never dictating. Voluminous as his writings are, he has published few pages which are not directly based on readings from nature. In his interpretations, he acknowledges that he may, sometimes, be mistaken. But he turns back and

reads and compares, with untiring scrutiny, sure that the truth will sooner or later speak audibly to the willing ear.

The philosopher, worthily so called, has faith in God; faith in nature; a subjection of self to the love of truth; unflagging patience in investigation; a clear apprehension of the true perspective among facts and principles, and of the resemblances, analogies, or harmonies they present, — in which faculty lies his inspiration and his inventive genius; and a cautiousness in testing all analogies, not by their seeming beauty, or by abstract argument, but by strict appeals to observation: — perfections, it is true, not often combined in one individual.

We could wish that all who are sedulous in reading the first revelation, were imbued with the truths of the written word, which so vastly transcends nature in its displays of God and in its ennobling view of man. The philosopher who can look upward with filial affection, whose soul is a fountain of love, supplied from the eternal fountain through Christ our only salvation, whose aim is truth, that he may better fulfil his duty to humanity and rise to a more perfect union with the Source of all truth, finds nature glorious with the reflection of the Divine image, and the Bible more sacred and sublime through nature's revealings of God the Creator.

But if all are not thus instructed, it is still true that, in no profession but the clerical, in our land, is there so large a proportion of religious men as in that of science. The charge of infidelity, as characterizing the savans of the nineteenth century (implied in the unqualified remark of Professor Lewis, on page 107 of his work), is most unjust to the scientific men of America. Who are these infidels? Is Prof. SILIMAN, father or son, or President HITCHCOCK, of the number? or Professor HENRY, the able physicist; or Professor MITCHELL, ALEXANDER, or OLMSTED, among astronomers; or GRAY or TORREY, the most distinguished of American botanists; or REDFIELD, one of the first of meteorologists; all of whom, besides many others, are members, "in good standing," of the same division of the church with Professor Lewis? Is Professor PEIRCE, preëminent in mathematics, whose writings are quoted

at the head of this Article, among the contemned savans ? or Professor BACHE ? But it is invidious to cite names ; the charge needs no refutation. Professor Lewis would probably say that he did not mean such men, although his slashing sentences strike right and left, without discrimination. Who, then, are these infidels ?

A weak book has recently come forth under the garb of science, to which he would probably point. But it betrays its unscientific character in wanting, completely, the cool argument and well-arranged facts of the philosopher, while its pages abound, on the contrary, in vituperations, sneers, and expressions of contemptuous triumph, which show hate to have been the prompter, and not a love of truth. Professor Agassiz's short contribution to the volume is wholly different in its spirit, and is, in fact, altogether out of place, as we believe he himself now regards it. The subject — The Unity of the Human Race — is assuredly a proper one for scientific investigation ; this, indeed, has been freely admitted, as regards those who take what is deemed the right side, for facts and reasonings from nature have long been appealed to, in its support ; and assuredly he who calmly endeavors to ascertain the exact value of these reasonings by reference to nature, is not, for this, to be denounced. No one but a coward in his religious faith, should fear the result of the freest discussion. We believe that the commonly accepted view will be sustained ; but we would not, as we wish truth to prosper, desire those interested in the research to relax one iota of their efforts : “ for, if this counsel or this work be of men, it will come to nought ; but if it be of God, ye cannot overthrow it ” (Acts 5: 38, 39).

Science is often charged with pantheism. But intellectual philosophers first gave the monster birth, long before this age of “ infidel Geology.” It is a natural product of that philosophy which takes its own visions for truth. And if science found pantheists to interpret her laws in a pantheistic way, does it prove that *science* is infidel ? The intellectualists imposed upon her their own folly, and upon them should fall any deserved imprecations. From pantheism

science has fairly escaped, by her own native growth ; and, moreover, she is unsettling the very foundations of pantheism itself, through the evidence she affords of a personal and omnipresent Deity, benevolent as well as omnipotent, and the indications everywhere discerned of a spiritual purpose in creation.

The world of mind unavoidably suffers from all false philosophy ; and if the infidelity from this source were duly considered, and that also prompted by the natural propensities of man, whatever his pursuits, science, in comparison, would be found to be chargeable with little of the evil. The fact that bad or deceived men now and then misuse her developments, or that wrong deductions are sometimes made, is no apology for the ill temper that often assails science, or the timidity that watches her progress. The scientific writers in our language that aim to exalt the Bible in their works, greatly outnumber those that publish words of detraction. From the past comes the lesson, in distinct utterances, that if her announcements are not of God, they will speedily 'come to nought,' *science herself being the judge* ; for her errors have, in no instance, been corrected by outside philosophers. And she makes the needed corrections in far shorter time than happens among intellectual theorists, a few years at the farthest sufficing to erase a false conclusion, while ages have felt the gloom of an error engendered of pseudo-philosophy. Her face is towards the light of truth, and brief are the passing shadows.

After this exposition of the nature of science, its modes of progress, its aims, its limits, and its men, we return now to the subject with which we started, — the influence of the views brought forward in "The Six Days of Creation." Our first proposition, that it exhibits the relations of the Bible to science in a false light, and thereby tends to promote the rejection of the Bible, is abundantly established. But this, it might be said, is involved rather in the drapery of the book than in its principles. Although the two may not be easily disentangled, we will now endeavor to direct attention to its cen-

tral ideas, and, if we do not greatly mistake, shall show that the term "infidel philosophy" was not misapplied.

But one word, first, on the recent Letter of Professor Lewis written in reply to our review. The author implies in this letter, that we have mistaken him on many points. Unfortunately, the quotations he himself makes from his "Scriptural Cosmology," leave the reader's mind in a quandary as to the actual opinions held, the assertions looking one way and the quotations another. We will give the work another chance to express its views, as they stand, by farther citations. As to its obvious teachings, we believe we were right; and, if our readers would peruse the volume, we should have no occasion to add to our remarks. One point in his theory of nature we passed over without giving it a paragraph; we will try to do it justice beyond. Before taking up these subjects, we may mention an example or two of the mode of argument in the Letter.

In our review we observed that, in the scriptural cosmology of Moses, there was, on the sixth day, the creation of "cattle, creeping things, and beasts of the earth," as well as of man; while in the "Scriptural Cosmology" of Professor Lewis, only the creation of man is alluded to, when considering the same day. The author replies, that his object "was not to talk about mammalia," but to explain the use of the word *day*, — an explanation of his state of mind, but no good reason for departing so widely from Moses, in an exegetical work. Substitute for "mammalia" its signification "cattle, creeping thing, and beast of the earth," and the scope of the sentence will be appreciated, while it will have lost its point.

Again, he says, speaking of the creation of man: "The general expressions of formation, as also the word *Adam*, it is well known, have been interpreted (and by authority which Professor Dana eulogizes) of the creation of man generally, or of races, or of many individuals under one general classification, instead of *one* single pair, made to be *one* centre of life for all humanity." The sentence seems to imply that Professor Dana eulogized the authority spoken of,

on the particular point referred to ; which is not, in any way or sense, true. This may be deemed an ingenious mode of reply ; but is it ingenuous ?

We pass on without further interruption of our course of argument.

The erroneous notions respecting science in both the warp and woof of the volume, were illustrated in our former Article. But that they may be distinctly in mind, we again refer to some of the author's statements. We thus read : " What is it, after all, that she [Science] has given us, but a knowledge of *phenomena*, of appearances ? What are her boasted laws, but generalizations of such phenomena, ever resolving themselves into some one great fact that *seems* to be an original energy, whilst evermore the application of a stronger lens to our analytical telescope, resolves such seeming primal force into an appearance," etc. (p. 107). " Science may boast as she pleases ; but, according to her own most vaunted law, she can only trace the footsteps of a present or once passing causation " (p. 220). " Science is ever showing not only its phenomenal character, but its utter deficiency, when we would make its conceptions identical with, instead of representative of, the fact or facts " (p. 120).

This language is sweeping ; and if the author, as may be alleged, had reference only to effective causes, the least we can say is, that, in his ignorance of science, he was not aware that there were any stable laws. In his $P, p_1, p_2, p_3, p_4, \dots, p_n, \dots, X$, representing error succeeding to error as a necessary result of research, and in his denunciations of the " boasted laws," he evidently aims to shake down the whole fabric of science, deeming it the best way to get rid of its " infidelity."

But, regarding only effective causes, what is there under the terms Heat, Electricity, Crystallization, that is to fall to pieces or vanish away ? What is the law, or cause, that is to turn out an " elephant ?" The precise nature of Heat, Electricity, Attraction ? Suppose a change on such a point, how much of these sciences, that is, of their recognized

laws, would be disturbed or unsettled by the catastrophe, or become an "appearance?"

When an error is discovered in any deduction, science does not name it an *appearance*, a *phenomenon*, but honestly proclaims it an *error*. The conceptions of "phlogiston" and "vortices" were, from the first, false conceptions, and never represented appearances or phenomena. It is true that there were certain appearances, supposed to correspond to the notion of phlogiston; but even the appearances turned against the conception, and it dropped from the world as a blunder engendered through the "elephant" philosophy. The old "elephant" was a false conception, a product of the human mind laboring with itself; and so it was to the end. "Crystallization" is a term standing for the process by which such appearances as crystals are produced, or for the phenomena of the forming of crystals. But the threatened transformation of crystallization, at some future period, into an "appearance" or "phenomenon" is to us unintelligible.

These terms, "appearance," "phenomenon," "conception," in the author's lexicon, mean anything or nothing: *appearance* stands, in fact, for an *actual* or a *false* appearance, or anything the mind has conceived to have been, or to have represented, an appearance, — senses which it can be admitted to have only in a system of philosophy profoundly sceptical.

Science, as we have said, admits that about its confines there is the doubtful, the imperfectly interpreted part of the volume of nature; and is ever looking for more light. But is it true that the human mind is so made, or so adapted to nature, that it can attain only to false theories or laws? or, as regards the profounder causes, that the progress of study is tending, not, as science claims, to an elimination of error and a clearing away of doubts, but, as Professor Lewis holds, to deeper and deeper errors, in endless succession? that the *Systema Naturæ* which Science believes she is bringing out to view is only a rickety structure, ever tumbling to pieces? that there is no foundation for full faith in the teachings of nature, or the deductions of the human mind

therefrom? If such be actually the end of man's contemplations of the works of his Maker, he would be forced, in just indignation, to write FALSE over the whole face of nature, and to replace the word GOD with that of DEMON. The enlightened mind, perceiving the fatality under which it exists, would naturally sink into hopeless scepticism, as its own powers would be impelling it irresistibly to error. God in nature could not be recognized, and the Bible could have defenders only among the superstitious and unreasoning.

Such is the philosophy we find penetrating through and through the "Scriptural Cosmology;" and this is a *second way in which the influence of Professor Lewis's work is infidel.*

In our review, we explained the general points in the system of nature which Professor Lewis has espoused. We alluded to the plastic power in nature, "given originally by God," her supposed "tendency to decay," and need of revivification from the presiding Deity; her reanimation, or endowment with new powers, at intervals, by "a sudden flashing in of the extraordinary or the supernatural" (p. 98); the introduction and development of generic germs, and the elimination of "species from species." Professor Lewis would have his readers now understand that all his development theory was an *if* in his work. "There is much virtue in an *if*," and some convenience. It appears here like the cautiousness of one afraid of the judgment that might be passed upon his orthodoxy. We have looked over his work again, and find the theory staring at us in many ways, being argued out warmly and with various apologies; and assuredly the author, like many a lawyer, has presented the wrong side well, if not its real advocate. It falls into his theory of nature so nicely, that it evidently seemed to him to be very naturally a part of it, and worthy of being true if not so; indeed, no matter what science says, or how startling the idea to theologians, he obviously deems it a very good idea, and very probably true. Not one reader in a thousand would gather any other opinion than this from the work.

In his Preface, page v., he says (with truth and apparently

a little uneasiness), "What will most startle some readers, perhaps, is the manner of connecting the Platonic ideas with the unseen entities mentioned by the Apostle;" and again, on the same page, "God makes types, and nature prints them." On pages 3 to 11 he lays out his plan, and, among his heads, enumerates this (p. 11): "The Physical Origin of Man, and what is meant by his being formed from the dust of the earth." On page 40, where he says, "the great generic beginning of animal life may have had many specific beginnings accompanying and following it," the development theory is plainly alluded to; and similar hints appear, at intervals, beyond. Then, in chapters 16, 17, 18, where animal creations are considered, he pronounces "a development theory of species from species" pious enough, and shows how it may be the working of predetermined laws, like that of the "Vestiges of Creation," only originating in the Deity. He closes his explanation of the theory as follows:

"It would be the same *word* repeating, yet expanding itself in every ascending species, just as it is the same specific word repeating itself in every individual birth which the laws of the maternal nature are ever bringing out from the seminal energy" (p. 214).

Then, after thus expounding what science has shown to be false, he continues as follows:—

"What Science would say to this, we do not clearly know, nor are we much concerned about her decisions. An immense time, as well as an immense accumulation of data are required to give them any claim upon our confidence. Neither, on the other hand, if it be most in harmony with the language of the Bible, would we be concerned about the charge of naturalism. A development theory which has no divine Word, is indeed atheism. That which acknowledges only one divine origination, and this from the logical necessity of getting a starting-point for physical speculation, is as near to atheism as it can be. It hath said in its *heart*, There is no God; and the only thing which prevents it from being also the conclusion of the mere scientific intellect, is this logical impediment, which God has mercifully put in its way. But a development theory, in the sense of species from species, as well as of individual from individual, may be as pious as any other. It may have as many Divine interpositions as any other. It may be regarded as a method of God's working; and that, too, as rationally and as reverently as the more limited system to which we give the name of *nature* in its ordinary or more limited sense. *Modern theologians have been too much frightened by certain assumptions and speculations on this field*" (p. 214, 215).

Again, that he may be fully understood (for we would not, knowingly, misrepresent), we quote from the following page :

"It is enough for us to learn, without doing any violence to the language of the account, that the production of the vegetable and animal races are set forth as having been originally a *φύσις*, or growth — a growth out of the earth, and by and through the earth ; in other words, a nature with its laws, stages, successions, and developments.

"There was a previous nature in the earth, whether it had been in operation for twenty-four hours, or twenty-four thousand years. We may compare this to a stream flowing on and having its regular current of law or regulated succession of cause and effect. Into this stream, we may say, there was dropped a new power, supernatural, yet not contra-natural, or unnatural, varying the old flow and raising it to a higher law and a higher energy, yet still in harmony with it. New causations, or new modifications of causation, arise ; and, after the successions and steps required, be they longer or shorter, a world of vegetation is the result of this chain of causation in the one period, and through an analogous if not similar process, an animal creation arose in another. Our mode of argument may be denounced as metaphysical, and yet it is but the analysis of a common thought which every man, who examines his own mind, will find that he has in connection with the words *nature*, *growth*, etc. ; or the terms that, in all languages, grow out of roots corresponding to those that are here employed in this plain narrative of the Bible."

In the following chapter, he arrives at the profounder conclusion, which we did not discuss in our former review, that spiritual entities preceded material forms. The reader will find the views, at large, in the work ; we cite only two or three passages.

Speaking of the principle sustained, he says :—

"It is neither more nor less than the essential act of faith, as Paul sets it forth, Heb. 11: 3, in which we believe that "the worlds (*τοῦς αἰῶνας*, the æons or ages) were brought out, in order, by the word of God ; so that the things that are seen were made [or generated] from things that *do not appear*" (*ἐκ μὴ φαινόμενων*). That is, the outward or phenomenal entities were generated born or (*γεγονέναι*) from the invisible, immaterial, vital powers, principles, laws, *σπερματικὸι λόγοι*, spermatic words or ideas, call them what we will, which are, themselves, the first and immediate creations of the Divine Word going forth, before any new agency of nature, whether the universal or any particular nature"¹ (p. 224).

¹ We leave it to others to criticize the liberty taken with the Greek version in transposing *εκ* and *μη* in the phrase "*εκ μη φαινόμενων*."

Then, on a following page, in the same chapter: —

"To apply all this to our present argument, we would say, with all reverence, that here, in the works of the third and fifth days, or in the production of life from the earth, the "unseen things that are understood," are the created ideas, or types, the divine seminal powers which are anterior, in time as well as in order of existence, to all natural or outward manifestation" (p. 230).

"However progressive and natural the after-production from the earth, the creation of these seminal types or principles was wholly supernatural, immediate, divine. We do not hesitate to use here the sublime expression of Plato; for we regard it as akin to the thought which Paul presents, in the Eleventh of Hebrews: "God is the Maker of types (*τῶν τύπων*). He is the architect of ideas;" but not as barren thoughts or speculative theorems. Along with the law and constitutive of it, there is the plastic or formative power, the ruling or directing energy. This, there is no absurdity in saying, was put in the earth to grow; for it means, that by a new power, then given, the earth was made to bring it forth or out, that is, give it birth in *outward material form*. This was the *genesis* of the first vegetation" (p. 231).

"There is a spiritual reality — shall we shrink from using the term? — or, at least, an immaterial entity, in all, even the lowest forms of vegetable as well as animal organization. * * * Call it law, idea, power, principle, whatever we may, it is a reality, a high reality, the highest reality connected with the material organization; and this it is which God made before the tree was in the earth," etc. (p. 232.)

Finally, he shows in another chapter how man, as regards his "physical nature," *might* have conformed to the development theory of species from species. We cited his cautious statement in our review. On the next page of the "Cosmology" (p. 249), he adds: —

"From an old organism, there might thus have been made a *new man*. On this head, however, the Bible gives us no distinct information. We can merely say, it *seems* to imply an immediate formation, even of the material nature, as though man were altogether a new thing, wholly severed from all physical connection with any previous states of being; still the language is not inconsistent with the other supposition. In fact, the mention of earth as the material from which the body was made, would appear to intimate some use of a previous nature, together with the laws, the growths, the affinities, the established on-goings, of such previous nature."

Again, on page 251, he says, as he has cited in his recent Letter, that the creation of woman suggests another origin for man's physical nature; but he does not use the fact to

point an argument against the development theory. On the contrary, he aims to take off the edge of the argument which the creation of Eve suggested to his mind ; for he continues directly on with the sentence : —

“ Still, however formed, there is a deep significance in the phrase “from the dust of the earth.” High as may be our celestial parentage, we have an earthly mother. The most touching appellations, in all languages, are expressive of the idea. Man “is of the earth, earthy.” He is *Adam*, he is *homo, humus, humilis*. If he has a spiritual life that connects him with the higher worlds, he has also an animal, and even a vegetable life, that links him with all below.”

Then, as if to relieve the pious mind, that had been accustomed to higher thoughts of man's origin, he admits the doubt, and adds a word of comfort, as follows : “ Be it, then, when it may and how it may, it is the inspiration of the higher rational life that is the true *beginning* [his own italics] of our distinctive humanity.”

Now, why this long disquisition on the development theory, in an exegetical work illustrating a portion of the Bible ? Why does the author continue dallying with the subject, until he has suggested that man's body might have been a brute's corpus ennobled ? Simply to present, as he states, an “hypothetical argument,” in which he meant only to say, “If the Scriptures had clearly taught it, there would be nothing monstrous or incredible in the view ?” Would it not be more natural for a disbeliever in the theory to say, Since neither the Bible nor nature teach it, the view *is* both monstrous and incredible ?

In fact, the cyclical view of nature, with its spiritual entities and the theory of development, constitutes the fundamental idea of the work, to which all about *days* and *time* is subordinate. To the absorption of the author's mind with this idea, may be attributed the negligent way in which he follows the record in Genesis, giving prominence to those points that bear on the theory, and quite overlooking much that ought to have been brought out in an exposition of the Mosaic narrative, or the true scriptural cosmology.

Science shows, with regard to plants and animals, that God

instituted types; that is, his purpose or plan of creation, embraced certain type-ideas; and that these type-ideas had expressions in entities, when represented in material forms, such as plants and animals. Of any previous existence of created types as spiritual entities, from time to time developed, it tells us nothing. On the contrary, it declares as plainly as it can, that the type-ideas were only purposes in the great unfolding plan of the omniscient Creator, with whom there could be no after thought.

In illustration we direct attention, for a moment, to the Vertebrate type. Consider the range of animals: fishes, reptiles, birds, quadrupeds, man; and conceive, as far as possible, of the type-idea for the vertebrate section of the animal kingdom. This type-idea has been viewed by science, in the light both of existing species and geological history. It has been shown to be represented by a consecutive series of vertebræ, having a brain at the anterior extremity, a bone-sheathed cavity along the back for the great nervous cord, and a larger cavity below, ventrally, for the viscera; and involving in its successive expressions in material forms, modifications of these parts according to a predetermined plan embracing in its purpose systems of subordinate types: these modifications corresponding to variations through coalescence or multiplication in the number of vertebræ, variations of length, form, etc., in their processes and appendages, and analogous variations also of other parts in the type-structure.

The vertebrate type-idea was expressed first in fishes; then in amphibians, reptiles, birds; then in quadrupeds; and finally in man, the last of the series,—the succession taking place according to a system, as mentioned in my former Article. Geology declares, unequivocally, that the new forms were new expressions, under the type-idea, by *created* material forms, and not by forms educed or developed from one another. It also teaches that the first expression of the type-idea, that is, the Devonian fish, suggested a view of the type very inferior to that we now gather from the great range and diversity of existing vertebrates; and our modern species

express a view far below that which the mind derives from the whole series of vertebrate creations in the grand unfolding plan of past time. Thus we learn, from geological history, that in the succession of events, step followed step in progressing order, and ever-rising harmony and grandeur. The material manifestations of the type-ideas were successively made in the progress of creation.

But as to spiritual entities preceding by a period of time the material manifestations, we gather no hints, either from nature's teachings, or the Bible reasonably understood. They are obviously a product of ambitious mind, revolving upon itself, and imagining that, in the movement, it is making progress; and all such efforts of the mind can only produce "elephants." The author denies a knowledge of science, denounces its laws, and the result is, as might have been expected, a clumsy fifth wheel that nature disowns.

In striving to fasten upon the Bible a false development theory, and the idea of nature as a nursing mother, is not the "Scriptural Cosmology" anti-scriptural?

This is *the third way in which the influence of the work is plainly infidel.*

Had any man of science propounded, in a scientific treatise, the very same view of nature, and the same development theory of species from species, admitting the Deity near by, that there might be, at times, "a sudden flashing in of the extraordinary," and also to plant generic germs or spiritual entities, and raise nature from the decay to which she tends, denunciations would have assailed him from every direction. These views have come from one writing as a Biblical student; and even religious Journals, claiming to be guardians of sacred truth, have been so led away, as to abuse science for exposing the doctrines of the author.

The influence of the work in the country we, therefore, pronounce to be largely infidel; infidel through its denunciations of truth and of truthful men; infidel through its teaching that error is the unavoidable end of science; infidel through its theory of nature and its degrading and degraded development theory.

Such an influence, Professor Lewis would regret, we doubt not, as much as any one. He has endeavored, in his writings, to sustain and magnify the word of God. He has brought to the task a mind rich in classic learning and imbued with firm religious faith. He has erred, not in purpose, but, like many others who have disdained science, by regarding mind as, of itself, an absolute source of knowledge with regard to nature, instead of a dependent agency deriving light through the works and workings of God around us. He enjoins humility on the man of science, and will undoubtedly admit that we should all be humble. And if we have not partly failed in our end, he will acknowledge with us, that, in becoming humility, we should seek for knowledge from nature, before attempting to expound her laws, taking God's manifestation of His power and wisdom as our guide to physical truth, as God in Christ is our source of spiritual truth, our light, our life, and our eternal joy.

ARTICLE VIII.

NOTICES OF NEW PUBLICATIONS.

I. THE ROMAN EXILE.¹

THIS is a volume of rare interest. We had anticipated its perusal with much pleasure, but we have received more delight and improvement from its pages than, in our partiality for its author, we had ventured to expect. Dr. Gajani was educated at the University of Bologna. He is a gentleman of a clear, active mind, excellent culture, and sound religious principle. His charming simplicity of character shines through his style of writing, and delights those of his readers who have no personal acquaintance with him,

¹ The Roman Exile. By Guglielmo Gajani, Professor of Civil and Canon Law, and Representative of the People in the Roman Constituent Assembly in the year 1849. Boston: Published by John P. Jewett and Company. Cleveland, Ohio: Jewett, Proctor and Worthington. New York: Sheldon, Blakeman and Company. 1856. pp. 450. 12mo.

to the happiness of the saints in heaven, it must be imperfect until that addition is made ; which does not seem consistent with the perfection of their state."¹

ARTICLE VI.

○ SCIENCE AND THE BIBLE. NUMBER III.

WITH REMARKS ON THE "SIX DAYS OF CREATION" AND THE "WORLD-PROBLEM" OF PROF. TAYLER LEWIS.²

By Professor James D. Dana, Yale College.

SCIENCE AND THE BIBLE,—the first and the second revelation ; the one telling of God's wisdom and power, and his plan of creation ; the other declaring God's holiness and love, his majesty as the Infinite King, his condescension as a Redeemer : the one proffering aid to physical and intellectual man ; the other meeting the highest wants of the soul, and opening to it the light and joy of heaven :—these are the views recognized in our earlier chapters on Science and the Bible.³ Our plan led us to dwell mostly on the earlier revelation, as this is too often misunderstood and depreciated even by men of whom more knowledge might be expected.

But our words have been regarded as an attempted ele-

¹ Bod. Div. pp. 1088, 1089.

² "The Bible and Science, or the World-Problem," by Tayler Lewis, Professor of Greek, Union College. "Cancta fecit bona in tempore suo, et MUNDUM tradidit disputationi eorum, ut non inveniat homo quod operatus est Deus, ab initio usque ad finem."—Ecclesiastes 3: 11. "And there was a voice from the firmament that was over the heads of the living creatures."—Ezekiel 1: 25. 352 pp., 12mo. Schenectady. 1856.

³ In the use of the word science, for nature-science or knowledge, we may seem to be ignoring other branches of science. The fault is in the English language ; for neither *natural science*, *physical science*, or *inductive science* covers the whole range. Besides abundant usage, we have the authority of the Preface and various other parts of the "Six Days of Creation." We were satisfied, therefore, that we should be rightly interpreted.

vation of reason or nature to a level with the Bible.¹ There are few that will see heresy or a "pious fraud" in the phrase "Science and the Bible." Yet some further illustration of the relation of the two revelations to one another, and to man and truth, may not be unprofitable.

¹ The "World-Problem" says, on page 183: "It is this putting nature and the Bible on a seeming par [that is to be dreaded]; a practice of which some are so fond, though all the real deference is in reality paid to Science in every case of seeming collision. It is this patronizing parallel, now so commonly run between the 'two books,' as they are styled, 'the book of Nature and the book of Revelation,' and of which we have such a fine specimen at the close of Professor Dana's article. These are the things most hostile to the Bible, most injurious to a true and hearty faith. This is the real naturalism."

Is this remark about Professor Dana true? The sentiment is often repeated in the "World-Problem." *Is it true?* We cite from that closing paragraph, that the reader may judge:—

"The universe and the Bible are consecutive parts of one glorious volume; the *former* teaching of infinite harmonies, coming up from the deep past, and of man's relation through Nature to God; the *latter* of man's relation through his own soul to God, and of still loftier harmonies in the eternal future; the *first part*, telling not only of the wisdom and power of God, but also of man's exaltation, at the head of the kingdoms of life, the being towards whom, with prophetic eye, all nature was looking through the course of ages, preparing his earthly abode, arranging every ridge, and plain, and sea, and living thing, for his moral and intellectual advancement, and with so much beneficence that man, when he came to take possession of the domain, found everywhere lessons of love and adoration, and read in his own exaltation a hope, though a trembling hope, of immortality; the *second part*, after a chorus epitomizing the former revelation, pursues its closing thought, Man in his relation to his Maker, makes that hope of immortality sure, and points out the way of life, by which he may enter into everlasting communion with God his Creator and Redeemer. If students of nature fail of that way of life, it is not that science is evil, but man fallen."—Bib. Sac., Jan. 1856, p. 129.

Page 217, the work says: "But it is folly to talk of Professor Dana's views of the Bible account. What he presents does not lean upon the Bible at all, and he takes no pains even to give it that appearance." *Is this true?*

Page 140, we read: "There is one thing connected with this matter of 'the eternity of matter,' that really tries the patience. We allude to the bugbear of Platonism raised by such writers as Mr. Lord and Professor Dana, and the stereotyped charge they make, that Plato taught this doctrine." *Is this truth?* Has Professor Dana made any such charge? Platonism has been charged on Professor Lewis, but not this doctrine on Plato, not even by way of implication. And, moreover, the Platonism was in effect acknowledged in the "Six Days of Creation," by the citation of the similar views of Plato.

Page 225, it is stated, that "The most astonishing thing of all is, the fact that this poor natural knowledge,—poor, we mean, in the attitude assumed by the reviewer [Professor Dana], though having a beauty and an honor when it

It will be seen from the confession of our faith, more than once given, that we regard the two revelations as holding distinct positions; in harmony, it is true, both having the same Author, but yet different in scope and purpose. The past and present constitute the subject of one; the present and future, of the other; and that future an eternity; that eternity, the life-time of the soul; and that soul capable of piercing eternity with its gaze, and reaching upward to realms of happiness only through the light of this second revelation.

The revelation in nature was first opened to man, while he was still bearing the image of his Maker. With that image bright, like heaven's own orb, he could read of love

chooses to be modest,—should so dare to put itself face to face with the Scriptures; not in the attitude of a manly, though impious, antagonism, but in the far more insulting spirit of petulant rivalry."

"Face to face with the author of the 'Six Days'" is here made equivalent with "face to face with the Scriptures." Is this good arithmetic?

The "World-Problem" is remarkable for its personal abuse of "Professor Dana;" not only his opinions or writings, which were legitimate subjects of criticism, and opinions called Professor Dana's, but not his, which are still better game though not as legitimate, but also his personal character. Two additional examples will suffice to illustrate this quality in the work.

"The professed orthodoxy of his [Professor Dana's] literary position would lead him to speak well of the Bible, and to be rhetorical about 'the harmonies;' but he is sometimes off his guard," etc. *ib.* p. 152.

After mentioning, inaccurately, the relations of Geology to the Mosaic narrative, laid down by Professor Dana, he adds:—

"This scanty act of homage once rendered to the Spiritual Power, very much as the Italian Machiavelli makes his appeasing bow to the Conclave, science breathes freer and passes on." p. 239.

The above is part of a running fire kept up through the volume about "pious" Professor Dana. After the first shock at finding one's honesty and general character assailed had passed, an indifference followed, mingled with a disposition to stand and wonder if all this could have come from the author of "The Six Days of Creation." We could have wished, however, that he had spared Professor Silliman, who is wantonly made the subject of a sneer about pious freethinkers, on page 174. Perhaps he would say that he refers only to his science;—strange words, if so. We quote:—

"There are parts of the world, there are schools of thinking where faith in any objective or supernatural revelation has in the main already died out. They are able schools, too, most scientific thinkers, as good thinkers as can be found among us, but where do they find the supernatural? As far as science is concerned, or their rank in science, these foreign free-thinking naturalists ought to be, at least, as pious as Professor SILLIMAN or Professor DANA."

and infinite glories in every work from a Father's hand. A perpetual radiance then passed from heaven to earth, and from earth to heaven, and the light of nature added brightness to the ever-flowing interchange. But man fell; self usurped the place of God; the light became dim within, and the revelation in nature dim also, to such a soul. Then the second revelation began its announcements, seeking to restore to man that which had been lost of the image of God, to rekindle the consciousness of Heaven's sympathy, and guide him to the paradise he had forsaken. And the revelation went on deepening in its tones of love, until God himself came down to man in the person of Christ, as the promised Deliverer. When now, through him, truth and love again possess the human soul, nature, although herself an uncertain guide to divine truth, may become effulgent with celestial light. The two revelations thus stand apart. As much as eternity exceeds time, and the soul, all else created, so far does the second transcend in importance the first revelation.

"*Science and the Bible*" is a glorious climax, like that of creation itself, when the earth's passing ages of beautifying features and life reached their completion in the age of Man; or like Man's own progress, from scenes of toil and care to the freedom and bliss of the heavenly paradise. To one whose mind, instead of dealing in abstract discussion, is occupied with thoughts of progress, progress in the earth's genesis, progress in the moving nations, progress in man towards his upper home, the phrase "*science and the Bible*" is most natural. The mind expands with the idea, as if now gathering strength from the finite, to rise, with growing faith and love, towards the Infinite.

But although these two revelations are so diverse, and the second vastly transcends the first in its realities, we may not speak lightly of the study of nature. One who is buried in his own contemplations, and knows nothing of the depths of truth in God's works, is ill prepared to be a self-appointed judge. In such hands, the world must fare poorly, and the world-problem become more of a riddle than ever. We have here an example.

In a tone not at all good-natured, the author of the "World-Problem" speaks of the sciences,¹ especially the natural sciences, as very easy to learn and very mischievous in their influence; of the "scientific conventions," as given up to physical or natural science (not because men in these sciences choose to have conventions, but), because "these topics are most directly popular;" of geology as "the most vaunting" of all the sciences, and having its special charm, to many minds, from "its furnishing a ground of objection, whether true or false, to the credibility of the Scriptures;" while in fact it demands no greater powers of mind "to examine the epidermis of the earth and make curious discoveries among its dorsal fins," than "other branches of the same scientific genus." It talks of the "wondrous conceit of science in the common mind," the scientific "lingo" used by quackery, and "that miserable concoction of inane delusion, modern spiritualism;" as if all this, and much more of the same sort, had anything to do with the true bearings of science, or was presenting a just view of its influence on the age. It is very much opposed to the "grand display of decimals," and "the millions and billions" in some scientific lectures, and has quite an argument on the subject, in which the wit is too good to be lost. He is speaking of lectures on astronomy, p. 47.

"A rigid exhibition of the mathematical modes of determining the distances of the planets, would be dry and wearisome. In most audiences, moreover, notwithstanding the boast of its being a scientific age, it would be unintelligible. But to make a grand display of decimals, to talk of millions and billions, and distances which the cannon-ball could not traverse in a thousand years, and rows of figures reaching round the earth, this gives them a wondrous view of the science, and of the still more wondrous human mind that can make such computations, and entertain such far-reaching ideas. Thorough and patient instruction in the doctrine of transits and parallaxes, with the necessary demonstrations and diagrams, would drive the wearied audience from their seats; but let them be told, in thaumaturgic style, of the wondrous swiftness of light, and how a luminous stream, two hundred thousand miles long, enters the eye every time a man winks, and there is immediately a hail-stone chorus of applause."

¹ World-Problem, Chapter I. *passim*, for the quotations which follow.

Again science, according to the "World-Problem," parades its utilities and practicalities, and this is one great source of its popularity. Consequently science is becoming too popular; "it is demanding a deference from all other departments of thought, which is not due to its dignity or its true reality." "In the language of prophecy, 'it has become the horn having a man's voice speaking great things,' and the world, even the religious world, is wondering after it."

It admits that "there are scientific men of loveliest piety, of most religious modesty." But then in the next breath, thinking evidently that some have dared to call in question the author's nature-theory and exegesis, he comes down vehemently on "pretentious, noisy, arrogant science;" and observes that "the want of religious strength and earnestness" in the age, "is very much in proportion to the noise it makes about the Bible," and the so-called 'harmony of science and revelation,' or the 'two revelations,' as it is fond of styling them." Modest science appears to include those students of nature who have no nature-theory but that of the "Six Days of Creation," and who walk directly behind its author.

These views may seem to be of little importance to any one. But the conclusion of the whole matter is, that "all science must be excluded from Biblical interpretation, as well as all deductions from any science which we are sure was unknown to the writer." A plea is afterwards added for the author's favorite faculty: he says, that "*Imagination* may be soberly indulged; but all scientific hypotheses, as such, are worthless and contemptible."¹

The author has a special horror of crucibles and magnifying glasses. Speaking well of outside nature, he thus discourages (the italics are ours):

"Nature is ever praising God." "But it is the *fair, round, honest, open face* of nature that does this, that face that we all perceive and understand at once, that we see by the *naked eye*, and without the aid of *scientific glasses*." p. 324.

¹ World-Problem, p. 70.

Again, as to ideas of *law* and *nature*, he speaks exultingly of —

“Those broad and universal views that lie upon the *honest, intelligent face* of nature, those views that require not so much the *experimenting crucible*, as the *musings, meditative mind*.” p. 160.

These are not casual remarks only; the position is supported by arguments at considerable length, and the Bible is brought in (pp. 329, 330) as giving its weight to the view.

To oppose such notions by sober argument, seems almost belittling. Indeed, the sentiments are not all wrong; and later in the volume it is admitted that “science wakes up thought, thought beyond her own discoveries, or the strictly scientific domain; and this is the main use of her.”¹ But the truth is so mixed with error, is so much like the sugar in a bitter dose, that it is hardly perceived after the whole is taken. There are also, in the same chapter, many excellent remarks on the Bible, enforcing the necessity of its profounder study as the true cure of scepticism, of implicit faith in its teachings as our only law of life, and of earnest desires after the riches of Christ’s love: and in this we most heartily concur; for we believe and know that the sacred word is all and more than is pronounced, the very truth which, if Christians will only take it into their lives, breathe it in their words, and labor for it with body, mind, and soul, will stay the materializing influences of the age, and carry forward the church to victory. But the praise of the Bible is brought forward in a way to throw a false light over science. We therefore offer here a few general thoughts upon nature as man’s assistant in progress.

Although man is immortal, the earth is his appointed place of pupilage. His body is of the dust of the earth, and is under the same laws of growth with animals, and also depends largely upon the laws of chemistry or inorganic nature. While having senses to put himself in connection with nature and serve as avenues of knowledge and aids to his thinking mind, the world is filled with knowledge, not, it

¹ World-Problem, p. 304.

is true, of Greek and Hebrew, but of another language of wider significance and deeper wisdom; the depths of nature being the unfathomable depths of the infinite.

The earth was thus made the arena from which Man was to rise to celestial heights. It was his duty to love and obey his Maker; but this was not all his duty. He was ordered to subdue and have dominion, and so to take strength and wisdom from the infinite source within his reach. While other species reach maturity, within and without, by simple growth, being in a sense made by nature, even to the finishing stroke, Man is required to work out his elevation, and is held responsible for his ignorance and weakness. He was to love, love with all his heart, but none the less to search and "find out knowledge" from the world around him. And thus Science and the Bible were to go hand in hand in man's education.

In that early age, when the *whole Bible* consisted of merely the first commission and first promise given to man, nature was by his side. The beauty of flower and leaf, were there, to refine and cultivate; the grandeur of the hoary mountain and the rushing torrent, to quicken his soul to great deeds; and all the earth sent forth an incense that should bear him upward, in devout contemplation. And beyond this, there were truths of utilitarian character beneath the surface, essential to his very existence. He was to learn to strike the fire from the flint; to change the stony ore into the implement of toil; to search out fibre for cord or useful fabrics; to fertilize the soil as it became exhausted by cultivation; to find the plastic clays and mould them into utensils. So in many ways, his life and subsistence were dependent on help gathered from nature.

Is it said that knowledge so simple as this, is not science? It is nature-knowledge, and of the very same kind that is the basis of existing science. It is a shallow notion that only more recondite facts make up science. Nothing happens around us, in the material world that is not now embraced within its range. The rising and setting of the sun, the changes in the seasons, the dew and rain, snow and hail,

each and every fact, however trivial, is taking its true place in man's comprehension of the system of nature. Denouncing scientific knowledge is denouncing all knowledge of material things and their changes.

The ancient world saw matter only in its broad generalities. Beauty found its response in the soul; the sublimity of the vast and unmeasured in time and space had there a sympathetic chord; the order and system in nature answered to the love of harmonies that possessed man's inner being. And under these expanding influences, and growth in intellectual and moral truth, a lofty elevation of the individual man was attained. Yet along with these means of growth, there was also a knowledge of nature that gave man some control of her powers, although that knowledge was not systematized and reduced to scientific law.

Thus nations were enabled to rise in intellectual strength, and also to fill their coffers and enlarge their bounds by pillage and rapine. Pillage and rapine were essential to that greatness while the acquaintance of man with nature remained so meagre. The philosophers of that era, as of others before it, found it vastly more pleasant to lie at ease and dream out worlds, than to study profoundly the world which God had made; and it was very natural, therefore, that metaphysics should have preceded physics.¹

In these modern times, man has gone beyond facts to principles, which is equivalent to grasping the deep centres of motion in the grand systems of forces, instead of simply using the outer effects or operations. It is going to the very springs of action, and from them wielding nature's mighty energies. In this seemingly presumptuous daring, man simply searches into nature, learns how the single energy evolves its multitudinous effects, and then accommodates himself strictly to her friendly laws, and so takes her aid; and the profounder the acquaintance, the more profuse her yield of bounties. It was a great step of progress when, instead of simply gathering the ripened fruit from nature's

¹ The "World-Problem" appears to find great significance in the fact that metaphysics preceded physics; see page 103.

orchards and fields, man learned that there were germs within the fruit which were themselves capable of developing trees. And so it is in investigating nature,—every new law made out is a germ for man's use in securing the fruits of the earth; and the more fundamental the law, the vaster the range of products.

The Divine light shed over the world and down the ages, from Christ, the centre of history, taught man to *love* and *trust*. To love God, God's law, and all truth; to love man; to love God's works; to trust God in humility; to trust one's self.

It was man ennobled that fell humbly at the foot of the cross. And after he had escaped from the tyranny of a spiritual despotism that sprung up, and, for a while, stifled the germ in its growth, he became conscious of his dignity, and felt strong in the use of that reason which placed him above the brute. He loved all truth; and while having, in the Bible, an unimpeachable standard for moral duty, he looked for as sure a test and as profound a source of law for the physical world. He therefore humbly and assiduously sought of natural phenomena their laws; and thence came the sciences of nature, which, in a single century, have grown to an extent that reproaches the ancient world for its indolence, and rejoices the modern for its rapid exaltation.

Now wherever we look, we see the gifts of nature that have been gathered by her students. Our dress, and the little implements about our person, to ink and paper; the furniture and material of our houses; our fuel, lights, modes of heating and ventilation; our printing, copying, engraving; our means of transporting water, air, time, or thought; our aids to poor eyes, deaf ears, broken limbs, and suffering humanity in numberless ways; in fact, nearly all our material sources of comfort, necessity, and luxury, have derived much from modern scientific research. The heavens and earth, with their overflowing treasure-chambers, appear to have had their broad doors thrown open before us, for all to take that will; for God, in nature as in spiritual life, is no respecter of persons. The plodding man of science, in his

cell, caring little apparently for the world, seems to be the very impersonation of concentrated self. Let it be so: still the fountains which he lays open are nature's fountains, and whatever his aims, the fountains are generous to all.

Science has its non-utilitarian side, its truths of unspeakable grandeur, its beauty of transcendent excellence. But, as long as a God of love rules, the useful will stand by the side of the beautiful and true. The latter are enjoyed by the few, while the useful reaches all, like the water, air, and light. Every new law, learned in any branch of science, is a source of universal good. And thus nature, with her myriad voices, is ever repeating: God is good! God is good!

The world, moreover, is becoming conscious of the good received, and cannot help rejoicing in the blessings. It recognizes that the world's growth, even her intellectual and religious growth, is directly connected with this rising of nature, as from her grave, to man's help; for every new element of power gained, if man is faithful, will strengthen the arms of Christian benevolence, and become leagued for the spread of truth. It is no light thing, in the history of this wide-spread nation, no trivial event in the progress of the race, that steam and electricity have been added to the world's forces. Can we know of the sympathies that run along the wires of a continent and over the globe and not recognize the moral power in those cords of metal? Can we come from the Bible or Tract House, where these agencies are working for Christ, to doubt that God means all for good? They are giving a quicker flow to Heaven's light, and widening its circle of radiance. And if the devil claims to use them too, so he did with the great central force of Christianity, when this was sent forth. Yet the victory shall be to the strong; and where is strength but with Him who shall forever reign?

May not, then, the man who preaches divine truth and loves his race, rejoice over the triumph of mind, and mingle this with other causes of thanksgiving; and, while rejoicing, urge man to trust and press on in the great contest with evil? Or shall he rather come out in rapid declamation

against the growing monster ? or, within his cell, write ill-tempered books about the age, giving vent to his thoughts in words like these ? —

“ Hence there is so much mere talk about the Bible. Politicians magnify the Bible. Are they really going to the Bible, drawing nearer to the Bible, or is the Bible viewed as coming down to them ? Literary men are sentimental about the Bible. Social reformers cant about the Bible. The tendency sometimes manifests itself in an appearance which would be ludicrous were it not profane ; the bully chief of the Empire Club breaks up a meeting of fanatics, as he calls them, because “ they abuse the Holy Bible,” and the vile makers of vile political platforms endorse the act, and the spirit of it, in their canting resolutions about our civil and religious liberties.”
— *World-Problem*, p. 39.

The age has its evils ; but surely this is not applying a Bible-corrective. There is little profit in looking fierce at Science. Her movement is the movement of mind, and is as resistless as that of a planet in the highway of the heavens. And as she moves onward, she shall become inscribed throughout with “ Holiness to the Lord,” but not the sooner for such treatment.

It is not surprising that one who talks of “ transient,” “ pretentious, noisy, arrogant science,” should also denounce what are called the internal evidences of the Bible ;¹ for this is carrying a principle to its legitimate conclusion. It is natural that such a man should see only evil in “ Lowthian criticisms,” and discover in them “ a mixture of the ‘ Jews’ language’ with the ‘ speech of Ashdod ;’ ”² that he should go to the good old days of ignorance and credulity, when there was no “ infidel geology,” for his examples of the loftiest faith ; and that he should take the side of the priests against Galileo.³

Moreover, it is not wonderful, perhaps, that his imagination should be troubled by those dreadful crucibles and magnifying glasses ! which man uses to work out evil from nature’s depths instead of delighting in her “ round, honest, open face ! ” those depths that send forth bad-looking imps

¹ *World-Problem*, p. 31.

² *Ibid.* p. 38.

³ *Ibid.* p. 55.

of science, to haunt the faithful and make them lose their equanimity in fruitless contest with the evil things!

A few weeks since, we were in the laboratory of a friend, a good chemist and a good Christian. He was so blind to the world's welfare as not to know the evil of meddling with crucibles. So he took down one, put in it a mineral containing the essential ingredient of clay, mixed with it some pieces of a very soft inflammable metal, called sodium, and placed the crucible in the fire. There was nothing specially objectionable in the fire, as it was that of a common coal-stove. After half an hour had passed, he found in the crucible, in place of the material put in, a metal, as white nearly as tin, as hard as iron, more malleable than silver, as sonorous as bell-metal, and not liable to rust like iron or copper; and, moreover, it was only half as heavy as iron. It was, therefore, a metal combining most admirable qualities with this remarkable levity. It had been called *aluminium*. He has often performed the experiment; and, along with other believers in nature, he sees from it that at least one third by weight of all our clay-beds, granites, slates, and many other rocks, consists of this strange metal aluminium. In his infatuation about the thing, he will not admit that there is any harm in this dragging of aluminium out of its hiding-place, or any proof about it that nature is hateful or false beneath the surface. Indeed, he believes that in this very aluminium, there is proof of the goodness and wisdom of God, and therefore cause for renewed thankfulness for His gifts in nature.

Another friend delights in using those suspicious-looking pieces of glass, convex on one or both sides, called magnifying glasses. Instead of being satisfied with the eyes which God gave him, he most daringly puts such a glass to his own optics, and ventures to affirm that he sees what was before invisible; and, moreover, he confesses to no compunctions for this prying spirit. He should, no doubt, be content with the "honest, open face of nature;" but he has a curious way, and will look. He sometimes puts a miserable little scale of a butterfly's wing under his magnifying-

glass, and observes a delicacy of detail in its configurations quite in harmony with nature over her broader features, showing new beauties and no trace of imperfection. A display of colors, as well as perfection of form, is often brought out, which calls forth his admiration ; and his Christian soul rejoices in believing, "my Father made them all." Such self-deception would not, of course, be possible, had he listened to teachings from a higher source ; he would not longer grovel among nature's littlenesses, but take big trees, big mountains, and the "fair out-speaking face," to help him, above the world, toward his Maker. Every look at the minims of existence, impresses the truth that God is not, like man, one who makes only big things well ; but that his perfections are seen even in the extremest limits of microscopic vision. What pitiable error ! This natural theology is a dark labyrinth, "where there is just light enough to see the terrific darkness."¹

The same friend sometimes turns his microscope towards a little worm or insect — a contemptible thing, that Nature should have known better than to have made at all ; and probably would never have made, had she not blundered sometimes ; for "nature does sometimes blunder" and "do her work badly." Through the lens, he observes the heart beating, the blood coursing through the body, muscles contracting as the little limbs move, nerves branching off from the nervous centres to play telegraph between the parts of the body ; and thus all the wheels of life are in motion under his eye. He is enchanted with the sight. He pursues his studies, and learns of universal laws of life, and believes them God's laws. But poor miserable man, should he not know that there is danger, fearful danger, to the highest interests of the race, in such lookings ? that this is the road to infidelity, and the more he sees the worse he will grow ? — He reflects that many, very many, look over the broad face of nature and see no God there, and some trust to "pure reason's" wings, and yet descend to the fool's depths. And

¹ World-Problem, p. 326.

he pleads that looking with glasses only extends the field of observation and widens the area of God's glory ; and that what is thus brought to light speaks no less of an Infinite Mind than the "honest, open face." Deluded mortal, that he should not see that evil lurks beneath the face, — evil to man's material, intellectual, and religious interests. This searching of nature dwarfs the mind ; for, are not thoughts, like pyramids, proportioned in size to the square miles of surface on which they rest ? It degrades the whole being ; for, is it not chaining to infinitesimals a soul fitted to rise, in its contemplation, towards the infinite ?

But does not some material good come to physiology, and so to man, from this close study of inferior animals ? So it goes, with this evil age, there is "this continual appeal to utility,"¹ "the everlasting sing-song of the steam-engine and the magnetic telegraph," of "the manufacturing of paints, and soaps, and quack medicines" by chemistry, of the discovery of coal by geology, and other triumphs of these crucible and microscopic men ; they are ever proclaiming the useful, and even pretend to thank God for the utilities of science.

But the thoughtful man says : "the open face of nature" looks, to most men, very much like a lap full of eatables ; and they even buy and sell land according to its productiveness in these materializing products. They look at an apple-tree, and instead of being content to live on its beauty of leaf and golden apples, actually ask "How much a bushel ?" and buy and eat, as Eve ate in paradise. Then running water,

¹ Page 49, The "World-Problem," says on this point : It is urged that chemistry is of vast importance in the practical arts ; it is a great aid in the manufacturing of paints and soap ; it furnishes us tests whereby to distinguish poisons and quack medicines ; as though these ludicrous impositions that science may multiply, but which it will take something more than science ever to drive from the world, were the only kind of quackeries from which we have now-a-days anything to apprehend." Page 50, "And then there is the everlasting sing-song of the steam engine, the daguerreotype, and the magnetic telegraph, as though the rapid transmission of a thought were of vastly more importance than the quality of the thought transmitted, or the age was to be lauded for the improvement of the one, whatever deterioration might take place in the rank and true value of the other."

even glorious old Niagara, is turned into a mill-stream, and the ocean's borders into salt-pans. Thus man looks at that "fair, out-speaking face," and, instead of taking its spiritual food alone, and breathing the atmosphere of heaven, he allows his lower nature to treat the earth as if it were a great potato-bin. Indeed, when autumn comes round, instead of dwelling on the glories of the returning orb of day through the revolving year, the bright flowers and foliage of summer, and the magnificent displays of lawn and forest, hill and mountain, starry nights and storms, he appoints "a thanksgiving" for the successful harvest, as the Jews did in ancient time, because the cellar is full, and the loft stored with corn. Thus even the "open face," the "round, honest face," that "fair out-speaking face," takes, to most men, the aspect of a broad lap; and, so far as its utilities go, it seems to have as depressing an influence on the spiritual man as the manufacture of paints and soaps by chemistry, or the discovery of coal by geology, or the invention of the electric telegraph through the laws of the physical world. And then the old familiar face, which to all has been in sight since the first-opened eyelids of childhood, is very commonplace and unsuggestive to most men; while a look beneath the surface, sometimes awakens the sudden thought that God, in truth, is here. Besides, the "honest, open face," is, after all, a very deceitful one, — making men think that the sun and all the stars go around the earth as a centre, that the planets have a very criss-cross sort of movement, or perhaps go whirling in eddies, and every day's experience tells of some of her outside falseness; so that men now know better than to trust always the "honest, intelligent face," and look deeper for the truth.

What matter if men do blunder? it does not hurt the soul like the perilous searching into nature's depths. There is the free and open heaven above the earth's surface, while, "as we descend into this region, the pure upper air grows dim." "As we get down among the wheels of the vast machinery, we lose the light of heaven above, and yet find no sure standing-place for our groping feet below. It is

like the insect who has gone down into the interior of the great Haarlem organ,"¹ etc. For nature is like a big Haarlem, with "pipes, and keys, and springs and pedals;" and the insect man, to take in its glorious harmonies, must flit aloft to where he may receive the whole chorus of sounds as one.

But the thoughtful man observes, that the harmonies of nature do not all come from big pipes or wide superficies; that, as Elijah was taught, they are not in the storm or earthquake, but God speaks in "a still small voice;" that the deepest wisdom in nature, and its most wonderful music, rise from unseen depths, and not from the surface, open to man's indolence; that nature claims to be, throughout, God's work; and even the minutest point is as much a manifestation of his wisdom, as the "round, honest, open face," and affords as broad a basis for soaring thought. And then he quotes David's words: "Great are the works of the Lord, sought out of all who have pleasure therein;" knowing that it is as true of the works in the creation, which God pronounced "good," "very good," as of his dealings with man. Thereupon his opponent says, with emphasis, that he

¹ Not to do injustice by this fragmentary way of citation, we quote at some length from page 326: "We have presented the two extremes. There is a middle region which is 'neither day nor night,' or rather where there is just light enough to see the terrific darkness. It is the region of natural theology, to use the name without admitting its propriety: it is the dark labyrinth of physical adaptations, as distinguished from ends or true ultimate designs. As we descend into this region the pure upper air grows dim. As we get down among the wheels of the vast machinery, we lose the light of heaven above, and yet find no sure standing place for our groping feet below. It is like the insect who has gone down into the interior of the great Haarlem organ. He is crawling among pipes, and keys, and springs, and pedals; if an intelligent insect, — a supposition that may be rationally entertained, — he may be deep in acoustics, estimating the time of aerial pulsations, or measuring with his microscopic eye the chords that subtend vibrating arcs; but the glorious anthem that rolls above is all unheard, or comes to him only in dull and discordant tones. The comparison is not extravagant. Its justice has been verified in men who have seen nothing but mathematics in the heavens, and chemical affinities upon the earth. This interior anatomy of causation, where there is nought before the eye but passing links, joined letters of which we can not spell the words, with double readings, too, and oft times double interpretations, may be all very curious as matter of inductive science, but it is certainly unnecessary, if not unfavorable, to faith."

should not apply David's words to such a purpose,¹ words often desecrated by being "taken as the motto of a lecture, or occasionally of a scientific book," and, what is less proper, "sometimes found at the head of a sermon, so called, which does the Scriptures the honor of selecting from them a text, whilst its substance, if substance there be, is made up from geology and telegraphs, and the wonderful discoveries of the age." He adds: "Among all the wonders science reveals, there is nothing so truly wonderful as the fact that some of its Professors can stand in the presence of these four great scriptural ideas — the Word, the Spirit, the Ineffable Working, the Divine Repose, and yet babble away about their rock-written revelation."² The revelation in the rocks! "Batrachian clamor!" "Quackery!" "Foolery!" "Insane bigotry!" "Gabble!" "Prattling," "vaunting," "pretentious, noisy, arrogant science!"³ "The lamentably perverted use of the word *inspiration*, in certain transcendental quarters, is bad enough; but it is more defensible and less mischievous than that corresponding abuse of the term *revelation*, which is such a favorite with a certain kind of naturalizing orthodoxy."⁴

The author of the "World-Problem" is ever mixing up the study of nature with infidelity. At one moment he speaks of science as well enough, sometimes says it has grown vastly, and then starts off with a series of denunciations, which imply that science is all bad enough, and worse for its growth. He will take it for granted that natural theology is religion made from nature, and therefore "overwhelming scepticism" (although, as commonly understood, it is the religion of the Bible gathering some thoughts of God from nature), and then he will battle away as if Apollyon's host were in sight, and would surely turn their backs, in cowardly defeat, before his valiant pen.

The flashy sentimentalism of nature-religion, which talks of God's power and goodness, and the beauty of flowers

¹ World-Problem, p. 332.

² Ibid. p. 226.

³ Ibid. Epithets applied to science or scientific men.

⁴ Ibid. p. 333.

and dew-drops, as if they were subjects of equivalent value, which ascends to heaven with the fragrance of pinks and roses, and knows nothing of prayer, the Christian's means of heavenly communion, or of humility and love, his badges of fellowship with Christ, deserves the severest rebuke. And that style of preaching that exults in the progress of science as if this were man's chief hope, rather than one of the means of promoting the far more glorious triumph of the Gospel, merits no less condemnation. But the darkness and labyrinthine features of *adaptations* in natural theology, however inconclusive the argument they afford, is far from obvious. The subject takes its tinge from the mind that contemplates it, and is by no means necessarily disconnected from the final *ends*. Nature is full of adaptations, pressing themselves on man's attention; and it is very bad for us all, if they all are "terrific darkness." It is, in that case, a very pernicious feature of the world; and of course man should be very careful not to see one of these adaptations; or if he sees, he should never put 2 and 2 together, for that would be the beginning of corruption. But we have yet to learn, that the case with us or the world is so bad.

In the relations of the utilities of science to man, the truth is simply this. Here are facts, in vast numbers, poured on the world, through scientific research; facts from nature, or, more correctly, forces, intended for man's good. On the other side, there is mind. The forces are good, mind bad. Which is to be attacked? The proclivity to evil in mind is so great, that it is almost sure to accept good without gratitude, and sink virtue beneath selfishness, when it does not also say: "There is no God;" and it matters not whether the good things come from one source or another, whether from chemistry or crops, the material or ideal. Now what are we to do? Denounce the things received, as a child quarrels with its playthings? Denounce the men who gather them and call them the materializers and naturalizers of the age? Rather let every one who loves his Bible endeavor to promote spiritual life in man. This is meeting the evil in its source. And if wrong principles spring up among the facts,

or worse infidelity from high-flying philosophy, while exposing the error as far as you can, still press on with only greater zeal for the spread of Christian truth, and more earnest labor in turning men to God. Believe, too, that science will run its own errors in the ground, even if it have no help from other sources. When men are right within, facts from without will reach their proper place, and serve their true end in promoting both intellectual and religious elevation.

One great duty of nature, with her finite forms and measured distances, is, like that of objects in the foreground of a picture, to aid man in his conceptions of things more remote, and educate him into some appreciation of the boundless. The "World-Problem" views the matter differently, and objects, as we have shown, to the use of numbers and comparisons with visible things for such a purpose, deeming them mathematical, emotionless, and naturalizing; and, accordingly, it condemns certain works on the "Architecture of the Heavens." But he who remembers that the sublime is not in the thing seen, or words uttered, but in the mind, would not thus write. It is the sublime mind that looks over the broad ocean and feels its sublimity. Most men are so bound to sense as scarcely to rise beyond the actual; while with others, eternal and infinite are overwhelming words that almost crush the soul in their vastness. If a speaker or writer endeavors to enlarge the conceptions of the world of beings whom he sees so intent upon the earth alone, if he states the distance of the sun from the earth, of the earth from Neptune, of Neptune from Sirius, and so carries the mind by stages to the distant nebulae, and then to the thought that the milky-way, with our planetary system, is but one of the nebulae of space, like those that are mere points to the telescope, he may afford no help to some minds, beyond what comes from the expression "worlds of worlds."

¹ World-Problem, pp 117, 118. At bottom of p 118, it says: "We may seek to compensate for this [the disuse of old expressions] by rows of decimals, and frigid conceits of solar systems turned into sand-glasses to measure eternity; but it is all a blank as compared with those mighty pluralities, the *aeons* and *olams*, and 'worlds of worlds' of the earlier mind."

But many will feel the soul expanding with the contemplation, and will acknowledge this as one of God's appointed means of helping short-sighted man to understand his glories. Man may thus talk of nature and see no God beyond, or rise only into the upper regions of æsthetics; but this, as we have said, is more against man than nature.

Science has a great work of good to perform in connection with the Bible. It is true, the Bible can stand without human aid. But fallen man has need of help. He is liable to be led astray by his own heart, and by false opinions around him; and science, if false, may strengthen the evil propensity within, and all perverting influences; or, if true, it may point him in the right way, and confirm right principles. Whenever it proves a helpmeet to the Bible, it fulfils its highest purpose, giving sacred truth a firmer hold on the world of beings whose faith needs support from every source within its range. This is its great end: not to "patronize" the Bible, as the "World-Problem" has it, in its contemptuous misrepresentation of our views, but to remove sources of infidelity arising from misused science; to supply truths that are beyond the compass of the Bible, and elucidate others that have deeper meaning as man rises in knowledge; to check the presumptuous exegete in his eagerness to philosophize, by presenting facts that fix limits to speculation; to bring nature out to view in her true grandeur, so as to enliven the love and increase the wisdom of believing man, and throw some light among groping beings that have not yet cast their eyes upward to a God of infinite goodness. Science here has a great work to perform, and we would say: "Onward, with all your might." And in the same breath we should say, as Christians: "Speed on, and rest not." God has given us his promise of help, as he has not to science; and if the church fails in her mission, it will be owing to her own feeble, faltering, cowardly self.

The "World-Problem" and the "Six Days" have another grave charge against the study of nature. They say that Plato and Aristotle, through "pure reason," soared into regions of loftier and surer truth than modern science is

capable of, the method of the old philosophers being expansive in its influence, that of the other *narrowing*.¹ The question suggests itself: How did these philosophers attain to such an elevation? By what method did Plato acquire his ideas of nature?

We may be excused if we enlarge a little on a point touched upon in our second Article, even if the thoughts are not altogether new.

The mind has the power of gathering, and also, through its intuitive faculties, of expanding and developing, what it receives, and educing truth therefrom, but not the power of originating, without some previous perceptions. Having gathered ever so little, that little, like a germ, may expand or grow to great dimensions, the extent depending on the quality of the mind itself that receives the germ. The faculty, or rather group of faculties, most promotive of this expansion, is embraced in the power of appreciating order or system, and consecutive relations, whether in external nature or moral and intellectual truth, together with a consciousness of the unity of all harmonies; these qualities rendering the soul responsive, as we have said, to the order or system in nature, and involving, as we believe, in the perfect mind, the idea of a one author, God. The growth of the mind is carried forward through the differences or discordants and concordants which it perceives in objects or actions; it being in-

¹ The "World-Problem" remarks as follows, on p. 314, with a mixture, as usual, of truth and error: "No modern school ever entered more profoundly into the questions of origin, first matter, first motion, first form, first unity, first diversity, first organism, first laws, ideas, types, and which was first respectively things,—that without which they could not be things or have in any sense a self-hood or *ipseity*,—no modern school, we say, ever entered more profoundly into questions like these than some of the earliest thinkers. Bacon and Leibnitz may be ransacked for anything on these subjects more acute, and we may confidently say, more satisfactory, than the reasonings of Aristotle in his *Physica* and *Metaphysica*. We might safely go farther up the stream of time, or we might come nearer to our own age, and still find evidence of the position that what is called science is got the only, not even the best, preparation of the soul for the higher cosmological questions, if we *will* discuss them apart from revelation." Then is the error here of supposing that science has nothing to do with the reason, instead of being knowledge systematized by the reason for the use of the reason."

tuitively capable, in itself (though very differently, in minds of different qualities), of judging of error, of preferring the good, of appreciating the harmonious in all departments of knowledge; and the inferiority of a mind, in any of its faculties, is manifest in this, that facts enter and remain mostly as disconnected thoughts, and do not rise into their concordant or discordant or consecutive relations. The mind must start from objects and experiences it has met with, in striving towards any conclusions regarding the philosophy of nature. A few tones of harmony may become the germ of a philosophy of music; while without the experience, the mind, as regards this faculty, would have been a blank. Again, on looking abroad, man sees the regularly recurring events of night and day, summer and winter, the rising and setting of the sun and stars, and the proportions in nature's forms; and there is, here, a response within, if the sensibility be of high order, as much as in the case of musical harmony; and there is a yearning after other experiences of order, system, or harmony, in objects or occurrences around; and as the sensibility increases, nature is found to be fuller and fuller of delight, and the music of the spheres a reality. The mind observes the progress from the seed to the plant, then to the blossoms, and finally the seed; again, from the egg to the perfect being, and so on; and in each case, the being perpetuating itself in a seemingly unending round. This also strikes the chord of system within, and, if the chord be a susceptible one, and the mind vigorously expansive, the idea of growth or progress in cyclical successions becomes a joy to it, and the endless roll of earth's changes a chorus of harmonies.

But it has been well said, that we may be led by the very height of our pleasure in system, to imagine it, where it is not, and so grow in error; for mind is too apt to send out its rampant fancies on the nurtured side, far beyond the truth. We may, in our eagerness, through momentum gathered from nature around us, spring with a bound from the earth to the heavens, or from life on this little sphere to universal nature, and in order to account for successive creations, conceive of creative power dropping seeds of exist-

ences into the womb of a self-subsisting nature, as the husbandman drops his seed into mother earth ; or, with deeper thought, observing that the spirit of man is the man, and, thinking of the life-spirit of an animal as the essence of the animal, we may conceive of life-essences or spiritual types or entities, now and then sown in the seed-time, springing up and harvested, and followed by the declining season, or a winter of decay, all in true cyclical succession ; and so rise to a theory of nature as a separate, growing, sleeping, and blundering individuality, in analogy with the individuality of man.

We may go still higher, and conceive of many natures having thus been made, each to go through with its cycles of activity and sleep, growth, successive germinations, and death ; and regard existing nature as one in a series, that began somewhere in the infinite past, and the germinations in its progress as due to some law of reproduction, or to action on the part of the Creator imparting the life-essences necessary to new births. Thus the mind ascends from the facts of this dull world, to a system which shall embrace an infinity of worlds, and an infinity of successive natures. And should not finite mind exult in seeing, within its grasp, universe upon universe of worlds, reaching from eternity to eternity ?

This is the path by which ancient philosophy ascended to its sublime height. The philosopher started from the earth, from *scientific facts* and *analogies*, indeed, whether so recognized or not ; and from these took his adventurous flight. And is it not from somewhere in those heights, that the author of the " World-Problem " looks down, and talks of the " gabble," " prattle," and " Batrachian clamor " of science ? At so lofty an elevation, he sees only the surface of things, and rejoices in the " honest, open face."

Now, to his misfortune, the elevation is no real one. The ascent is very much such as a man may make by pulling at his ears : if persevered in, the effort might perhaps make the ears long.

We may see the harmonies of earth ; we may take in

all these harmonies as one chorus ; and then, in ecstasy of joy, we should look up and give praise to the one infinite God. This is the legitimate end of all the finite around us. Its very oneness was intended to exhibit God's oneness ; its beauty, perfect order, and unbending law, his wisdom and inflexibility of purpose ; its irresistible energies, his power ; and its passing and past events, his appointed plan of progress through the ages. But when we begin to scale the heavens on reason's wings alone, it ends, whether we think it or not, in an assault on the eternal throne. This is the daring Babel of intellect, of which the brick Babel was but a type.

We see well the feebleness of mind for such attempted flights, in its devising or adopting a "development theory," and suggesting at least the hypothesis, that a monkey might have been straightened up into the body of a man.¹ We see its spirit in its grand nature-system, while the study of nature is held in distrust. Arrogant, pretentious, bigotted science ! Arrogant, because it dares to clip the pinions of such philosophy. Pretentious, because it claims to study God's works, and learn truth therefrom. Bigoted, because its faith in nature, as a revelation from God, allows it not to swerve from the true interpretation of His laws !

Philosophy of the "pure reason" kind, in its ambitious reachings, once claimed that man, and all nature, were but an eternal round. But the records placed in the earth have put a check to that conception, confirming the sacred word, and curbing hypothesis. It thought to make creation a growth from the simple planting of monads, and a beautiful idea it was deemed. But here God's records in the earth put another check, declaring that it was not so. It thought to make a few successive plantings to give out the grand result. But the same records, like a voice from omnipotence coming up from the depths of the past, say beware ! there has been no making of species from species. Man is thus almost forced, by his study of the earth, to acknowledge the Creator's hand. He may walk firmly and joyfully as far as

¹ Six Days of Creation.

² World-Problem.

he has that hand to guide him, and then should bow humbly before him who alone is from everlasting to everlasting.

We have yet to inquire, What is the true idea of nature's individuality.

[To be concluded.]

ARTICLE VII.

BRANDIS ON THE ASSYRIAN INSCRIPTIONS AND THE MODE OF INTERPRETING THEM.

By Professor George E. Day, Lane Theological Seminary.

[The following essay is taken, with some abridgment, from a recent treatise "on the historical gain from the Deciphering of the Assyrian Inscriptions," by Dr. Brandis of the University of Bonn, of whose labors in this department, honorable mention is made in the Annual Report of the Royal Asiatic Society for 1856. It has been translated for the *Bibliotheca Sacra*, not only as furnishing an interesting view of the serious difficulties to be encountered in ascertaining the meaning of these ancient records, and the means employed to overcome them, but also as exhibiting the ground of the distrust with which many of the translations of Rawlinson and Hincks have been received in Germany.]

Not far from the eastern bank of the Tigris, opposite to Mosul, rise two mounds, between which winds a small stream called the Khosser. Upon the northern mound, which is about fifty feet in height, and much larger and higher than the one on the south, stands the village of Koyunjik; upon the southern one, called Nebbi Yunus, stands a mosque [said to be] erected over the tomb of the prophet Jonah, and surrounded by dwellings. Both of these mounds are remains of artificially constructed terraces, on which

THE
BIBLIOTHECA SACRA,
NO. LV.
AND
AMERICAN BIBLICAL REPOSITORY,
NO. CVII.

JULY, 1857.

ARTICLE I.

SCIENCE AND THE BIBLE. NO. III. [CONCLUDED.]

By Professor James D. Dana, ^{Sr.} Yale College.

BEFORE entering upon our discussions with regard to the individuality of nature, we give an abstract of the views on this subject presented in the "Six Days of Creation," and the "World-Problem," with some citations also from Plato, that the reader may better appreciate the point of the remarks that follow.

According to the recent works just mentioned, Nature is a great individuality, so far independent of the Deity, that she may be said to go of herself, to require rest, to deteriorate and decay, to need reviving through the act of the Deity at intervals in her progress, in order to her recovery from her decayings; and that to carry on her series of growths, she received *λόγοι σπερματικοί* or "immaterial entities" (explained to be not merely invisible force from the Creator, but actual "immaterial entities," put into nature) as germs of the existences that were afterwards produced in nature as the womb.¹ Moreover, as all that is finite errs, therefore nature

¹ See our Article, No. II., Bib. Sac., July 1856, pp. 651, 652.

may "blunder," and "work out an idea badly,"¹ though, "in general, she is to be regarded as honest." The author also observes :

"This constant tendency of nature, general or partial, to degenerate from the primal force (or, in other words, when thus left to itself, to manifest its necessary finiteness), this, taken in connection with God's from time to time renewing it, and even supernaturally raising it to a higher law than before, may be regarded as constituting those periods of torpor and re-*viscence* which are so appropriately styled *evenings* and *mornings*."—*World-Problem*, p. 343.

And thus he explains the successive days of Genesis, and the accordance of creation with the "cyclical law, which is the law of all natures."² The idea is presented as follows in the "Six Days of Creation :"

"Not merely is each period considered in its comparative imperfection an evening to the more perfect that follows; but there is, in a still more marked sense, in each period, *considered in itself*, an evening and a morning—a time of growth and a time of decline, a time of energy and a time of torpor, when nature requires a higher power to wake her from her commencing slumbers."—*Six Days*, p. 242.

We should add, in justice to the author, that he expresses a willingness to give up his views, if they can be shown to be incorrect. To secure this end is, and has been, an object with us in our communications.

The views of Plato, as given in the myth in his *Politicus*, and cited in the "Six Days" as "germane to the argument" on nature,³ are briefly as follows: "The leading idea is the one on which we [the "Six Days"] have dwelt, the *cyclical alternation of the natural and supernatural*." The myth says: "At one time, it [the world] is guided by a divine cause, during which *period* it receives again the acquired power of life, and an immortality not innate but imparted by the Demiurgus; and then again, that it goes by itself, being left to itself so long, that even many ten thou-

¹ *World-Problem*, p. 202.

² *Six Days of Creation*, p. 239.

³ *Ibid.* pp. 243-245.

sand years may be occupied in its revolutions." The period under the direct care of the Deity is the period of production, and, in general, the order of things is from death to life ; it goes on for an immense duration, and at last comes to an end, as follows :

" The Divine Pilot, letting go the helm, retires to His secret place of observation, and destiny and innate tendency are left to turn back the revolutions of the world. Then commences the reign of evil. Nature, through all her works, gives signs of woe." . . . " Deteriorations everywhere take place ; first of the vegetable, next of the animal, and finally of the human race ; until, here and there, a small and wretched remnant alone survive." . " The former laws of nature are, at length, all reversed ; until finally, when the cosmos is on the very verge of utter ruin, God beholding it in great extremity, and being concerned, lest, by being overwhelmed in disorder and utterly dissolved, it should plunge again into the limitless, formless region of dissimilitude or chaos, once more seats himself at the helm, and, having arrested it in its course to ruin, arranges it again in order, rectifies it, and thus renders it immortal."

To these views should be added, the notion of types as ideal entities. The world and all things constituting it had, to Plato's mind, an ideal existence, not merely as a thought, but as an actual though invisible entity. The ideas were the prototypes of the sensible.

The points of resemblance between Plato and the " Six Days " or " World-Problem " are as follows :

1. Immaterial entities existing before material entities.
2. The cyclical alternation of the natural and supernatural. (It will be observed, that this is not cyclical alternations in the natural alone, the thought in nature, but also between the natural and supernatural.)
3. Nature " self-subsistent," though originating in a creative act.
4. The occasional revival of nature by one or more supernatural acts.
5. The deterioration and decay of nature, when left to itself by God ; this decay finally arrested by the supernatural act.

We remark, in passing, that the charge of Platonism

against the "Six Days of Creation," is surely not unjust, according to its own showing.¹

This work differs, in one essential point, from Plato; and this is of Mosaic suggestion: in the idea that a supernatural reviving, followed by a decay, corresponded to each of the *six days* of Genesis; while Plato, if his hypothesis were consistently carried out, would make only one revival and one decay for a cosmos; or, taking the myth in its more obvious meaning, as referring to periods in a single cosmos, they are, still, not periods of successive steps of progress, but, as he says, like alternations of fruitful and barren years. The golden age—the Saturnian of Plato—was in the past; and, in his creation of the animal kingdom, he made man come first, and, some time afterwards, woman, and the beasts and lower animals.

Plato, in his *Timæus*, the work in which he especially aims to give his theory of nature, does not introduce the notion of decays and supernatural revivings. He makes but one world—the earth—the stars being "the immortal gods." He holds that before the creation of the world, there was the eternal Creator—the Good and Intelligent. The ideal world, as the archetype of the sensible world, also existed from eternity; and, apart from it, though not without beginning, there was an indeterminate chaotic mass. Within the latter, the ideal archetype was placed by the Creator, making thus the world-soul, and creation went on according to the har-

¹ In the edition of Plato against the Atheists, published by Prof. Lewis in 1845, with copious notes and dissertations, he everywhere manifests great admiration for Plato, though not more than this loftiest of philosophers merits. But the extent to which he apologizes for the Greek sage, and endeavors to prove his accordance in sentiment with St. Paul, manifests the partialities of an advocate rather than the wisdom of a just critic. Many of the views brought forward in the "Six Days of Creation" appear in the notes to this edition of Plato. The more recent work is in fact a development from the earlier thoughts, although with some modifications and additions.

The discussion in the "Six Days," of the meaning of the word *day* in Genesis, bringing out the conclusion, on exegetical grounds, that the days were "indefinite periods of time," is one deserving attentive consideration. But this, as we have before said, is incidental to the main topic in that work,—the theory of nature, which is the special subject of our criticisms.

monic relations of numbers. Thus the material world, and, after it, the organic, came forth — the beautiful and the good displayed in sensible forms. In the closing sentence of the *Timæus*, we read: "Thus has been formed this universe, which comprises all animals, mortal and immortal; a visible animal, containing all visible animals; a sensible god image of the Intelligent God, very great, very good, finished with beauty and perfection, the one world, of one nature."

The account seems to imply that there was a series of supernatural acts in the creation; but this apparent successiveness has been attributed to the historical method of presenting the subject. It speaks of the world as having a beginning in an act of the Creator, but makes it eternal in duration, and not subject to age or decay, "since it is only the evil that would destroy what was beautifully made." Yet Plato elsewhere argues that nature is necessarily finite.

The myth appears to have been written when thoughts rising from the earth, and the bondage of matter with its growths and decays, were occupying the author; and the *Timæus*, when ideas, coming from above, of the Good and Beautiful as the supreme ideal, and God the end and source of all science, "the pattern after whom all is fashioned," gave a very different character to his views of nature. The two proceed from the opposite poles of the good and the evil, which Plato's philosophy was never able to harmonize.

The idea of some kind of individuality in nature, at least as regards a *law of progress*, is not a mere dream. With the ancient philosophers, it was only an inference from changes in animal and vegetable life and other cyclical movements. But through modern research the idea has the basis of actual demonstration. In the world, finite mind stands before the works of Infinite Mind; and these works, as has been shown, are expressly adapted to the characteristics and limits of finite mind. It is, therefore, in a sense, mind studying mind. And among the results to be looked for, is a knowledge of certain laws of finite mind, of the laws of matter and life, and of all progress or history. We have reason-

able assurance, therefore, that what we read, we read aright, if reason is just to itself and to its Author. We hence speak confidently when we say that science has traced out the history of the earth from its youth onward; that it has noted its featureless beginnings, a mere globe of fire; its spreading lands and multiplying rocks, forming continents and rising mountains, coming forth in order; till, finally, it appeared finished, with all its diversity of detail, in climate, surface, rivers and oceans, fitted for its great destiny. So we have read, too clearly to doubt, respecting a parallel progress in living beings, from the time of their first appearance: the earlier tribes, of inferior grade; then others, ranging to a higher level in species; and so on, gaining in superiority, through the ages, according to an exact system. And we have learned, besides, that all this progress, both of lands and life, reached its culminant point in man.

There is progress, therefore, and progress by law, as truly as in any developing germ. The details on this point were, to some extent, given in our first Article. We now pass to the consideration of the question:

What is the true idea of Nature's individuality?

Among species, in the world, there are two kinds of individuality: the *inorganic* and the *organic*. Only the last involves in itself any true progress, or the principle of cyclical developments; and this, alone, can be the type of any plan of progress in nature. Still, the inorganic is at the basis of the organic and of universal laws. We therefore may review some of the characteristics of individuals in this, as introductory to a statement of those in the other, department of nature.

L. INORGANIC INDIVIDUALS.

1. Made of matter, combining or accreting through its ultimate forces,¹ and reaching its perfection of individuality in

¹ It should be understood that modern science knows of no forces in nature but those that were early recognized by man. She has only studied out the

mathematical solids, called crystals; as complete in the first molecule as in the large aggregation, and therefore without any true growth.

2. Capable of change by the reaction of its own and external forces of combination or aggregation, but not by reproduction in cyclical order.

3. Forces characterized by an oppositeness in opposite directions, or what is called polarity; illustrated in the laws of attraction or combination, electricity, magnetism, light, heat. From crystallization, the true organizing process in dead matter, we learn that the three diameters of a prism correspond to axial directions of polarity; so that the prism, in view of the different polarities of its sides, may be said to have an upper and a lower surface, a right and a left, a front and a back.

4. Forces acting by undulations, or an alternateness of movement. The phenomena of light are connected with these undulations. The law of alternateness in the action of force is exemplified also in the cleavage of crystals and the symmetry of parts in many inorganic formations.

5. Forces characterized, in some actions, by a spirality of movement, shown by the dependence of magnetism on the spiral flow or activity of the electric force.

6. A universal sympathy, through all matter; not merely in the direct action of attraction, but, more comprehensively, in a mutual reaction of all forces tending to mutual modification or change, and a certain mean condition as a result of the reaction:—As when two bodies, unequally heated, force one another, through this interaction, to some mean temperature, the particular value of the mean being dependent on the *rate of cooling* in each, as well as the *temperature* in

laws of those forces. Light, heat, electricity as in the lightning, attraction, have been exhibited in common phenomena ever since the world began. Nature cannot keep her forces secret; but the modes of their action or their laws she holds concealed, until they are sought out by truth-loving man. So perfectly is this now understood, and so thoroughly has science searched nature, measured and weighed her powers, and blended them together in one, that the future discovery of a new power in nature is as probable as that the philosopher's stone will yet come to light.

each ; or, as when bodies, in the process of active combination, tend to promote activity of combination in other bodies.

7. Finite forms, finite laws of combination, finite proportions and harmonies.

II. ORGANIC INDIVIDUALS.

1. Made of matter growing through an internal process, carried on by living cellules, and passing, through a rising grade of changes, to an adult organic structure.

2. Capable of reproduction of self, through the evolution of germs, the process going on in continued cyclical order. — The germ, a minute cellule, consisting, in animals, seemingly of oil and albumen, for all species alike, but in each endowed with a special nature or condition of force, on which the peculiar line of development depends ; this force, fixed in character or amount, so that it is no more capable of change, or obliteration, by any mixing of breeds, than the equivalent of oxygen, or of either of the other elements.

3. An oppositeness essential to reproduction, termed sexual ; also an oppositeness exhibited in growth, — as in the root by inevitable law descending, whether in the light or the dark, and the stem ascending, making an upper and a lower extremity in plants, and similarly in animals ; besides which, there is also, in the latter, a right and a left, and a front and a back, the opposite sides being seldom identical.

4. Growth involving alternations or cycles of activity and rest ; illustrated in successions due to the cycles of the year, as the ayers of wood in a tree, marking its annual growth ; in others, due to the cycle of the day ; and for man, at least, to that of the week.

5. Growth characterized by a spirality in its progress ; brought out distinctly in vegetation, but disguised among the higher forms of life ; the spiral being the line of continued progress.

6. A mutual sympathy ; but only between individuals of a species. — But besides this, the process of growth is, to a great extent, under the laws of inorganic forces ; as it de-

depends on the conditions and nature of the material around. Mutual action and reaction, therefore, come in ; and while germs are essentially stable, as stated under 2., they admit of variations, or librations from outside influences, like all else in nature ; and the amount of libration is part of the law of a species, to be specifically ascertained by investigation.

7. Finite forms, finite proportions, and finite harmonies.

The parallelism between certain of these characteristics of inorganic and organic existences, will be observed by a simple comparison of the two, number for number. The alternateness in acting force, besides being expressed in the very nature of force, is seen again in crystalline cleavage (or the quality of splitting, naturally, into thin laminæ), this being due apparently to weakness and strength of attraction, alternating with one another, in the process of aggregation ; and this is parallel with the alternations in the tree, producing its layers of wood, and also in other products of life. The spiral lines, in progress, are at the very bottom of nature, as well as at the top. An expression in external nature comes up, resounding from its very foundation, and with a depth of tone in proportion to its depth of origin. Finite proportions are seen in a cursory glance at the earth's surface-decorations ; and mind, attuned within to harmony, thence readily educed the idea of numbers, as an element in creation.¹ But as we bend down more attentively to Nature, we discover simple proportions and fixed numbers in all her forms and movements : in the laws of the celestial spheres, in the details of the forest and all living structures, in the shapes of crystals, in the relations of the elements, in the flow of light and heat, etc. Instead of a faint conceiving of harmony, we actually hear the many tones that rise in multiplied combinations. And if a mind is not moved thereby, it is because *that* mind, at least, is emotionless.

But we proceed with some other statements respecting organic beings, and those to which beyond, we more particularly refer.

¹ The World-Problem says (p. 101) that the ancients " did not wait for the slow groping discoveries of modern chemistry " to learn about these numbers.

8. In the growth or development of a germ to its ultimate result, the perfect individual, there are, as Professor Guyot states, three epochs: 1st, the germ-cellule produces, through a process of gemmation, a multitude of cellules, preparing for the new structure or organism; 2d, from these cellules, by combination and evolution with continued growth, the organism is formed; 3d, the individual is completed to the adult stage, by changes within and without, and then, there is the development of the new germ in which a following generation is involved. There are thus three epochs, and the last a double one, its second part involving the future.

9. The law of germ-development, as announced by von Baer and others: *The general evolving the complex, through a systematic specializing process of growth*; that is, from the memberless germ, or simple unit, proceeding the finished individual or complex unit, through a progress which, in the whole, is according to the principle — *the general before the special*; the more fundamental qualities of the structure under development being first brought out, and afterwards those less and less general, or more and more special; until, finally, the surface-peculiarities are completed.¹

10. The law of reproduction, *like from like*; that is, the parent is repeated essentially in the developed young, since a specific amount of any kind of concentrated force (see 2., above), can produce only an equivalent in result.

11. The spiritual part of a being is so far involved in the organization, as to continue in regular expansion with the growth of the individual.

12. Besides the *simple individual*, in organic nature, there is also the *compound individual*. The zoophyte tree is made up of many individual animals called "polyps," one having grown from another until the tree was formed, and all being combined, intimately, in the one zoophyte. An apple-tree is a compound individual, of analogous character, in the vegetable kingdom. Among the many polyps in a zoophyte, certain ones only produce ova; as, in the apple-tree, certain buds give out flowers, while all the rest are leaf-buds.

¹ See our first Article, Bib. Sac., Jan. 1856, p. 112.

Without further extending this enumeration of fundamental truths in science, we come now to the question of the kind and degree of individuality in nature, as suggested by nature, the Bible being, here, left out of consideration.

We may consider, first, that free individuality of which man is essentially the type, as adopted by Plato and the "Six Days," and also by pantheists and materialists; and then inquire how far towards it we are borne by science, where the scientific path stops and reason mounts off.

After taking the idea of this free individuality from the analogies of species on the earth, pure reason unaided by science or the Bible, can do no less than follow the analogies faithfully; for this is its true law.

If then Man be the type, we have to admit that nature, through a plastic power or life-force, received at the creation of the germ or its vivification, evolved, in succession, her various parts—that is, the worlds, in all their details; that the progress went on, through this now inherent life-force, to higher and higher conditions in the developments, until the nature was completed; and this, not only for the inorganic arrangements, but also the organic, in all their diversity. And if man has a soul, then nature has a soul or controlling mind, for mind is among its surface-developments, and the very constitution of the inorganic in the earth, has had reference to its being the dwelling-place of mind.

Such a nature may or should have its beginning, or at least the beginning of its development or growth, in the action of a separate Power or God; it should have its period of adult years, age, and decay. If the analogy were perfectly sustained, the final grand development would be the production of the germ of another nature, of similar character, through the medium of some supernatural act; or, less perfectly, a reviving of the decaying nature by the Deity, after Plato's method.

If we assume so free an individuality, pure reason can hardly stop short of the admission that the vegetable kingdom was an evolution, through the plastic energies of nature; and so also the animal kingdom. It finds special Di-

vine interventions for these developments unnecessary. If it be admitted that one planting or act could give birth to the whole, or a large part of one of these kingdoms, why not go further, and let one act give birth to both kingdoms, or one to all inorganic and organic products? It is more simple and consistent for pure reason unaided or unrestrained by science or the Bible to conceive of the creation of a germ that would develop into the completed organism, than one that would require retouching: it is admitting the infinitude of the Creator's power; and the "World-Problem" argues that it is not atheistic. That nature, on this type, should "blunder," or do things badly, produce fungi and the like, as man has freckles and warts, and also have its torpid intervals, would, perhaps, be no inconsistency.

There is another kind of individuality, suggested by the tree, or zoophyte. It would have the same inherent and continuously acting life-force, or spirit, as that above considered; the same succession of growths without external intervention, after the first act of creation; but the surface-developments would correspond to the leaf-buds and flowers of the plant, or the unproductive and productive polyps of the zoophyte. We should therefore have to regard animal life as analogous to the leaf-buds of the great compound nature-individual, and man as the blossom, sending up its fragrance of mind to the celestials.

With such premises, one of these two notions is the legitimate conclusion of reason. It would be easy to put the hypothesis into language that would sound more transcendental. But we prefer to look the thing in the face, instead of leaving it in the clouds.

That we do not err in pronouncing these the natural conclusions of reason, is shown by the fact that the systems of many deists, ancient and modern, of pantheists and materialists of different schools, all follow, alike, the course of pure reason pointed out, as regards the continuous line of development from the first act or cause, or through inherent powers. Plato's theory is essentially of this kind, if taken in its true spirit.

After vaulting to such a height in philosophy, it is very easy to slip out "the beginning," and substitute an infinite series of natures ; and the Deity also, unless the theory requires a duality of powers to continue the line. The human mind, by its very velocity, under the influence of such aspiring views, almost inevitably passes the bound, and makes matter and nature eternal, and either one eternal nature-individual, or a succession endlessly continued.

We arrive, by this process, at a nature-theory in precise harmony with known individuality, perfect and magnificent, and as simple as A, B, C. Its special character would vary with the idea of the Creator to which reason would ascend, and might be theistic, pantheistic, or atheistic, and of several varieties under each.

The "World-Problem," or "Six Days" theory, although adopting the notion of a free individuality, as has been shown, does not carry it out consistently. It admits of supernatural revivings, and then decays, and also blunderings ; but, contrary to the dictates of pure reason, it makes out six revivings, and six decays or periods of repose. Individuality on the earth has its epochs ; but they are epochs of continued progress without intermediate repose, as well as without Divine intervention. The nearest approximation to repose, is in the chrysalis interval in the butterfly. But this is more apparent than real, as the changes are going on within, preparing for the next stage of the animal ; and it is merely a temporary condition in the course of the development. There is, therefore, no basis in reason for such a notion of six alternate decays and revivings. The theory is Plato's less inconsistent theory, adapted to the six days of Moses.

The theory goes so far, however, in the Platonic direction, besides adopting "immaterial entities," as to deny that "the beginning," in Moses, means the beginning of material existence, and to suggest that there may have been, "in time," before the beginning, "many other inceptive epochs in the great spiritual and material works of God." It also holds that the heavens and the earth existed as such pre-

vious to the same "beginning;" and that *light* was in the universe, long before the "first day," in which God said: "Let light be;" on which point it brings forward much argument. The author holds that matter, at some time, had a beginning in the act of a Creator, and that each inceptive epoch was begun by a direct act of the Deity. He claims that his theory of nature, and of "immaterial entities," is in Moses and other parts of the Bible. Upon this, we shall soon remark. It is plain that it does not stand the test of "pure reason."

The hypothetical assumption, in this philosophy, is the idea of this kind of free, independent individuality. Reason, looking at the "honest, open face," and proudly within itself, here takes its venturous leap from this earth of rocks, plants, and animals. And now, to ascertain the precise point from which this leap is taken, we may look from the "fair, outspoken face," to the more truthfully outspoken depths.

The great result of science may be mentioned in a word. It has learned that, in the earth's history, there has been a progress according to a regular system, harmonious in its parts and successions; and that the same natural causes acted through the past as are now at work. This much it has learned. As to methods of first origin, whether of matter or life, or specific forms of life, it knows nothing, and proclaims its ignorance; it only prescribes some limits to speculation. The plan of progress which it develops, it may show to be the appointment of an Infinite Mind. But with regard to the origin of an animal or a plant, it can only say, physical forces of the existing world did not create it: God made it. Between the Creator and these creations, lies a field over which science has run no paths and made no plotting; and here, pure reason has space for her mazy excursions.

Science is guided by facts and analogies; and the only analogy afforded, with reference to such creations, is the single one that they have come forth according to law; whence the argument, that, since the inorganic world has been

evolved through appointed forces acting as natural causes, therefore the system of life, which is according to law in its progress, has so come forth. But science discovers, even in the arrangements of the inorganic world, in its surface-features and other appointments, a reference, as we have observed, to its becoming the residence of mind ; and for this, and much besides, it has no secondary cause to suggest. It therefore takes no advantage from the simple analogy pointed out ; for it is aware that, whether made through natural causes or not, there would in either case be law, and refers all to Infinite Power or Intelligence. And here it must rest, with those who would not build a Babel. Science thus acknowledges its limit.

Moreover, in the very outset, we are met by the absence, in the world or universe, of anything like that systematic organization that belongs to a true organized individual. We see an agglomeration, only, of various kinds of dead and growing things, and we meet with no transitions that favor the view. The earth, after all our searching, shows us only physical forces, that cannot rise into vital ; and vital, that cannot change to intellectual or moral, and affords no analogies of structure that authorize our making, of the agglomeration of combined worlds, an individuality developed, in all its parts, by inherent powers.

The law of progress, and the laws or relations among created things within the reach of study, not the mode of first origin, constitute the true object of scientific research and reasoning. What, now, are some of the teachings of nature, on these subjects, teachings addressed to pure reason, and by reason to be digested.

1. *The earth and the universe one in history.* The earth is one among a number of satellites of the sun, all of which satellites would make a sphere only 1-630th the size (or 1-700th the mass) of the sun. It is one of the smaller of these satellites, being about 1-1,400,000th the size (or 1,355,000th the mass) of the central orb, which it obediently attends. The sun, moreover, is one sphere in a vast system, involved with that system in all its movements in

space, and in its laws of gravitation, of light, of heat ; that is, in the very essence or fundamental qualities of existences. We naturally conclude, therefore, not only that the earth is subordinate to the sun, and also to the universe, but that it was not created first, any more than the hand before the body of which it is a part. The point of the argument here used, is not in the inferior size of the earth, but its dependent relations to the system of the universe ; and science could not, without defying the laws of mind, come to any other conclusion. From this result flow the important principles :

(1) The *fact* of progress, in the history of the earth, implies concurrent progress in every other part of the universe.

(2) The general *law* of progress for the earth, is in analogy with the general *law* of progress for every other part of the universe.

(3) The condition of matter, in the earth's beginning, was essentially the condition in the beginning of other parts of the universe.

These conclusions make the earth's history a type, in a general way, for other worlds and the universe. We know that a single animal, as regards its more fundamental laws of development, is a type for all species of the animal kingdom : the law for one, is the law for all ; so of one plant, for all plants ; and so, we say, of one world for all worlds. This holds true, not for details, but only for the general principles of progress.

The power of appreciating such conclusions, will depend on the apprehension of the unity of God's works — their oneness in forces, in laws, in plan, thought, and end. The earth, although a small sphere in space, embodies the forces that fill immensity ; and deciphering its readings, gives the key to a universal history, which it may take an eternity to unfold.

2. *Correspondence between the progress of creation and the law of germ-development — the general before the special.* We have explained this subject (following Professor Guyot's views) in our first Article, and shown that the correspondence extends not only to the inorganic earth, but also to the pro-

gress of life. There are many details that might be given, which would add to the evidence; but we will not stop.

Reaching back in this line of history through geology, from the present era of finished continents to periods or ages of less and less extent of land, greater and greater simplicity of features, and more and more universal oceans, we come, in the remote past, to a state of general igneous fluidity, a chaos of earth. As the heavens and earth must have had a common history, this line *seems* to point still farther back, to an era of worlds combined in a more universal chaos, when Nature was all one formless deep. This suggestion relates merely to mode of progress in the line of physical causes, and does no violence to any known principles in nature or reason. But with even so good an analogical foundation, science can give the hypothesis no place, without observations carried on through the heavens and earth, that add strongly to the presumption in its favor. These researches are going on; and certain laws, already ascertained as to the forms, densities, distances, and velocities of the spheres in our planetary system, correspond so well with what would have been true in case of such an evolution from a universe chaos or deep, that the tendency is towards a belief in the nebular hypothesis, rather than against it; and this is the most that can now be said.

3. *Correspondence between the progress of creation, and the epochs of progress in germ-development.* We here, again, follow Professor Guyot. The germ of a living being, in its first state, exists, but is inert. Then development, at a moment of vivification, begins. We repeat the three epochs: *First*, the elimination of cells, preparing material for the organism; *second*, the evolution of the organism; *third*, the final perfecting of the being and the production of the new germ. There is thus a first work, a second, and then a third of double-nature, the last part the seed of the future. This is to be regarded as an exhibition of a philosophical principle, that must be true in all development, and it is essentially recognized in different systems of philosophy. There is, in every case of development, an organism, or some organized result-

ant, to be produced, and from this, the germ is to come. The first epoch *must*, therefore, be that of the preparing of material for the commencing evolution; after this, should come the forming of the structure; and then, the completion within, and the new production bearing on the future. It is not a system of progress established simply for the germ: it is the grand principle of all progress, as Professor Guyot urges, whether for embryology, geology, or human history.

Professor Guyot accordingly observes that the earth's inorganic history has three epochs, corresponding in value to the three here mentioned. The first, he reckons from the lighting up of chaos; the second, was the evolution of the universe or its system of spheres; and the last was characterized in the special case of our planet, by, 1st, the completion of the inorganic history of the earth, and 2d, the creation of the new principle, *life* (expressed in vegetation) — this the element of progress in the second era of creation; thus making a double work for this third epoch (as so made by Moses).¹

The three days of the organic history have a similar relation; and in the last of the three, in addition to the completion of the kingdoms of life, man was created with a soul—again a double work for the third epoch, and the soul the germ of the future, or the element whose progress makes the history of the following period in time.²

Creation has thus its two triads of epochs, as it has its

¹ On the third day, there was *first* the appearing of the dry land, as a result of the inorganic progress; and then *second* the creation of vegetation. The separation of the dry land and waters, as Prof. Guyot observes, was the last grand principle brought out in the inorganic history, the change afterward, only carrying it forward to its completion. This is precisely parallel with the facts respecting vegetation. The great idea of vegetable life was expressed in the first creation of a plant, although that plant was but a sea-weed; the subsequent epochs witnessed the progress of the vegetable kingdom by creations successively higher in grade, but with nothing essentially new in idea.

² We refer the reader to our first Article for other discussions on the parallels and peculiarities of the inorganic and organic eras. The fact is there pointed out that *Light* leads off each era, the *first*, light cosmical, the *second*, light to the earth for its days and seasons and the special necessities of organic progress. It is also observed that the third day of each era (the third and sixth) had *two* creations, the *second* of the two bearing on the future.

two divisions, the inorganic and the organic, making in all *six*. To these follows a *seventh*, the day of God's rest and man's redemption; and parallel with this, as Professor Guyot and Hugh Miller have brought out, redemption is the special intent of man's seventh day of rest.¹

Thus comes the number *seven*. The "World-Problem" dwells at some length on this number, speaking of it as "a dual of trinity *connected* by unity," while it should have said a dual of trinity *followed* by unity,—this unity being the time of succeeding history.

We leave the subject for further development by Professor Guyot, who, we rejoice to know, will before long publish his views. We are sure that his work will be read with deep interest, and an admiration of the man as well as his philosophy, even by those who may not adopt all his conclusions.

4. *Nature, or the universe, finite in space.* The fixed and finite numbers and proportions, as to weight, volume, and all molecular actions and conditions, have been spoken of as proofs of the adaptedness of nature to finite mind. There are no infinite blendings between elements, and none between species; so that both the inorganic and organic departments of nature consist of specific individualities of determinate value or characteristics. We have thence an analogy proving finiteness in the ultimate constitution of matter; that is, that matter consists of finite molecules or particles,—a fact which also may be otherwise proved. Ascending to a view of the universe, we may infer with equally good reason, that is, from *finiteness* in other char-

¹ Some minds would sooner pronounce the harmonies in the Mosaic account accidental, than admit any true philosophy there. But with us, they are most impressive evidence of the divinity of the chapter. With every perusal of the sacred narrative, we feel more deeply the truth, that only He who created could have written the history; the wisdom of the works is the wisdom of the word. The inorganic, the organic, and the spiritual, were the three grand steps in creation; and the Bible account makes three days for each of the first two, and the present time for the last. Its accordance with the true formula of progress, as Prof. Guyot calls it, can be no accident. There is no more reason for attributing its order of announcements to "chance" or man's unaided thought, than the succession in creation itself. Admit such a notion and you prove the chapter a myth.

acteristics, and its oneness of origination and historical progress, that *the universe is finite in its space-limits*. What there may be, in space, beyond our finite universe — what “mansions,” or systems, it is beyond philosophy to say, or the finite mind to know, before it passes the bounds of its present existence.

5. *Nature finite in time : the fact of her beginning and her final decay*. Since we can fix, through geology, a beginning to the era of man, and so also can trace all the units of earth — its species of plants and animals — back to a time when they first appeared, the time of their creation ; and beyond this, can make out a progress in the earth’s past, corresponding to the general law or formula of progress illustrated in the development of a germ, we have conclusive evidence that there was a time when the earth’s progress began ; and therefore, since the earth’s progress is the type of progress through space, as argued above, *the universe had a beginning*.

We have to admit that what is created cannot be infinite, for infinitude is an attribute only of the Creator ; and if we make the universe infinite, either in space or in time, we necessarily sink into pantheism or atheism. Hence in proving the universe finite in space and a unit in origination, we go far towards proving the fact of its creation by an independent Being or Creator.

Going back in the earth’s history, we pass through eras of greater and greater heat, to a time of complete igneous fluidity, when the earth was, itself, a sun. The moon also affords evidence of having cooled in a similar way. From the laws of light, its direct connection with heat, as well when produced by electricity as in other cases, we know that the spheres in space, shining by their own light, are also suns, having a high temperature. The history of the earth from chaos, and these other facts, thus indicate that the progress of the universe, in its history, has been a progress from a state of intenser heat than the present ; and that a diminution of heat, or cooling, has been going on from the first. This is so, whether the nebular hypothesis be true or not, but to a much greater extreme if true.

Intense light is dependent on, or connected with, a state of extremely rapid vibration of molecular force. The condition, in earlier time, may therefore be expressed by reference to molecular activity, as one of its intensest action. Light, of course, as we ordinarily understand it, is a subjective existence, our eyes being so made as to perceive, through their sensibility to certain rates of vibration; that is, to those rates that observation has found to pertain to light of different colors; and the special rates for our earth (for there may be different rates on other spheres) were ordained in the creation of eyes among animals. By characterizing the period in terms of the vibrations, we avoid any reference to seeing eyes.

Now this process of cooling, to which we have alluded, was unavoidable with the existing laws of matter, unless all space were so filled with heated matter that there could be no cooler space into which to radiate it, — a condition that would have admitted no change, and therefore no progress. But with one or more finite heated bodies in colder space, and space perhaps not absolutely empty, there is, in this respect, the duality essential to development. A gradual refrigeration would be involved in the very existence of those bodies through progressing time, preparing the way, in its earlier states, for new creations; and, in its later, leading on towards a decay of all things. For, since cooling must be still in progress, it is natural to infer that the suns are getting colder, though imperceptibly so, and must end, as has been urged by some writers, in becoming quite cold. Like all else that is finite, therefore, the end of the universe is apparently indicated in its early history. A cold sun would be death to all that lives in our planetary system; and a cold universe, a dark, lifeless nature. We may know too little of the truth, to pronounce this the actual mode of final decay in nature; still we have reason to conclude, from the finiteness in this and other qualities, and the fact of a beginning, that the universe is finite in time in the future, as well as the past.

6. *Partial decays attending the course of progress.* In all growth, there is attending decay. The animal body is in incessant movement, growing and dying, in all its history.

Besides this continuous flow, there is also, in growth, an adaptation to new conditions of existence, involving certain changes of structure. So the earth, in its^o geological progress, passed through changes of climate from hot to cold, and changes in the waters and land ; and these involved a passing away of the old species of plants and animals, as the new conditions came on. We have abundantly illustrated this, in our first Article, where it is shown that destructions of life followed destructions ; creations, creations ; and thus the earth was in incessant change.¹

Speculating on such decays in nature, the mind rather naturally thinks of some deterioration in vital force. But in fact, these so-named decays (really destructions) were largely due to changes of level in the earth's crust, a raising of the sea-bottom out of the water, over regions of continental extent, or even larger surface, destroying all sea-life, and a sinking, obliterating land-life. This old-fashioned cause of destruction is yet at work, though more limited in its effects, destroying individuals rather than species. Igneous action was another efficient cause ; and this cause also still acts, in a weaker way. Besides these, the change of climate in progress through past ages, operated ; but not so much in causing the extinction of species as of tribes, by bringing about conditions which were not favorable to any new creations of species under certain of the old tribes fitted only for earlier time and circumstances. It may also be, that species have died out from exhaustion of vital force, independent of such physical changes ; but of this we have no evidence. Moreover, this would not be precisely accordant with the analogies of animal life. For in an animal the decays attending growth are connected with the general progress of the organism, and are not due to independent finiteness in the parts themselves.

¹ Twenty or more sweeping destructions occurred (besides other partial ones) on this continent after the appearance of animal life (that is, through or during the 5th and 6th days of Genesis, and mostly the 5th), and a larger number in Europe. The catastrophe after the coal period in North America corresponds to the *middle* of the *fifth* day. The World-Problem has a remark about this catastrophe, which is based on a misunderstanding of the facts.

7. *Nature's Types.* This subject has been explained by us, but may have here some additional elucidation.

In the progress of the creation of the animal tribes, as well as plants, there could have been no system or order, unless the kingdoms of life had been constructed according to predetermined plans of structure. Such plans there were, as has been stated, and they are called *types*. We speak of quadrupeds, birds, reptiles, and fishes, as formed on the *Vertebrate* type, since a single plan, the vertebrate, is at the basis of the whole. So fishes were made on the fish-type, one subordinate to the vertebrate. These types are presented to us for study in species. A common plan of structure may be, in a similar way, at the basis of a number of related machines (say printing presses), which were made one after another for different purposes, by modifications of a general idea; and each such machine would be an example under the type. We may say that such a machine, once thought out, existed before it was made, as an idea in the mind of the maker; and if the series could have been foreseen, the whole series might thus have had an ideal existence. An idea of the type, or general plan, would involve certain constants as the type-basis: and upon these, a number of systems of variables; that is, plans of variations in the parts, as to their relative size, form, etc. A type without variables in its parts, would have but one species; and with variables, the species might be indefinite in number.

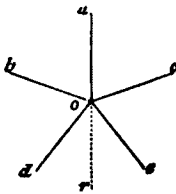
In nature, every part of a living structure is, to some extent, a variable, although some parts are far more so than others. In the Fish-type (which, in its elemental idea, comprises a series of vertebræ, with a brain at the head-extremity, a spinal cord along the body in a bone-sheathed cavity above the vertebræ, a ventral cavity beneath, and respiration branchial or by gills), the form and number of the vertebræ may vary, the amount of stony material they contain, the length of the processes and the ribs; and so also the bones of the head, the fins, skin, scales, muscles, etc. Moreover, all things are so exactly balanced in an animal species, that is, so harmonious, that a small change in the form of the ver-

tebræ, for example, involves some modification in every other part or organ of the species, and such a one as is required to keep up the just relations of the structure.

If there were any method of expressing the type and its systems of variables in mathematical terms, we might give it a definite mathematical expression. We might next think of the force corresponding to the type, or equivalent to creating the fish-type, as a particle of some specific size, — and as germs are spheres, we might as well give it a spherical form, in our conception, as any other; — for this thought is within the range of idealizing mind, although facts oppose this notion of the fish-class or any other coming from a single positing of force; and although, too, we have nothing sustaining this conception of creative force. But, this done, the mind still cannot conceive of the type-structure as an entity in space, as it cannot have a distinct and permanent conception of a variable image, although it should know the law of its variables.

We allude to this point, not from its bearing on the question between Nominalism and Realism, but to illustrate the subject of types; and for this end, we add another example.

Suppose we have, as the type, a star; the stellate form, *one* constant; symmetry between the two halves (either side of line $\hat{a}r$), a *second* constant; the star, five-rayed, a *third* constant. This symmetry requires that, however a , b , and d vary, in all cases $b = c$, and $d = e$; and also for the angles, however they vary, that $aob = aoc$, $bod = coe$, and $dor = eor$. Now suppose a system of variables, on this idea: *First*, the star, being equal-rayed and equiangular, let there be an equal variation of length in all the rays alike. This is one system of variables. 2. Let there be a symmetrical variation in length, but not an equal variation for all the rays (a , b , d differing, but $b = c$, and $d = e$). 3. Let the angles between the rays vary, still retaining the symmetry. In nature, this third system of variables would, as a necessary requirement of harmony, accompany the second.



We have then, by these methods, the rays and the angles varying through a multitude of forms and sizes according to mathematical law, for we suppose it a result of a process of evolution, the type-idea being a five-rayed symmetrical star of no particular size, form, or angles. This is a simple case of variation on a type-structure; and it will be a convenient practice to attempt to conceive of the type-structure in the midst of its variabilities.

4. Let the rays vary in breadth as well as length, and equally or unequally (though always symmetrically, as explained), through linear, oval, lanceolate, triangular, and other shapes, and according to a law for each; again, 5. let the rays vary in thickness, equally or unequally, through cylindrical, prismatic, lamellar, triangular, and many other forms. And while the rays thus have breadth and thickness, the centre will have the same, and may vary in form; be flat, conical, ovoidal, etc.: or the rays may disappear altogether, and the form change to a simple disk, or, by lengthening upward, into a conoid, ovoid, spheroid, or a long cylindrical shape, etc. The *constant* is here the same ideal star as at first, but with the addition of breadth and thickness.

6. Let the rays of the star (of 5) vary in their markings or ornament, and be few or many branched; 7. be hollow within, under various conditions; 8. vary in texture, between stony and fleshy; and also in color.

9. Let the stony material be in pieces put together like beads, in order to make the rays; or the surface be made of plates fitted together, or of grains of various forms; or let the fleshy material be thick and opaque, or clear like jelly, the rays short and simple, or long and fringed; let the surface be smooth or covered, with spines; and let all these variations take place according to a perfect system of evolution and harmony.

10. Let now the star-type (of 4, 5, 6, 7, 8, 9) be an animal: this adds to the constants of the type the fundamental qualities of animality, viz. sensation, growth by food taken and digested within, reproduction by germs through

sexual relations, and a superior surface differing from an inferior in its functions and forms. It adds to the above variables (as to form, texture, structure, color, kind of symmetry) many new variables: as, to a mouth, whether with teeth or with none, etc.; as to the form of the teeth and their modes of movement, etc.; as to the stomach and its appendages, and all their variations; as to the liver (if any) and its variations; as to the system of reproduction; as to means of movement, taking food, etc.; as to senses, or none, etc.

11. Let, again, the number of rays, instead of five, be a multiple of five; or let it be four, or a multiple of four; or six, or a multiple of six; or let the number be indefinite.

12. Let the radiate structure be not strictly the rays of one or more mathematical planes, but of a spiral approximately circular, and this, like the above, a result of systematic evolution — a fact of all apparent circles in plants and animals.

We have passed these steps in review, in order to give some idea of the *Radiate* type in the animal kingdom, the simplest of its *four* grand divisions or sub-kingdoms. With mere animality in its lowest forms, and no senses but touch and sight (the latter usually wanting, and at the best imperfect), the type-idea includes a radiate arrangement of the organs externally and internally, and a symmetry between the two halves either side of the medial line. These are the *constants*, and the true basis of our notion of the type. It is to be observed, again, that these constants are not constants as to form, proportions, size, color, or texture, those qualities which are necessary, at least in part, in all mental images. There are limits to each system of variation; and, in this respect, the variables become constants, but in no other. Again, it should be borne in mind, that all the variations are so harmonized, that a change in one part involves others throughout a structure. From the abstract notion of the type, the mind obtains a conception of the whole system under it, as far as it can, by flashing along the systems of variables; and whenever it rests for an instant, it has lit on

some special example or species under the type. An idea of a certain amount of force equivalent to creating the sub-kingdom Radiata, if we could give it size or quality as compared with the same for the other sub-kingdoms, would not be a conception of the type-structure. Moreover, as we have said, all such notions of force are empty of knowledge, being without a foundation in reason or nature.¹

Under the type Radiata, there are three grand subdivisions: POLYPS, MEDUSÆ, and ECHINODERMS; and these have, each, their subordinate groups; and these, again, others, and so on. Now the type of one of the subdivisions, is the type for the Radiata with the addition of certain other constants, these other constants, for the highest range of subdivisions, being constants as to some of the more fundamental qualities of structure.² And so one system of constants is added after

¹ We have shown that there is no foundation for such an idea in geological facts. There is no evidence that any group of species was ever made through one process of development (see our first Article, Bib. Sac., Jan. 1856, pp. 122-127). Many of the various genera of animals have had their species distributed over several geological ages, each period having a new set of species, but all constituting the one genus. The genus *Lingula*, as has been remarked, began with two or more species in the earliest period of animal life, and has been continued, by a succession of new species, through all periods since, to the existing era. The animal kingdom has thus been brought forward by its new creations, partly through new genera and tribes replacing the old and extinct, and partly through the perpetuation of the old groups in new species. We must admit that there was somehow force used by the Creator in creation; and this is the end of knowledge, and should be the end of speculation.

² We mention some of the characteristics of these three subdivisions:—

POLYPS. A simple stomach and large ventral cavity, without ramifications; the circulating fluid, consisting of chyme (the first result of digestion) and water from outside; form, like a flower, the mouth being at the centre of a disk which is bordered by tentacles; in the normal state, the mouth, extremity upward, the polyp being attached to its support by the opposite extremity; texture fleshy, sometimes secreting coral internally.

MEDUSÆ (Sun Fishes, Jelly Fishes).—A stomach with radiating ramifications for the distribution of the circulating fluid, which consists of chyme and water; form usually a convex disk, concave below in the normal state, swimming with the mouth downward; texture usually nearly transparent, looking like jelly.

ECHINODERMS (include Star-Fishes, Sea-Eggs).—A stomach with radiating ramifications; chyme changed to chyle before passing to this system for circulation; also a distinct system of vessels for water circulation; mouth at the centre below; exterior of the animal usually made of calcareous (stony) plates or grains, and often covered with spines,—the name Echinoderms referring to this fact.

another, for each subdivision, i. e. the *class, order, tribe, family, genus*. And even for *species*, which constitute the last grade and include individuals, there may be still some variables as to the less essential qualities of size, proportion, color, and other external peculiarities, and upon these variables the *varieties*, under species, depend. We might continue these illustrations; but this is not the place for further detail.

This subject derives additional elucidation from the nature and development of germs. The whole structure and history of an animal is involved in the characteristics of the invisible germ-cellule. It is the material entity that represents the species; and which, once made, if in the circumstances fitted for development, will produce the perfect being to the finish of every organ. This it accomplishes through its inherent powers and their extrinsic relations, by bringing matter around it into its own state, and going on, rising or expanding in its scale of productions, according to a serial order, unto the final result.

The characteristics of a species are, therefore, not merely the qualities of this resultant, but the characteristics of a serial line of developments from the germ to the complete individual, which has, all along its course, for each species, some characteristic differences. We have no proper comprehension of the animal until we understand this series in its history, and the law of the series, through all the variables that partake in the progress. The law of the series may be supposed to admit of mathematical expression, though incomprehensible to minds on the earth.

These germ-cellules consist of the elements, carbon, oxygen, hydrogen, nitrogen, with a little sulphur and phosphorus, all of which are present in both the waters and the earth. To make one of these infinitesimal germs would require, then, the union of these elements, through some external power (for as inorganic material they have no tendency, of themselves, to unite into such compounds as constitute the germ), which power should also, either in the constitution or otherwise, unfix the line of serial development, that is, the sub-kingdom, class, order, tribe, family, genus, and species, to

which it pertains. If the power of such a germ may be expressed by a mathematical number, the mind might give the number a lodgement, and compare it with other numbers. It might conceive of the proportions of the elements combined, if this were known. But a conception of the germ in its potentiality is, after all this, an idea that as much demands time for its development, as the evolution of the germ itself.

Through the various grades of types that rise one above another, in unity of law and subordination, and the parallel unity in the germ, we gain some apprehension of the absolute perfection of system in the kingdoms of life. As we comprehend a species by understanding all its phases in its serial line of developments and their law, so we have a complete idea of the animal kingdom, not from existing species, but from bringing to view the succession of tribes and families along the line of history.

In attempting to conceive of the relations among the comprehensive types and those subordinate, we should not bring to mind a system of ramifications, as if the animal kingdom were like a tree with its great and small branches and branchlets—although this is a common notion; the comparison to a universe of systems in space is far more exact. The animal kingdom is a vast all-comprehensive system. The vertebrate sub-kingdom constitutes one of four grand systems within it; the fish, bird, reptile, and mammal divisions, are other subordinate systems or clusters of groups. Then the fish-type embraces its several subordinate systems; and these, still others, more subordinate. Thus there are systems within systems, in as perfect harmony as the systems within systems of the universe. And the terms in classification (genus, family, tribe, order, class, and so on), when correctly used, correspond to systems of greater and greater comprehensiveness. Each system is essentially distinct from the others of like grade, though approximating to adjoining or affilient systems by their borders, or through aberrant and usually inferior species. There are serial lines of species in nature and parallelisms among groups, but they are subordinate to this grand plan.

8. *What was put into the earth and waters, in the act of creation?* Science does not answer this question. It only says, that the germ-cellule is the simplest condition of the animal, and that if the germs were made in the waters or earth, that is, if the elements there present were, by any power, brought into the new state of combination they have in the germs, and vitalized, and at the same time they were so surrounded that they could develop, they would grow and thus contribute to the peopling of the earth. The surrounding circumstances necessary for development, are for the hen, just such as attend the germ-cellule in the egg, that is, the presence of albumen and other ingredients which contribute to the growth of the embryo. Had such ova been created of elements *in the waters*, it would have been true that "*the waters brought forth*;" if of elements *in the earth*, as truly, "*the earth brought forth*" (see Genesis, ch. i.). We only know this, — that the power of creation was exerted; and if germs preceded the perfect animals, then, of course, it was exerted in making the germs.

We repeat that we have no evidence that a group of animals has, in any case, been made from a single positing of force. Science has discovered no method of looking beyond the material entities to the "immaterial." It claims not to fathom the Eternal Mind. It leaves it for "pure reason" to flutter, clap its wings, and look the sun in the face, *if it can*.

9. *Nature's Unity.* This subject has been, more than once, alluded to in the course of our Articles. We here pass it in brief review.

The unity of nature is declared —

1. In the universality of the laws of molecular forces: one law binding the universe together in harmonious movements; the same light passing from star to star, in recognition of their one brotherhood; the same heat coming from the heavens that rises from the earth's depths or is struck out of her rocks; the same elements and laws of combination in the wandering meteorites as in our own sphere.

2. In the harmony among all molecular forces: magnet-

ism, electricity, galvanism, being but different conditions or modes of action of one power; and this one power probably the same with the universal chemical attraction; and this attraction so intimately related to cohesion, that the laws of crystallization are a fertile source of knowledge as to chemical composition; while heat and light appear to be but attendant effects of molecular activity, and have many analogous laws.

Electricity (or galvanism) and chemical attraction are so closely related (if the former be not a mode of action of the latter), that the decomposing action of the galvanic current on different substances is exactly proportioned to the combining equivalents of the elements. The combining equivalents, for example, of hydrogen, oxygen, chlorine, lead, are: $1 : 8 : 35\frac{1}{2} : 103\cdot7$. (That is, oxygen and hydrogen unite, in the proportions $1 : 8$, and $1 : 16 (= 1 : 2 \times 8)$; chlorine and hydrogen, in the proportion $1 : 35\frac{1}{2}$; chlorine and oxygen, in the proportions, $35\frac{1}{2} : 8$, $35\frac{1}{2} : 24 (= 35\frac{1}{2} : 3 \times 8)$, $35\frac{1}{2} : 32$, ($= 35\frac{1}{2} : 4 \times 8$); chlorine and lead, in the proportions, $35\frac{1}{2} : 103\cdot7$, and so for other elements). Now, 1 of hydrogen with 8 of oxygen = water = 9; $35\frac{1}{2}$ of chlorine and 103·7 of lead = 139·2. A current decomposing 9 parts, by weight, of water, will decompose 139·2 of chlorid of lead; and also, the decomposition of 9 parts of water develops an electric current just equivalent to decomposing 139·2 parts of chlorid of lead. Again, the combining weights of the elements, and their degrees of specific heat, have an inverse relation; or, in other words, equivalent parts have the same specific heat, or some simple ratio; as, $1 : 2$, $2 : 3$. Heat, moreover, is equivalent to a certain amount of mechanical force; so that heat and work have a definite relation, there being a loss of heat in steam, for example, precisely proportioned to the amount of work done. This, as well as the fact that change of size, by contraction or expansion, is a precise measure of change of temperature, brings heat and attraction into one category.

Thus the molecular forces, or so-called "imponderables," seem, to science, to be falling under one general law, or a single duality of force.

3. In the fundamental laws of structure, growth, and reproduction, common to all living species, vegetable and animal — this unity being seen in the universal law of reproduction from germs through sexual relations, the male and female functions being as distinct in plants as animals; in celules as the constituent element of organic structures; in the growth by means of arrangements for of circulation, respiration, digestion, secretion.

4. In the unity of system in each of the great kingdoms of life, the vegetable and animal.

5. In the cyclical relation of the vegetable and animal kingdoms, binding the two together into a single mutually-compensating system, the one a counterpart of the other, and both blending in with the laws of inorganic matter.

6. In the adaptation of nature and finite mind to one another,— nature's numbers and harmonies being pleasurable to the human soul, and all her beauty, wealth, and strength calculated to promote man's development.

7. Historically, in the parallel laws of development for the germ, the vegetable and animal kingdoms (looking at them through geological history), the earth, and — may we not say — the universe.

In consequence of this unity, the physics of the universe, even to the profoundest laws, are involved in a drop of water, and the grandeur of nature is dependent on the qualities of molecules. It is for this reason that man learns more of nature's secrets from her infinitesimals than from her large masses. Going to these minims for knowledge, is going our farthest towards the source of nature's energies.

10. *Nature the work of Infinite Mind, and its great end the nurturing of finite mind.* By proving that the inorganic and organic went on their systematic courses of progress together, through long ages of the earth's history, and that both reached their climax in the Age of Man, science makes the existence of mind not only a fact, but a prophesied fact; and not a prophesied fact merely, but an end towards which the past was tending, precisely as much so as the body, by development, for the uses of the soul. He who knows how

to interpret the arrangement of the lands and waters of the earth, and the reliefs of the continents, as well as the fitting up of the earth with its veins, ore-beds, and strata, sees that every mark and point has been ordered by Infinite Mind for the development of finite mind; and that the human face is not better suited for the outflow of the spirit within, than the earth's appointments for man's education as an intellectual and moral being. Indeed, man's virtues, vices, and various emotions, high and low, are, to a great extent, portrayed in nature, so that if, in his early development or afterward, he needed to speak of a moral quality or feeling, there was some animal that was its seeming personification, to act out and give permanency to the mind's impressions, and so aid him in extending his language over abstract thought, and increasing his knowledge of himself. The world of plants also is full of sentiments, and nature is ever in seeming communion with the sensitive soul. This is a common thought; still, it is not always appreciated how much man's development is indebted to the ideas embodied and acted out in the inferior living things of earth.

Years ago, when the evidences of mind in the earth's structure were little appreciated, and physical forces but half understood, the tendencies of science, as regards its relations to revealed truth, were not altogether manifest. But as the exact powers and limits of these forces have become more perfectly known, their oneness in system recognized, their completeness as a full revelation of the powers of inorganic nature apprehended, and also their subordination to mind as a final end, man's faith in nature has tended to develop faith in an Infinite Mind above nature. Knowing of no law on earth for turning matter into mind, and believing in the impossibility of such knowledge, he naturally rises, in a single thought, from nature to God. And hence it is that the old materialism is not a natural growth from the science of the present day. The healthy mind, trained in inductive science, rests not in inscrutable physical forces, because its faith is so implicit in the scrutable; it sees no foundation for a belief in world-souls, for organisms are definite organisms in

the natural world, involving specific structural relations; and it therefore appeals to an Infinite Being, rather than stop in the half-way house of Pantheism. This is the tendency of thought, if not always its result.¹

¹ We do not mean to say that science leads to no evil consequences; we could not say this of fire, light or air; but only that they are not its legitimate effects.

The wonders of science are to many minds little short of miracles, and the quick succession in which they have flashed upon the world, during the past half century, has tended to produce a spirit of credulity in wonder-working powers, and cherish among the unenlightened, a belief in the superstitious. And hence the world is now alive with necromancers, astrologers, and spirit-mongers. Science is as much to blame for this, as the sun for shining with all its brilliancy into a now clear, but once shaded, dell, and starting up new crops of weeds. Proper culture is required to remedy the evil, and not improvements in the face of the sun.

Much mischief is flowing from the misapplication, of scientific analogies, through the strong tendency of the mind to resolve the spiritual through the material, or the infinite through the finite. There comes forth the superstition of spirit-rappings, one of the mind's abnormal productions, and it bolsters itself up by an assumption of some new "magnetic" force, without considering whether the laws of force (its necessary mathematical relations) are complied with in the reputed phenomena. Thus a heresy gains strength from the false claim of a scientific basis.

Again, the searching out of natural causes in creation, increases faith in the natural, and engenders development theories. Such generalizations are partly a consequence of the progress of science, in connection with man's perverse and perverting nature. But the Bible also in some hands, even after prolonged study, has led to the hypothesis of development theories.

The great fact that in individual growth, the germ or infant expands into the intellectually endowed being, and the mind varies with the condition of the brain, as if all were a material result, is the most fertile source of materialism man has to encounter. Yet there is no more obvious fact in nature; it has been long known, and it presses the idea of natural causes as omnipotent, upon the mind of every rising generation.

It is not a discovery of Science. Still it has gained some seeming strength through the extension of our knowledge of natural causes; and the special truth in chemistry that tends to carry the mind towards this theory, is this; that rising in the scale of being is rising in the scale of chemical products, and in man the seat of what is called the mind, that is the brain, is the highest of all such compounds, that which is farthest removed from the results of mere dead forces; as if matter had here reached a height or kind of combination through the properties of a living structure that of itself evolved the faculties of the so-called mind, as other combinations possess other active qualities.

But with this extension of science, is coming also a truer appreciation of the limits of natural causes, and thus the evil has a corrective springing from its own place of origin.

Nature's teachings with reference to the special attributes of the Deity, come, as others have argued, through man's own constitution, and the adaptation of the world to mind, to which allusion has already been made :—man's power as a cause or agent, suggesting a First Cause ; man's mind, together with the system in nature and its adaptations, an Infinite Mind over creation ; man's affections and sense of right, a Being of infinite love and righteousness ; man's free-will and self-consciousness, an Infinite Freewill :— in other words, a Personal God, infinite in power, wisdom, and love ; for the Creator must be equal to the best of his creations in their highest qualities, and, more than this, he must partake of these qualities to infinity.

If we pursue a path down the lower pole of nature, the material, we descend to the obscure starless depths of inexorable fate. If we rise along the opposite pole, the ideal, we may go on till we lose sight of the material, and reach only an empty infinite, no less cheerless. But keeping both the material and spiritual in view, as two distinct elements in combination in man, we may then begin to read nature aright, and rise to a true view of the Being above nature.

11. *Nature's Individuality.* The study of nature, as we have shown, has brought to light laws of forces, movements, and systems, among material things, and laws of progress in individual life, the kingdoms of life, and the earth's history, and it tends to establish the unity of all in one plan. But physical forces, life, and mind, still remain as three distinct uncommutable elements, the progress of research having served only to widen the gulf between them. We have reached no theory as to the mode of origin of matter, of life, or of the soul ; or of a living species, high or low. Science simply reads nature's story of herself, and interprets according to reason's established methods ; and where nature stops

The misuse of truth, is no sound argument against Science, any more than against the Bible. It proves that the only safety in the case of each, is in a thorough and faithful knowledge, proceeding from a pure love of truth ; and we would add, a love of both of these orders of truth united, the latter to preside over the whole being, and promote the right and harmonious expansion of the former.

teaching, science stops learning. It is true, then, as stated in the outset, that between the creations and the Creator, science claims to have run no paths.

The individuality science perceives is, therefore, that of a world or universe that has passed through a regular systematic course of progress, from its early chaos to its completion, under the action of ordained inorganic forces and laws, and with the institution of the kingdoms of life through the creation of living species ; the whole the work of a Being of Infinite Intelligence, whose power has sustained the forces and laws he ordained, who has guided the earth, it knows not how, with reference to its being the residence of mind, and whose connection with man and the universe it leaves among life's mysteries.

Our argument, based on nature's teachings, has given us reason to believe that the universe had a beginning, and will have an end ; that it has its limits in space ; that its progress has been a regular progress, like that of germ-development in its system and epochs, and with only such decays as were necessarily involved in its progress and the one final decay ; that, from the beginning to the end, it corresponds to but one grand cycle of progress, like one progressing individuality among living species ; that with man it reached the Day of Rest or Divine Repose, its meridian of life or finished growth, when the education of mind began. The accordance of this progress with germ-development, it should be understood, is not in any specific resemblance in the parts to those of a germ, but an accordance, only, with the two grand ideas it involves, namely, *the general before the special*, and *the triad of epochs* ; and this resemblance exists, because these are the fundamental principles in all progress under system.

If man goes beyond this study of progress, to specific methods of first origins of any kind ; to the mode of positing creative force ; to the method of germinating a plant-kingdom or an animal kingdom ; to notions of a self-working force in nature that develops more than self by reaching to higher and higher grades of results, or to hypotheses about

chemistry developing life ; and life, mind ; to the idea of an infusion of mind or soul through the gross material of the earth, in order to the origination of the earth's ingredients, arranging her features, evolving her results, and bringing out a self-made earth or nature, as if self-creation were possible for a universe any more than for a tree ; to conceptions of ideal entities back of the material, or to thoughts of a Creator throwing, now and then, the reins on the back of a rampant stupid nature ; the bold plunge in the dark is not to be charged to science. It is reason's own audacity, and let her have the credit. We may find, in nature, the cyclical law of all natures, but not the cyclical alternation of the natural and supernatural, appealed to in the "Six Days ;" this deterioration of nature at intervals, because she is left to go alone, is against all analogy in a growing individuality, and without any proof in facts.

We may here recapitulate the points which we have sought to illustrate.

1. The earth and the universe one in history.
2. A correspondence between the progress of creation and the law of germ-development.
3. A correspondence between the same progress and the epochs of germ-development, making three for the inorganic history of the earth, and three for the organic, or six in all.
4. The universe or nature finite in space.
5. The universe finite in time, both as regards the past and the future.
6. Progress involving decays or destructions throughout the earth's history, and as frequent creations ; the destructions being consequent upon the gradual change of climate and the movements in the earth's crust which were carrying forward its own development.
7. Nature's types or plans of structure, involving systems of variables upon a basis of constants ; the characteristics of a species presented in the characteristics of its line of serial developments from the germ onward ; conceptions of types, species, germs.

8. What was put into the earth and waters in the act of creation.

9. Nature's unity.

10. Nature the work of Infinite Mind, and its great end the nurturing of finite mind.

11. Nature's individuality.

It should be understood that science arrives at its conclusion through inductive reasoning, which is not, and cannot be, absolute demonstration. The conclusions are such as pure reason, under the influence of nature-truth, is persuaded, not forced, except by its own laws of action, to adopt. And we are not aware that any of the conclusions are heretical, or that science arrogates to itself the special privileges or rights of the Bible by these annunciations.

We may now compare a few of the more prominent of the views of God and nature, and see where we stand.

1. CHRISTIAN THEISM, I. *God*, infinite in wisdom, power, and love, and a moral Governor. *Nature*, a progressive work, from "the beginning," through successive original creations by God, and laws and ordained free-working forces kept in action by his power.

2. CHRISTIAN THEISM, II. *God*, as in "1." *Nature*, a work, during the interval of time preceding man, wholly by direct creations or fiat; since man, by laws and ordained forces, sustained by God's power.

3. COMMON DEISM. *God*, infinite in wisdom and power. *Nature*, a progressive work or growing individuality, set agoing by God, and left to go on alone.

4. PLATONIC DEISM. *God*, infinite in wisdom, power, and love. *Nature*, an individuality, having a world-soul, which is a præxistent immaterial representative of the sensible world, put into nature by God; sometimes for ages left to go alone, and then deteriorating and ending in decay; requiring, for revival, a new act of the Deity, and thus involving, in the course of her existence, a cyclical succession of the natural and supernatural. In the *Timæus*, nature without decays or revivings; the world eternal in duration.

5. "SIX DAYS" THEISM. *God*, as in "1." *Nature*, nearly as in "4," as to decays or "going alone" and revivings; but world-soul not included, although immaterial entities admitted as preceding material entities; also differs in making the periods of revivings and decays correspond to the successive days of Genesis; the heavens and earth and the light created long before "the beginning" mentioned in the first verse of Genesis.

6. "VESTIGES" DEISM. *God*, infinite in power, but nearly resolvable into no-God. *Nature*, an individuality, growing by inherent forces, from the first inorganic mass, to man; the animal and vegetable species proceeding from evolved monads as the first forms of life, through a series of successive developments; matter, eternal. Graduates into Atheism or Pantheism.

7. PANTHEISM. *God*, identified with nature, and having no existence as a personality. *Nature*, an individuality whose totality is God; its successive developments, successive manifestations of the divinity; finite mind, the highest evolution — these manifestations, in this last step, reaching self-consciousness.

8. ATHEISM. *God*, none. *Nature*, an individuality growing by inherent natural forces, in or over which there is nothing divine or spiritual; mind, an evolved quality of matter.

The view of nature and of the Deity which we have entertained, is the first mentioned in the above review. Precisely this, and no other, we aimed to present in our former Article; and we have regarded it as the doctrine of the Bible, and the common belief of the religious world. We doubt not that the waves and running waters move through inherent powers and not by direct Divine action; that, in a sense, nature carries forward her own work. But we believe that he who established the forces of matter and their laws, still, by his power, keeps those forces and laws as they were established; and so nature pursues His work while acting under inherent qualities.

Pantheism merges the Deity in nature, and knows no In-

finite Mind on the throne of the universe. But the God we adore, and have acknowledged in our writings, is real although incomprehensible in his personality, a beneficent Parent, a righteous Lawgiver, a merciful Redeemer. He created; and He has thus carried forward, in infinite wisdom, his plan, and continued in action the system of forces, under law, which He established by the word of his power. This is the "Logos" in nature.

After this discussion of nature's individuality, we may turn aside to notice some statements on this and related subjects in the "World-Problem."

Charge of Pantheism. There is, first, the charge of pantheism against Professor Dana. In style of language it is like the rest of the volume, as will be seen from an example. On page 338, it says:—

In his [Professor Dana's] attempt to talk piously about God in nature, and to make others atheistical, the writer, without seeming to be aware of it, runs down into sheer undiluted Pantheism."

After several pages on the subject, the point is finally demonstrated by three propositions, according to which, the "World-Problem" view of nature is the only one that is not either atheistical or pantheistical. The work then speaks of "modern physical speculation ignoring that old doctrine of the Logos in nature;" and adds (p. 352), that "until this doctrine, now hardly recognized even in theology [sufficient proof, if none else were at hand, of the author's delusion], is made a fundamental and all-pervading axiom, science must be atheistical." Ergo, science can never be theistical until it adopts doctrines hardly recognized in theology!

Nature's Blunders. The nature-theory of the "Six Days" and "World-Problem," is quite consistently carried out; and the *reductio ad absurdum*, in which it ends, would convince any one but the author, of its fallacy. In the first of these works, mushrooms or fungi seemed to be set down among nature's unaccountable mistakes or abnormalities.¹ And now, in the new book, it is a principle that, since all

¹ Six Days of Creation, p. 172.

that is finite errs, therefore nature may "blunder," and "work out her ideas badly,"¹ besides becoming weary and going into a temporary decline. The *Hyle* of the ancients, in which the ideas, that is, "immaterial entities," were placed, has done the best it could — for this would seem to be the doctrine; but inherently limited and unpliant, it gave the ideas but an incomplete expression, and was ever exhibiting its imperfectness or gross nature; and sometimes it manifested its low qualities in giving out mushrooms, in spite of the ideas of the good and beautiful that pertained to the eternal archetype, or emanated from the Infinite source of all good.

But if nature be an expression of the purpose of God, can we, with truth, speak of her blunders? His laws were sent forth; and whatever appears abnormal or normal in nature was involved in those laws; and shall we say, if that plan admitted of deserts over the land, excrescences on the oak, lice and fleas and intestinal worms about living beings, and monstrous births, that nature does her work badly? Disease and death are part of the same system of evils; are they also blunders? Are they chargeable to nature acting out, in any true sense, her own unfortunate propensities, or to God as expressing his will in nature; that is, in the system which He established? We can offer, here, but a few brief remarks in reply to these great questions.

The institution of death is universal for all life on the earth. It is in the history of every plant and of every animal; and is, therefore, in the very foundation-laws of nature. Moreover, since death is directly connected with growth, and, in a sense, grows out of it, the laws of life are, therefore, bound up with laws of decay. A single mullet has been found to contain thirteen millions of eggs, and a codfish eleven millions. These facts give no extravagant view of prolific nature. They exhibit a profusion of life to meet a profusion of death. Life is the *in-flowing* stream; death, the *out-flowing*; the *in-flow*, in such a world as ours, necessitating the *out-flow*, as much as in any current-

¹ World-Problem, p. 202.

movement. The expression, in the opening chapter of the Bible, "whose seed is in itself," therefore assures us that, on the third day of creation, *death* as well as *life* became an established ordinance in the earth's history.¹ All the conditions which these laws of decay necessarily demanded, we cannot know; and still it is plain, that they required a liability to evil from some extraneous influences; for growth itself is dependent, largely, on the external. A system of evils is, in fact, embraced under the grand principle alluded to on a former page, that throughout all nature there are mutual reactions,—a condition of one substance affecting the condition of others,—or a process going on, hindering or promoting other processes; and this for the inorganic world as well as for the organic, or rather, as the basis of the same in the organic. When crystallizing a salt, we are sure to get a bad result if the normal conditions required for the purpose are not attended to. So each development or step of growth in a living being, demands certain normal conditions for its perfect accomplishment; and if these precise conditions are not at hand, perfect results cannot take place. Besides these, there is the certain inherent decay of the finite.

Thus it was the purpose of Omniscience, in the earth's creation, both in its foundation of rocks, and its superstructure of life, that possible imperfections should be concurrent with the perfections. And the analogy runs through all things, up to man's moral nature; but with this difference, in the last mentioned, that it is connected with a power of choice and resistance in the free soul, or is voluntary, while it is involuntary in the physical world.

It should also be considered, that death is not only an appointed end of the life of individuals, but an ordained means of feeding a large part of the animal kingdom; and these carnivorous propensities were acted out in the earliest geological epochs. Death being the ordered end, what did it matter whether it came by natural decay or external agen-

¹ This topic is discussed at considerable length by Professor Hitchcock, in his *Religion of Geology* (Boston, 1855), Lecture III.

cies? whether it should be hastened or retarded in individual animals of the globe? The facts in nature reply—*nothing*, whether we are wise enough, or not, to say Amen. And of what concern to man, if true to his mission, when death but opens the gates of Paradise?¹

Deserts are due to the laws of atmospheric circulation, and are located thereby, as much as the moister forest regions; we may go deeper, and say, that they are involved in such a world as ours, in the very nature of matter or a particle of matter; and no cause short of sinking the lands, to a very great extent, in the ocean, or altering the laws of molecular forces, would rid the world of deserts. The evil may be partly averted, but not prevented. It has been so averted over far the larger part of America, by the lofty range of mountains along the *western* shores, whence flow down the great rivers that water the continent. Had those mountains been located along the *eastern* shores, the side which receives the moist winds (unlike the western), they would have condensed all the moisture of the Atlantic or trade-winds, and poured it immediately back into the sea (like the *eastern* mountains of Africa), instead of allowing them to blow, far and wide over the land, laden with continental showers. The evil is still further averted by the great Gulf of Mexico on the south, and the Lakes to the north; and, in Europe, by the Mediterranean. Who dare say that nature blundered in making the earth's deserts?

Another lesson may be learned from the rocks. We know

¹ Man, like the rest of nature, is subject to the one great law of death. And had he not fallen, the out-flow, we may believe, would still have been necessitated by the in-flow. Like other beings, he was created male and female, and commanded to multiply, and in his perfect state, the world would have had no wars or pestilences to retard the increase. From the teachings of Christ and his apostles about heaven, we know that, to enter there, a change of the earth-born body, whether corrupted by sin or not, was required; and therefore a time of change was necessitated, when, to each individual in succession, earth should cease and heaven become a reality. We may call this change death: but it would not have been death as now experienced. It would have been only a welcome beginning of a brighter life,—a waking to celestial glories. It would have little concerned man, whether, in the change, he laid himself down and slept, or were otherwise translated; whether by one process or another, the old body returned to its original elements.

that crystals are the perfect individuals in the inorganic kingdom. And yet in all rocks, crystals are rare exceptions, for irregular grains make up the mass instead of regular crystalline forms. This is abnormal as regards the true perfection of individuals; and yet the rocks are all the better for it. Here is another fact based on the fundamental constitution of matter, the very laws that have ever been at work; and they afford little evidence that nature was ever left to follow an erring course by the Deity.

All creations in the kingdoms of life, the lowest and highest, are equally parts of one system; and the most insignificant is often the mightiest agent in the great work of nature. No being, but one who can claim equality with the Deity, may play critic or draw rude erasures over lines that offend his private judgment. The spirit that thus arraigns the Creator, belongs to the tribunal that would say: "Away with him."

Let us bow humbly, and not challenge the Infinite Being with light or reproaching words on the origin of evil.

In this theory of nature, we have a key, not only to the whole philosophy of the "World-Problem" and the "Six Days," but even to all their extravagances about science. For if nature "blunders," if she sometimes does her work badly, and is only "generally" honest, is she not a contemptible subject for man's study? Is she not transient, and may not the truth we learn, be like refuse to a future age? So the work argues, in very fact. The author of the "World-Problem" charges us with interpreting his words "phenomena" and "appearances," as if he meant "phantasmata." He proves them phantasmata by pronouncing all truth but a seeming, that will turn out error,¹ like the old elephant; and should we not suppose he meant what he said?

Is the theory of nature of the "Six Days" in the Bible?
We have shown clearly that the "Six Days" theory of nature is not in accordance, either with pure reason (that is,

¹ Six Days of Creation, p. 38; Bib. Sac. for Jan. 1856, p. 89, and July 1856, p. 64.

reason with the help of the "honest, open face"), or with science (that is, reason with the aid of the out-speaking depths and all truth in nature). We now come to the special claim of the author, that it is based on the Bible.

Where is the Bible foundation? Mainly here. The word "created;" the phrases, "*Let the waters bring forth,*" "*Let the earth bring forth;*" the succession of *evenings and mornings*, in the account of creation; and the recapitulatory statement, that "*God made every tree before it was in the earth*" (Gen. 2: 2).

The theory is, that nature was six times revived and set to work, by the putting in of "immaterial entities," and six times left to herself to go towards decay. It is not merely that God acted at the commencement of six periods, and then rested; but that, in these intervals, there was a great decline in nature's forces, in consequence of the withdrawal of God's hand.

Is this a fair interpretation of the words of Genesis? or is it not evidence that, while the author has avoided science, he has gone to a less truthful source for his philosophy?

Create. The meaning of the word *create*, has no necessary bearing on the question with regard to nature (except as respects the beginning, to which we allude beyond); for, the signification of evolution, framing, or developing, which the "Six Days" would give, is as well answered by the views we have presented. Moreover, the derivation of such a word, is little evidence as to its actual use.

"*Evening and morning.*" If these words, in connection with the first, imply that nature passed through a period of revival, from an efflatus of "the supernatural," followed by a period of rest, on the part of God, and decline in nature, then it was so on the fourth day, when, according to the author of the "Six Days," the creation of the sun and stars was simply a becoming visible to the earth. May we recognize, in such progressive changes, a reviving and a decline?

The Bible speaks of the creation of vegetation, on the third day. But are we to understand from what Moses, our authority here, says about the fourth day with its evening

and morning, that before the sun appeared, nature went through a period of decay, as to its vegetative and other forces?

The account does not read, *morning and evening*, but *evening and morning*. If the word *morning* came first, there would be a show of support for the notion of an evening of sleepiness and decay, after the revived work. But it is the *evening first*; as if the idea of the writer were simply that of progress. Where does he speak of a poor, limping nature, inveterately bent on sleeping after work?

Finally, the first day had also its evening and morning; and when was the period of decline corresponding to that first evening, *before* the first work?

We comprehend the grand truth, if we consider that the *darkness* of chaos, as the first day opened, was followed by *light*. The great epoch of progress was correctly described by the words *evening* and *morning*, the darkness and then the light; they denote progress to the finished work, and serve well as a general formula for all epochs. The declaration of God's pleasure over the finished work of each day, and over the whole work at its close, looks little like nature being left, at any time, to her waywardness. The seventh day is the day of rest, according to Holy Writ.

"*Let the waters bring forth,*" "*Let the earth bring forth.*" These words are regarded as sustaining the Platonic notion that "immaterial entities" were put into the waters and earth in order to the development of the kingdoms of life. But if the germs were created in the waters and the earth, with elements there present, as already suggested, the accordance is as literal as if the hypothetical entities were first put in. Moreover, in that case, also, "the trees of the field would have been created before they were in the earth, and every herb before it grew." But from the nature of the record and of human language, we still regard the fact that the life of the fifth day was mainly *marine*, and that of the sixth characterized by the *terrestrial* quadrupeds, all the accordance the text demands.

There are some other texts brought forward in behalf of the "immaterial entities," on one or two of which we add a few words.

St. Paul says, in our Bible, Heb. 11: 3, " Things that are seen, were not made from things which do appear," the thought being generally regarded as equivalent to an assertion of creation from nothing; and, in the Greek, it stands, *μη̄ ἐκ φαινομένων*. The " Six Days " makes the Greek *ἐκ μη̄ φαινομένων*, and translates it (p. 224) " Things that are seen were made (or generated) from things that do not appear," i. e. from " immaterial entities."

With regard to this reading, the " World-Problem " repeats what is stated in the " Six Days," that the reading *ἐκ μη̄ φαινομένων* is " sanctioned by the two oldest versions, the Latin and Syriac, brought out by Calvin, and sustained by the best modern German authorities;" and, in the " Six Days," the German authorities mentioned, are, Tholuck, Olshausen, and Ebrard.

Again, in Col. 1: 16, our translation reads: " For by him were all things created that are in heaven and that are in the earth, visible and invisible, whether they be thrones," etc. On this passage, the " Six Days " says, (p. 227) that " the invisible " are the " unseen dynamical entities, which are not only the *law*, but the *life*, of the phenomenal and material;" thus again making Paul a good Platonist. But are these the invisible things of God, of which Paul here, and elsewhere, speaks?

A further argument from Heb. 11: 3, is derived from the spirit of the context. It observes (p. 226), that " Faith is the evidence, not of what *is not*, but of what *is*," though unseen; and afterwards adds: " How beautifully the symmetry of the argument is presented in the Syriac and Vulgate versions—' Faith is the evidence of things unseen;' for, by it ' we understand that (in creation) the things that are seen came out of, or were born of, things that are *unseen*;' " and then argues that the faith referred to is in unseen dynamical entities (!), and not in the great facts of creation, which were equally unseen; that is, a faith in the originating forces of nature, and not in God as Creator—directly against the spirit of Paul's teachings with regard to faith.

Now the simple fact is, as we are informed by one of our profoundest biblical scholars, that not one of the known Greek manuscripts sustains the reading *ἐκ μὴ φαινόμενων*; that the two *versions* or translations referred to (the Vulgate and Syriac) are only indirect testimony that, possibly, such a text once existed, while it is as possible, and more probable, that the "ut ex invisibilibus visibilia fierent" of the Vulgate, and the corresponding phrase of the Syriac, were translations from a text like our own; and, further, that the above *ἐκ μὴ φαινόμενων* cannot be correct, as the Greeks would not use the negative *μὴ* in such a case, but the negative *οὐ*; so that this reading is not only bad Paul, but bad Greek. On this point, the best Greek authority in the country sustains, as we know (and so must all Greek scholars), the assertions of standard German commentators. We leave the rest of the argument for the criticism of others.

The phrase *invisible things*, in the Vulgate, if it were the right translation, would not mean, necessarily, "unseen dynamical entities." The second verse of Genesis speaks of *darkness* over the face of chaos, whose beginning the first verse announces; and this would meet all the requisites of interpretation without the "entities." But it is an objection to such a view that it makes Paul reckon creation from the third verse of Genesis, instead of the first.

We believe it now demonstrated, that the author of the "Six Days" brought his philosophy to the Bible, instead of taking it out of it by faithful exegesis. And if it has no foundation in the Bible, none in pure reason, none in science, how far is it worthy of commendation? How far, of reprobation?

It is not wonderful that the "World-Problem" prefers "imagination" to sober science. The same convenient assistant carries him over "the beginning" in Moses, as we have said; so that we have nature waking and sleeping *before* "the beginning," as well as after, and the heavens and earth, and light also, earlier creations. The great thought, "the creation out of nothing," which has been believed to come forth from the opening chapter of the Bible, which is

in the spirit of every fiat, and of the whole Jewish Scriptures, and which is in bold contrast with all other cosmologies, is set aside. The "World-Problem" says: "The writer [Professor Dana] really thinks that Moses, by the word 'beginning,' meant the beginning." We will not controvert the statement. The argument drawn, by the "Six Days," from the word "created," has been ably met by Professor Barrows,¹ and shown to afford no reason for audaciously staking out "the beginning" forward of the first beginning of the universe.

The blank before creation. There is another argument worthy of note. Speaking in favor of the framing of the world out of the invisible entities, and against "the beginning" as the beginning, because this presents a blank to thought, in contemplating the past, he says (p. 277) : —

"We understand, notionally and logically, the proposition — *what is, once was not*. We can carry it, thus notionally and logically, to the extreme negation of all sense-conception; but what have we left, but a blank in thought, unless the sense reacts, and images a dark nihilism, as, in some way, the material *ex quo*, out of which all things, in some way, came? We may, at any time, if we please, have this blank thought as a refuge against that apprehension of matter's eternity, which some would regard as the sum of all heresy, and which the author himself holds to be atheistical. But when we have reached such an extremely rarefied or rather nihilified negative, what is it, for strength, and vividness, and power of religious emotions, as compared with the conceptions aroused by the radical images of these Arabic and Hebrew words? [that is, a creation, or a framing, without any thought of a beginning.] If God has made the revelation in this manner, by way of "accommodation" to us, why should we not be accommodated by it?"

What is this, in effect, but an argument for the eternity of matter? Stop where we will, in going back in time, suppose any *bona fide* beginning, and we come to a "blank in thought;" and if there is reason for setting the beginning one step back, because of such a blank, why not another, and another? If the argument is not utterly puerile, it makes no stopping place possible. The author, if he please, may have this blank thought as a refuge against what *some*

¹ Bib. Sacra for November, 1856.

make the sum of all heresy ; and he, only atheistical. But what a refuge is this ?

It is surely true, as we have said, that the human mind which daringly attempts to fathom the Infinite, almost of necessity will find a God gradually fading from before it, matter stretching on through eternity, worlds going alone and blundering at times, and development-theories becoming beautiful. If the "World-Problem" stops short of the last fatal step, its system of philosophy does not. This is sufficient reason for pronouncing the teachings of the "Six Days" infidel in tendency ; and the "World-Problem" has added force to the charge. To one grubbing through the solitary depths of the Ego, the light of Heaven "grows dim" indeed, and many a rank heresy is started up. The author of the "World-Problem" speaks truly of the unknown pouring upon us fast, as we go back or on in time ; and adds, that "unless we fall back on revelation [so far, well], or some unscientific *à priori* principles, as some sneeringly call them, all becomes a guess, a fool-hardy assumption, that has not even the dignity of a conjecture." The door by which he enters his labyrinth, is thus made obvious.

Use of science in exegesis. False philosophy is prolific in the errors to which it leads. Among these errors, is the canon of Bible interpretation announced, "that the only office of science is to stimulate inquiry, and chiefly in cases where it may have already had an obscuring influence on the meaning of a text" (p. 67) ; that, in exegesis, we "must divest ourselves of science" (p. 65, 75), at least that which was unknown to the writer of the work ; that "the Bible should be interpreted of itself and by itself" (p. 59).

The canon might seem plausible, if the writers of the Bible were, in every sense, its authors, and there had been no directing Mind to guide them to language about the creative acts, or other subjects, embracing truth which they could not fully comprehend, and which should ever expand with increasing knowledge. It might seem plausible, if all knowledge of facts in nature were not knowledge of facts in sci-

ence; if man were not a part of nature and an object of scientific research; if language were divested of all reference to natural objects; if man's life had no dependence on the material things which now splice into his very existence; if truth of any kind were hurtful to the interpreter. It might have some shadow of foundation, if finite mind, the power brought to bear in interpretation, could be made a fixed, unvarying force.

But when we observe how completely man, in his thoughts, language, and necessities, is enveloped in the world, and penetrated by it, and when we consider, further, that the mind is of exceedingly diversified character in different individuals, and far more diversified through those extrinsic influences that aid in developing it, that it is liable to adopt errors of facts and philosophy, and even stand by them as Divine, we cannot admit any such exclusion of one part of knowledge from the brain or active force of the student. When we find that a mind may be so permeated with Plato's views of nature and type-essences, as to claim them to be a true result of exegesis, may we not bring up nature, God's own work, to withstand Plato, or such an exegete?

It is the wonder and glory of the Bible, to be free from all statements of scientific principles. Its truths stand forth in their majesty, little aided by human knowledge, and not contaminated by its ignorance. But exegetical operations are human, varying with the nature and furniture of the mind, and the moral character or the training of the individual. While it is plain, therefore, that the meaning of the Bible is all that should be aimed at, there is no truth that may not have its place, either in suggesting or extending thought, or warding off proposed or adopted exegetical error.

In Deut. 14:7, our translation says that the camel, the hare, and the coney were unclean animals to the Jews, because "they chew the cud but divide not the hoof." Would not a whisper from science, that the hare and coney do not chew the cud, have helped the translators?

St. Paul says: "all nature travaileth with pain until now," and an interpreter infers that, with Adam's fall, mountains

were thrown up, and deserts made, and the whole earth was stamped with horror, and joined in the wail of nature. May not evidence, gathered from the earth, be used to prove that there were mountains and deserts, and louder groanings than now, before man was created? From the same and other texts, interpreters have concluded that, with the fall, death first entered the world. But may not the proof the earth bears, that there was death among shells, corals, fish, reptiles, birds, and quadrupeds, before man, be uttered within the hearing of such an interpreter? and if he should take heed to the evidence, would he be defiling himself, or the sacred text, by receiving meat from idolaters?

If an interpreter suggests the query, after his profound and prolonged study of the first chapter of Genesis, whether the monkey were not straightened up into the body of a man, may not truth, gathered from nature, sound a gentle no in his ear? and should he not take it kindly?

Indeed the author of the "World-Problem" admits that scientific truth may sometimes be used by way of suggestion. But it must be careful not to suggest any error in his own conclusions.

The truths of Science once generally accepted among men, are not ideas which we can believe or disbelieve at will. If the evidence is appreciated, man's very nature forces him to believe and continue to believe. When geology proved that time, before Adam, was long, and that the formation of the rocks took place through natural causes, it became a truth, which evidence from no source could set aside, without unsettling faith in both God and reason.

The natural, in creation. This point — the natural in creation — the study of the earth has made clear; and, although the theological world, with a rare exception, had otherwise understood Genesis, regarding creation as a series of simple fiat, Chalmers early admitted the evidence; and now, most writers on the first chapter of Genesis receive the proof from Geology, and derive thence new views on the Mosaic narrative.¹ There are few, like the author of the "Six Days,"

¹ We refer the reader to the remarks of Prof. Barrows on this subject in the *Bibliotheca Sacra* for January, 1857.

who will adopt the conclusion and at the same time deride the source. The comparison, in our first paper, is quite apposite; and, for a reason that will soon appear, we repeat it. The "Six Days" had said of Geology (p. 98) :

"Infidel as her spirit often is," she is "driven, more and more, to acknowledge the mixture of the natural and supernatural, in the production of the earth."

To which we replied, repeating the words *geology*, *natural*, and *supernatural*, "very much, we think, as a current is driven by the boat it carries; for, *geology first* proved that the natural was involved in creation, and, with a rare exception, has always admitted the supernatural; and she has finally drawn off exegesis so completely into the same course, that some, like Prof. Lewis, as they are hurried on by the current, exclaim in great glee over their wonderful progress; and, in remarkable self-complacency, look down frowning upon the current that they imagine is trying to keep up with them."¹

We acknowledge, after re-perusing the passage in the "Six Days," that we misunderstood its exact point, for the author seems to have had the *supernatural* especially in view. But other statements in the "Six Days," and the sneers and arguments on pages 156 to 169 of the "World-Problem," aimed at the remark that "Geology first proved that the natural was involved in creation," make the criticism just. We might suspect also that he has since misunderstood us, and gathered from our sentence, above cited, the absurd idea that exegesis had been *driven* by geology to admit the *supernatural* (instead of the *natural*, our actual meaning), were it not for the arguments just referred to; for we can otherwise hardly account for his style of harangue over the boat scene. We quote a few examples:—

"There is no mistaking the meaning, or certainly the spirit, of the representation. The writer did not intend to be impious. The professed ortho-

¹ Bib. Sac., Jan. 1856, p. 93.

doxy of his literary position would lead him to speak well of "the harmonies," etc. ; but he is sometimes off his guard," etc. (p. 152.)

"There is no mistaking this language, nor the spirit from which it proceeds. It is a spirit, we say it boldly, that is more odious than the avowed infidelity that has led scientific men (some of them, perhaps, in deep sorrow) to regard the Scriptures and scientific discovery as hopelessly irreconcilable. It is a language, moreover, we say it fearlessly, which is, and ought to be regarded, as an insult to the Christian world. It was an insult to the Biblical Editors of that *Biblical Review* in which, by a circuitous route [we were not aware of this, before], he sought to obtain an influence for his criticism which it never could have had on its own merits. It was an insult to every clergyman, unless it be those who regard this mode of defending the Scriptures as better and more available than interpretation. Such are pleased, doubtless, because it so piously patronizes Moses, and makes him so much more scientific than they had imagined. But what is their occupation, not to speak of their vocation, if the above paragraph be true, either in its letter or its spirit? What are the clergy, what are orthodox Professorships, what is Yale-College or Andover theology ; what are *Biblical Reviews*, if the Bible is indeed such a nose of wax, which can be made to suit any countenance, and Biblical faith such a "floating boat" on the current of science, as this writer has so unmistakably represented it." (p. 154). "We say it fearlessly, there is no form of Bible rejection we would not respect more than the spirit of the above quoted passage ; there is no position of infidelity we would not openly avow, rather than be the author of such a declaration." (p. 155.)

"Geology," says Professor Dana, "*first* proved that the natural was involved in creation. Here there is something very sweeping. No room for modifications or exceptions. Has he traced the consequences of this far-reaching assertion? What, too, must we think of its modesty, when we keep in mind the connections in which it is said, and the references it invariably suggests? Geology *first* proved! It is a claim of priority. Against whom? against what?" etc. (p. 156.)

To all this, and the rest like it, of which there is much, a reply is unnecessary. We believe that our readers are, by this time, pretty well satisfied that the *boat*, in the scene, is not the Bible. The exegetical novelties, in "the Six Days of Creation" and the "World-Problem," are quite good evidence that exegesis, or *that* "nose of wax," and the Bible, are far from identical. The fact that geology (or readings from nature) first proved natural causes to have acted in the progress of creation, is now a part of the history of Bible interpretation itself. Even the "World-Problem,"

towards its close (150 pages nearer the end of the volume), seems to have attained to a more sober mood, and presents a somewhat modified view of what geology has done, saying (p. 304), that the thought about natural causes, after being suggested in early time, long slumbered, until Geology again awoke it.

There is another point, in the boat scene, that calls forth strong words. It is this: "with rare exceptions, she has always admitted the supernatural." The word "supernatural," it should be observed, was a repetition of his own phrase. We quote a few sentences from the many pages on the subject, to show their drift.

"This, we can not help regarding as more perilous ground than the other, although, perhaps, not so insulting to the Scriptures. If he means, by the supernatural, some far-off First Cause, brought in as a logical necessity, or some prime mover, or something like a first originating power, without which we cannot reason at all about creation, the proposition is hardly worth any serious notice. Auguste Comte, much as he has been assailed by inferior men, who are no better believers than himself, Auguste Comte would admit that. The author of the *Vestiges* would admit all that; in such a sense, and in some still nearer senses, he willingly concedes the supernatural. But if, taking it in its true, and higher, and more special sense, the reviewer means, that leading geological minds have been fond of the idea of the supernatural, that they have *not* preferred to explain everything by uninterrupted natural causality, and that the leading authority among them does not regard this natural causation, as of itself, sufficient to explain all the phenomena that science now discovers in the rocks and formations; if he means this, he could not well have made a statement more at variance with known and indisputable facts." (pp. 169, 170.)

"Admits the supernatural! he says. But what language is this for Science? Science does not '*admit*;' she proves: such is her claim. She discovers; sometimes she graciously *accepts*, as Professor Dana accepts the Mosaic account," etc. (p. 171.)

What a frenzy for nothing! His mind sees phantom after phantom, and at them he goes. Swarms of heresies arise, which common sense could never have evoked from our language. We meant simply to say, that almost all geologists *believed* in "the supernatural" precisely in the sense in which the "Six Days" had used the phrase; and,

more than this, that they believed in a personal God. We do not know of a single work on geology, in our language, that questions this. Mr. Lyell is denounced by name, in one place, in these volumes, and appears to be alluded to in the above-cited paragraph. But in his "Principles" (London, 1850, p. 774), this geologist says: "In whatever direction we pursue our researches, whether in time or space, we discover, everywhere, clear proofs of a Creative Intelligence, and of His foresight, wisdom, and power;" a sentence indicating that the "World-Problem," to use its own gentle insinuation, "is at variance with known and indisputable facts." Evidently, however, these pages were impetuously penned; for they sound like the passing of a tempest.

"*Vestiges of Creation.*" The "Six Days of Creation," in its denunciations, partly identified "infidel geology" with the theory of the "Vestiges of Creation;" and, in our reply, we observed that geology, far from sharing in the error, had proved the development-theory of that work false. Geology, we said, had found no transitional forms; and, moreover, had proved that, many a time, the thread of life had been cut by sweeping catastrophes, each one enough to blast the hopes of monad-planters; and, coupling these facts with the principle from zoology, that in all reproduction, it is *like from like*, the theory was shown to be without foundation. And it is to be noted that in consequence, mainly, of the teachings of geology, the monad-theory has no advocates in science.

But the "World-Problem" brings up the question: "Who killed the Vestiges?" "Who killed the monster?" and devotes a chapter to this discussion; and says: "*It may come, in time, to excite as much interest as the famous question of the nursery-book, with which we are all familiar,*" — Who killed Cock-Robin?

It should be remembered that the development-theory of the Vestiges was introduced into the "Six Days" with favor, though with a Personal God, to make it go, by putting "immaterial entities," at intervals, into the earth and wa-

ters. The "World-Problem" represents it as only a suggested hypothesis; yet it was propounded with favor. Moreover, it denies any force in the argument against the "Vestiges" from geology, because it is possible, it says, that after a species had gone on, for a long while, producing its like in individuals, it might at last, by some sudden change, produce a new *species*. But is it any the less true, that science gives the development-theory no scientific foundation, and no ground for belief among scientific men, even if "pure reason" has the power of breeding *such* a monster by way of setting aside science? Geology and zoology, as we have remarked above (on the preceding page), are utterly opposed to the Vestiges, root and branch. There is no end to the suppositions that unrestrained reason may make. Science claims no share in them; and it disproves, not by showing that reason cannot conceive itself to fly high, but that nature affords no basis or warrant for the flight.

After saying that the "Vestiges of Creation" has been made "a bugbear in the religious world," and evincing a leaning to some of its doctrines, the "World-Problem" brings in the following note (p. 186):—

"It is a number of years since we read this book. The impression left upon the mind, was not favorable to its piety. It appeared to us decidedly anti-Biblical in its tone and spirit. Its style, both of thought and expression, is very different from that of the Old Testament. It does not talk like Mosea. If we may judge, however, from its very confident manner, so much resembling that of certain other productions of a similar Baconian genus [this Note is to a paragraph pronouncing the science and theology of the "Vestiges" as good as that of Professor Dana], it must certainly be considered a work of respectable science."

Whether the monster was really deserving of being killed, might be questioned after so cautious an opinion from such an author. It would seem, too, that the work had not received very close attention. But that it may be seen to be a *very* bad book, we cite from a review which appeared in the American or Whig Review, for 1846, p. 525. The Article begins thus :—

"The spirit of infidelity is as malignant as ever, but it has lost the boldness and openness which formerly characterized its attacks upon revelation."

And, in the course of its illustrations of the Development-theory of the "Vestiges," it says (p. 537) :

"For example, a certain species of vegetation, after having, for one hundred million and one times produced its like, is, by virtue of a hidden law contained in its organization (but all this time concealed and inert), suddenly developed into a new species, in the first stage of animal life. * * * * In this way, the plant becomes an animal, the reptile a fish, the fish an inhabitant of the dry ground, and terrestrial animals rise, in the ascending scale, until the development reaches the Simia [monkey] tribe. From this the machine goes on, age after age, apes begetting apes, each one in his own likeness and after his own kind, until, at last, some one revolution of the wheel brings everything into that state in which the "conditions are fulfilled;" — the hidden spring is touched: the monkey loses his tail, and man comes out, No. 2762. Oh, shade of Moses! We cannot help apostrophizing thy meek spirit, thou ancient man of God! Is it for this that we are called upon, in the nineteenth century, to reject that sublime account, the superhuman grandeur and simplicity of which furnish evidence that thou couldst have derived it only from the voice of inspiration? *And God created man in his own image; in the image of God created he him; male and female created he them; and God breathed into his nostrils the breath of life, and man became a living soul.* Now, we ask again, what is gained by all this? * * * * Why not the man, directly, without the monkey? The only answer is, that there is a spurious philosophy, whose chief element is a most hearty (and yet, it may be, unconscious) dislike of the idea of a personal Deity. If it cannot bear the name of Atheism, it at least wishes a God afar off; anything but an ever-present, ever-energizing, ever-watchful moral Governor."¹

According to this account (and much of even stronger denunciation might be cited), *it is a very bad* book, beyond all doubt. The review would make *thirty-six* pages like this, and it is no hasty production. It is positive in its assertions, as if the writer had well considered, and was determined, in 1846, to kill Cock-Robin at a single blow. And who wrote this long review? The writer was the author of the "Six Days of Creation" and the "World-Problem." Besides

¹ Would not the judgment of the World-Problem pronounce this last sentence "sheer, undiluted Pantheism?" See a citation above, on p. 500.

abundant other evidence, the name Prof. TAYLER LEWIS is given in the Index of the volume.

It would not have been expected, after such an apostrophe to the "shade of Moses," and such words about a spurious philosophy, that we should so soon have had a work from the same author, suggesting the possibility that a monkey's body might have been "made to assume an erect, heavenward position, whilst it takes on that beauty of face and form which would become the new intelligence [man], and, indeed, be one of its necessary results."¹

Science has achieved its greatest triumphs in the check it has given to some forms of infidelity. It acknowledges, however, that there are creations of "pure reason," which are impregnable to her modes of attack alone. A subtle atheistic system may make nature an individuality, in which its results, even to all creations, are brought forward through some inscrutable, inherent, vital force. With such a theory, science can do little directly, beyond pronouncing it of the pure-reason breed, unless it rise to a consideration of the profounder characteristics of nature and man's position and qualities, in which case it may suggest truth, if it does not prove it. But the theory of "the Vestiges" is within its range of study.

Science makes no unrighteous claims. If it has done good, it is because it is God's appointed means of good. We would ever exclaim: "NON NOBIS, DOMINE, NON NOBIS." We read these thy works, and gather wisdom, because Thou art wise; and take strength, because Thou art strong. To thy name be the praise.

Parallelism between Geology and the Bible. On the parallelism between the Bible and the declarations of nature, we make, here, but a few brief observations. It should be understood that Geology has never assumed that the divisions between the six days of Genesis were legibly marked off in the rocks. Nearly all of its developments pertain to the fifth and sixth days alone; and there is no great V drawn

¹ The Six Days of Creation, p. 249.

over the middle and lower strata, or VI over the uppermost. It ascertains, from the rocks, a series of events or consecutive facts in the history of creation. And, in view of its enunciations, it is a natural question, with the student interested in the Bible, whether the order is the same with that in the Mosaic account? or whether there is an irreconcilable discrepancy? Should not theology ask these questions? Is it a perversion of exegesis to study out the parallelism, and attempt to reconcile seeming difficulties?

We give, concisely, the order of events in the two records, that the degree of discrepancy and doubt may be fairly seen.

GENESIS : I. creation of light ; II. firmament, separating waters above and below it ; III. dry land ; vegetation created ; IV. sun, moon, and stars ; V. marine and amphibian animals, and birds created ; VI. quadrupeds created ; MAN created.

GEOLOGY : the earth in igneous fusion ; its oceans, in vapors, over it ; partly cooled and covered with its oceans, but the atmosphere, above, still dense with vapors ; lands rising above the waters, becoming dry land (the azoic, of geology) ; traces of vegetation, in the rocks of this age, uncertain ; cooling continued, and finally a clear sky, with the sun, moon, and stars no longer obscured ; marine and amphibian animals, and birds (making up the ages of molluscs, of fishes, of coal plants, and of reptiles) ; quadrupeds created ; MAN. (The details of geological history fill out this mere list of epochs, and thus supply what the Bible does not undertake to give.)

In these accounts, the *Bible* says that MAN was the last creation. *Geology* says the same.

The *Bible* says that quadrupeds next preceded man. *Geology* says the same.

The *Bible* says, that inferior animal species, up to reptiles, were created before quadrupeds. *Geology* says the same.

The *Bible* says that there was, earlier, an age without animal life. *Geology* does the same.

The *Bible* says that, after the world had been long in formation (for its three days), the sun, moon, and stars ap-

peared in the heavens. Geology, also, makes this an event long after the earth's beginning; and it may be shown to be *probable*, though not actually demonstrated, that this occurred after the earliest dry land appeared.

The Bible says that vegetation was created with the first appearance of land, before animal life. Science gathers but indistinct records from the earth on this point; yet, plainly, has no counter-statement; and, as far as there are any indications, they favor the above.¹

The Bible says that the world had a beginning. Geology, by its very system of progress, points to a beginning.

Thus it is clear, that there is an accordance, to a considerable extent; and that facts in science are stated in the Bible, although not there recorded simply as scientific facts.

Geological science commences with the fact of the earth's fluidity, and cannot go back of this; leaving the hints respecting earlier time to be gathered from other sciences. If the nebular hypothesis be not true, and the earth was, at first, a chaotic sphere, then we should infer, from science, that the light of the *first* day was the light communicated to the chaos — and similarly, for all parts of the universe, at once. The *second* day would be that of the first appearance of the waters, as an ocean, separated from the "swaddling band" of vapors above. The *third* day would be that of the first appearance of dry land, and the creation of vegetation; the *fourth*, the appearance of the sun, moon, and stars; the *fifth*, the creation of animals, from the lowest to reptiles and birds (with some inferior quadrupeds in the latter half of the era); the *sixth*, the creation of quadrupeds (age of mammals), and, lastly, of man.²

If the nebular hypothesis be true, as supposed in Professor Guyot's exposition of the chapter, then the light of the *first* day would be the first light in the great deep or universe chaos. The *second* day would correspond, either to the evolution of worlds, including the earth, from the chaos or nebula, as suggested by Prof. Guyot; or else, the earth

¹ See our first Article, Bib. Sac. Jan. 1856.

² This is essentially the view brought out many years ago by Prof. Silliman.
VOL. XIV. No. 55. 45

having been evolved on the first day, to the earth with the vapors about it, as in the preceding paragraph. The *third* day, and the following, as above.

We purposely avoided discussing the nebular hypothesis, in our first Article, and therefore gave an explanation (Prof. Guyot's) of the *second* day, in a note. Much ado is made about this Note, in the "World-Problem," in a manner quite like the stir about the boat-scene and the "Vestiges," and with as much appositeness. Professor Guyot, we trust will soon supply what is needed on this subject.

The author of the "World-Problem" expresses great admiration for the Nebular hypothesis, though not asserting actual belief in it; and, in the "Six Days of Creation," the "deep" or "water" of the second verse was explained as "an immense floating nebulosity, or part of some larger nebulosity." In the "World-Problem," the "water" is set down as the same that was about the dry land of the third day, and the application of the nebular hypothesis in an explanation of Genesis is pronounced absurd. The existence of these waters before the first day, is the basis for his argument for the existence of light *before* the same day; for he says: "it is not easy to conceive that the absolute origination of light was later than the constitution of the water;" and the creation of "light in itself must therefore have been before that of the grosser fluid." (p. 286.)

Now it is important to observe that the history of creation was not written by Moses, but by God himself; that the facts were unseen by man, and are both inconceivable by the human mind, and indescribable with exactness in human language; that therefore, like the prophecies relating to our Saviour, they may express more than was ever in the mind of the sacred penman; in fact, more than the accumulating knowledge of progressing mind, on this earth, will ever comprehend.

It is also to be considered, that if the nebular hypothesis be true, and if the Bible describes the beginning of our universe, the account should naturally have commenced with that beginning, whether so understood by the Jews or not.

Moreover, as our earth is but a dependent part of the universe, and since the command "Let light be," is of the most general kind, and besides, light would be the immediate concomitant of the first movement of the Spirit over the deep and the consequent action of forces in matter, there is certainly reason for giving the chapter the grandeur it may claim as the opening page of Heaven's message to man, by regarding the "Let light be" the fiat that rolled through immensity when light first entered upon its mission, and the universe of worlds its course in history.

There are many subjects, in the "World-Problem," yet untouched, that challenge criticism. But after our discussions of fundamental principles, it is unnecessary to dwell longer on its pages. There is much, also, in both works, to commend. But the "World-Problem," as a whole, only adds further reason for pronouncing the writings of the author injurious to the cause of the Bible. For, however great the author's love for its glorious revelations, which we would not question; however arduous his labors for the spread of truth and demolition of error, we still believe that infidelity may legitimately fortify itself from his philosophy; and the youth of the land be led to scorn the truth that has so unwise and uncharitable an advocacy.

We entered upon these discussions under a sense of religious duty. Unacquainted with the author of the "Six Days of Creation," and knowing, from hearsay, that his work sustained the view of long periods for the "days" of Genesis, we opened the volume with the expectation of both pleasure and profit. But with almost every page, we found truth denounced, the study of nature contemned, and God's works treated as if the Creator were some ill-natured Genius determined on deceiving man to his ruin.

It had been our sure conviction that science, in all its developments, could and would stand by the Bible; and the proofs of their harmony were daily multiplying. We had watched, with special pleasure, the fading out of seeming oppositions, the breaking down of infidel entrenchments,

and the increasing grandeur of Bible truth with every word that was deciphered in the book of nature. We had loved the latter, because it was the work of Him who, through his gospel, had declared his love in tones of infinite tenderness; and to us, nature, although not giving origin itself to such tones, seemed still to send back ten thousand echos and fill out the mighty chorus. The words of a man defying science, declaring its utter hostility to the Bible, and its baselessness, were, to our ears, words of profound infidelity; and although mingled with better thoughts, the volume appeared plainly hostile to man's best interests. The question of long or short days, discussed in it, seemed trivial compared with the spirit of the work. Adding to this, a theory of nature that was, in our view, at variance with both Bible and science, made of patches from the Development-theory of the "Vestiges," Plato's philosophy, and the Bible, and an exegesis that let "the beginning" drop out of Genesis, and made light to shine before God said "let light be," the writings appeared calculated to do valiant service for the evil one. As much as we were repugnant to controversy, it seemed a failure of duty to remain silent. With these motives we wrote, and have written again, and now offer our concluding words. And we shall feel that a life consecrated to the Bible, and to science as its tributary, has accomplished some good, if our pages shall have strengthened the faith of any in sacred truth, the exaltation of which is the end of all knowledge.

We close in the language of Bayne's "Christian Life :"
"Is it too much to predict, that when Science shall have filled its orb, it will be seen, by all nations, that the Father of spirits has had a higher design regarding it, than that of spreading man's table, or shortening his path; and that it casts a light, to reveal and demonstrate, over every pillar, down every avenue and colonnade, into every nook and crevice, of his word? Wait on the Lord; be of good courage, and He shall strengthen thy heart. Wait, I say, on the Lord."

Then be it ours to testify alike our gratitude and our faith by our efforts to Christianize the world. To whatever barbarous tribe the Anglo Saxon race shall carry their free and pure Christiaaity, their own homestead bears witness, that "*the wilderness and the solitary place shall be glad for them; and the desert shall rejoice, and blossom as the rose.*"

ARTICLE VII.

THOUGHTS ON SPECIES.

By Professor James D. Dana, Yale College.

[PREFATORY NOTE.— The discussion with respect to the Unity of the Human race based on the study of Nature, is naturally divided into three sections :

1. Is man of one, or of several species.
2. If of one species, was he created on one only, or on different continents, or in other words, was there a plurality of original birth-lands.
3. If of one centre only, was there but one first pair, or a plurality of first pairs.

The plurality of species, of birth-lands, of parentage, are three distinct subjects of inquiry.

If man is of *more than one species*, the creation of man on more than one continent and of more than one pair must necessarily be admitted; and hence the inquiry as to unity of species is of the widest import. The course which scientific discussion has recently taken, makes this, in fact, the great fundamental question, involving all others. It is understood, that proving a plurality of species, is putting down all opposing arguments at a stroke; and this is, therefore, the point towards which attention is now especially directed. It is hence of the first importance, to those who would consider the bearings of science on the

grand topic, that this question should be profoundly considered.

In treating it, we might perhaps have made a more satisfactory argument to many minds, had we taken up the special results of observations on the distinctions and variations of species. But it is reasonable and profitable, first, to take a survey of the wide range of nature, and gather up the testimony which science in all her departments is bringing to light. These departments, although so diverse, are yet coördinate in their relations. Each sheds light into the precincts of the other, and all combine in harmonious exhibitions of truth. More than this, common ideas underlie the whole system of the universe, declaring a unity of nature, parallel with the unity of the Infinite Author. An appeal to general principles, is therefore an appeal to the deepest and widest range of knowledge.

Moreover, the argument from the direct study of individual plants and animals, is only in its incipient state of preparation; for we yet know little as to the limits of species and their laws of variation. Different investigators are at work on the subject; and until these and others have given it a long and thorough examination, it would be presumptuous to say with positiveness what the facts in this department of science do teach. We believe, that when fully worked out, they will only add force to the argument presented beyond.

The subject of unity of species is too often approached as if a hastily made observation were sufficient to settle it *pro* or *con*. It is sometimes treated with careless or flippant remarks, as though there were no general principles in nature bearing with mighty force on one side of the great question. The due appreciation of those principles will lead to more investigations and cautious scrutiny in the collection of facts, and more wisdom in weighing and using them.

Again, there is often impatience on the other side, that Science, in making its deductions should not draw support of the truth from the Bible. But to be of value to the

cause of truth, it must be an independent source of argument. If a word from the Bible is allowed to influence its reasoning, the testimony is simply the Bible for the Bible, and not science for the Bible; we should not forget that as surely as nature and the Bible are of the same All-wise Being, so surely will nature stand by the Bible, and fulfil its mission in shedding light on the sacred page.

The terms *species* and *genus*, although having precise significations in science, are not always interpreted in the same way by metaphysicians. A word of explanation may not therefore be out of place.

In classification, we rise from *Individuals* to *Species*; then to *Genera*, — and so on, in the following order; *Families*, *Tribes*, *Orders*, *Classes*, *Sub-kingdoms*, *Kingdoms*. In the subdivisions above *genus*, Botanists vary a little from this order, but that is of no importance here.

Individuals of a common kind we say are conspecific. Take for instance the *horse*. The horses domesticated over the world are of one *species*. There are various breeds; they exemplify the extent to which the species varies, and are called *varieties*, a grade of subdivision under species; the *varieties* breed indefinitely with one another, while the different *species* of horse do not. The material group of horse-like animals, characterized by having a simple solid hoof or single toe, no rudimentary toes behind, the same dentition (number and arrangement of teeth) as in the common horse, and some other peculiarities, constitute the *genus Equus*. If the dentition presented two distinct types (the teeth having a high importance in classification because they vary with the food and whole structure of the species), or the foot had other rudimentary toes, there would have been two genera of solid-hoofed (solidungulate) quadrupeds. But in fact there is only one, so that the *Family* of *solidungulates* has but one known *genus*; this includes as *species*, the *Horse*, the *Ass*, the *Hemione* of India, and the *Zebra*, *Onagga* (or *Dauw*) and *Quagga* of Africa, besides some extinct fossil species.

But there are other hoofed or *Ungulate* species of quad-

rupeds, as the sheep, deer, hog, elephant, constituting a large group. They are very distinct from *Unguiculates* or clawed species, like the Lion, Cat, Bear; from the Monkey-tribe or *Quadrumania*; from the Whales and Walrus which swim and have no hind feet, and are hence called *Mutilates*; from the group of bats, or *Cheiropters*; from the *Insect-eaters*, as the mole and hedgehog; from the *Rodents* or gnawers, like the mouse and squirrel; from the sloth and armadillo group called from their half toothless mouths, *Edentates*; from the *Marsupials* or pouched animals, like the opossum and Kangaroo. The large group of *Ungulates*, embracing the elephant, hog, sheep and related animals along with the horse, is thus a natural division of quadrupeds, and is called an *Order*; — the *other orders* being those just mentioned, the *Quadrumania*, *Unguiculates*, *Mutilates*, *Cheiropters*, *Rodents*, *Insect-eaters*, *Edentates*, and *Marsupials*.

Now the *order* of *Ungulates* is naturally divided into two *tribes*; one having an *even* number of toes like the sheep, cow, hog, or *Pari-digitates*; the other, an *odd* number of toes, like the horse and Rhinoceros, or the *Impari-digitates*. This is seemingly a characteristic of little value; and yet it is so fundamental, that an even-toed *Ungulate* when horned, has its horns in even pairs, one either side of the middle, while the odd-toed have, if any, a single horn on the *middle* line of the head, or if two, one is in advance of the other.

The several *orders* mentioned are orders of the *Class* of *Mammals* under the *Vertebrate subkingdom*, and *Animal Kingdom*. To complete our explanations we repeat what is touched upon in another number of this Journal. The animal kingdom has its *four* subkingdoms, or four distinct plans of structure: — 1st. The *Radiate* or lowest subkingdom, having a flower-like or star-shaped structure, as the star-fishes, jelly-fishes; 2nd. The *Molluscan* subkingdom, having a soft jointless body not radiate, as the oyster, snail; 3rd. The *Articulate* subkingdom, having a jointed body, with the articulations formed in the skin, and no internal jointed skeleton as insects, lobsters, worms; 4th.

The *Vertebrate* subkingdom, having vertebra, or an internal jointed bony skeleton like birds, fishes, quadrupeds. Again, the *Vertebrate* type is adapted to the different conditions of life afforded on the globe, and hence come the four *classes*: The Class of *Fishes*, of *Reptiles*, of *Birds*, of *Mammals*, the last embracing the quadrupeds, and characterized by the species suckling their young.

From this survey it is seen that the horse belongs to the Animal *Kingdom* — *Vertebrate subkingdom* — *Class* of *Mammals* — *order* of *Ungulates* — *Tribe* of *Impari-digittates* — *Family* of *solidungulates* — *Genus*, *Equus* — *Species*, *Equus Caballus*.

We have barely glanced at this subject, in order to explain its elements, and show the relations of species to the higher groups, and not to present a philosophical exhibition of the principles of classification. It is simply an example of the method of subdivision in each department of nature. It should be understood, moreover, as explained in another Article in this volume, that the groups are not arbitrary cuts, but *natural* groups or types. They are sometimes quite distinct from the groups, as in the case of the genus *Equus*; and often when shading into one another, it is much like the coalescing of two radiant centres by their borders, each group having in general, its central idea or type structure. The Kingdoms of nature are literally Kingdoms: there is throughout an order and beauty of System, in which the wisdom and power of the Creator is displayed even more wonderfully than in the creation of a world or any one of its living species.

With these introductory remarks, we pass to the subject of our Article.]

WHILE direct investigation of individual objects in nature is the true method of ascertaining the laws and limits of species, we have another source of suggestion and authority in the comprehensive principles that pervade the universe. The source of doubt in this synthetic mode of reaching truth consists in our imperfect appreciation of uni-

versal law. But science has already searched deeply enough into the different departments of nature to harmonize many of the thoughts that are coming in from her wide limits; and it is well, as we go on in research, to compare the results of observations with these utterings of her universality.

We propose to present some thoughts on species from the latter point of view, reasoning from central principles to the circumferential, and if we mistake not, we shall find the light from this direction sufficiently clear to illumine a subject which is yet involved in doubts and difficulties.

The questions before us at this time are :

1. What is a species ?
2. Are species permanent ?
3. What is the basis of variations in species ?

1. *What is a species.*

It is common to define a species as a *group* comprising such individuals as are alike in *fundamental* qualities; and then by way of elucidation, to explain what is meant by fundamental qualities. But the idea of a group is not essential; and moreover it tends to confuse the mind by bringing before it, in the outset, the endless diversities in individuals, and suggesting numberless questions that vary in answer for each kingdom, class, or subordinate group. It is better to approach the subject from a profounder point of view, search for the true idea of distinction among species, and then proceed onward to a consideration of the systems of variables.

Let us look first to *inorganic* nature. From the study of the inorganic world we learn that each element is represented by a specific amount or law of force; and we even set down in numbers the precise value of this force as regards one of the deepest of its qualities, chemical attraction. Taking the lightest element as a unit to measure others by, as to their weights in combination, oxygen stands in our books as 8; and it is precisely of this numerical value in its compounds: each molecule is an 8 in its chem-

ical force or law, or some simple multiple of it. In the same way there is a specific number at the basis of other qualities. Whenever then the oxygen amount and kind of force was concentrated in a molecule, in the act of creation, the species oxygen commenced to exist. And the making of many such molecules instead of one, was only a repetition in each molecule, of the idea of oxygen.

In combinations of the elements, as of oxygen and hydrogen, the resultant molecule is still equivalent to a fixed amount, condition, or law, of chemical force; and this law, which we express in numbers, is at the basis of our notion of the new species.

It is not necessarily a different amount of force; for it may be simply a different state of concentration or different rate or law of action. This should be kept in mind in connection with what follows.¹

The essential idea of a species, thence deduced, is this: a *species* corresponds to a *specific amount or condition of concentrated force, defined in the act or law of creation.*

Turn now to the organic world. The individual is involved in the germ-cell from which it proceeds. That cell possesses certain inherent qualities or powers, bearing a definite relation to external nature, so that, when having its appropriate nidus or surrounding conditions, it will grow, and develop out each organ and member to the completed result, and this, both as to all chemical changes, and the evolution of the structure which belongs to it as a subordinate to some kingdom, class, order, genus and species in nature. The germ-cell of an organic being develops a specific result; and like the molecule of oxygen, it must cor-

¹ When we have in view oxygen and the elements, we are apt to think of their molecules as distinguished by a different *amount* and *kind* of force. But when we consider the many different compounds that may be made of the same elements (as carbon and hydrogen), in the very *same* proportions, we are led to conceive of these as differing molecularly in a different *law* of the same force or forces. When, again, we see the same element under conditions as diverse as any two compounds, as in cases of allotropism, we are still better satisfied with adopting, for the present, the most general expression — a different law of action or condition of molecular force.

respond to a measured quota or specific law of force. We cannot apply the measure, as in the inorganic kingdom, for we have learned no method or unit of comparison. But it must nevertheless be true, that a specific predetermined amount, or condition, or law, of force is an equivalent of every germ-cell in the kingdoms of life. We do not mean to say that there is but one kind of force; but that whatever the kind or kinds, it has a numerical value or law, although human arithmetic may never give it expression.

A species among living beings, then, as well as inorganic, is based on *a specific amount or condition of concentrated force defined in the act or law of creation.*

Any one species has its specific value or law of force; another, its value; and so for all: and we perceive the fundamental notion of the distinction between species when we view them from this potential point of view. The species, in any particular case, began its existence when the first germ-cell or individual was created; and if several germ-cells of equivalent force were created, or several individuals, each was but a repetition of the other: the species is in the potential nature of the individual, whether one or many individuals exist.

Now in organic beings, — unlike the inorganic, — there is a cycle of progress involving growth and decline. The oxygen molecule may be eternal as far as anything in its nature goes. But the germ-cell is but an incipient state in a cycle of changes, and is not the same for two successive instants; and this cycle is such that it includes in its flow a reproduction, after an interval, of a precise equivalent of the parent germ-cell. Thus an indefinite perpetuation of the germ-cell is in fact effected; yet it is not mere endless being, but like evolving like in an unlimited round. Hence, when individuals multiply from generation to generation, it is but a repetition of the primordial type-idea; and the true notion of the species is not in the resulting group, but in the idea or potential element which is at the basis of every individual of the group; that is, the specific law of force, alike in all, upon which the power of each as an

existence and agent in nature depends. Dr. Morton presented nearly the same idea when he described a species as a *primordial organic form*.

Having reached this idea as the starting point in our notion of a species, we must still, in order to complete and perfect our view, consider what is the true expression of this potentiality. For this purpose, we should have again in mind, that a living cell, unlike an inorganic molecule, has only a historical existence. The species is not the adult resultant of growth, nor the initial germ-cell, nor its condition at any other point; it comprises the whole history of the development. Each species has its own special mode of development as well as ultimate form or result, its serial unfolding, inworking and outflowing; so that the precise nature of the potentiality in each is expressed by the line of historical progress from the germ to the full expansion of its powers, and the realization of the end of its being. We comprehend the type-idea only when we understand the cycle of evolution through all its laws of progress, both as regards the living structure under development within, and its successive relations to the external world.

2. *Permanence of species.*

What now may we infer with regard to the permanence or fixedness of species from a general survey of nature?

Let us turn again to the inorganic world. Do we there find oxygen blending by indefinite shadings with hydrogen or with any other element? Is its combining number, its potential equivalent, a varying number, — usually 8, but at times 8 and a fraction, 9, and so on? Far from this; the number is as fixed as the universe. There are no indefinite blendings of elements. There are combinations by multiples or submultiples, but these prove the dominance and fixedness of the combining numbers.

But further than this, fixed numbers, definite in value and defiant of all destroying powers, are well known to characterize nature from its basement to its top-stone. We

find them in combinations by volume as well as weight, that is, in all the relations of chemical attraction; in the mathematical forms of crystals and the simple ratios in their modifications,—evidence of a numerical basis to cohesive attraction; in the laws of light, heat, and sound. Indeed, as we have elsewhere said, the whole constitution of inorganic nature, and of our minds with reference to nature, involves fixed numbers; and the universe is not only based on mathematics, but on finite determinate numbers in the very natures of all its elemental forces. Thus the temple of nature is made, we may say, of hewn and measured stones, so that, although reaching to the heavens, we may measure, and thus use the finite to rise toward the infinite.

This being true for inorganic nature, it is necessarily the law for all nature, for the ideas that pervade the universe are not ideas of contrariety but of unity and universality beneath and through diversity.

The units of the inorganic world, are the weighed elements and their definite compounds or their molecules. The units of the organic are *species*, which exhibit themselves in their simplest condition in the germ-cell state. The kingdoms of life in all their magnificent proportions are made from these units. Were these units capable of blending with one another indefinitely, they would no longer be units, and species could not be recognized. The system of life would be a maze of complexities; and whatever its grandeur to a being that could comprehend the infinite, it would be unintelligible chaos to man. The very beauties that might charm the soul would tend to engender hopeless despair in the thoughtful mind, instead of supplying its aspirations with eternal and ever-expanding truth. It would be to man the temple of nature fused over its whole surface and through its structure, without a line the mind could measure or comprehend.

Looking to facts in nature, we see accordingly everywhere, that the purity of species has been guarded with great precision. It strikes us naturally with wonder, that

even in senseless plants, without the emotional repugnance of instinct, and with reproductive organs that are all outside, the free winds being often the means of transmission, there should be rigid law sustained against intermixture. The supposed cases of perpetuated fertile hybridity are so exceedingly few as almost to condemn themselves, as no true examples of an abnormality so abhorrent to the system. They violate a principle so essential to the integrity of the plant-kingdom, and so opposed to nature's whole plan, that we rightly demand long and careful study before admitting the exceptions.

A few words will explain what is meant by perpetuated fertile hybridity. The following are the supposable grades of results from intermixture between two species:—

1. No issue whatever— the usual case in nature.
2. Mules (naming thus the issue) that are wholly infertile whether among themselves or in case of connection with the pure or original stock.
3. Mules that are wholly infertile among themselves, but may have issue for a generation or two by connection with one of the original stock.
4. Mules that are wholly infertile among themselves, but may have issue through indefinite generations by connection for each with an individual of the original stock.
5. Mules that are fertile among themselves through one or two generations.
6. Mules that are fertile among themselves through many generations.
7. Mules that are fertile among themselves through an indefinite number of generations.

The cases 1 to 5 are known to be established facts in nature; and each bears its testimony to the grand law of purity and permanence. The examples under the heads 2 to 5 become severally less and less numerous, and art must generally use an unnatural play of forces or arrangements to bring them about.

Again, in the animal kingdom, there is the same aversion in nature to intermixture, and it is emotional as well as

physical. The supposed cases of fertile hybridity are fewer than among plants.

Moreover, in both kingdoms, if hybridity be begun, nature commences at once to purify herself as of an ulcer on the system. It is treated like a disease, and the energies of the species combine to throw it off. The short run of hybridity between the horse and the ass, species very closely related, reaching its end *in one single generation*, instead of favoring the idea that perpetuated fertile hybridity is possible, is a speaking protest against a principle that would ruin the system if allowed free scope.

The finiteness of nature in all her proportions, and the necessity of finiteness and fixedness for the very existence of a kingdom of life, or of human science its impress on finite mind, are hence strong arguments for the belief that hybridity cannot seriously trifle with the true units of nature, and at the best, can only make temporary variations.

It is fair to make the supposition that in case of a very close proximity of species, there might be a degree of fertile hybridity allowed; and that a closer and closer affinity *might* give a longer and longer range of fertility. But the case just now alluded to seems to cut the hypothesis short; and moreover it is not reasonable to attribute such indefiniteness to nature's outlines, for it is at variance with the spirit of her system.

Were such a case demonstrated by well-established facts, it would necessarily be admitted; and we would add, that investigations directed to this point are the most important that modern science can undertake. But until proved by arguments better than those drawn from domesticated animals, we may plead the general principle against the *possibilities* on the other side. If there is a law to be discovered, it is a wide and comprehensive law, for such are all nature's principles. Nature will teach it, not in one corner of her system only, but more or less in every part. We have therefore a right to ask for well-defined facts, taken from the study of successive generations of the interbreeding of species known to be distinct.

Least of all should we expect that a law, which is so rigid among plants and the lower animals, should have its main exceptions in the highest class of the animal kingdom, and its most extravagant violations in the genus *Homo*; for if there are more than one species of Man, they have become in the main indefinite by intermixture. The very crown of the kingdom has been despoiled; for a kingdom in nature is perfect only as it retains all its original parts in their full symmetry, undefaced and unblurred. Man, by receiving a plastic body, in accordance with a law that species most capable of domestication should necessarily be most pliant, was fitted to take the whole earth as his dominion, and live under every zone. And surely it would have been a very clumsy method of accomplishing the same result, to have made him of many species, all admitting of indefinite or nearly indefinite hybridization, in direct opposition to a grand principle elsewhere recognized in the organic kingdoms. It would have been using a process that produces impotence or nothing among animals for the perpetuation and progress of the human race.

There are other ways of accounting for the limited productiveness of the mulatto, without appealing to a distinction of species. There are causes, independent of mixture, which are making the Indian to melt away before the white man, the Sandwich Islander and all savage people to sink into the ground before the power and energy of higher intelligence. They disappear like plants beneath those of stronger root and growth, being depressed morally, intellectually and physically, contaminated by new vices, tainted variously by foreign disease, and dwindled in all their hopes and aims and means of progress, through an overshadowing race.

We have therefore reason to believe from man's fertile intermixture, that he is one in species; and that all organic species are divine appointments which cannot be obliterated, unless by annihilating the individuals representing the species.

It may be said, that different species in the inorganic

world combine so as to form new units, and why may they not in the organic? It is true they combine, but not by indefinite blendings. There is a definite law of multiples, and this is the central idea in the system of inorganic nature. In organic nature, such a law of multiples, if existing, would be general, as in the inorganic; it would be an essential part of the system and should be easily verified, while, in fact, observation lends it no support, not even enough to have suggested the hypothesis.

In one kingdom, the *inorganic*, there is multiplication of kinds of units by combination, according to the law of multiples, and no reproduction; while in the *organic*, there is reproduction of like from like and no multiplication of kinds by combination. And thus the two departments of living and dead nature widely diverge.

Neither does the possibility of mere mixture among inorganic substances afford any analogy to sustain the idea of possible hybrid mixture indefinitely perpetuated, among living beings. The mechanical aggregation of units that make up ordinary mixture, is one thing; and the combination that would alter a germ, one of the units in organic species, even to its fundamental nature, is quite another. This last is not aggregation. It is as different from mere mixture as is chemical combination and stands somewhat in the same relation, so that the analogy has no bearing on the question.

3. *Variations of Species.*

. But there are variations in species, and this is our next topic. The principles already considered teach, as we believe, that each species has its specific value as a unit, which is essentially permanent or indestructible by any natural source of change; and we have, therefore, to admit in the outset, if these principles are true, that variations have their limits, and cannot extend to the obliteration of the fundamental characteristics of a species.

To understand these variations, we may again appeal to general truths.

Variation is a characteristic of all things finite; and is

involved in the very conditions of existence. No substance or body can be wholly independent of every or any other body in the universe. The most comprehensive and influential law in nature, most fundamental in all change, composition or decomposition, growth or decay, is the law of mutual sympathy, or tendency to equilibrium in force through universal action and reaction.

The planets have their orbits modified by other bodies in space through their changing relations to those bodies. A substance, as oxygen or iron, varies in temperature and state of expansion from the presence of a body of different temperature; in chemical tendencies from the presence of a luminous body like the sun; in magnetic or electrical attraction from surrounding magnetic or electrical influences. There is thus unceasing flow and unceasing change through the universe. All the natural forces are closely related as if a common family or group, and are in constant mutual interplay.

The degree or kind of variation has its specific law for each element; and in this law the specific nature of the element is in a degree expressed. There is to each body or species, the normal or fundamental force in which its very nature consists; and, in addition, the relations of this force to other bodies, or kinds, amounts or conditions of force, upon which its variations depend. One great end of inorganic science is to study out the law of variables for each element or species. For this law is as much a part of an idea of the species, as the fundamental potentiality; indeed the one is a measure of the other.

So again, a species in the *organic* kingdoms is subject to variations, and upon the same principle. Its very development depends on the appropriation of material around it, and on attending physical forces or conditions, all of which are variable through the whole of its history. Every chemical or molecular law in the universe is concerned in the growth, — the laws of heat, light, electricity, cohesion, etc.; and the progress of the developing germ, whatever its primal potentiality, is unavoidably subject to variations,

from the diversified influences to which it may be exposed. The new germ, moreover, takes peculiarities from the parent or from the circumstances to which its ancestry had been exposed during one or more preceding generations.

There is then a fixed normal condition or value, and around it librations take place. There is a central or intrinsic law which prevents a species from being drawn off to its destruction by any external agency, while subject to greater or less variations under extrinsic forces.

Liability to variation is hence part of the law of a species; and we cannot be said to comprehend in any case the complete idea of the 'type until the relations to external forces are also known. The law of variables is as much an expression of the fundamental equalities of the species in organic as in inorganic nature; and it should be the great aim of science to investigate it for every species. It is a source of knowledge which will yet give us a deep insight into the fundamental laws of life. Variations are not to be arranged under the head of *accidents*; for there is nothing accidental in nature; what we so call, are expressions really of profound law, and often betray truth and law which we should otherwise never suspect.

This process of variation, is the external revealing the internal, through their sympathetic relations; it is the law of universal nature reacting on the law of a special nature, and compelling the latter to exhibit its qualities; it is a centre of force manifesting its potentiality, not in its own inner working, but in its outgoings among the equilibrating forces around, and thus offering us, through the known and physical, some measure of the vital within the germ. It is therefore one of the richest sources of truth open to our search.

The limits of variation, it may be difficult to define among species that have close relations. But being sure that there are limits, — that science, in looking for law and order written out in legible characters, is not in fruitless search, we need not despair of discovering them. The

zoologist, gathering shells or mollusks from the coast of eastern America and that of Japan, after careful study, makes out his lists of identical species, with the full assurance that species are definite and stable existences; and he is even surprised with the identity of characters between the individuals of a species gathered from so remote localities. And as he sees zoological geography rising into one of the grandest of the sciences, his faith in species becomes identified with his faith in nature and all physical truth.

If then we may trust this argument from general truths to special, — general *truths* we say, for general principles as far as established are truths — we should conceive of a species from the potential point of view, and regard it as —

a. A concentrated unit of force, an ineffaceable component of the system of nature; but

b. Subject to greater or less librations, according to the universal law of mutual reaction or sympathy among forces.

And, in addition, in the *organic* kingdom,

c. Exhibiting its potentiality, not simply or wholly in any existing condition or action, but through a cycle of growth from the primal germ to maturity, when the new germ comes forth as a repetition of the first to go another round in the cycle and perpetuate the original unit; and, therefore, as follows from a necessary perpetuity of the cycle —

d. Exhibiting identity of species among individuals, by perpetuated fertile intermixture in all normal conditions, and non-identity by the impossibility of such intermixture, the rare cases of continuation for one or two generations, attesting to the stability of the law, by proving the effort of nature to rid herself of the abnormality, and her success in the effort.

e. The many like individuals that are conspecific do not properly constitute the species, but each is an expression of the species in its potentiality under some one phase of its variables; and to understand a species, we must know its law through all its cycle of growth, and its complete series of librations.

We should therefore conceive of the system of nature as involving, in its idea, a system of units, finite constituents at the basis of all things, each fixed in law; these units in inorganic nature as adding to their kinds by combinations in definite propositions; and those in organic nature adding to their numbers of representative individuals, but *not* kinds, by self-reproduction; and all adding to their varieties by mutual reaction or sympathy. Thus from the law within and the law without, under the Being above as the Author and sustainer of all law, the world has its diversity, the cosmos its fulness of beauty.

It may be remarked again, that we must consider this mode of reaching truth, by reasoning from the general to the special, as requiring also its complement, direct observation, to give unwavering confidence to the mind; and we should therefore encourage research with a willingness to receive whatever results come from nature. We should give a high place in our estimate to all investigation tending to elucidate the variation or permanence of species, their mutability or immutability; and at the same time, in order that appearances may not deceive us, we should glance towards other departments of nature, remembering that all truth is harmonious, and comprehensive law the end of science.

A word further upon our conceptions of species as realities. In acquiring the first idea of species, we pass, by induction, as in other cases of generalization, from the special details displayed among individuals to a general notion of a unity of type; and this general notion, when written out in words, we may take as an approximate formula of the species. One system of philosophy thence argues that this result of induction is nothing but a notion of the mind, and that species are but an imaginary product of logic; or at least, that since, as they say (we do not now discuss this point), genera are groupings without definite limits which may be laid off variously by different minds, so species are undefined, and individuals are the only realities — the supposed limits to species being regarded as proof of

partial study, or a consequence of a partial development of the kingdoms of nature. Another system infers, on the contrary, that species are realities, and the general or type-idea has, in some sense, a *real* existence. A third admits that species are essentially realities in nature, but claims that the general idea exists only as a result of logical induction.

The discussion in the preceding pages sustains most nearly the last view, that species are realities in the system of nature while manifest to us only in individuals; that is, they are so far real, that the idea for each is definite, even of mathematical strictness (although not thus precise in our limited view), it proceeding from the mathematical and finite basis of nature. They are the units fixed in the plan of creation; and individuals are the material expressions of those ideal units.

At the same time we learn, that, while species are realities in a most important and fundamental sense, no comprehensive type-idea of a species can be represented in any material or immaterial existence. For while a species has its constants, it has also its variables, each variable becoming a constant so far only as its law and limits of variation are fixed; and in the organic kingdoms, moreover, each individual has its historic phases, from the germ through the cycle of growth. The general idea sought out by induction, therefore, is not made up of *invariables*. Limited to these, it represents no object, class of objects, or law, in nature. The variables are a necessary complement to the *invariables*; and the complete species-idea is present to the mind, only when the image in view is seen to be ever changing along the lines of variables and development. Whatever individualized conception is entertained, it is evidently a conception of the species in one of its phases, — that is, under some one specific condition as to size, form, color, constitution, etc., as regards each part in the structure, from among the many variations in all these respects that are possible: mind can picture to itself individuals only and not species, and one phase at a time in the life of an organic individual, not the whole cycle.

We may attempt to reach what is called the typical form of a species, in order to make this the subject of a conception. But even within the closest range of what may be taken as typical characters, there are still variables; and moreover, we repeat it, no one form, typical though we consider it, can be a full expression of the species, as long as variables are as much an essential part of its idea as constants. The advantage of fixing upon some one variety as the typical form of a species is this, — that the mind may have an initial term for the laws embraced under the idea of the species, or an assumed centre of radiation for its variant series, so as more easily to comprehend those laws.

Again, abrupt transitions and not indefinite shadings have been shown to be the law of nature. In proceeding from special characters to a general species-idea, nature gives us help through her stepping stones and barriers. In former times, man looked at iron and other metals from the outside only, and, searching out their differences of sensible characters, gradually eliminated the general notion of each, by the ordinary logical method of generalization. But science now brings the elements to the line and plummet, and reaches a fixed *number* for iron and other elements as to chemical combination, etc. By this means, the studying out of the idea of a species seems almost to have escaped from the domain of logic into that of direct trial by weights and measures. It is no longer the undefined progress of simple reason, with a mere notion at the end, but an appeal to definite measurable values, with stable numbers at bottom, fixed in the very foundations of the universe. So, in the organic kingdoms, where there is, to our limited minds, still greater indefiniteness in most characters, the barrier against hybridity appears to stand as a physical test of species. We are thus enabled in searching into the nature of a species, to strike from the outside detail to the foundation law.

The type-idea, as it presents itself to the mind, is no more a subject of defined conception than any mathematical expression. Could we put in mathematical terms the precise

law, in all its comprehensiveness, which is at the basis of the species iron, as we can for one of its qualities, that of chemical attraction, this mathematical expression would stand as a representative of the species; and we might use it in calculations, precisely as we can use any mathematical term. So also, if we could write out in numbers the potential nature of an organic species, or of its germ, including the laws of its variables, this expression would be like any other term in the hands of a mathematician; the mind would receive the formula as an expression for the species, and might compare it with the formulas of other species. But, after all, we have here a mere mathematical abstraction, a symbol for an amount or law of force, which can be turned into conceptions, only by imagining (supposing this possible) the force in the course of its evolution of concrete realities, according to the law of development and laws of variations embraced within it.

ARTICLE IX.

NOTICES OF NEW PUBLICATIONS.

Mrs. KNIGHT'S LIFE OF MONTGOMERY.¹

THE early life of the poet Montgomery was a checkered one. At the age of six years, he was placed at the Moravian School, at Fulneck, near Leeds, where, after an interval of six years, he received a visit of three months, from his parents, just before they left their country, as missionaries to the West Indies. His parents he never saw after this visit; as they both died in the field of their missionary labors, about seven years after. Young Montgomery had been intended for the Ministry, but he showed so little interest in study that the Moravian Brethren soon gave up the hope of educating him for this purpose, and placed him in a retail

¹ Life of James Montgomery. By Mrs. Helen C. Knight, author of "Lady Huntington and her Friends," "Memoirs of Hannah More," etc. Boston: Gould and Lincoln, 1857. 12mo. pp. 416.