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ï»¿Life: Its True Genesis

By R. W. Wright

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¸‡Æ¿ ˇ . [Septuagint.]

"Whose general principle of life, each in itself after its own kind, is upon the earth." [Correct Translation.]

Second Edition

1884

RESPECTFULLY DEDICATED
TO
ARTHUR E. HOTCHKISS, ESQ.
OF CHESHIRE, CONN.

Contents.

Preface to Second Edition.

Here is the law of life, as laid down by the eagle-eyed prophet Isaiah, in that remarkable chapter commencing, "Ho, every one that thirsteth"--whether it be after knowledge, or any other earthly or spiritual good--come unto me and I will give you that which you seek. This is the spirit of the text, and these are the words at the commencement of the tenth verse:

"As the rain cometh down, and the snow from heaven, and returneth not thither, but watereth the earth, and maketh it (_the earth_) bring forth and bud (_not first bud, bear seed, and then bring forth_), that it (_the earth_) may give seed to the sower, and bread to the eater (_man being the only sower of seed and eater of bread_): so shall my Word be (_the Word of Life_) that goeth forth out of my mouth (_the mouth of the Lord_); it shall not return unto me void (_i.e., lifeless_), but it shall accomplish that which I (_the Lord Jehovah_) please, and it (_the living Word_) shall prosper in the thing whereto I sent it."

This formula of life is as true now as it was over two thousand six hundred years ago, when it was penned by the divinely inspired prophet, and it is as true now as it was then, that "Instead of the thorn shall come up the fir tree, and instead of the briar shall come up the myrtle tree; and it shall be to the Lord for a name, for an everlasting sign that shall not be cut off." That is, as the rains descend and the floods come and change the face of the earth, a law, equivalent to the divine command, "Let the earth bring forth," is forever operative, changing the face of nature and causing it to give expression to new forms of life as the conditions thereof are changed, and these forms are spoken into existence by the divine fiat.

In all the alternations of forest growths that are taking place to-day, on this continent or elsewhere, this one vital law is traceable everywhere. In the course of the next year, it will be as palpable in the Island of Java, recently desolated by the most disastrous earthquake recorded in history, as in any other portion of the earth, however free from such volcanic action. On the very spot where mountain ranges disappeared in a flaming sea of fire, and other ranges were thrown up in parallel lines but on different bases, and where it was evident that every seed, plant, tree, and thing of life perished in one common vortex of ruin, animal as well as vegetable life will make its appearance in obedience to this law, as soon as the rains shall again descend, cool the basaltic and other rocks, and the life-giving power referred to by Isaiah once more become operative. There is no more doubt of this in the mind of the learned naturalist, than in that of the most devout believer of the Bible, from which this most remarkable formula is taken.

We have no disposition to arraign the American and European "Agnostics," as they are pleased to call themselves, for using the term "Nature" instead of God, in their philosophical writings.

As long as they are evidently earnest seekers after _Truth_ as it is to be found in nature--the work of God--they are most welcome into the temple of science, and their theories deserve our thoughtful consideration. It is only when they become dogmatic, and assert propositions that have no foundation in truth, as we sincerely believe, that we propose to break a lance at their expense, and lay bare their fallacies. We claim nothing more for ourself, as a scientific writer, than we are willing and ready to accord to them. Indeed, we would champion their right to be heard sooner than we would our own, on the principle that it is our duty to be just to others before we are generous to ourselves, or those of our own following.

But our Agnostic friends should remember that when they charge us with being "dogmatic in science," the charge should be made good from a scientific stand-point, and not merely by the bandying of words.

When they tell us, for instance, that a toad has hibernated for a million years in any one of the stratified rocks near the surface of the ground, we interpose the objection that none of these batrachian forms can exist for a period of more than twelve months without air and food. And yet they have been blasted out of cavities in the surface rocks of the earth, where they have apparently lain for the period named by our scientific friends referred to. The fault is not ours, but theirs, that they are in error. Had they determined to study the subject of life, as we have done, from the Bible as well as from nature, they would have commenced at these toad-producing rocks, and worked their way upward to the source of all life, and not downward to the vanishing point--that where animal life ceases in the azoic rocks. The batrachians are low down in the scale of nature, but they have a determinate period of existence, as do all other forms of life. Try your experiments with them; see how long they will live without light, air, and food. This you can do as well as ourself. Conform to all the conditions required--the absolute exclusion of light, air, and food--and you will find that the toughest specimen experimented with is a dead batrachian inside of one year.

This experimental test should settle the question of lengthened vitality between us. There is no miracle about this matter at all, and science finds no stumbling-block in the way of a complete explication of this riddle, if, in the light of nature, there be any such riddle. We claim there is not, when we interpret nature in the light of nature's God. Let the earth, or rather its silicious and other decaying rocks, bring forth these batrachian forms. The command is imperative and not dependent upon any "seed" previously scattered or sown in the earth itself.

The father of the writer was Superintendent of the Green Mountain Turnpike Company, extending from Bellows Falls to Rutland, Vt., from 1812 to 1832, and worked every rod of that road many times over. From our earliest boyhood we accompanied him on these working trips, attended by a large force of laboring men, and our attention was early called to the characteristics of these toad-producing rocks. The rotting slates, shales, sandstones, shists, and rocks of various kinds, were often ploughed up by the road-sides, and the _dˆ"bris_ scraped into the centre of the road-beds; the heaviest ploughs of that day being used to cut through these wayside rocks, and often requiring as many as six or eight yoke of oxen to break the necessary furrow. In many of these decaying slates, shists, sandstones etc., hundreds of young toads, many of them not more than half an inch in length, were turned out at different seasons of the year, showing that they were produced independently of any parent batrachian, there being no trace of a mother toad in connection with them.

The parent toads bury themselves in the gardens and ploughed fields in the early autumn, and if they survive the severity of the winter months, may propagate their kind the second year, and probably for several years. But they require remarkably favorable conditions to continue their life for any considerable number of years in open-field propagation, while under no

circumstances whatever can they make their way into these decaying rocks in order to propagate their species. The reason why such fresh specimens appear under these circumstances, and in the cavities of the rocks named, is conclusively that indicated by the prophet Isaiah, in the text quoted by us; and when Professor Agassiz was forced to admit that trout must have made their appearance in the fresh-water streams emptying into Lake Superior, instead of originating elsewhere, it is to be regretted, for the sake of science, that he did not boldly enunciate the formula of life as taught by the eagle-eyed prophet of the Bible, and not as proclaimed by the owl-eyed professors of the London University College.

What is true of the trout in these Lake Superior streams, is true of them almost everywhere, even right in the town of Cheshire, Conn., where we are inditing this preface, the 10th day of October, 1883. We recently visited the Rev. David D. Bishop, in the northeastern portion of this township, where that cultured gentleman was constructing an artificial trout-pond. It was at a season of the greatest drought known for years in that portion of the town.

The point selected for this trout-pond was at the farthest eastern source of what is known as "Honey Pot" brook in Cheshire, a famous one for trout in former years. Mr. Bishop proposed to stock his pond with the best spawn he could procure. We remarked to him that there was no need of that expense, as no stream ever produced better trout than the "Honey Pot"; and on closely examining one of the six or eight cold springs developed in his enclosure, to his surprise, not ours, we discovered several small trout, not more than six weeks old, as lively as they could well be under the blasting operations then going on there; while his children were fishing out from the rocks any number of young frogs (of the common _Rana_ family), abounding wherever rocks and water make their appearance in similar localities. This incident was all the more remarkable for the reason that this small stream, or rather source of one, had been apparently dry for months, as had been many of the best wells in the town.

Our well, in the western part of the town, had been dug some six feet into the solid rock and an inexhaustible supply of the coldest water secured. We invited our neighbors, those living on both sides of us, as well as at some distance from us, to come and draw all the water they wanted, remarking that they might now and then draw up a small frog, originating therein, but that, by fishing him out of the pail, he would make his way to the neighboring streams not dry, and would flourish well enough as one of the _Rana_ family. It was only to our more intelligent neighbors (such as Mr. Bishop) who had read our work on "Life," that we stopped to explain this phenomenal fact. And so of all life, wherever it appears, whether vegetable or animal. Our experiments with mosquitoes are equally conclusive. Three years ago we took two barrels of rain-water from our cistern, tightly covered; one barrel we left open to the warm sun and air, and the other we covered with the finest mosquito netting. The barrel left open was soon thronged with mosquitoes, constructing their little rafts of eggs and paving their way for the swarms of young wigglers that in the course of a week or two made their appearance in the open barrel in immense numbers. The process by which these wigglers hatch out into mosquitoes is an interesting one, and will bear the closest

study, as well as scientifically pay for watching the operation. At the proper time they come to the surface of the water, undergo a palpable modification in their structure, and beautifully burgeon forth into the tormenting little insects that they are during the summer and autumn months in our Northern climate. The object of the covered barrel was to ascertain whether we could reach the conditions favorable for the development of this little pest of the _Culex_ family, independently of the eggs of the insect itself. This required some patience and not a little care. We knew that an egg dropped through the interstices of the netting would sink to the bottom of the water and fail to germinate, as every scientist understanding the process well knows. It must be floated on the water at first, or until it reaches the point of development into a wiggler. The first step in the process of its life is as cunningly devised as the second, and the second as the third, until the full-fledged mosquito is reached.

All precautions must be taken against any mistake or error in the experiment named. But we persevered and found nature responsive to our demands. Wigglers after awhile made their appearance sparsely in the covered barrel, but the mosquitoes developed from them proved innocuous of harm, as we kept the barrel covered, and they were soon drowned in the water, not having sufficient area of flight to answer the conditions of their life. We might instance some remarkable discoveries in the vegetable world, showing conclusively that plants and trees come without seed, and we feel the more pride in this discovery because we have been assured by Prof. Othniel C. Marsh, of Yale College, a gentleman highly distinguished in his specialties, that if we would show that an oak tree came without an acorn, he would abandon Evolution and accept the exposition given by us of the Bible genesis; but we have no special ambition to make so eminent a convert from Herbert Spencer’s ranks. He is a much younger man than ourself, but the great English Evolutionist or Involutionist, whichever he may ultimately decide to call himself, is about the writer’s own age, and, for special reasons, he would prefer to win him to the vital side of this question, that he may act with Professor Beale in the great controversy now waging in England on this subject, and we will assure both Prof. Marsh, and his friend, Herbert Spencer, that if either of them will show that an acorn comes without an oak tree, we will abandon any position we have taken on this subject, and accept theirs, however absurdly (to our mind) it may have been taken in the past. We know that "tall oaks from little acorns grow;" but that is when man becomes the sower of seed, and knows the origin of each specific tree that is brought forth. When we talk about the squirrel, or the birds becoming the "sowers of seeds," especially the acorns, we are talking at random, and without any certain knowledge. This we say with all due deference and respect to our learned Agnostic friends, and wish they would treat their vitalistic brothers with the same becoming courtesy.

In a work which we have now in preparation for the press, to be entitled "Biodynamics; or, The Laws of Life," we shall give this "seed question" a more exhaustive inquiry than we have yet done.

Our proofs in regard to one form of life are equally applicable to any other plant, insect, or animal, and there is no greater or less mystery in

the life of a blade of grass than in the cedar of Lebanon figuring so conspicuously in the historic page.

When the Nile overflowed its banks in ancient times, and caused the young frogs to swarm up as a pest upon the Egyptians, the same law of life was operative in that land, as when warm thunder-showers pelt the earth with us in the summer season, causing hundreds and thousands of these batrachians to come out of the gritty waysides, and swarm along our highways and by-ways, leading ignorant and thoughtless people to suppose that they have rained down from the sky. The simple fact is, that the earth was commanded to bring them forth, and that great mother of all vegetable and animal life is obeying the command to-day, just as she did in the beginning.

One of the greatest errors that science has yet committed, or rather that scientific men have stumbled upon, is the theory that all living forms have appeared but once in time and place, and that they have thence diffused themselves, in pairs, throughout the globe, as from specific centres of origin. In the primeval oceans, whenever and wherever the environing conditions of matter were the same or identical, the like living forms made their appearance and flourished for hundreds and thousands of years, and finally disappeared, in a fossilized state, as their environing conditions were changed. They came not genetically--as in pairs--but thronged the seas in thousands and millions as the divine edict went forth.

As another conclusive proof, to our mind, of the existence of this law of life, we instance the case of the mango-tree growing in the West India Islands, especially along the sea-shore, where it becomes the natural _habitat_ of the oyster. It is the belief of some ignorant persons that the oyster climbs these trees and deposits its spawn or "spat" upon the extreme limbs of the same as they bend down toward the water. This is manifestly an error, and belongs to the same class of fallacies as the common impression that toads rain down from the sky. The smaller mango-trees growing about the bays and inlets of these islands, furnish, as we have said, a natural _habitat_ for the oyster, and as the salt sea-spray washes their roots and the bark of their trunks, the long thin-shelled oysters of that region make their appearance thereon without the presence of spawn, just as they do when old oyster-shells are dumped along our sand-banks in New England. On these dumped shells oysters will be produced abundantly, simply because the conditions are favorable, and not in consequence of the presence of "spat." Oysters have little, if any, locomotive power, and can no more climb the mango-tree than they can scale the cliffs of the Azores. The reason why they hang in pendent clusters from the extreme boughs of the mango in the West India Islands is, that these boughs are sprayed upon by the rippling waters, and the environing conditions being favorable, the indifferent oyster of that region makes its appearance.

There has been no migration of the oyster from one centre of origin to another, any more than there has been a transference of the white whale from the arctic seas to the fiery equator. Every thing has its place in nature, and comes with or without seed as natural laws determine. During

the last year I have gathered cedar trees that did not make their appearance till late in August and September, long after the seed of the previous year had entirely disappeared, and there was no more life in them than there is in acorns that have crossed the Atlantic a dozen times in bulk. And the late Henry D. Thoreau, in his "Excursions," says that they will not stand one such shipment to Europe, and that every acorn that does not sprout by the end of November of the year it matures, is hopelessly a dead acorn. This is in harmony with our experience, and we have no doubt of the correctness of his observations. How absurd, then, to suppose that acorns can retain their vitality so as to germinate after years of out-door or other exposure. The seeds of forest-trees that mature in May and June, or the majority of them at least, have to be planted in those months, as all persons engaged in forest culture well know. This is specially true of cedars and oaks, as well as of elms and maples.

Study the paleontological facts as given by Prof. Frederick McCoy, of the University of Melbourne, in Australia, a gentleman highly distinguished for his learning and research. He has explored portions of that continent as far down as the azoic rocks, and made many important discoveries as to the past life of the globe. His researches have been especially rich in the Cambrian or Lower Silurian epochs, and have led to many modifications in the classification of the various forms of life pervading those earlier periods, and we may say that the facts he has brought to light tend strongly to show the correctness of our theory as taken from the biblical text; as, for instance, the _Trilobites_, occurring so abundantly in what is known as the Utica slates. Wherever the slates make their appearance, whether in Australia, America, or any portion of Europe, this fossil, characteristic of the Silurian and Devonian systems, appeared, not so much in time and place as in extended localities and conditions--indicating the presence of a law of life such as we have enunciated. We once inquired of the elder Prof. Silliman how long it took for the formation of one of these periods or systems? His reply was curt and pertinent: "It took long enough, young man!" That satisfied us at the time, and we have never asked the question since. It is prying beyond scientific depth, and the ablest scholars in the world will so regard it in the end.

All fossils follow the same developmental law, and seem to have been governed by corresponding conditions everywhere. The doctrine of "_similia similibus gignuntur_"--similar conditions producing similar forms--obtains universally. The _Graptolites_, occurring in the bituminous shales of the Silurian sandstone period, afford only another instance of the same law to which we have called the attention of our readers. In fact, the annals of natural history abound in the most conclusive proofs, as well in the fossilized as the living world, of what the paramount text of the Bible teaches us.

When Professor Ehrenberg, one of the most distinguished classifiers of minute forms of life in the world, declared, as he recently did before the Royal Geographical Society of London, that there was "a great invisible rock-and earth-forming life in nature," he came pretty near enunciating a great truth in science; and had he connected his language with the induction of "environing conditions" and the sequence of life therefrom, he would have accomplished what we undertook to do in our work begun

several years ago, but not completed and published until 1880. For it will be seen that we had been gathering the material for "Life: Its True Genesis" for many years before we sat down to the task of writing it.

When we said to one of our most intimate college friends that we were less than six months preparing it for the press, we stated what was literally true; but we had no intention of giving him to understand that we had spent only that time in gathering the vast amount of material at our command--twenty times as much as we could possibly use in the preparation of such a volume for the press. The long months and even years of toil and study spent by us in the needful preparation, were a part of the labor, as every author, writing intelligently on any subject, knows. The immense amount of care and labor that enabled Hermann von Meyer to prepare his paper on the _Archˆopterix_, rescued from the lithographic slate, is a case in point, as showing how small apparently the labor of accomplishing a great work for science. The time devoted to preparing the paper was trifling as compared with the result of his achievement. And so with every one who enters the temple of science with a devout wish to attain success.

It will be apparent to the religious mind of this country and England, if not to that of Mr. Tyndall himself, that, if the exegetical rendering we have extended to the Bible be correct, there is no necessity whatever for the vast uncomputed periods of time intervening the different geological strata, to which that scientific gentleman refers in his fanciful musings upon the Matterhorn!

Nor is there any such necessity for it, if what Professor Ehrenberg says be true in regard to the basaltic rocks thrown up by volcanic action in the Island of St. Paul. For if these rocks possess this mysterious power of life, He who made them manifestly imparted it. One thing is certain, at least, the rocks did not make themselves; nor did they impart to themselves any life-originating power after they were made. The same power that originated them originated all their characteristic properties, and the same may be said of Professor Tyndall's "sky-mist" or any other mistier name suggested by scientific men. We have only to take the "Thesaurus" of the Silurian period, and connect it with the induction of the biblical text, and we shall see that the forms characteristic of that period appeared not only synchronously in time and space, but also in physical conditions, and consequently, that no immense epochs were expended in the propagation, of species on the "two-pair" theory of our materialistic friends. They simply flourished over vast areas for a while, and were then locked up as fossils where they are now found. How long it took for this transformation to take place is manifestly beyond any data we may now have for determining. In the case of some artificial baths in which crystalline forms appear, we know that it takes only a few weeks at least, and why should natural processes be any more delinquent or defective in their operation than those that are purely artificial? Remember that we are not "musing on the Matterhorn" as was the gifted English naturalist, but upon the text of the equally gifted Isaiah, and pondering the works of God as seen by the devout prophet in his day. When Mr. Tyndall can tell us how long it took God to lift the towering Matterhorn from its base, he will be in a frame of mind to answer the other problems involved in the controversy between us. In an instant--the

twinkling of an eye--some of these phenomena have occurred, and recent events, such as wide volcanic disturbances, show how idle it is for man to place a limit to the power of the Most High. Even the "red snow," unmistakably a vegetal formation, appearing at times on the loftier Alps, is as much a proof of God's power as the ragged mountain peaks on which it appears--covering vast areas within a few hours' time.

When such men as the late Professor Silliman, and Professor Dana, Sen'r, of Yale College, take up the Bible genesis, and speak in high commendation of its value to science, it is idle for the Agnostics of that or any other institution of learning to speak sneeringly of their efforts. They both know (for the elder Benjamin Silliman "still lives") that the first command of this genesis was, for the earth to bring forth its vegetation, not from "seed" distinctively so-called, but from the germinal principles of life therein; what Ehrenberg calls the "rock-and earth-forming life" or power of life in matter.

That the second command was, for the waters of the earth to bring forth their specific forms of life, including the birds; just where science now asserts they originally came from.

And that the third command was, for the earth to bring forth the beasts thereof, and every creeping thing thereon. Here the "rock-and earth-forming" power of life ceased, and the language of the genesis changes. It is no longer "Let the earth bring forth," but let the Divine energy intervene!

"Let us (the divine Trinity in Unity) make man in our own image"--after our own conception of what he should be--the being of two worlds, the material and spiritual; and man was made accordingly. God breathed into his nostrils the breath of life, and he became a "living soul." This is the record--brief, grand, historic. No "evolution," no "involution," no word without sense or meaning. He who was to have dominion, in his limited sphere, over all the earth, thus came in due time for a wiser and grander purpose than man has yet seen; but which, in the providence of God and the light of His word, he will yet come to see, as scientific truth advances with the march of religious knowledge. Heaven speed the day when this millennium of truth shall dawn upon us here!

In this remarkable genesis we have a bridge that spans the chasm between the man and the anthropoid ape as no other bridge spans it. It is a bridge over which is flung the living garment of God, and angelic hosts may pass it to and fro, as well as the master-minds of our own and future ages. It takes man out of the category of a "beast of the earth," and places him where all soul-aspiration lifts us--lifts even Robert G. Ingersoll, in his higher inspirational moods, or will lift him when his extreme material dogmatisms and false teachings desert him, as we trust they some day will. Let him read the "Student," by Bulwer, and he will learn how narrowly Voltaire escaped becoming a "Reformer" in the Church of England, instead of the violent antagonist he was of the corrupt Church of Rome in France. We do not make ourselves; it is the environing circumstances and conditions in which we are placed which oftentimes determine our career for good or for evil.

We had proposed embodying in this Preface one or two caustic reviews of our late work, from an Agnostic source, but have been deterred from so doing, for the reason that we deem it in bad taste as well as irrelevant at this late day. We shall be pardoned, however, in alluding to _The National Quarterly Review_, for the captious manner in which it treated us after we had courteously replied to several inquiries made of us in its two- or three-page review. After complaining that we had been "hailed, by a class of callow religious critics, as a 'Savior' from scientific error and enormities," it charged us with certain unscrupulous methods of criticism,--such as putting language into Mr. Darwin's mouth that he never thought of uttering, etc., etc. And as this pretentious Quarterly put several questions to us, such as "When and where the great Evolutionist had taught any such doctrine as this?" we ventured to reply as courteously as we knew how. We endeavored to treat our reviewer fairly, as he had handsomely accorded to us the credit of "searching the fields of natural science, lance in hand, to deal hard thrusts at impious skeptics, materialists, and evolutionists--of which Mr. Darwin and Mr. Bastian fare the most severely." But we had no thought of using these offensive adjectives toward either of the distinguished gentlemen named, and did not so use them; however "unscrupulous" our methods may have been in other respects. Our reply was unnoticed by the bulky Quarterly, and we were content with knowing that it was received by its editor, and shared the fate of all intrusive communications which it is easier to throw into the waste-basket, especially in hot weather, than to answer in the interests of science, when such answers are difficult to be made. This was the first and only discussion we attempted to provoke with our "exhaustive Reviewers," and it will, in all probability, be the last. Little is gained by these polemical controversies, when conducted in the spirit of unfairness, or with greater asperity than the true interests of journalism demand. The beauty of its kindly advice to us, as a "scientific critic," was that every word of it came back, as a cruel boomerang, into the writer's own face.

But this is enough. For the last three years we have been mostly engaged in writing another book, the character of which is already sufficiently indicated in this Preface. The reasons why we have been led to adhere to our original purpose of making this a "Bible Genesis," as _The National Quarterly Review_ speaks of it, are best known to our more intimate friends, and we do not propose to disappoint them in their expectations.

If we have failed to make our theory understood by others, we regret it; if others fail to understand the inspired text, it is manifestly a matter for them to regret, and for us to deplore.

To those who have spoken kindly of "Life: Its True Genesis," we return our thanks: to those who have extended to it their sharpest criticisms, in what they believe the true interests of science, we also return our thanks. We have no fear that Truth will be crushed in this contest:

"Truth crushed to earth shall heavenward rise again,
Like wayside flowers that lift their heads, aglow
With a far sweeter fragrance when they've been

All rudely trampled on by hostile foe,
Than when in Flora’s gentle arms they’ve lain
The long night through, and wake at early dawn
To greet Aurora--jewelled queen of morn!"

R. W. Wright.

West Cheshier, Conn., _Oct_. 12, 1883.

Prefatory.

The office of a preface is twofold; first, to introduce the author to the public; second, to introduce his work. As the writer seeks no personal introduction, beyond what a favorable or unfavorable reception of his work may give him, he leaves the more formal, if not formidable branch of salutation untouched.

The work has cost him some labor, as the reader will see. The field he has traversed is vast and varied, and the facts he has gathered are numerous and from many and diversified sources--all bearing more or less conclusively on the one vital point he seeks to establish, viz: _That the primordial germs (meaning germinal principles of life) of all living things, man alone excepted, are in themselves upon the earth, and that they severally make their appearance, each after its kind, whenever and wherever the necessary environing conditions exist_.

The foundation of this emphatic formula we find in the Bible Genesis, in the words given on our title-page, which are more accurately translated in the Septuagint, than in our common English version of the Old Testament. The words are to be found in the 11th verse of the first chapter of Genesis, and the writer confidently believes that they contain the true Genesis of Life, although entirely overlooked, heretofore, by both the biblical and scientific scholar.

In the work which he here gives to the public, he will endeavor to show that all the vital phenomena of our globe, with the single exception named, find their complete explication in this Genesis of Life; and that we have only to take the scientific Genesis out of some of its more imposing categories, to make the two either entirely harmonize, or fall into the same lines of incidence in human thought.

Science has long taught that the _absence_ of necessary physiological conditions results everywhere in the _disappearance_ of vital phenomena; by reversing its logical methods, it will also find that the _presence_ of these necessary conditions results everywhere in the _appearance_ of vital phenomena. Take, for instance, the vegetation of Northern Europe, where it is known that the oak succeeded the pine, and the beech the oak, after each had held possession of the soil for we know not how many thousand

years. In bringing about the necessary conditions of soil, the pine paved the way for the oak, and that in turn paved the way for the beech. Neither sprang from the other, nor did the "selection of the fittest" have anything to do with the appearance or disappearance of either. Each yielded fruit "after his kind," whose "seed" (germinal principle of life) was in itself, i.e., after its own kind, upon the earth, and made its appearance spontaneously,--that is, without the presence of natural seed,--whenever the necessary environing conditions favored.

And the same law of vegetal propagation is everywhere operative to-day, in the alternations of forest growths, the spontaneous appearance of oak forests where pine have been cleared away, and _vice versa_, in some parts of the country, where heavy forests of oak timber have been felled. So with the new growths of timber springing up in the paths of tornadoes, over large burnt districts, in soils brought up from below the last glacial drift, and in hundreds of other instances which the reader will find conclusively verified in these pages,--all making their appearance without the possible intervention of natural seeds.

The great value of the Septuagint, as compared with other versions of the Hebrew Bible, will appear from the fact that it is older by many hundred years than any manuscript copy of the Hebrew text now extant. It was undoubtedly translated at Alexandria, in Egypt, as early as the third century before Christ, while the oldest known Hebrew MS. is a Pentateuch roll dating no further back than A. D. 580. Its translators had before them much older and more perfect MSS. than any that survived to the time of the masoretic recension, when an attempt was made to give uniformity to the readings and renderings of the Hebrew text by means of the vowel points, diacritical signs, terminal letters, etc., all of which are now subject to rejection by the best Oriental scholarship.

According to Irenˆƒus, this Greek version was rendered at the request of Ptolemy Lagi, in order to add to the treasures of the Alexandrian library, and it no doubt derived its name from the number of Hebrew and Hellenistic scholars,--probably the most eminent to be found in that day,--employed upon the work. The version comes, therefore, with paramount authority to our own times; and we accept its Greek rendering as the highest and most conclusive evidence of the authenticity of the text, and the "new genesis of life" we derive therefrom.

¸£˘ ¸›˘ ¸…¸– (as contained in the Septuagint) has almost an identical signification with the Hebrew word ZRA. It means the "_germ_ of anything," or the "germinal principle of life," as contained in anything that lives or grows. No one will claim that it is used in its literal sense of "seed," in the text. For, when the divine command was issued, there was no plant or tree, and, presumably, had been none upon the earth from which seed could have been derived. The word was used in its larger and more comprehensive (that is, metaphorical) sense, as the "germinal principle of life in matter," or precisely in the sense in which the Greek stoics used it in their philosophy. Both Theophrastus and Diogenes use the terms ˘ ˘ ¸µ˘ ¸…¸–˘ Æ¿‰¸”¸¿Æ‰¶ ¸‡˘ ¸‡¸¿¸„ expressing "the _laws of generation contained in matter_"--precisely the meaning we attach to it in its textual connection. The eleventh verse should read, therefore, as follows: "Let

the earth bring forth grass, the herb yielding seed, and the fruit-tree yielding fruit after his kind, _whose germinal principle of life, each in itself after its kind, is upon the earth_"

We accept this rendering of "the seventy," because they had the most complete and perfect Hebrew MSS. before them, and were no doubt better scholars, and far more competent renderers of the original text than the Masorites who came some seven or eight hundred years after them.

But this is not the most important point of inquiry in this connection. The materialistic objector may say: "Admit all this; grant that the true rendering is here given; grant even that the true law of vegetal development and growth is here enunciated; what has 'star-eyed science' to do with the '_odium theologicum_?'" We answer, nothing. We would bury both theological rancor and atheistical pretension in the same barrow, and agree never to "peep and botanize" over their common grave. But if a great scientific principle--one that fits into all the phenomenal facts of nature--explains them all, and is, in turn, explained by them--be found in the Hebrew _Hagiographa_, of what less value is it to science than if it had been originally enunciated by Aristotle or Plato? Or--to make the inquiry still sharper and more emphatic--of what less value is it to science than if it had originally come from Professor Tyndall or Mr. Herbert Spencer?

Take the "biblical genesis" as we have enunciated and explained it--with all the facts crowded into these explanatory pages--and science has no longer any genetic mystery to brood over, further than that every operation of nature is a mystery into which it is useless for scientific speculation to pry. We know what nature _does_, or may know it by the proper scrutiny, but we shall never know the causes of things, any more than we shall find God at the bottom of Herbert Spencer's crucible, or at the top of his ladder of synthesis. In the light of the Bible genesis, science can account for the origin of the stalwart oak or the lordly pine, without going back to any mycological or cryptogamic forms, to follow down an ever-changing vital plexus that is as likely to land in a buttonwood tree as an oak, or in a hemlock as a pine,--in fact, quite as likely to land in a carnivorous animal as in an insectivorous plant. "Let the earth bring forth," is still the eternal fiat,--just as implicitly obeyed to-day as it was in the world's primeval history, when an exuberance of endogenous vegetation laid the foundation of the coal measures. It requires no greater effort on the part of nature to produce the pine, the oak, the beech, the hickory--all of which we see springing directly from primordial germs to-day--than it did to produce the lowest vegetal organism, from an invisible, indestructible "vital unit," or Darwinian gemmule, thousands of years ago.

He who is the same yesterday, to-day, and forever, and in whose sight a thousand years are but as yesterday, knows no such "law of variability" as our materialistic friends have been spinning for us in their unverified theories of evolution, natural selection, selection of the fittest, rejection of the unfit--force-correlations, molecular machinery, transmutation of physical forces, differentiation, dynamical aggregates, _molˆcules organiques_, potentiated sky-mist, undifferentiated

"life-stuff," and other hylotheistic and purely hypothetical formulˆƒ, with which the average mind has been well-nigh crazed for the last fifteen or twenty years.

Believing that the time has come to call for "a halt" in scientific speculations, and a return to the phenomenal facts of nature as the true and only basis on which to formulate the immutable laws of life, matter, motion, etc., the writer submits this volume with trustful confidence to the public. [1]

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True Genesis.

Chapter I.

Introductory.

It is undeniably true that the progress of scientific thought and speculative inquiry, both in this country and in Europe, is rapidly tending towards a purely materialistic view of the universe, or one that utterly excludes the ancient and long-predominating metaphysical conceptions of Life, to say nothing of the more regnant and universally prevailing conception of a God. And it is quite as undeniable that the current of experimental research and investigation is setting, with equal rapidity, in the same direction. According to the views of many of our more advanced chemists, physiologists, and other scientific and speculative writers and thinkers--those whose experimental investigations have, it is claimed, reached the ultimate implications of all material substance--there are but two immutable, indestructible, and thoroughly persistent elements in the universe--_Matter_ and _Motion_. Everything else, they confidently assert, is either purely phenomenal, or else essentially mutable, ephemeral, transitory. Force, according to their theory, is only another name for motion or its correlates, and, hence, the two terms are interchangeably used by them in predicating their ultimate conclusions respecting matter.

Light, heat, electricity, magnetism, chemical affinity, molecular force, and even life itself, are only so many manifestations or expressions, they claim, of one and the same force in the universe--_Motion_, With the exception of matter, it is the only self-persistent, permanently enduring, ever active and reactive agency.

Light, they say, is dependent, heat conditional, electricity and magnetism more or less phenomenal, chemical affinity and molecular force mere modes or correlated forms of motion, and all-pervading life itself a mere postulate of the schools, or at best only the result of the dynamic force of molecules.

Deem not this collocation simply a burlesque on Scientific categories. Professor Bastian, in his great work on the "Beginnings of Life," has unhesitatingly said: "The 'vitalists' must give up their last stronghold--we cannot even grant them a right to assume the existence of a special 'vital force' whose peculiar office it is to effect the transformation of physical forces. The notion that such a force does exist, is based on no evidence; it is a mere postulate. The assumption of its existence carries with it nothing but confusion and contradiction, because the very supposition that it exists, and does so act, is totally averse to the general doctrine of the correlation of forces."

And this defiant challenger of the "vitalists," who thus half-sneeringly speaks of those who believe that the vital forces of the universe are among the highest potential factors expressed therein, is one who, for the last decade and a half, has mostly lived in the ephemeromorphic world, and who, in diving into the "beginnings of life," has so far lost his way that the all-glorious end of it is as much an inexplicable mystery to him now, as when he was more successfully expounding pathological anatomy and ruthlessly hacking away at anatomical subjects over the dissecting-slab of the London University College. Had he spent less time over this dissecting-slab, and more in studying the marvellous manifestations of life in its outspoken beauty of leaf, bud, flower, fruit--things of not mere guess and fancy--he would undoubtedly have had a higher appreciation of what is most vital in nature, and less of what is simply material in a non-functional sense. With Mr. Herbert Spencer, he gratuitously sneers at the "old specific-creation hypothesis," or the divine fiat in the beginning; but without that fiat, where would he find his ephemeromorphs? or even the dead tissues used in his organic infusions for the vainest of all human endeavors--that of producing life, or seeking to produce it, _de novo_? He is so immeasurably disgusted with the vitalists that he hardly allows himself to speak of "life" or even use the term "vital" as applied to its simplest manifestations, without quotationizing them as terms to provoke both incredulity and derision.

The world may, however, overlook much of this in him, in view of his past professional pursuits, as well as in consideration of his eminent services as a specialist in science. The dissecting-room of a university is not the most desirable place in the world for profoundly studying the vital forces of nature. It is too grim and ghastly a repository of dead men's skulls, and "holes where eyes did once inhabit," in which to regard "life's enchanting cup" as one sparkling to the brim. Detaching a muscle here, and laying bare another there; taking out a sightless eye in one subject, and putting the dissecting-knife deep into the pulseless heart of another; cutting the fragments of a human body into shreds and tatters over one dissecting-slab, and loading down another with splintered bones and mangled hands and limbs, is not exactly the sort of occupation to enkindle

the highest enthusiasm for "life," in any of its more manifold phases in nature. Too many lifeless notions get crammed into the head--to say nothing of baffled endeavor in the pursuit--to admit of the more conclusive and satisfactory inductions respecting living organisms.

But why should an assumption of the existence of life carry with it any greater "confusion and contradiction," than a like assumption respecting either matter or motion? Simply because the materialists insist, in their logical inductions, upon so distributing the terms of their syllogism that only a negative conclusion shall follow.

"Matter and motion," they say, are alone indestructible.

Life is neither matter nor motion,

Therefore: Life is not indestructible.

This syllogism is manifestly unanswerable, if there be no fallacy in the distribution of its major and minor terms. But wherein lies the incompatibility of reversing the order of its terms, so as to prove that neither matter nor motion is indestructible? And would such a judgment, thus derived, be any more spurious, the process of reasoning any more illicit, or the conclusion any less unanswerable? We might as well say that neither matter nor motion is an absolute entity in the universe, without some apprehensive intelligence, or rational intuition therein, to embrace them as distinct concepts or objects of thought; nor can either have the least conceivable attribute without some co-existing intelligence to ascribe it. For to ascribe an attribute, is to conceive or think of such attribute. And as our general conceptions are conceded to be realities, even by the materialists themselves, it necessarily follows that this conscious _ego_--this thing that conceives, thinks, ascribes attributes--is either co-existent with matter, or else antedates it in the order of existence. And here--at this identical point in the argument--we are irresistibly forced back, in our inductive processes, to the theological conception of a God--the one supreme _Ego_ of the universe--from whom alone all our intuitions of consciousness, as well as apprehensive intelligence, is derived.

We can no more get rid of these inductive processes than we can change the order of nature or reverse the inevitable laws of thought. Hence, we are constantly driven to formulate the following, or some equivalent inductions:--

1. Cause must exist before effect.

2. Without some vital principle, therefore, preˆ«xisting as a cause, there can be no life-manifestation.

3. But there can be no life-manifestation without organic structure.

4. The reverse of this proposition is also true.

5. Which, therefore, precedes the other as a cause, and which follows as

an effect?

6. Nothing can organize itself. To do so, it must contain within itself both the operating cause and the resulting effect, which is at once an incongruent and conflictive judgment.

7. But the thing that organizes must exist before the thing organized, whether it be a vital principle or an intelligent agency.

8. Hence Life, either as a preˆ«xisting cause or vital agency, must precede both animal and vegetal organism.

Again:--

9. Cause is that which operates to produce an effect, as effect is that which is produced by an operating cause.

10. But whatever operates to produce a life-manifestation must precede it as an operating cause.

11. Life, therefore, whether as a blind or intelligent force or agency, must precede its own manifestation; that is, must exist as an operating cause before there is any produced effect.

12. And this is true both as regards physical and moral effects.

13. Our intuitions, as the final arbiters of judgment, demand this or some equivalent order as the only one embraced in a logical praxis.

And since there can be no sound without an ear to appreciate it, so there be can no matter without an existing _ego_, in some state of consciousness in the universe, to apprehend it--to ascribe to it attributes.[2] On what, therefore, are we to predicate the existence of either matter or motion, except it be these intuitions of consciousness whose validity, so far as we have any knowledge whatever on the subject, rests exclusively on that "breath of life," which was breathed into man when he became a living soul? But if our intuitions are not realities, then nothing is a reality. All is as unsubstantial, as vague and shadowy, as Coleridge's "image of a rock," or Bishop Berkeley's "ghost of a departed quantity," as he once defined a fluxion. We may, therefore, retort upon Professor Bastian:--The "materialists," must give up their last stronghold--we cannot even grant them a right to assume the existence of either matter or motion, since both manifestly depend, for their slightest manifestation, upon the more potent agency of "vital force," as expressed in thought, volition, and consciousness--that triumvirate of the intellectual faculties without which neither matter nor motion could have so much as a hypothetical existence.

The great trouble with Professor Bastian, as with Mr. Herbert Spencer, is that he advances a purely materialistic hypothesis, and then goes to work, with his quantitative and conditional restrictions, to eliminate all vital force from the universe. As he has been no more successful in finding God--the Infinite source of all life--at the point of his

dissecting-knife, than has the speculative chemist at the bottom of his crucible, or Mr. Spencer at the top of his ladder of synthesis, he resolutely grapples with logic, as a last resort, and as remorselessly syllogizes God out of the universe as he would a mythological demon infecting the atmosphere of his dissecting-room. In the same way, he successfully syllogizes all life out of existence: although, in the very act of constructing his syllogism, he demonstrates its existence as conclusively as that matter and motion are objective realities in the world of mind and matter which is about him. He fails to see, however, that the thing which demonstrates must necessarily precede the thing demonstrated, as life must necessarily precede its manifestation. In admitting the existence of "vital manifestation," therefore, he virtually admits an antecedent vital principle, lying back of an effect as a cause, which must exclude anything like a contradictory judgment, so long as the laws of the human mind, in respect to logical antecedents and consequents, remain as they are.

Whatever may be the alleged inaccuracies of the Bible Genesis or the disputes heretofore indulged in respecting the _Hagiographa_, or "sacred writings" of the Jews, it will hardly be denied by the Biblical scholar that some of the most important discoveries in modern science, especially in the direction of astronomy, as well as in geological research and inquiry, confirm rather than throw doubt upon their more explicit utterances. This has been so marked a feature in the controversy, that whenever scientific speculation has thrown down any fresh gage of battle, as against the validity of these "sacred writings," the advocates of the latter have only had to take it up to dispel the mists of controversy and achieve a more conclusive triumph than ever. For the truth of this statement it is only necessary for us to instance a few of the more important facts contained in the Bible Genesis. And should it be found that the writer of this volume has discovered, in a long overlooked, much neglected, and inaccurately translated passage of this Genesis, a key that unlocks the whole "mystery of life," as the great battle is now waging between the materialists and vitalists of this country and Europe, it will most conclusively establish the point we shall here make--that in no equally limited compass, in ancient or modern manuscript or published volume, since the first dawn of letters to the present time, are there to be found so many conclusively established facts of genuine scientific value as in the first chapter of Genesis.

In dispelling the mists of prejudice, and possibly of doubtful translation, let us look this "genesis" squarely in the face:--

1. Take the statement that "in the beginning" the earth was without form and void, and darkness rested upon the face of the depths. Here is not only no conflict with science, but the great suggestive fact which led Laplace to construct his "Nebular Hypothesis," or that magnificent system of world-structures which regards the universe as originally consisting of uniformly diffused matter filling all space, and hence "without form and void," but which subsequently became aggregated by gravitation into an infinite number of sun-systems, occupying inconceivably vast areas in space.

2. Nor can science well afford to cavil at that other most important suggestive statement that "the spirit of God"--the great formative force of the universe--moved upon the face of the depths, after which the evening and the morning were the first day, that is, the first distinctive epoch in the order of creation. When materialistic science shall define "gravitation"--the supposed aggregating force of infinitely diffused matter in space--so as to make it a distinct and separate factor in the universe from "the spirit of God,"--that spirit which was breathed into man when he became a living soul, and which, we are told, "upholds the order of the heavens," then its devotees may sneer at the Bible Genesis, and the logical deductions to be drawn therefrom.

3. Again, science can have no conflict with the Bible Genesis, except in the most hypercritical way, in the affirmative statement that God set two great lights in the firmament, the one to rule the day and the other to rule the night; and that "he made the stars also." For it is nowhere stated that the "greater light" was not made to perform a similar office for each of the other planets of our system, or that it was not set in the firmament to adorn the skies of other and far-distant worlds, as "bright Arcturus, fairest of the stars," adorns our own.

4. Nor can materialistic science dispute the more explicitly revealed fact, that the order of creation, so far at least as animal and vegetable life are concerned, is precisely that to be found in geological distribution, or as unerringly recorded in the lithographic pages of nature. And yet nothing was known of these pages--not a leaf had been turned back--at the time the Bible Genesis was written. So that, whoever was its author, this precise order of distribution could only have been "guessed at," setting aside its inspirational claims, by the writer of this most remarkable genesis.

5. And again, science can have no successful conflict--certainly none in which she will ultimately come off victor--in reference to the equally explicit statement that every living thing, and every living creature, either yields seed, bears fruit, or brings forth issue, "after his kind," and distinctively none other. For this would seem to be the one inflexible law governing all living organisms, from which there can be no divergence in any such sense as the "scientific genesis," pretentiously so called, would authoritatively indicate. No "increase in variety," which Mr. Spencer regards as the "essential characteristic of all progress," will ever enable us "to gather grapes from thorns or figs from thistles."

6. Nor will materialistic science ever succeed in overthrowing the Bible theory herein advanced, that "the germs of all living things, man only excepted, are in themselves (that is, each after its kind) upon the earth," and that they severally make their appearance whenever the necessary environing conditions occur. This most remarkable statement of the Bible genesis will be found to fit into all the vital phenomena occurring upon our globe, explaining the appearance of infusoria, all mycological and cryptogamic forms, as well as all vegetal and animal organisms. All these come from "the earth wherein there is life," and hence the divine command for the earth "to bring forth" every living thing (except man) "after his kind."

But let us embrace, in the proper antithetical summary of statements, some of the more distinctive points of antagonism between the Bible genesis and that of materialistic science:--

THE BIBLE GENESIS.

1. The Bible Genesis presents the theological conception of a God, or an Infinite Intelligence in the universe, with whom, as personified, there is no variableness, neither shadow of turning.

2. The Bible Genesis represents every living thing as _perfect_ of its kind, which the earth was commanded to bring forth from seed or "germs," declared to be in themselves upon the earth.

3. The Bible Genesis represents God as causing to grow, out of the ground, every tree that is "pleasant to the sight and good for food," also every plant of the field "before it was in the earth," and every herb of the field "before it grew."

4. The Bible Genesis represents God as causing the waters of the earth to bring forth abundantly great whales and every living creature that moveth therein, and every winged fowl that flieth above the earth in the open firmament of heaven.

5. The Bible Genesis represents God as causing the earth to bring forth every living creature "after his kind," enumerating them in the order in which they appear in geological distribution.

6. The Bible Genesis represents God as making man in his own image, after he had commanded the waters and the earth to bring forth abundantly of every other living creature.

7. The Bible Genesis represents God as breathing into man "the breath of life," and he became a "living soul,"

8. The Bible Genesis represents God as creating the earth for the abode of man--giving him dominion over the fish of the sea, the fowl of the air, the beasts of the earth, and of every living thing that creepeth upon the face of the earth.

9. The Bible genesis represents God as exercising a moral government over man, to the exclusion of every other living creature.

10. In fine, the Bible Genesis represents man as only "a little lower than the angels."

THE SCIENTIFIC GENESIS.

1. The Scientific genesis virtually eliminates the idea of a God from the universe, by assigning to natural causes all the diversified and myriad-formed phases and changes that have taken place therein, extending

through an infinite duration of past time, and constantly confronted by an infinite duration of time to come.

2. The Scientific Genesis represents every living thing as more or less _imperfect_ of its kind, but advancing towards perfection by some underlying law of variability or selection of the fittest, or by gradual development from lower into higher organisms.

3. The Scientific Genesis emphatically repudiates the idea of any divine agency in the growth of plants and trees, and insists that "life," in all its manifold phases, is only "an undiscovered correlative of motion," or, at best, only a sort of _tertium quid_ between matter and motion.

4. The Scientific Genesis represents all fishes, amphibia, reptiles, birds, etc., as travelling along their respective lines of developmental progress and differentiation, from points far back in geologic time, and constantly working their way up from cold and flabby creatures into those of higher cerebral activity, and brighter and more varied life, until gigantic winged reptiles mounted into the air and became birds.

5. The Scientific Genesis attributes the appearance of every living creature upon the earth to a law of "evolution," by which one thing constantly overlaps another, forming a sort of stairway for lower organisms to climb into higher, without regard to "kind," or even orders, genera, or species.

6. The Scientific Genesis distinctly takes issue with that of the Bible respecting the divine origin of man, and insists that he has been climbing up from protoplasmic matter, through a thousand other and lower organisms, until he finally leaped from an anthropoid ape into man.

7. The Scientific Genesis emphatically repudiates the idea of a soul as thus derived, and even insists that "conscience," the highest known moral factor in the universe, is only a modified expression of the social instincts of the lower animals--the difference being in degree only, not in kind.

8. The Scientific Genesis promptly takes issue with this creative plan and purpose--insisting, in the dazzling speculations and fancies of its adherents, that well known physical and physiological laws have worked out all these phenomenal aspects and changes, and that these laws are wholly indifferent as to whether man shall have dominion over the shark and the tiger, or they dominion over him.

9. The Scientific Genesis illogically insists that "natural laws,"--those expressing no sovereign will, and having "no seat in the bosom of God"--are fully adequate for the government of man, he exercising to that end all the higher powers with which, by evolutional changes, he has become endowed.

10. While the Scientific Genesis represents him as only a little higher than the apes!

And yet no scientific authority has ever been claimed for these sacred Hebrew writings. They were simply designed as a rule of human faith and conduct, ostensibly having the divine sanction, and containing historical, devotional, didactic, and prophetical writings, to be read through, at least once a year, in the Jewish synagogues.

But the most important of these antithetical statements, so far at least as modern scientific research and inquiry are concerned, is that which represents the germs of all living things--man alone excepted--as being implanted in the earth itself. We take the definition of the Hebrew word _ZRA_, translated "seed" in the 11th verse of the 1st chapter of Genesis, from Professor Edward Leigh, of Magdalen Hall, Oxford, in his "Critica Sacra," first published in 1662:--"_Sparsit, asparsit, cum aspersione fudit, diffudit_," etc, that is, "something sown, scattered, universally diffused, everywhere implanted," as a germ in the earth. That the Hebrew word _ZRA_. does not mean, in this connection, the seed of a plant or tree, is manifest from the fact that the first plant or tree, from which "seed" could have been derived, had not yet appeared upon the earth.

The exact translation is, "whose primordial germs are in themselves (that is, each after its kind) upon the earth," implanted therein, as the "_diversa diversorum viventium primordia_" of Dr. William Harvey, were originally implanted in the earth. This illustrious physician and biologist, the discoverer of the circulation of the blood, not only taught the doctrine expressed in his phrase "_omne vivum ex ovo_," but that of "primordial germs"--living indestructible "principles of life"--existing in the earth itself. For it is evident that he uses the word "egg," in its more general sense, as designating any material substance capable of receiving his "primordium" (first principle of life) and developing itself into a living organism.

The whole controversy, as at present conducted by the materialists and vitalists, resolves itself into this one question:--Whether life springs from what Dr. Harvey calls a "primordium,"--a pre-existing vital germ or unit--or whether it originates _de novo_, as the materialists assert, from infusions contained in their experimental flasks, or from plastide particles contained in protoplasmic matter, or from the still more daring hypothesis of "molecular machinery" as worked by molecular force? It is certain that the materialistic theory is quite as inexplicable, on the basis of analogical reasoning and microscopical investigation, as that indicated in the Bible Genesis; while the vitalistic theory would seem to be more in harmony with vital phenomena, and hence the more rational hypothesis of the two. Besides, the Bible Genesis answers to the logical necessity of predicating a determinate cause for each and every vital effect, or each living organism apparently springing from plasmic conditions or mere structureless matter. Whenever the seeds of plants or trees are actually planted or sown in the earth, this logical necessity rests on an induction impregnably laid in cause and effect; while the materialistic dogma, _nihil ex nihilo_, would necessitate a like induction wherever seed is not sown. In either case the change that ensues is manifestly due to vital properties, whether the same be inhering in the seed, or in necessary environing conditions. And the vital processes are the same, with the single difference as to actual environment.

The germ in the seed is capable of assimilating, by well-determined and thoroughly specialized processes, the nutrient matter contained in its environment, precisely as the "primordial germ" develops under its environing conditions. From the moment they strike their rootlets into the ground, the processes of development and growth are the same. The only point, however, necessary to make in this connection, is, that when we go back to the first living organism of a species--its primordially developed form--we necessarily reach environing conditions within which there is no such thing as a germ-cell with an exterior environment corresponding to the testa of seeds, or to any conceivable notion we may have of seeds themselves.

At this point--one not merely theoretical, or speculatively possible only, but absolutely fixed and determinable in our backward survey of the vital forces of nature--we find individual parentage lost in a natural matrix, or in the vital principle implanted as a "primordium," in the earth itself. To this inevitable induction of Dr. Harvey we are all driven in the end, by those intuitive processes of reasoning which are hardly less conclusive than mathematical induction itself. We may call these "primordia viventium" plastide particles, bioplasts, vital units, or whatsoever we will,--the name is nothing, the working process is everything. Scientific speculation accomplishes nothing, therefore, by its new terminology, except it be to confound the ignorant and astonish the wise. To call the homogeneous basis of an egg "blastima," and its germinal point a "blastid," is all well enough in its way; but it adds no new knowledge, nor additional wealth of language, wherewith to predicate vital theories, whether they relate to the progeny of a hen-coop or the lair of a tiger in an Indian jungle.

Teach us to know what nature _does_, not what she _is_; and whatever of "divine revelation" is vouchsafed us, whether it be found in the majestic "Poem of the Dawn," attributed to the inspired pen of Moses, in the "myriad-minded Shakespeare," or the irradiated and deeply-prophetic soul of a Shelley, let us accept it with thanks, if not to the inspired authors themselves, at least to "the great Giver of life" who imparted their inspiration.

We accept the theory of "primordial germs," not simply because it is contained in the Bible Genesis, nor because it was conceived by the great and gifted Harvey as a possible solution of the whole difficulty, but because it presents, as we have before said, a satisfactory explanation of all the phenomenal facts of life with which we are acquainted. If Mr. Herbert Spencer will descend from his stilted theory of "molecular machinery worked by molecular force," and tell us what it all means; and, at the same time, turn us out a single plastide particle, or fungus spore, by any generating process referable to "the machinery" in question, we will as devoutly worship Matter and Motion as ever ancient Egyptian did the god Osiris. But until he does this, we prefer to accept the positive assurance of Professor Lionel S. Beale, a far more competent authority to speak of hypothetical molecules, that none of the "forces possessed by the molecules of which the primitive nebulosity of the universe was composed" ever produced a vital manifestation, or succeeded in "making life a slave

to force." We shall consider this question of "molecular force" in its proper place, and with reference to the different theories of life advanced by the materialists, without pursuing it further in this connection.

The evidence we shall present in reference to the alternations of forest growths, and the impossibility of accounting for them on any theory of seed-distribution--alternations covering, in many instances, independent forests springing up on a vast scale--and the still wider dispersion of domestic weeds, grasses, forage plants, etc. in localities where they were never known before, will be conclusive, we think, of the correctness of our position, that the Bible Genesis contains _the true key to the mystery of life_. Bear in mind that the true theory of life, whenever it shall be reached in human conception and formulated into definitely-known processes of action, must satisfactorily explain all life-manifestations, as Newton's theory of gravitation accounts for the movements of all celestial bodies. And the simpler the theory when once formulated--the more perfectly it falls into the grooves of definitely-expressed thought, and the more harmoniously it adapts itself to all vital manifestations--the more conclusive must be the induction on which it rests.[3] The emphatic statement that the "primordial germs" of all living things are in the earth, from the lowest infusorial form to the highest vital organism below "specifically-created" man, when supplemented by the scientific statement that "vital units" make their appearance whenever environing conditions favor, is conclusively a theory which accounts for all the life-manifestations heretofore occurring upon our globe.

And this theory falls at once into the necessary categories of human thought. Life, as generally defined, is a state of organized being wherein there is functional activity; while a state, or _status_, is an incidence determined by environing conditions. But back of each of these--life and its _status_--there must lie some efficient cause, producing, in the first instance, the environing conditions, and then the functional activity dependent on organization. To assume that this efficient cause is simply the effect or result of organization--one of its dependent conditions--is begging the whole question, and, at the same time, discarding a very important element in the problem--that of conditional environment. What this efficient cause _is_, is a question that awakens no responsive inquiry. It strikes its roots too deeply into the intuitions of consciousness for the soul to give back an intelligible reply. Certain it is that neither metaphysical speculation, nor scientific inquiry, will ever enable us to reach the roots of this question, or extract from them the first quantitive essence of life itself.

We shall also consider, in their proper place, the various theories of life which have been advanced from time to time by the materialists, in their avowed hostility to current religious beliefs, and especially those founded on the sacred Hebrew writings, and the supplementary teachings of the New Testament. And to show the extent of this hostility, and the real _animus_ of those waging it, it is only necessary to refer to the great central doctrine of the Sacred Scriptures, that Life--natural, spiritual, eternal--is "the gift of God." And this is the grand corner-stone of all religious edifices--those erected by the Egyptians, the Assyrians, the

Phoenicians, the Greeks, and even the inhabitants of farther India. Materialistic science must, therefore, deal its first and most effective blows at "Life," either as a theory to be resolutely assailed and overthrown, or else thoroughly ignored and set aside, in the more imposing and august temple of Science. Hence, the reader will find, in none of the great encyclopedias prepared under the supervision of scientific men, the slightest mention whatever of "Life" as a subject worthy of consideration at their hands. It finds, of course, its meagre definitional place in the dictionaries, but the bulky and more exhaustive encyclopedias have no room for it, except as it may be defined, under some correlate of motion, as "the latent possibility of a nebula," or of "undifferentiated primeval mist," originally pervading the interplanetary spaces.

We have no disposition to charge such materialists as Professors Tyndall, Bastian, Haeckel, Virchow, and Mr. Herbert Spencer, with directing their experimental batteries against the phenomenal facts of "life" for the purpose of overthrowing the foundations of religious faith and belief in the world. They are all eminent scientists, and apparently earnest seekers after truth in the several directions in which their respective paths of investigation have been pursued. But they manifestly array their opinions against the vitalists on the assumption that there is no scientific value whatever in the many and singularly diversified statements respecting "life" in both the Old and New Testaments. And this, it may be claimed, is necessitated by the generally accepted dogma, that science and religion are more or less hostile, the former resting on the inexorable logic of facts only, and the latter entirely on _pre_conceived and _pre_judicial notions respecting faith and belief. To this position of theirs we have no objection to make, so long as they subject their scientific statements to the one rigid ordeal of positively ascertained facts. But when they set themselves to spinning their theories of life on the strength of "nebular potentialities," and the possibilities of "undifferentiated sky mist," we must insist that they are infinitely wider of the mark than the theologians who claim that the great formative power of the universe is God, and that his "spirit," and not gravitation, "upholds the order of the heavens:"--certainly much wider of the mark than was Pope, when he wrote of the universe:--

"All are but parts of one stupendous whole,
Whose body nature is, and God the soul."

The truth is, that religion is quite as much the handmaid of science as science can be said to be the handmaid of religion. She breathes far more household laws for her devotees, if she does not veil her "sacred fires" more modestly from the sight of men. She is certainly less dogmatic, less dictatorial, less abounding in positive assertion, than what now passes for "science," in the popular estimation. Perhaps Mr. Herbert Spencer represents the scientific side of a greater number of questions agitating the public mind to-day, than any other one man, and he is still industriously engaged in solving, or endeavoring to solve, a greater number of social problems. And yet the most enthusiastic admirer of this gentleman will be forced to admit, when driven to the wall of actual controversy, that one-half, if not two-thirds, of his more formidable statements, put forth in the name of science, remain undemonstrated as

scientific truths. We are thankful enough, however, for the one-third he has vouchsafed us to let the other two-thirds pass as the dogmatic achievements of his wonderfully gifted pen.

Professor Beale asks the question, whether "a man who has the gift of science must ever be wanting in the gift of faith?" It is certain that this inquiry sharply emphasizes the antagonism at present existing between materialistic science and religious faith. But there is only one reason why this antagonism should be continued, and that is, the persistent claim of science to superior recognition in all cases where there is the slightest apparent conflict between the two. Certainly no man ever did more to popularize the genuine truths of science in this country than Professor Agassiz, or worked more successfully to that end. He was willing to place the decorative wreath on the starry forehead of science, but refused to pluck from the soul "the starry eyes of faith and hope," that man might be dwarfed down to the "nearest of kin" to the anthropoid ape.

When we come to this assumed relationship in genetic types, we have not so much as laid the first abutment of the bridge by which these revivers of Lucretian materialism would span the chasm between mind and matter, between the spiritual and physical side of man, between dark brute sense and "a soul as white as heaven." For going back to undifferentiated primeval mist, and following down the whole line of vital phenomena, from whatever subtle molecular combinations their first manifestation may have arisen, until we reach the highest differentiated organism below man, we shall find the chasm between the physical and the psychical not a thousandth part spanned. And even if man, with the assistance of all the maleficent spirits that "walk the air both when we wake and sleep," could span this chasm, it would be only by another bridge of Mirza across which no daring mortal could ever pass.

Mr. Herbert Spencer, in his "Principles," thinks he has mastered the necessary psychological, if not mechanical, engineering for the successful construction of this bridge. In that branch of his work entitled the "Principles of Psychology," he so far abandons the exact scientific method as to take up psychical phenomena, and deal with them genetically, as he would with the phenomenal manifestations of organic life, in the continuous chain of ideas every where presented as consecutive thoughts in the universe. He finds, or claims to find, in these psychical manifestations, a constant tendency towards differentiation--towards advanced and continuously advancing differences, varieties, and new modes of thought--the same as, or similar to, those taking place in living organisms. He accordingly assumes, for the science of mind, as complete a foundation on which to base the doctrine of "evolution," as in the case of either physical or physiological science. But he is no less troubled, in this psychological realm, with divergent varieties, and exceptional variations and changes, than when he plants himself on the more solid substratum of life in the abounding realm of nature. His psychological differentiations present too many and constantly-shifting divergencies and re-divergences--exceptional branchings in one direction, and still more exceptional in another--to admit of any sufficiently potentiated potentiality for bridge timber. The arch to such a bridge would have to abut, according to Professor Tyndall, on a vital foundation at one end,

and spring from undifferentiated sky-mist at the other.

The bridge will never be built.

Chapter II.

Life--Its True Genesis.

The profound Newton did not attempt to show what the gravitative force of the universe was. He bore himself more modestly, only endeavoring to show that such a force existed, and that it accounted for all the movements of celestial bodies, even to their slightest perturbations. He frankly admitted his inability to determine what this force was, but by observations and calculations made with the greatest care, he ascertained that its action upon matter was proportional to its mass directly, and to the square of its distance inversely; and, with the requisite data and the principles of pure geometry, he demonstrated that this mysterious force--utterly inapproachable by human conception in its mystery--not only governs and controls the movements of all the mighty masses of matter rolling in space, but transmits its influence--not successively, but instantly and without diminution--to the smallest conceivable molecule on the outlying boundaries of the universe. In the same calm and comprehensive spirit, if it be possible for us to reach it, let us look upon this mysterious force called "life," not to show that it is simply a "correlate" of this or that motion (a thing utterly impossible of demonstration, if it actually exists), but to ascertain how and in what way it acts, and by what known law, if any, it is governed.

In all the vast realm of Reality there is no more conclusive and palpable fact than that "life" exists--appearing wherever the bright light flashes, the loving raindrop falls, the dancing brook ripples, the sparkling streamlet murmurs, and the broad river flows to mingle with the sea. All along this bright pathway of sunlight and cool translucent wave, this wonderful principle of vitality manifests itself in all-glorious life--filling the air with balmy odors; making perennial bud, leaf and flower, speeding from sire to son, from heart to heart, from spirit to spirit, from age to age, from time into eternity.[4] For like all living principles, in this realm of Reality, it cannot die. It is immortal in its primal source, immortal all along its bright pathway, immortal as it flows onward to eternity, immortal in its return to the bosom of God. It is no postulate, no corollary, no mere hypothetical judgment; no "undiscovered correlative of motion," no "baseless fabric of a vision"--but the one grand comprehensive _Datum_ on which all the objective, as well as subjective, data of the universe rest. It is the same "spirit that moved upon the face of the depths," in that majestic Dawn of Creation when the "evening and the morning were the first day;" the same spirit that "upholds the order of the heavens;" that pervades the vast realm of Reality, that flashes in the bright sunlight, descends in the loving

raindrop, ripples in the dancing brook, sparkles in the murmuring stream, and forever flows onward bearing its primal fulness to the sea.

To deny the existence of this vital principle because we cannot bottle it up in our airless flasks: to reduce it to some unknown correlate of motion because it constantly defies our poor mental grasp; to insist upon its artificial production because elementary substances may be chemically handled in our laboratories--is the same sort of preposterous folly that Newton would have been guilty of, had he attempted to show that there was no such thing as "gravity" in the universe; that it was only some undiscovered correlative of a thermal limit,--some unknown molecular complexity or entanglement in cosmic ether--some spontaneously occurring affinity or antagonism of ethereal molecules in the interplanetary spaces--some "potentiated potentiality" of mere sky-mist,--conditions of which he could have had no experimental knowledge, nor have given the slightest analogical proof. That we are justified in thus partially travestying the technical methods of some of our modern scientists, so called--especially those of the materialistic school--those advocating a purely physical theory of life, we need only quote a sentence or two from Professor Lionel S. Beale, of King’s College, London. This eminent physiologist, in his recent work on "The Mystery of Life," says: "Notwithstanding all that has been asserted to the contrary, not one vital action has yet been accounted for by physics and chemistry. The assertion that life is correlated force rests upon assertion alone, and we are just as far from an explanation of vital phenomena by force-hypotheses as we were before the discovery of the doctrine of the correlation of forces." And he further adds that each additional year’s labor, in this special field of investigation, "only confirms him more strongly than ever in the opinion that the physical doctrine of life cannot be sustained."

Many able and eminently learned physiologists have been disposed to recognize the presence of pre-existing "germs" in the earth, but not to the extent of accounting for all life-manifestations therein, as the doctrine is conclusively taught in the Bible Genesis. The language of this genesis is too clear and explicit to be misunderstood, in its proper renderings. It especially emphasizes the remarkable and most extraordinary statement, at least for the period in which it was written, that all life comes primordially from the waters and the earth. Note the order in which the command "to bring forth" was issued:--

1. Let the earth bring forth its vegetation.

2. Let the waters bring forth the fishes, the amphibia, the reptiles, _the fowl of the air_.

3. Let the earth bring forth the beast, the cattle, every living creature, and everything that creepeth upon the earth--each after his kind.

4. _Let us make man in our own image_.

And this is the precise order in which the Scientific genesis proceeds, with all the lithographic pages of nature turned back for its inspection. Before vegetation there could have been no animal life upon the globe.

This fact is most conclusively proved, not only by geographic and paleontologic records, but by legitimate induction. From the highly crystalline, and, for the most part, non-fossiliferous era, far back in the Laurentian period, down, in the order of time, to the modern or post-tertiary period, there is one continuous history of life-manifestations, written upon the stratified rocks, in the order of the Bible Genesis. Was this mere guess and fancy on the part of the writer, even to the seemingly improbable element wherein is assigned the origin of the "fowl of the air?" Bear in mind that nothing was known of geological distribution at the time this most remarkable genesis was written. Had there been, it is certain that the careful and painstaking Hesiod, who suffered no important fact of the _Cosmos_ to escape him, would have given us some hint of it in his "Works and Days;" for Greece was, even in his early day, largely the recipient of Phoenician learning and literature, as she was certainly Phoenicia's foster-child in letters.

But the more conclusive proofs of the correctness of the order of creation, as given in the Bible Genesis, are to be found in the accurate observations of modern geological science. Before there could have appeared in the primeval oceans any living organism, even the lowest primordial forms of crustacea, there must have been marine vegetation--that springing from inorganic matter and laying the foundation of organic life. Plants originate in, and are solely nourished by, inorganic substances; or, to speak more definitely, they originate from primordial germs--the first elementary principles of life--whenever inorganic conditions favor, and, assimilating air, water, and other inorganic materials, convert them into organic substances, or such as answer to the conditions of organic life. In doing this, they take up and decompose carbonic acid, retain the carbon, and give off oxygen--a vital process not known to occur in the case of animal life. That their primordial germs, or vital units, are in the earth, as the Bible Genesis declares, is conclusively shown by the experimental processes first successfully entered upon by the Abbˆ' Spallanzani, Charles Bonnet, and others, and more recently renewed and advocated by M. Pasteur, and his co-laborers in super-heated flask experimentation, as well as logically established by inductive methods.

Nihil ex nihilo is conceded to be as conclusive an induction as _omne vivum ex vivo._ That is, as without some chemical unit--some primary least considered as a whole--there can be no chemical action, so without some vital unit, in the same primary sense, there can be no vital manifestation. The doctrine of "chemical units" is universally conceded, and that of "morphological units" almost as universally claimed. What greater incongruity is there, then, in assuming the presence between the two of a physiological or vital unit? [5] At all events, it is as impossible to demonstrate the non-existence of the one unit as the other. And so long as legitimate induction supports the doctrine of the Bible Genesis, it is useless to indulge in a contrary assumption which is wholly without verification or proof.

But to return to land vegetation. This appeared and flourished throughout the Devonian period, if not anterior to it, and long before the appearance of batrachian reptiles and other low air-breathing forms of life. In fact,

there could have been no life-breathing atmosphere until the earlier land vegetation had whipped out its more destructive elements, and paved the way, in necessary conditions, for the appearance of air-breathing animals. Hence the command for the earth to bring forth both marine and land vegetation--the vegetation of the earth--before there was any similar command respecting either marine or land forms of organic life. But by what logical method was this exact order inferred in the Bible Genesis? Neither the Jews, nor their earlier Hebrew ancestors, nor the Phoenicians before or after them, were in any sense of the word metaphysicians; nor did their language admit of those nicer distinctions and speculative conclusions which would have enabled any writer using it, thousands of years ago, to draw the commanding induction contained in this remarkable genesis. There is nothing in the incomparable methods of M. Comte, or the metaphysical spirit of Herbert Spencer, in his most daring speculations, which gives the world a more legitimate and conclusive induction than is contained in this simple statement of the order of creation. That it should have been a mere piece of guess-work on the part of Moses, or any other writer of his time,--covering, as it does, so many particularities of statement, all according with the exact observations of geologic science, and supported by paleontologic records,--requires quite as much credulity of judgment as to accept it for divinely inspired truth. A disciple of M. Comte might object to this conclusion as susceptible of two interpretations, the one a legitimate induction, and the other not. But the mind of the profounder reasoner would accept the interpretation which is supported by the higher reason, and validated by the greater number of conclusively-established facts. In the case of a strongly intuitive mind, it might be possible to guess the exact order of three or four apparently disconnected events, but to arbitrarily associate with them other and more distinctively subordinate occurrences, like the appearance or disappearance of whole groups and classes of plants and animals, the supposition that guess-work, and not positive information, governed in the formation of a judgment, is at once rejected because of its utter incredibility.

It is not our purpose, however, either to affirm or dis-affirm the inspirational claims of the Bible Genesis. We simply take its language as we find it, stript of its Masoretic renderings and irrational interpretations, and unhesitatingly aver that the three Hebrew words, translated in our common version--"whose seed is in itself upon the earth" --contains, when properly rendered, the key that unlocks the whole "mystery of life," or, as Dr. Gull emphasizes it, "the grand _questio vexata_ of the day." It expressly declares that "the primordial germs of all plant-life (and, inferentially of all life) are in themselves (_i.e._ each after its kind) upon the earth," and we have only to supplement this physiological statement with the "necessary incidence of conditions," as formulated by the physicists, to explain every phenomenal fact of life hitherto occurring upon our globe.

Take all the hints as to the spontaneous origin of life to be met with in Aristotle; all those subsequently repeated by Lucretius and Ovid; all the experiments of the renowned Abbˆ' Spallanzani--all the alleged "fantastic assumptions" of M. Bonnet--all the theories of "panspermism," by whomsoever advocated--all the fortuitous aggregations of "_molecules

organiques,_" as put forth by the French school of materialists--all the _primordia viventium_ of the gifted Harvey--all the "molecular machinery" and "undiscovered correlates of motion" formulated by Herbert Spencer and Professor Bastian--in fine, all the more brilliant theories of life ever spun from the recesses of the human brain,--and we shall find that they all fit into the three simple Hebrew words to be found in the Bible Genesis, _and all are explained by them._ We say _all_, with one exception only--that of man. And how inconceivably grand and majestic this exception! The crowning work of creation was MAN. He came from no "muddy vesture of decay;" no mere life-creating fiat spoke him into existence. He who was to have "dominion over all the earth"--who was to be created only a little lower than the angels--"in the image of God created He him." And, breathing into his nostrils the breath of life, _he became a living soul_!

Here is the "bridge" over which the "evolutionist" may pass, if he will, without wearing either the dunce's cap or the ass's ears. It spans the chasm between the anthropoid ape and man as no other bridge can span it. Across this bridge is flung the living garment of God, and how grandly, yet reverently and humbly, did the profound Newton cross it! Oh, ye defiant iconoclasts of sublime faith in the "old doctrines;" ye who talk so flippantly of the "potentialities of life in a nebula;" who sit on the awe-inspiring Matterhorn, at high noon, and muse in sadness over "the primordial formless fog," teeming with all the mighty possibilities of myriads of sun-systems like our own; and, musing, sneer, if you can, at the idea of a "specific creation" in the beginning--of an Infinite Intelligence that directs and superintends all! Because _you_ cannot annihilate matter, nor conceive of its annihilation in the infinitessimal compass of _your_ brain, is that any reason why Infinite power and intelligence may not have spoken it into existence at _His_ sovereign and commanding will? If man would presumptuously press towards the threshold of the Infinite, let him do it reverently, and with humility of spirit, and not as one "that vaunteth himself of strength," or "multiplieth words without knowledge."

But let us examine the Bible Genesis a little further in this direction. It is said in the second verse of the first chapter that "the spirit of God moved upon the face of the waters," that is, upon the face of the abyss--the chaotic mass at creation--the earth "without form and void."

What is here meant by "the spirit of God," is that life-giving breath or power of God which operates (continuously operates) _to impart life to inanimate nature._[6] From the connection in which it here stands it means this, as in other connections it means the power which operates (continuously operates) to produce whatever is noble and good (God-like) in man. There is no implication in the text that this life-giving principle or power was suspended in the act of creation. On the contrary, there is abundant evidence in nature to show that it is just as operative now as it was in the beginning. One of the definitions given by Professor Gibbs of this spirit is, "that which operates throughout inanimate nature," not that which once operated, and then forever ceased its operations. And Professor Gibbs no doubt meant by "nature," in this connection, not only all the physical phenomena she presents, but the aggregate or sum total of all her phenomena, whether active or passive,

animate or inanimate, embracing the world of matter or the world of mind.[7] "All are but parts of one stupendous whole,"--not a part nature, and a part not nature.

Again, in the eleventh verse, it is distinctly declared that the _ZRA_. the "germinal principle of life," is in the earth, producing each living thing, at least in the vegetable world, after its kind, that is, after its own class, order, genera, species. Hence, the three distinct and separate commands given to the earth, or to the earth and its waters, "to bring forth." No such command would have been given to the earth, had it not first received its _baptism of life_ from God--in other words, derived the animating principle of life from the source of all Life.

And hence, also, the two separate averments in the second chapter of Genesis, both entirely meaningless apart from the construction we here give it, that "out of the ground made the Lord God to grow" the vegetation of the earth, and "out of the ground" produced he (or caused to be produced) every beast of the field, etc.,--all of which has a definite and comprehensive significance in this one sense only, that the animating principle of life is in the earth, as the language of this most remarkable genesis implies. And this seems to have been the patristic idea, namely, that law and regularity, not arbitrary intervention, nor any specific act of creation, were what governed in the case of both vegetal and animal life.

St. Augustine says: "In prima institutione naturˆƒ non quseritur miraculum, sed quid natura rerum habeat." And it is certain that both St. Thomas Aquinas and St. Basil held the same view. And they further held that the animating principle of life once implanted in nature, held good for all time. But we are not seeking for early and mediˆƒval authority. What we propose to show is, that nature is still implicitly obeying just such a law as that implied in the command given her "to bring forth," however doubtful may be the authority on which it rests, in the opinion of our modern scientists.

And how completely does this genesis of life take man out of the definitional formula embracing the "beasts of the earth." From the lowest vertebrate, in Mr. Darwin’s plexus, to the highest quadrumane (his nearest allied type to man), covering almost an infinite variety of distinct living forms, the distance to be traversed, in order to reach man, is hardly more than one-third the length of the still unlinked and uncompleted chain. In the average capacity of the monkey’s brain-chamber, to say nothing of his other characteristic differences, the distance is not half traversed. As a "beast of the earth," he remains allied to his own type, and nothing higher. Both Darwin’s vertebral _plexus_, and Herbert Spencer’s "line of individuation," must begin with the lancelet and its disputed head, and end in the Catarrhine or Old World monkey. No _a priori_ induction will ever extend this line _or plexus_ to man. The developmental chain, if indeed there be one, has no congenital link that will either drag man down to the "beast of the earth," or lift the latter up to the transcendent plane of humanity. Each must remain specifically in his own type, whatever may be their vertical tendencies, upwards or downwards.[8] And this word "type" implies a fundamental ground-plan--an

archetype--an original conception of what each should unconditionally be, and what plane each should as unconditionally occupy. Man's place in nature can never be changed or modified by materialistic speculations. Whatever theories the materialists may spin into the unsubstantial warp and woof of their scientific formulˆƒ respecting life, will never stand before the tenacious and stubborn physiological facts which almost any thoroughly-informed and well-read scholar of nature may readily present against them.

Even the wild Indian of our prairies has a more rational conception of life and its accountabilities, than some of these learned professors whose theoretical conclusions we find it imperative to handle. With all his rude, rough nature, hanging like so many mental clogs about him, this unlettered savage recognizes the fact that the earth is the _genetrix omnium viventium_, or the living _mother_ on whose bosom he shall rest when his spirit has passed to the happy hunting-fields beyond. Unlettered as he is, and unread in any genesis of life, he fails not to perceive that the earth is forever teeming with the germinal principles of life, and that when his prairie fires have invaded the forests in which he had previously hunted the deer, other and different forest growths are constantly making their appearance, without any apparent intervention of seeds, but not without the supervisional care and direction of the Great Spirit,--while many of his hardier prairie grasses have disappeared, only to give place to the more nutritious _gramma_ coveted by his favorite game.

And here we may as well anticipate an objection which will be raised against the presence of this animating principle of life in the earth, as to meet and answer it further on in the argument. But as the objection to which we refer is one of those dragon's teeth we do not care to leave behind us, we will meet it at the very threshold of the controversy. It will probably be admitted that the vegetation of the earth may appear in the way and manner indicated in the biblical genesis, the same as infusorial forms appear in super-heated and hermetically-sealed flasks. But how about the preˆ«xisting germs or vital units of the mastodon, the megatherium, and other gigantic mammiferous quadrupeds of the Eocene period? From what experimental flasks, in the great laboratory of nature, did they first make their appearance? The objection is a legitimate one, and we will answer it.

But first, let us do so from the materialist's own stand-point. Time, they all agree, is practically infinite--past time, as well as future; while matter is susceptible of an infinite number of diverse movements, changes, modifications, combinations, etc.,[9] chemically as well as molecularly considered. This, they claim, is not a mere hypothetical judgment, but a mathematically demonstrable proposition. Grant it for the sake of the argument, and then see if the mastodon does not promptly emerge from some one of their "experimental flasks," as they choose to put it.

For if the number of these diverse movements, changes, modifications, etc., of matter, have been infinite, in its progress from the lowest statical to the highest dynamical manifestation, then every possible, as well as conceivable, form of matter, must have existed somewhere, and at

some time, in nature, even to its highest and most potentially endowed plasmic form in which there is life. And if this be true, and the materialists will not deny but rather affirm it, then the inter-uterine conditions of matter, in the case of all animals (the mastodon included), as well as the inter-cellular conditions in the case of all plant-life, must have existed, with their necessary environments, somewhere and at some time, in the all-hutched laboratory of nature. Hence, in the infinite number of these changes and combinations--in the countless collocations of molecules and chemically changed conditions of matter, we have the possibilities of all terrestrial life-manifestations, as we have, in the infinite number of cosmical changes, the possibilities of all planetary, cometary, and asteroidal manifestations. For whenever these vital changes occur, the life-manifestations dependent thereon, must as inevitably follow as that infinitely diffused matter should be aggregated by gravity, or by what Humboldt calls, in his "Cosmos," the "world-arranging Intelligence" of the universe.

Who shall say, then, that in that immensely remote and long-protracted era--the Eocene period--in which the gigantic elephantoids first made their appearance, there did not exist somewhere, in some one of nature's more cunning and prolific recesses, the exact plasmic conditions necessary for the appearance of the mastodon? If they existed anywhere (which is concessively possible), with the necessary environment (also concessively possible), then the mastodon could no more help wallowing out of his essential plasma than the earth can help responding to its axial motion. All things are framed in the prodigality of nature, and she never commits an abortion upon herself. If both the conditions and necessary environment were at any time present, as they must have been on the materialistic theory, the mastodon is just as easily accounted for as the first fungus, or the first fungus-spore. [10]

All physicists, as well as physiologists, agree that individual species of both plants and animals have _disappeared_ from the earth for the want of the "necessary conditions" under which they once lived and flourished. What greater fallacy is there, then, in the assumption that they originally _appeared_ from the presence of these identical conditions, whatever they may have been, and whenever they may have occurred? We put this question not simply because the Bible Genesis asserts that "_out of the ground_ made the Lord God to grow" every plant of the field "before it was in the earth," as well as every herb of the field "before it grew;" nor because it declares that their primordial germs are in the earth; nor because it speaks of the earth as containing within itself the "animating principle of life." But we put it on the irrefragable logic of the materialist's own premises and conclusions. They may use other and different physiological terms from what we should care to employ, but their "correlates of motion," their "molecular force," their "highly differentiated life-stuff," etc., may possibly mean nothing more than what we mean by "vital units," "vital forces," "vital conditions," etc. Their preference for the terms they employ, over essential "qualities" or "properties" of matter, is entirely due to the obvious invalidity of their conclusions, except as their physical theory of life may help them out of an unpleasant dilemma. "Force" is a more convenient term on which to allege the _de novo_ origin of life--its spontaneous manifestation in

their experimental flasks--than any vital principle primarily inhering in matter, and manifesting itself whenever conditions favor. It is to validate their own reasoning that they construct their fallacious force-premises, from which to draw their materialistic inductions. In other words, theirs is the fallacy of _non causa pro causa,_ or that vicious process of reasoning which alleges some other than the real cause of vital manifestation, and fastens induction where none is legitimately inferable.

Burdach, Buffon, Pouchet, Needham, and other professed vitalists, agree that in all life-manifestations there must be some preˆ«xisting vital force or principle, without which no living thing, whether plant or animal, can come into existence.[11] M. Pouchet says: "I have always thought that organized beings were animated by forces which are in no way reducible to physical or chemical forces." The Abbˆ' Needham is satisfied to formulate a "force vˆ'getative," so far as plant-life is concerned; Buffon invariably falls back on vital force or energy; and Burdach on a "force plastique," which is essentially inseparable from nature in her vital manifestations. According to the latter, the whole universe is an "_organisme absolu_" constantly endowed with life, and giving expression to it in all conceivable directions. And all that these vitalists need, to give a full interpretation to their facts of observation, is to supplement their theories with the Bible declaration that the animating principle of life is in the earth, from which all living things make their appearance, each distinctively after its own kind, whenever environing conditions favor. For they severally recognize these "necessary conditions" as inseparable from all vital manifestation.

An effort has been made to show that Goethe was the great inspired prophet of the doctrine of "Evolution," as a ceaselessly progressive transformation of one thing into another, in the metamorphoses of plants and animals; and Haeckel quotes this passage from him as entirely conclusive of this point: "Thus much we should have gained (towards solving the problem of life) that all the more perfect organic beings, among which we include fishes, amphibians, birds, mammals (and at the head of the latter, man), to be formed according to an archetype, [12] which merely fluctuates more or less in its ever persistent parts, and moreover, day by day, completes and transforms itself by means of reproduction." But this attempt to give a poetic glorification to Haeckelism in Goethe's speculations, and bring his commanding name into support of the evolution theory of development, will prove utterly futile in the light of his "archetype," and the persistency with which he concedes that nature adheres to perfected forms.

Goethe accepts the doctrine of _vis centripeta_, beyond the influence of which no developmental progress can be made in the way of diversifying or variegating ideal types. In other words, he virtually fixes limits to variability, from the outermost circumference of which reversion must inevitably take place. His whole doctrine may be summed up generally, if not specially, in these words: "The animal is fashioned _by_ circumstances _to_ circumstances," as the eagle to the air and mountain top, the mole to the loose soil in which it burrows, the seal to the water in which he frolics, and the bat to the cave, the twilight, and the night air. We

should rather say that the animal is fashioned, after the Great Architect's pattern, _to_ circumstances, and is only varied _by_ circumstances, and that within the narrowest limits of variability. For the most that Goethe means by his "archetype" is an ideal pattern, after which, or on which, a natural group of plants or animals has been fashioned within the limits of possible variability. But by whose mind, or rather within whose mind, was this ideal pattern--this essential archetype--fashioned? Whence this ideal type, this natural group, this _Archeus_ pervading all nature and fashioning all organic matter? Not from the mind of Goethe certainly, nor from that of Aristotle or Lucretius, but from the one supreme mind of the universe, in which the groups of all living things were originally fashioned in the archetypal world--that world "which," according to Bolingbroke, "contains intelligibly all that is contained sensibly in our world."

This archetypal doctrine of Goethe, coupled, as he couples it, with the influences of environment, or necessary external conditions, with typical modifications only, while it entirely harmonizes with the Bible genesis of types (everything modeled after its kind), is far from aiding, or in any way abetting, the materialistic hypothesis of Haeckel, unless we make nature at once the creator and modifier of her own archetype. And even then the variability of species remains unaccounted for, except as we attribute to nature a _purpose_ to modify persistent forms under a law that is immutable even in its variability. For the assumption of an archetype carries with it an archetypal plan and purpose, with a degree of intelligence, either in or above nature, capable at once of conceiving the type and determining the limits of its variability. The question is not, therefore, as many may seem to think, whether species originate by miracle or by law, but whether laws and causes can exist independently of any predetermining will or agency in the universe.

Our language, and that of all civilized peoples on the globe, must be thoroughly recast, not only in its philological and etymological character, but in its ideologic, etiologic, and other significations, before we can successfully fall back on an antecedent cause without an effect, or an effect without an antecedent cause. Besides, the human mind would have to undergo as complete a subversion of structure as language itself, before any such attempt at recasting it, on the basis of modern materialistic ideas, could possibly prove successful. And then, at least one-third of our language would have to disappear in this iconoclastic reform. For instance, take any well-tabulated synopsis of our categories and their relations, and they would nearly all have to be recast or entirely abandoned. Time, space, matter, motion, intellect, abstract ideas, volitions, affections, etc., with their several correlates or co-relations, would all have to undergo a thorough recasting process. The personal, intersocial, sympathetic, moral, and religious relations and obligations, would have to be summarily set aside for future revision, if not for sweeping rejection. All our ideas of life, materiality, spirituality, animality, vegetability, sensibility, etc., would have to fall into greater or less desuetude, the language disappearing with the ideas. All the words expressing our ideas of a superhuman agency, of God, angels, heaven, revelation, religious doctrines, sentiments, acts of worship, piety, human accountability to divine institutions, rites,

ceremonies, etc.,--to say nothing of maleficent spirits, mythological and other fabulous divinities, entering so largely into the spirit and machinery of all our best poetry--would utterly disappear from our language. All our churches, minsters, chapels, tabernacles, cathedrals, and temples erected to the "living God," embracing the finest and most majestic architecture of the world, would have to succumb to the iconoclastic zeal of these materialistic reformers. The ten categories of Aristotle would disappear in the one category of Haeckel, or possibly the two categories of Bastian--Matter and Motion! Philologically speaking, we should all be at sea, drifting, like a set of deaf-mutes, on a wide and inaudible ocean--all inarticulate, tongue-tied, voiceless--with only the screeching of the sea-mew, or some other sepulchral bird of the night, to greet us as in wide-mouthed derision of our speechlessness and folly.

But let us see how the incontestible facts of nature, and the truths of science, fit into the three simple Hebrew words referring to "germs," or the germinal principle of life, instead of the natural "seeds" of plants or trees. We have given what we claim to be the true rendering of these words. To show how perfectly they harmonize with all the phenomenal manifestations of life in nature, we hurriedly pass to our third chapter.

Chapter III.

Alternations of Forest Growths.

No fact has more profoundly puzzled the vegetable physiologist than the alternations of forest growths which are everywhere occurring without the apparent interposition of natural seeds, and which have been considered as wholly inexplicable except as one unsatisfactory theory after another has been suggested to account for the wide dissemination and distribution of their seeds. We have had any number of these theories, more or less ingeniously constructed, but it is safe to say that none of them satisfactorily accounts for more than a very limited number of the phenomena presented. It is only within a comparatively recent period that these alternations of timber growth have attracted the attention of scientific men; consequently little more than crude suggestions and ill-digested facts are at the command of the general reader and writer. And yet the facts themselves, such as they are, would fill a dozen volumes of the size of Dr. Hough's recent "Report upon American Forestry." We can only give a few of the more important facts we have gathered, and many of these are so deficient in necessary detail that their value is greatly lessened for scientific uses. This is especially true of nearly all those noticed and collated by Dr. Hough, in his report to the United States Commissioner of Agriculture, made in 1877, in which the alternations in question are referred to at length, but no new suggestions presented, nor any very important new facts given.

If our construction of the Bible genesis be the correct one, it will, we

think, be unhesitatingly admitted that all the facts collected and collated by Dr. Hough, together with others more carefully noticed by our ablest writers on vegetable physiology, not only harmonize with this ancient Hebrew text, but so completely fit into it, both in its implications and explications, that adverse criticism will be awed into silence rather than provoked into any new controversy on the subject. This remarkable genesis declares that the germs of all living things are in themselves upon the earth--"upon the face of all the earth." It is true that this declaration, as contained in the 11th verse of the first chapter of Genesis, is textually limited to the vegetation of the earth; but the further emphatic statement that "the animating principle of life" is in the earth, coupled with the more substantive fact that God commanded the waters and the earth to bring forth abundantly of every living creature, with the single exception of man, conclusively extends the language of the 11th verse to whatever vegetable and animal life the earth was specifically directed to "bring forth." It is our purpose to consider, in this connection, not only the various facts noticed and theories suggested by our ablest writers and thinkers on the subject of seed-distribution, but to ascertain, as far as possible, to what extent their several facts and theories harmonize with natural phenomena, and at the same time determine what disposition should be made of them in the light of this new genesis, herein for the first time disclosed.

Professor George P. Marsh, in his work on "Man and Nature," in which he treats largely of forestry in Europe, says that "when a forest old enough to have witnessed the mysteries of the Druids is felled, trees of other species spring up in its place; and when they, in their turn, fall before the axe, sometimes even as soon as they have spread their protecting shade over the surface, the germs which their predecessors had shed, perhaps centuries before, sprout up, and in due time, if not choked by other trees belonging to a later stage in the order of natural succession, restore again the original wood. In these cases, the seeds of the new crop may have been brought by the wind, by birds, by quadrupeds, or by other causes; but, in many instances, _this explanation is not probable_." It is manifest that Professor Marsh uses the word "germs," in this connection, in the sense of seeds only; for no seed-bearing trees "shed" any other germs than the natural seeds they bear. And while he admits that, in many instances, the generally accepted theory concerning the dissemination of seeds is not a probable one, he still clings to the exploded notion that vegetable physiology furnishes a record of "numerous instances where seeds have grown after lying dormant for ages in the earth." He further says, in the same connection, that "their vitality seems almost imperishable while they remain in the situations in which nature deposits them;" although he is reluctant to accept the accounts of "the growth of seeds which had lain for ages in the ashy dryness of the Egyptian catacombs," believing that they should be received with great caution, if not rejected altogether. But why he should scruple about receiving these speculative accounts of ancient Egyptian cereals, which are sometimes hawked about the country for two and three dollars a seed, and, in the same breath, accept the absurder theory that seeds may lie dormant for ages in soils where the hardest and most enduring woods will utterly perish and disappear in a few brief years, is wholly inexplicable to us, except as an hypothesis to force a conclusion, or to account for the otherwise unaccountable alternations of

forest growths.

But the idea that nature has any cunning devices by which she may hide seeds away where they will remain "almost imperishable" for ages, is not entirely new with Professor Marsh, nor is it any suggestion that would be protected by copyright. In finding the winds, birds, quadrupeds, and other assumed agencies of distribution improbable, he seeks, with Dr. Dwight, for "the seeds of an ancient vegetation," and, finding none by actual observation, concludes that nature has some occult, and thoroughly surreptitious, method of hiding them away, even in soils below the last glacial drift, where no microscope can possibly reach them. As the accounts of seeds taken from the mummy-cases of Egypt may answer the purposes of those seeking to palm off some new cereal as a nine-days wonder on the ignorant, so these speculations about the indestructibility of seeds, when hidden away by nature, may answer a like purpose in imposing upon the over-credulous; but they will hardly be accepted by the intelligent, much less the scientific, in the light of all the facts herein given. The simple truth is that all seeds are speedily perishable by out-door exposure. We hardly know a single seed that will survive beyond the second year when subjected to such exposure. If they do not germinate the first year, their vitality is utterly gone the second year, as hopelessly so as if they had been cast into the fire and consumed to ashes.

But there is a large class of vegetable phenomena which wholly excludes the idea of this wonderful vitality of seeds. It is well known that soil brought up from deep wells and other excavations, often produces plants entirely unlike the prevailing local flora. This soil has been brought up, in many instances, from beneath the last glacial drift, where it must have remained for not less than a quarter of a million years at the lowest calculation, and may have remained for millions of years, if not longer; and yet the same singular phenomenon is presented. Exposed to the sun’s rays, and the fructifying influences of showers and dews, the soil burgeons forth into an independent flora, and such as are nowhere to be found in the surrounding locality. The writer, in digging a well in Waukesha, Wis.,--a place now famous for the curative properties of its waters--in 1847, struck soil at a depth of about thirty-five feet--that which was evidently ante-glacial. The place is some twenty miles back from Milwaukee, and the whole section, far into the interior of the state from Lake Michigan, is one of drift, covering the primeval soil at various depths, from a few feet up to a hundred or more; and the imbedded soil must have remained in its place for untold ages. And yet, it was no sooner brought to the surface than it produced several small plants that were wholly unlike the prevailing local flora; although, unfortunately, they did not sufficiently mature to enable us to determine their genera and species. Considerable portions of this soil were dried and subjected by us, and the late Dr. John A. Savage, then president of Carroll College, to microscopic examination, but without discovering the slightest trace of any seed, or anything resembling seed, in the several portions carefully examined. The soil, however, contained, in its imbedded place, several large Norway spruce logs, in a more or less perfect state of preservation. But there were no cones, nor chits to cones, to be found in it, although the most rigid examination was made at the time to discover them. That the

seeds of these delicate little plants should have survived the wreck of this ancient Norwegian forest, or the drift from one, and burst forth into newness of life after hundreds of thousands, not to say millions of years, is decidedly too large a draft upon our credulity to be honored "without sight." But we will return to the alternations of forest growths.

It is within a comparatively recent period that extensive areas of hemlock, in Greene and Ulster Counties, N.Y., were cut off to supply the neighboring tanneries with bark. These clearings were no sooner made than oak, chestnut, birch, and other trees of deciduous foliage, sprang up and entirely usurped the place of the hemlock; for the reason, no doubt, that the soil had become chemically unbalanced for the growth of the latter, while its condition was entirely favorable for the development of the "germs" (not the natural seed) of the former. These changes in timber growths have been widely noticed in all parts of this country, as well as in Europe, but the universal supposition has been that they came from the natural seeds of their respective localities, those either scattered by the winds, or borne thither by the birds, by quadrupeds, or by some other natural agency. No one has suggested the theory of "primordial germs" or "vital units," or come any nearer to it than Dr. Dwight did in suggesting "the seeds of an ancient vegetation." The great truth of the Bible genesis has been wholly overlooked by reason of a faulty translation in the first instance, as taken from the Masoretic renderings of the sixth century, and implicitly followed since.

In 1845, a violent tornado swept a wide strip of forest in Northern New York, from the more thickly settled portions of Jefferson County to Lake Champlain. The timber that succumbed to the force of the tornado, and growing at various points along its track, was mainly beech, maple, birch, ash, hemlock, spruce, etc.; but it was rarely replaced, at any point, by the same timber, in the growths that almost immediately followed. The trees that are now growing along the track of the tornado are principally poplar, cherry, birch, and a little beech and ironwood: no ash, maple, spruce, or hemlock, except here and there, at considerable intervals, a tree or two which may have been replaced by natural seed. The important fact noticeable, in this connection, is that the aggressive timber--that replacing the old--entirely usurped the place of the evergreen growths, supplanting them with those that were wholly deciduous. Besides, it does not appear that the poplar, the cherry, and the ironwood, which were altogether aggressive, previously grew near enough to the track of the tornado to have possibly supplied the seed necessary for their appearance and growth.

The fact was specially noticeable at the time, and has been widely communicated since, that the white oak timber cut off at Valley Forge for fuel and other army purposes in the American camp, in the winter of 1777-78, was succeeded by black oak, hickory, chestnut, etc.--the white oak entirely disappearing, although by far the most favorably situated for propagation by seed. But the alternations of forest growths had attracted too little attention at that time to render the meagre facts given of any special value to scientific men. If the usurping timber had grown in the immediate neighborhood (a fact not stated), it might have come from natural seeds, and not from primordial germs under "favoring conditions."

In the Ohio Agricultural Report of 1872, an account is given of a storm-track, in that state, which swept for a considerable distance, and was violent enough to bear down all the timber before it. It is stated that the path of this tornado (which must have occurred many years ago) "had grown up with black-walnut, another and different growth from that prostrated by the force of the storm." In this instance, there were no neighboring trees, except perhaps at distant intervals, from which the nuts of the black-walnut could have been derived, unless they had been promiscuously strewn by the tornado along its entire track. But it is, unfortunately, not stated that the tornado occurred at that opportune season of the year when the nuts were properly matured for planting.

In many parts of the United States, particularly in the South and West, the paths of local tornadoes--those sweeping the native forests long before the axe of civilization invaded them--may still be traced by the alternations of timber growths, extending for long distances, and through forests where there were no neighboring trees from which it was possible that their seeds could have been derived. One of these tornadoes the writer traced many years ago (as early as 1837) in South Alabama, and he is satisfied, both from observation and reading, that the instances are rare, if not altogether exceptional, where the clean path of a tornado, through any of our primitive forests, has been succeeded by the same growth of timber as that borne down by the winds. Where the path of this ancient tornado of Alabama swept through a pine forest, a clean growth of oak was buttressed on either side by pine; and _vice versa_, where it swept an oak forest. And it is certain that the tornado, whenever it may have occurred, could have exhibited no such discriminating freak as alternately to distribute acorns in pine growths, and pine cones in oak growths, either to make good a scientific theory or balk an unscientific one.

Professor Agassiz, in passing through a dense young spruce forest some years ago, on the south shore of Lake Superior, noticed that the ground was thickly strewn with fallen birch trunks, showing that their place had been but recently usurped by the spruce; and he supposed that the birch had first succumbed to the force of the winds, and the spruce promptly taken its place, since, as a general rule, an evergreen growth succeeds a deciduous, and _vice versa._ We have any number of well authenticated facts similar to this stated by Professor Agassiz, but we cannot give place to them, in this connection, without greatly exceeding our limits.

Dr. Franklin B. Hough, in his recent "Report upon American Forestry," to which we have already referred, says: "It is not unusual to observe in the swamps of the northern states, an alternation of growth taking place without human agency. Extensive tracts of tamarack (_Larix Americana_) may be seen in northern Wisconsin that are dying out, and being succeeded by the balsam fir (_Abies balsamea_), which may be probably caused by the partial drainage of the swamps, from the decay or removal of a fallen tree that had obstructed the outlet." The writer of this work resided for a period of ten years or more in Wisconsin, and during that time traversed extensive portions of its territory, both before and after it became a state. As early as 1844, the extensive tamarack swamps of that region were

manifestly dying out for the want of the proper nutritious elements in the soil, and the balsam fir rapidly taking its place, especially where the accumulations of soil, resulting from decayed vegetation, were favorable for its appearance. The drainage of the swamps had not been thought of at that time, nor had the swamps themselves been disposed of, to any considerable extent, by the federal government. They were subsequently granted to the state for educational purposes, and afterwards purchased up in the interest of speculative parties.

But the decay of the tamarack had really commenced long before population found its way, in any considerable numbers, into that section of the country; and the balsam fir had begun its usurpation, in many of the swamps, long prior to the advent there of the white man. Neither artificial drainage, nor accidental drainage, had anything to do with the appearance of the balsam fir, or the disappearance of the tamarack. The latter was manifestly dying out for the want of the proper nutriment, and the former coming in for the reason that the soil was chemically balanced for the development of its "primordial germs"--those everywhere implanted in the earth, to await the necessary conditions for their development and growth. The natural seeds of this balsam fir were not present in either the first, second, or third tamarack swamp in which this alternation of growth originally took place. The change commenced as soon as conditions favored, and not before. It is safe to say that, in none of these tamarack swamps, was there a single balsam fir cone, or a single chit to a cone, nor had there probably been for thousands of years, before the time when the first balsam fir made its appearance in that section. They came, as all primordial forests come, from germs, not from the seeds of trees. Universally, the germ precedes the tree, as the tree precedes the seed, in all vegetal growths, from the lowest cryptogam to the lordliest conifer of the Pacific slope. Otherwise, we should be logically driven back to an act of "specific creation," which the materialist stoutly rejects, and the Bible genesis nowhere affirms.

Mr. George B. Emerson, in his valuable work on the "Trees and Shrubs of Massachusetts," suggests as a cause (undoubtedly the true one) for the dying out of old forests, "the exhaustion of the nutritious elements of the soil required for their vigorous and successful growth." But he is evidently at fault in his speculations as to the alternations of forest growths. The Cretan labyrinth that everywhere confronts him is the "seed-theory," which is so inextricable to him that he constantly stumbles, as one scientifically blind, yet eager to lead the blind. All the phenomenal facts with which he deals admirably fit into the Bible genesis, but he fails to see it because the sublime truth (with him) lies locked up in an unmeaning translation. He is indefatigable, however, in his hunt after seeds where there are no seeds, and in his jumps at conclusions where there are manifestly no data to justify them.

He says: "Nature points out in various ways, and the observation of practical men has almost uniformly confirmed the conclusion to which the philosophical botanist has come from theoretical considerations, that a rotation of crops is as important in the forests as in the cultivated fields." And he supplements this statement (measurably a true one) by adding that "a pine forest is often, without the agency of man, succeeded

by an oak forest, _where there were a few oaks previously scattered through the woods to furnish seed._" This is a very cautious, as well as circumspect, statement; but one that Mr. Emerson would not have made, had his experience and observation been that of Professor Agassiz, Professor Marsh, and others we might name. His few oaks previously scattered through the woods are no doubt among the "theoretical considerations" taken into account by him, as a philosophical botanist rather than a practical one. They were necessary for the extreme caution with which he would state a proposition when its "conditioning facts" were not fully known by him. His anxiety to account for the appearance of an oak forest in the place of a pine, where the latter had been cut off, was commendable enough to justify him in a pretty broad supposition, but not in any such general statement as he here makes. Had he consulted any of the older inhabitants of Westford, Littleton, and adjoining towns, in his own state, he would have found that not a few oak forests had succeeded the pine without the intervention of "scattered oaks," or even scattered acorns, in the localities named. Nor would his "squirrel-theory" of distribution have been very confidently adhered to, fifty years ago, in localties where the shagbark walnut was almost as abundant as the white oak itself. No squirrel will gather acorns where he can possibly get hickory nuts, and few will gather hickory nuts where the larger and thinner-shelled walnuts are to be had for the picking. The squirrel is provident, but no more so than he is fastidious in the choice of his food. He never plants acorns except for his own gratification, and is never gratified with indifferent food so long as he can command that which is to his liking.

In further speaking of the "exhausted elements" of the soil--those necessary for the food of trees as well as plants, and without which they inevitably perish and disappear--Mr. Emerson says; "This is clearly indicated in what is constantly going on in the forests, particularly the fact which I have already stated, and which is abundantly confirmed by my correspondents, that a forest of one kind is frequently succeeded _by a spontaneous growth of trees of another kind._" In the sense in which he manifestly uses the term "spontaneous" in this connection, his new forest might be accounted for on the theory of "primordial germs," but not on that of "seeds;" for few trees or shrubs in Massachusetts bear winged seeds, or possess any other means of dispersion (the _Acer_ family excepted) than those common to our general forest growths. Spontaneity, in a strictly scientific sense, is not predicable upon the artificial or chance sowing of either acorns, hickory nuts, or the chits to pine cones. A spontaneous growth implies a process which is neither usual nor accidental--a growth without external cause, but from inherent natural tendency--and it is questionable whether there is any such process in nature. It belongs to the same class of idle speculations as "spontaneous generation" in the infusorial world--a subject that will be considered as we advance in this work.

Our vegetable physiologists, Mr. Emerson among the number, are simply unfortunate in their use of terms--those expressing even the commonest operations of nature. In their genesis of plants and trees they need to adhere a little more closely to the genesis of induction, and use language in harmony with the phenomenal facts and characteristics which they are called upon to explain. But Mr. Emerson was not alone at fault in this

almost universal slip of the scientific pen. He quotes from a letter of Mr. P. Sanderson, of East Whately, Mass., in which the writer says: "There is an instance on my farm of spruce and hackmatack being succeeded by a spontaneous growth of maple wood;" and he adds that "instances are also mentioned by him (Mr. Sanderson) of beech and maple succeeding oaks; oaks following pines, and the reverse; hemlock succeeded by white birch in cold places, and by hard maple in warm ones; beech succeeded by maple, elm, etc; and, in fact, the occurrence was so common that surprise was expressed at the asking of the question."

These several alternations in timber growths, effectually vouched for by Mr. Emerson, occurring "spontaneously" as stated, can hardly be accounted for on any other theory than the presence of "germs" and "favoring conditions," such as we have named in connection with the Bible genesis. They might possibly be explained on the theory of "scattered seeds," if the several growths had made their appearance gradually, and not "spontaneously," as stated. The misfortune with Mr. Emerson, as well as with his several "reliable correspondents," was, that his facts are too meagrely imparted, in the necessary details, to draw any satisfactory conclusions from them--such as the nearness or distance of surrounding trees of the same species, and the possible chances of their seeds taking lodgment in the soil from which they grew. But, fortunately, there are facts, and those abundantly substantiated, which entirely negative the presence of seeds in the soils where these "spontaneous growths" are said to have appeared. In some instances, they cover large tracts of land, at distances of thirty, forty, fifty, and even hundreds of miles, from any native forest from which seed could have been derived.

Dr. Dwight, in the second volume of his "Travels," mentions visiting a town in Vermont (Panton, near Vergennes), in which a piece of land that had been once cultivated, but was afterwards permitted to lie waste, "yielded a thick and vigorous growth of hickory, _where there was not a single hickory tree in any original forest within fifty miles of the place_." Of this piece of land he says: "The native growth here was white pine, of which I did not see a single stem in the whole grove of hickory." He is greatly puzzled to account for this isolated growth of hickory, but readily concludes that "the fruit was too heavy to be carried fifty miles by birds; besides" he adds, "it is not eaten by any bird indigenous to Vermont." And even if the birds had carried the nuts thither, not one of them could have been planted there unless the nut-eating bird had been caught and destroyed on the spot, and the nut released from its crop. This might account for the appearance of a single tree, but not for a "whole grove of hickory;" and the squirrels certainly could not have been provident enough to plant any considerable grove in this particular locality, and nowhere else within fifty miles of it. The winds could not have borne them that distance without dropping a single nut by the way, and there is only one supposition left, which is that indicated in the Bible genesis.

While Dr. Dwight emphatically rejects the "transportation theory," he imagined he had solved the difficulty in his suggestion "that the cultivation of the land had brought up the seeds of a former forest, within the limits of vegetation, and given them an opportunity to

vegetate." But the utter absurdity of this theory may be demonstrated by any one inside of two years, by placing hickory nuts, in different soils, at a depth to which an ordinary plough-point would reach in cultivation; and then, at the end of the second year, examining those that did not germinate the first year. The commonest observer of a hickory forest knows that if the fallen nuts do not germinate the first year, their vitality is utterly and hopelessly gone. It makes no difference whether you leave the nuts on the ground where they fall, or place them one inch or twenty inches beneath the soil, the result will be the same. At the end of two years, you can pulverize them between thumb and finger almost as easily as so much dried loam. The idea of deriving a new forest from such nuts, is hardly less absurd than that of emptying the Egyptian catacombs of their old mummy-cases, in the expectation of seeing a race of Theban kings stalking the earth as before the foundations of either Carthage or Rome were laid.

Dr. Dwight was a very close and accurate observer of nature, and suffered few of even the minor points of detail to escape him. In the same work, as well as in the same connection, he gives an account of another forest, which he supposes sprang spontaneously from "the seeds of an ancient vegetation." He says: "A field about five miles from Northampton (Mass.), on an eminence called 'Rail Hill,' was cultivated about a century ago (_circiter_ 1720). The native growth here, and in all the surrounding region, was wholly oak, chestnut, etc. As the field belonged to my grandfather, I had the best opportunity of learning its history. It contained about five acres, in the form of an irregular parallelogram. As the savages rendered the cultivation dangerous, it was given up. On this ground there sprang up a grove of white pines, covering the field and retaining its figure exactly. So far as I remember, there was not in it a single oak or chestnut tree;" and he adds, "_there was not a single pine whose seeds were, or, probably, had for ages been, sufficiently near to have been planted on this spot_." He supposes, however, that the "seeds" (pine cone chits) had lain dormant for ages before cultivation brought them up "within the limits of vegetation."

As early as 1807, Judge Peters, of Philadelphia, became satisfied that all that elevated region around the head waters of the Delaware, Alleghany, and Genesee Rivers, then covered with heavy growths of hemlock, or with forests of beech and sugar-maple, was originally an oak forest, probably covering most of that entire region. And Mr. John Adlum, of Havre de Grace, Md., who originally surveyed the lands south of the great bend of the Susquehanna, between that river and the Delaware, conceived the same idea as early as 1788. The section surveyed by him was chiefly covered with beech and sugar-maple; in fact, it was in what was called, at the time, "the beech and sugar-maple country." He drew his inferences from the fact that he found, here and there, at irregular intervals, red and white oaks growing to an enormous size, none being less than sixteen feet, and many measuring twenty-two feet or more, in circumference five feet above the ground. He says that "the hemlock in this region seems to have succeeded the oak, while the beech and maple no doubt succeeded the hemlock." This last inference would seem to have been made from the fact that clumps of large hemlock trees were, at that time, still growing at intervals among the larger deciduous trees.

Indeed, there is no better established fact in vegetable physiology than that of these alternations of forest growths. They sometimes come on gradually, but, in a majority of instances, they make their appearance at once on the cutting off of old forests, in the tracks of tornadoes, or where fire has devastated extensive regions of timber. From the facts which have been gathered, it is difficult to determine any regular order of alternation, except that oaks and other deciduous trees succeed the different varieties of pine and other evergreen growths, and, perhaps, _vice versa_. In Dr. Hough's report upon American Forestry, he makes a brief summary of the order of these alternations in different sections of the country, on the authority of persons apparently more or less well-informed on the subject, but by no means accurate observers. He says that in the region about Green Bay, Wis., overrun by the fires of 1871, "dense growths of poplars and birches have sprung up, and are growing rapidly;" but he omits the most important fact of all, in his failure to state the previous growths of timber, or whether there were any neighboring growths of poplar along the track of the burnt district from which seed might have been derived.

Here are some of his more important statements:--

"At Clarksville, Ga., oak and hickory lands, when cleared, invariably grew up with pine. This is true of that region of country generally."

"At Aiken, S.C., the long-leaf pine is succeeded by oaks and other deciduous trees, and _vice versa_."

"In Bristol County, Mass., in some cases, after pines have been cut off, oak, maple, and birch have sprung up abundantly."

"In Hancock County, Ill., oaks have been succeeded by hickories."

"In East Hamburgh, Erie County, N.Y., a growth of hemlock, elm, and soft maple, was succeeded by beech, soft maple, and hard maple, but a good deal more of the last named than any other."

This is the general character of the summary given, and if its object were simply to show the fact that these alternations actually took place (one that nobody has disputed in the last half century), his chapter on the "Alternations of Forest Growths," is a scientific success. The information really desired in these cases, was that imparted by Dr. Dwight in his suggestive work of travel, in which all the incidental facts and surrounding circumstances are fully given. It does not appear from any of the foregoing statements, given as a specimen, that there were any neighboring trees sufficiently near to have supplied seed for the new forests taking the place of the old,--manifestly the most important physiological fact connected with the whole inquiry, whether looking to proper forest-management, or to future "schools of forestry," certain to be established in this country, as they have been in most of the leading countries of Europe.

It is, however, stated by Dr. Hough, in his voluminous report, that, "in

New England, the pine (without giving its varieties) is often succeeded by the white birch, and, in New Jersey, by the oak; the succession of oak by pine, and the reverse, in the southern states." And it is further stated, without reference to the nature and quality of the different soils, or the absence or presence of neighboring seed-trees, that "poplars and other soft woods are very often found coming up in pine districts that have been ravaged by fire." "We have noticed," he continues, "in Nebraska, ash, elm, and box-elder following cottonwood. In the natural starting of timber in the prairie region of Illinois, where the stopping of fires allowed, we often see a hazel coppice; after a time the crat^fgus, and finally the oaks, black-walnuts, and other timber. These growths are often quite aggressive on the prairies. In Florida, the black-jack oak usually takes the place of the long-leaf pine." In all these cases, the contiguousness of similar, or dissimilar growths, is not stated.

He nevertheless cites a most important fact respecting the alternations of timber growth, noticed by Sir Alexander Mackenzie, in his overland journey from Montreal to the Arctic Ocean, in 1789, who found, in the vicinity of Slave Lake, that the banks were covered with large quantities of burnt wood lying on the ground, where young poplar trees had sprung up immediately after the destruction of the previous growths by fire. In noticing this fact, the indefatigable English explorer remarks: "It is a very curious and extraordinary circumstance that land covered with spruce, pine, and white birch, when laid waste by fire, should subsequently produce nothing but poplars, _where none of that species of tree was previously to be found"_. But facts of a similar character are too numerous and well-authenticated to be questioned by any intelligent authority. And they all point to but one solution--that of primordial germs quickened into life by the necessary environing conditions. The appearance of a single poplar in the locality named, or even a dozen of them for that matter, might be accounted for on the theory that a bird of passage had dropped them there after the fire; but, under no conceivable circumstances, could the dispersion of the requisite amount of seed to plant an extensive burnt district, along the banks of Slave Lake, have occurred on any other theory than that emphatically set forth, as a physiological fact, in the Bible genesis.

There is manifestly importance enough attaching to this subject to justify a much wider range of observation and inquiry than has yet been made. Pine forests have been cut off in Alabama and Georgia, covering extensive areas, where there was not a single oak tree in a circuit of miles; and yet the oak has promptly made its appearance, in several varieties, over the whole cleared district. And it is entirely safe to say that, had the ground been thoroughly examined, from the surface to ten feet below it, after the pine had been felled, not the first sign of an acorn could have been met with anywhere within the whole area of the clearing, no matter whether it covered ten acres, twenty, or a hundred. The paths of the tornadoes we have referred to conclusively show this. The new-born forests, in these cases, do not come from seed, but from the living, indestructible, vital principles implanted in the earth, before it was specifically commanded to "bring forth," in the language of the Bible genesis. The "materialists," like Professor Bastian, Herbert Spencer, and others, may sneer at this declaration, but let them advance some rational

theory to the contrary, to account for these alternations of forest growths, before they lay bare the joints of their scientific armor too confidently to the thrusts of the next new-comer in the field of scientific investigation. Sneers are cheap weapons--the mere side-arms of pretension and frippery--but they never bear so deadly a gibe as when effectually turned on the sneerer.

Professor Moritz Wagner, in his description of Mount Ararat, mentions "a singular phenomenon," to which his guide drew his attention, "in the appearance of several plants on soil lately thrown up by an earthquake, which grew nowhere else on the mountain, and had never been observed in this (that) region before." This writer, thereupon, goes into a disquisition upon the vitality of long-buried seeds, but only to mar the value of his very important observation. The fact that these new plants were rejected by the other soil of the mountain--that not thrown up by the earthquake--is the only other observation of value made by this writer. And the importance of this one observation lies in the apparent, if not conclusive fact, that the conditions of the other soil of the mountain were not favorable for the development of the primordial germs, or vital units, contained in that which was thrown up by the earthquake, a circumstance that most materially strengthens the view we have taken, as all candid and impartial readers will agree.

Mr. Darwin inadvertently makes a very material concession in favor of the theory we have advanced, although unconscious of any such theory, except that so broadly and unqualifiedly put forth by the "panspermists" as to meet with a ready refutation. He is laboring, of course, to strengthen his position that nature eternally works to get rid of her imperfect forms, or to ensure "the survival of the fittest." But while his facts accomplish little in this direction, they establish much in another, as the reader will see. He says: "In Staffordshire, on an estate of a relative, where I had ample means of investigation, there was a large and extremely barren heath, which had never been touched by the hand of man; but several hundred acres of exactly the same nature had been enclosed twenty-five years before, and planted with scotch fir. The change in the native vegetation of the planted part of the heath was most remarkable--more than is generally seen in passing from one quite different soil to another; not only the proportional numbers of the heath plants were wholly changed, _but twelve species of plants _ (not including grasses and sedges) flourished in the plantation which could not be found on the heath."

The attempt is here made, by Mr. Darwin, to convey an altogether different meaning to his facts than what they will warrant, even as adroitly handled by him. No heath plants were "wholly changed" in characteristics, but only in proportional numbers; nor did the "twelve new species of plants" make their appearance by virtue of any law of variability or selection of the fittest. The growth of scotch fir had simply changed the conditions of the soil, so that certain varieties of heath growth disappeared for the want of "necessary conditions," and certain varieties of forest growth made their appearance because conditions favored. Similar, if not greater changes, are constantly occurring in hundreds of localities in New England, where choked and worn-out pasture lands are left, untouched by the hand of man, to grow up as best they may into new forests. The

open-field plants and shrubs entirely disappear, as the stronger and more aggressive trees, taking root in favoring soils, advance in the struggle for supremacy, while the less hardy and more modest plants--those quietly seeking shelter in the woods--make their appearance, because they find, beneath the shade of the usurping forest, the precise conditions necessary for their more successful growth.

No perishable seeds have been awakened from their "sleep of untold centuries" by these changed conditions of the soil; but nature, everywhere obeying the divine mandate, brings forth her implanted life in all its bountiful diversity of stalk, leaf, bud, bough, blossom, fruit,--not in obedience to man's husbandry alone, but because, as the "vicar of God," she must provide for her benefice. "Let the earth bring forth" is the eternal fiat. Nature forever heeds it, and forever obeys it. "Oh, ye blind guides, who strain at a gnat and swallow a camel, doubt it if ye will." But forget not that nature has her "compunctious visitings," and will rise up in insurrection against you. Nothing in her breast lies dormant for ages, or even for an hour. Her appointed times and seasons forbid it. If the butterfly does not sport in her sunshine to-day, it is because it lies dead in its golden-colored shroud, and can never become a butterfly. In all her profusion and prodigality--flinging her glittering jewels, even in mid-winter, over all her enamored woods, and causing her little fountains to leap up from their crystal beds in delight, that they may be frozen, mid-air, into more sparkling jets--she exhibits no such munificence as in her unsparing prodigality of life. To be prodigal in this was the first command she received, and her great heart constantly throbs to give it expression. And in all this she simply obeys a kindly law which has been implanted in her bosom, and can never be displanted. She has no need of seeds in her cunning laboratory to perpetuate plant-life, and only yields them to man for use, and not abuse. He can utilize them if he will, so that all things of beauty and golden-fruited promise shall be his. In the language of her greatest and most profoundly philosophical poet,--

> "Nature never lends
> The smallest scruple of her excellence,
> But, like a thrifty goddess, she determines
> Herself the glory of a creditor--
> _Both thanks and use_."

Those who think, therefore, to make nature a debtor, by reversing her laws of propagation and making her dependent on what she bestows in use, will never find out the smallest scruple of her excellence, nor add to her glory as a creditor. All things are framed in her prodigality, and the seeds of plants and trees are no exception to the quality of her bestowals. We may reason, syllogize, speculate as we will, the first plant and the first tree were not nature's thankless bastards, but her legitimate and loving offspring. She engendered them in her own fruitful breast, and her "copy is eterne."

Chapter IV.

The Distribution and Vitality of Seeds.

Few questions have attracted more attention among vegetable physiologists, of late years, than the dispersion and migration of seeds from place to place in the earth, and it is safe to say that none has been more unsatisfactorily answered. In the case of quite a number of plants and trees, special contrivances would seem to have been provided by nature for insuring their dispersion, as well as migration. With a small number of plants, for instance, the seeds are discharged for short distances by the explosive force of their seed-vessels, when properly matured; an equally small number have certain membranous contrivances, called "wings," by which they may be borne still greater distances; others, again, are provided with light feathery tufts, to which the seed is attached, and these may be carried by the winds several miles before finding a lodgment in the soil; while many others are inclosed in prickly and barb-pointed coverings by which they attach themselves to animals, and even birds, and may be transported to almost any distance. But with the great majority of plants and trees, as the seeds fall so they lie, and must continue to lie until they either germinate or perish, or are accidentally dispersed or scattered by some extrinsic agency. The anxiety of speculative botanists to account for the recognized alternations of forest and other growths, have led to the different theories of transportation we have named; and when these theories have been supplemented by the alleged wonderful vitality of seeds, in the cunning recesses in which nature manages to conceal them, they imagine the whole difficulty solved, when, in point of fact, it remains wholly unsolved.

This theory of the "wonderful vitality" of seeds is simply one, as we have said, to force a conclusion--to get rid of a lion in the scientific path. Professor Marsh, with other eminent and scholarly writers on vegetable physiology, scouts the idea that the seeds of some of our cereal crops have been preserved for three or four thousand years in the "ashy dryness" of the Egyptian catacombs. But what better repository in which to preserve them? Certainly, none of our modern granaries, with all their machinery for keeping the grain dry, or from over-heating. Nor are the catacombs to be despised, as compared with any out-door means of storage yet suggested by the wit of man. The only means nature has of storage, or rather of preservation by storage, is to welcome the seed back to her bosom--the earth from which its parent-seed sprang--where it may be speedily quickened into life, and bear "other grain," not itself. For "that which thou sowest is not quickened, except it die;" and much more is that dead which is not quickened. Whenever seed is thus returned to nature’s bosom--all-palpitating as it is with life--whether it quickens or not, it dies; and there is no resurrection for dead seed from the earth, any more than there is for the occupants of the exhumed mummy-cases of ancient Thebes.

The belief in this wonderful vitality of seeds, in the positions in which nature deposits them, is pretty much on a par with that which assigns a thousand years to the life of a crow. As nobody but the scholastic fool in

the fable has ever attempted to verify the correctness of this latter belief, so it is safe to assume that the experiment of verifying the former will not be successfully undertaken within the next thousand years, to say the least. It is well known that the vitality of seeds (so far, at least, as nature handles them) depends, upon her cunning contrivances for their preservation, as well as their dispersion. But many seeds, in which these contrivances would seem to be the most perfect, will not germinate after the second year, and few will do so to advantage after the third or fourth year, even when they have been kept under the most favorable circumstances, or in uniform dryness and temperature. Farmers, who have had practical experience in this matter, and care little for what is merely theoretical, will never plant seed that is three or four years old when they can get that of the previous year's growth. It is certain that no hickory nut will retain its vitality beyond the first year of its exposure to a New England soil and climate, and few seeds are better protected by nature against such exposure; and it is equally questionable whether the chits to Dr. Dwight's pine cones would have had any better chance of survival at the time the Indians infested the neighborhood of Northampton, and regularly fired the woods every autumn.

Although Professor Marsh confidently says, in his work on. "Man and Nature," that "the vitality of seeds seems almost imperishable while they remain in the situations in which nature deposits them," he will no doubt admit that this statement rests on no experimental knowledge, but simply on the hypothesis that the new forests and new species of plants to which he refers, originated from seeds, and not from primordial germs everywhere implanted in the earth. Dr. G. Chaplin Child, who swallows the "Egyptian wheat" story, mummy-cases and all, in speaking of some of the English "dykes" or mound-fences which have existed from time well-nigh immemorial, says: "No sooner are these dykes leveled than the seeds of wild flowers, which must have lain in them for ages, sprout forth vigorously, just as if the ground had been recently sown with seed." He also mentions, as a more or less remarkable fact, "that a house, which was known to have existed for two hundred years, was pulled down, and, no sooner was the surface soil exposed to the influence of light and moisture, than it became covered with a crop of wild-mustard or charlock." And he instances these facts to show that the seeds of this charlock, and these dyke plants, had lain dormant in the soil from the time the dykes were built, and the house erected. But these physiological facts, however well authenticated they may have been, are no more conclusive of the presence of dormant seed, than the appearance of the common plantain about a recently built dwelling-house, where none ever grew before, is proof that the seeds of this common household plant had lain dormant for ages before the house was erected. We cannot tell why this common plant follows the domestic household, any more than we can tell why rats follow civilization. But they are both sufficiently annoying at times, to satisfy us that they _do_ follow, however inexplicable the reason may be.

The same writer further says, in connection with the foregoing statements: "Instances (of the vitality of seeds) might easily be multiplied almost indefinitely, but we shall be satisfied with noticing one of a very extraordinary kind. In the time of the Emperor Hadrian, a man died soon after he had eaten plentifully of raspberries. He was buried at

Dorchester. About twenty-eight years ago, the remains of this man, together with coins of the Roman Emperor, were discovered in a coffin (!) at the bottom of a barrow, thirty feet under the surface. The man had thus lain undisturbed for some 1700 years. But the most curious circumstance connected with the case was, that _the raspberry seeds were recovered from the stomach_ (!) and sown in the garden of the Horticultural Society, where they germinated and grew into healthy bushes," Here is circumstantiality enough to satisfy the most unlimited skepticism, provided that the facts were satisfactorily vouched for by the living, and the record left by the dead were sufficiently explicit in detail, and conclusive in identity of subject. Then to suggest even a reasonable doubt would, we admit, be equivalent to making truth a circumstantial liar.

But this most remarkable story will bear repetition, with a few running comments. "The man (presumably a Roman soldier) died seventeen hundred years ago." This is not unlikely. "He died of eating too plentifully of raspberries;" a circumstance not altogether improbable. "He was buried at Dorchester;" where, of course, there were no records of deaths and burials kept at the time, and hence, we should have to question the record, if one were presented. "He was also buried in a coffin, or, at least, dug up in one." This statement must be received _cum grano_. The Romans never used coffins, and, under the empire, they burnt most of their dead. After a battle, however, they generally piled them up in heaps, and, where there was a lack of fuel to burn them, they covered them with the surface soil, taking good care to put a Roman coin in each soldier's mouth, so that he might pay the ferryman in Hades. "There was thirty-five feet of surface soil shoveled on top of this particular Roman,"--showing that he was a very consequential personage in camp. No wonder, then, that all these nice particularities of statement should have been circumstantially noted in the commanding general's "order of the day," and thus been handed down to posterity for the future advancement of science! "He had lain undisturbed for nearly two thousand years." Almost any one would have done so, with that amount of surface soil shoveled on top of him. "The seeds were recovered from his stomach;" that is, after improvidently snatching away the Roman soldier's life, they took good care to preserve their own, as well as the stomach in which they were deposited. "The seeds were planted in the Horticultural Society's garden, where they flourished vigorously."

All these circumstantially narrated facts (?) were gathered (by somebody) about forty years ago. In what authentic and satisfactorily verified record are they to be found to-day? The writer gives us no clue. The stomach, the coffin, the Roman coins, some of the wonderfully preserved seeds, as well as the _obolus_ in the mouth of the dead soldier, should be found somewhere. They could not have disappeared in a night. If they had withstood the relentless tooth of time for seventeen hundred years, in the surface soil of Dorchester, the last forty years ought not to have obliterated all trace of them. The story is simply too incredible for belief, if printed in forty "Great Architects of Nature."

From 1847 to 1851, the writer went into any number of Wisconsin mounds--those not essentially dissimilar from the Roman barrows in England--in company with the late I. A. Lapham, of Milwaukee; and the idea of finding any human stomach, with or without seeds in it--with probably

not half the time intervening between burial and exhumation, as in the case of this Roman soldier--would have been instantly rejected by the distinguished archaeologist accompanying us. Indeed, had any such discovery been made, he would have unhesitatingly pronounced the mound tampered with for the purposes of imposition. It is possible that surface soil, containing some raspberry seeds, may have been taken to the "Horticultural Society's garden" to which Dr. Child refers, and planted there as stated; but that they were from a human stomach that had lain buried for seventeen hundred years in the surface soil of England, or any other country, is simply preposterous. It caps the climax of all the wonderful "seed-stories" yet manufactured for the scientific mind to wrestle with. It is easy enough to find soil about old stumps, and fallen trunks and branches of trees, which will produce raspberries, either with or without the presence of seed. And soil might have been taken from the bottom of this Dorchester barrow which produced them. But the appearance of the bushes must have depended on the conditions of the soil, not on seeds eaten by a Roman soldier nearly two thousand years ago. That version of the story must be summarily dismissed the attention of scientific men.

Professor Marsh, in the work to which we have already several times alluded, says: "When newly cleared ground is burnt over in the United States, the ashes are hardly cold before they are covered with a crop of fire-weed, a tall herbaceous plant, very seldom growing under other circumstances, and often not to be found for a distance of many miles from the clearing." The botanical name of this plant is _Erechthites hieracifolia_, and it is well known to the botanists of New England. Its seeds are almost as destructible by fire as thistle-down itself; and it is not to be supposed that any of the seeds borne by the winds or by birds, and scattered through the clearing before it was burned, could have survived the intense heat to which they must have been subjected in the burning off of a heavy and dense growth of felled timber. The seeds, if any, must have been scattered after the fire, and not before it. But these heavy clearings--those in which we have witnessed the most abundant crops of fire-weed--are generally burnt off in the early spring, when there are no seeds to be scattered, as all those of the previous year's growth find their proper lodgment in the soil before the winter fully closes in. The seeds for which Professor Marsh would have to search, therefore, would be those _grown in some corresponding latitude, or plant zone, in the southern hemisphere_, not within thousands of miles from the clearing in which they so promptly make their appearance.

Professor Marsh suggests, however, that they may have come from "the deeply buried seeds of a former vegetation, quickened into life by the heat." But had he examined these plants, in their incipient stages of growth, he would have found that they sprung directly from the surface of the burnt soil, their initial rootlets hardly extending to the depth of two-thirds of an inch below it, and where they must have utterly perished from the heat. The theory he suggests is the only possible one, he thinks, to account for the mystery, and hence its suggestion by him. But he has only to pass one of the delicate seeds of this plant through the flame of a candle to see that it instantly perishes by fire. His suggested theory must be abandoned, therefore, and that of the Bible genesis accepted in its place.

The fact is, and it ought to be well known to the closer student of nature, that the fire-weed makes its appearance in the "conditions" of the burnt soil, just as stramonium does in the conditions of the soil where a coal-pit has been recently burned; that is, not from seed, but from "vital units," or germs, everywhere present in the earth--those taking advantage of environing conditions, just as _Bacteria_ or _Torultz_ spring from the proper organic infusions. And the young shoots of stramonium, in a recently burned coal-pit, will be found to spring directly from the surface of the burnt ground, where all seeds and living organism must have perished in the heat, and not at any considerable depth below it. Their first appearance is on the immediate surface of the burnt ground, the same as in the case of fire-weed, and at a time when there were no seeds to be distributed, except such as must have come from the southern hemisphere, or been casually picked up by birds, and taken their slim chances of survival after passing through the natural "gristmills" of the birds. And even this supposition, would only account for the appearance of a single stramonium plant or two, not for a thick bed of it covering the entire ground. The theory of seed-distribution, in this and other cases, is wholly out of the question; as much so as when white clover makes its appearance on a closely-grazed prairie, hundreds of miles away from where there has been a single sprig of clover growing in a thousand years. Every closely observant person, living for any length of time on our western prairies, is familiar with the fact that when the rank and hardier grasses, usually growing thereon, are effectually fed down by stock, and especially by sheep, the prairie grasses disappear, and the ground at once comes in with white clover, and the other nutritious gramma or grasses of our common pasture lands. No seed has been sown in these localities, and none could have been found had every square inch of the surface soil been examined by the most powerful microscope. The white clover and these nutritious grasses make their appearance on these prairies, just as the first sprig of vegetation did on the earth, not from seed, but from preˆ«xisting vital units or primordial germs, implanted therein from the beginning, and awaiting the necessary conditions for their development and growth.

The "bird theory" is the one almost universally relied upon for the explanation of these phenomena, where the seeds distributed, or supposed to be distributed, are not winged. But we are satisfied that birds perform no such important office, in the matter of seed-distribution, as is generally attributed to them. We have examined, during the past two seasons, a large number of bird-droppings, and find our previous impressions respecting them fully verified. With all the more delicate seeds--those of our common field grasses and weeds--the chances are a thousand to one that none of them will ever pass the cloaca of the bird eating them, in any condition to germinate. All seed-eating birds are also gravel-eaters; and the pebbles and gravel they eat are mostly silex, or the material from which our best buhrstones are made. These pass into the gizzard, or pyloric division of the bird’s stomach, where they are utilized, the same as we utilize our buhrstones. The gizzard has sharply corrugated interior walls, extremely thick and muscular, which involuntarily contract and expand, giving the bird a tremendous grinding power over his food, considering the size of his grinding apparatus. The

seeds--all the seeds, in fact, he eats--pass at once into his crop, or the natural "hopper" to his "gristmill," where they undergo a moistening or macerating process previous to being ground into the finest pulp in the gizzard. As a general rule, all the seeds a bird eats are ground into this pulpy state before they pass into the intestinal canal, extending from the gizzard to the cloaca. The hard, semi-translucent, and highly elastic outer coating of most small seeds, may be measurably preserved in its passage through the gizzard, and, resuming its oval shape in the thinner pulpy mass contained in the upper portion of the intestine, present the appearance of seed in the cloacal discharges, and thus deceive the casual observer. But the use of a spatula and a small piece of polished stone slab will show that the entire discharge is excrementitious matter, with the single exception of this silicious coating of the seeds.

The case is different, however, with the fruit-eating birds. The fruits they consume are retained but a comparatively short time in the crop, pass hurriedly through the gizzard, and no doubt carry along with them some of the smaller seeds of berries, and now and then the pit of a cherry or small plum. The gizzard, in these cases, is simply gorged with the pulp and juices of the fruit, its muscular action more or less relaxed, and some of the seeds consequently escape the grinding process they would otherwise undergo. And yet we are satisfied that a majority of these seeds even, are more or less thoroughly triturated by a healthy gravel-eating bird. This would certainly be the case if they were retained for any length of time in the pyloric division of the bird’s stomach. All birds have gizzards, but their grinding capacity depends very much on the character of the food they eat. Birds of prey, and others subsisting mostly or entirely on animal food, have thin, membranous, and comparatively flabby gizzards; while those living on hard grains and seeds have extremely thick, powerful, and muscular ones,--those capable of crushing up and thoroughly triturating all the food they take into their crops. These gizzards are nature’s gristmills, and they grind exceedingly fine. If any seed escapes, it is because the mill has been flooded by the bird, and not because of any defect in the grinding apparatus.

These birds are not, therefore "natural sowers of seeds," as Professor Marsh and some others claim; but are, at most, only accidental or chance-sowers. Nature never designed that they should do anything more than consume the food they eat, or submit it to the proper action of their digestive organs. It might as well be claimed that the secretary bird is a "natural sower of serpents," as that many of the grain-eating birds are "the natural sowers of seeds." The theory is too foraminated--too full of loopholes and unsatisfactory conditions--to be accepted as an explanation of the more general phenomena presented. The fruit-eating quadrupeds are, relatively, far better sowers of seeds than the birds, for they eat fruit without sending their grists to mill. Dr. Dwight rejected the transportation theory as early as 1820, and Professor Marsh gives any number of cases where it was necessary for him to abandon it. And yet some of our ablest writers, publishing works of quite recent date, adhere to it as the only theory that accounts for all the phenomena presented.

Professor George Thurber, in speaking of the dissemination of seeds, finds other agencies therefor than winds, birds, quadrupeds, etc., such as we

have already named. For instance, he claims that rivers, ocean currents, mountain torrents, and even wars, contribute largely towards their dispersion and dissemination throughout different parts of the earth. All this may be true to a limited extent; but none of these enumerated agencies will account for more than a very few of the many well-authenticated facts we have given, and many others that might be given, if our limits permitted. Among the instances where wars have had, or are claimed to have had, an important agency in the distribution of seeds throughout an invaded country, he mentions the fact that "after our late civil war, a little leguminous plant (_Lespedeza striata_) sprang up all over the southern states," and adds, "that it was not known how it came, or where from, but its native country is Japan." In some parts of the South it is known as "Japan clover," and is highly valued as a forage plant. But the war had nothing more to do with the appearance of this plant "all over the southern states," than the changes of the moon, or the phenomenal man therein. The plant had been noticed in certain localities in the South before the war, but the circumstance of its very general appearance throughout a large area of that section of country, was not particularly noticed until the confederate troops began to move from one southern state to another, when, finding it a valuable forage plant, they naturally enough regarded it as a providential dispensation, especially in those sections where other forage plants and nutritious gramma were not abundant. But this plant would have made its appearance just the same had the war never been thought of as a possible remedy for aggressive legislation, however real or imaginary it may have been.

It can be easily accounted for, however, on the theory we have suggested--that of the germinal principle of life implanted in the earth, as the Bible genesis indubitably indicates. The plant in question has long been a native of Japan, which lies in the same warm temperate zone as the southern states. The same general hygrometric and thermometric conditions prevail throughout the two countries or sections of country. These, added to the necessary telluric conditions, give the required moisture, heat, and soil-constituents for the development of the Japan clover in the South, the same as it was originally developed in its native country. And it is just as much native to the South now, as it was hundreds or thousand’s of years ago to Japan. It did not come from seeds scattered by war, or any other imaginable agency of man, but from the indestructible, vital units or germs implanted in the earth itself. Had the plant appeared in any one locality, or even in half a dozen separate localities, in the South, it might possibly have been accounted for on the theory of Professor Thurber. But its simultaneous appearance over "all the southern states," as he puts it, absolutely negatives any such theory. Neither winds, river or ocean currents, casual mountain torrents, birds, quadrupeds, war, or even man himself, could have effected this sudden and wide distribution of the plant in question. It came as did all other plant-life, in the first instance, from geographical conditions--those favoring the development of primordial germs--just as the different organic infusions, experimentally prepared by the physiologist, produce their respective forms of infusorial life; each distinctive form depending on the chemical conditions of the infusion at the time the microscopic examination is made. Change the conditions, or defer the examination until the conditions themselves are changed, and other and different forms of

life will make their appearance, in harmony with the physiological law we have named.

This wonderful play of the vital forces of nature is no less dependant on "conditions"--on the necessary pre-existing plasma, chemically balanced soils, organic solutions, etc.--than the alleged "dynamical aggregates," "_molecules organiques_," "plastide particles," or "highly differentiated life-stuff," insisted upon by the physicists, in their materialistic theories of life. These physicists make even the slightest change in developmental phases--whether statical, as in the case of crystals, or dynamical, as in the case of living organisms--to depend on physical conditions,--those aiding and abetting what they call the "molecular play of physical forces." But with their theory that matter and motion are the only self-subsistent, indestructible elements in the universe, what "molecular play" can be attributed to matter but that which is derived from motion, or some one of its alleged correlates? We can only imagine two sorts of motion as possible metaphysical conceptions in connection with matter--_molar_ motion, or that relating to matter moving in mass, and _molecular_ motion, or that relating to the movements of matter in its unaggregated form, or as confined to molecules.

But motion itself is not an absolute entity. It is not so much even as a collocating or placing force of matter itself. It is, at best, only a mechanical impulse imparted by one moving body to another; or, more accurately speaking, a continuous change of place in a moving body. In other words, it is simply a _process_ or _mode_ of action, and stands in about the same relation to matter as _growth_ does to a living plant or tree. Independently of matter it has no existence, either objectively or subjectively, or even as a metaphysical conception. To allege its indestructibility, as the physicists do, is simply to predicate an additional property of indestructible matter. We may call it "force"--something that constantly expends itself in a moving body--but it is utterly incapable of definition, or of conception even, except as it stands related to such moving body. All the marvellous "correlates of motion," therefore, producing such wonderful effects upon matter, in both its molar and molecular states or conditions, are nothing more nor less than vague and inconclusive inductions, derived from premises having, at best, nothing but a relative existence in a universe of moving matter. It would be decidedly better to agree with Haeckel, that matter is the only actual existence, than to predicate of matter a co-existent and wholly inexplicable "somewhat," whereon to base a purely physical hypothesis of life.

But let us return from this slight digression. The beautiful and purely local fern (_Schizoea pusilla_) growing in the pine barrens of New Jersey, affords quite as conclusive proof of the correctness of the Bible genesis of life as the phenomenal appearance of Japan clover in the South. It was at one time supposed that this most delicate and beautiful of all our ferns was peculiar to the New Jersey pine barrens. But it has been ascertained that it grows quite as abundantly in similar barrens in New Zealand, which are in the south temperate zone, at about the same latitude south, that these pine barrens of New Jersey occupy in the temperate zone north. So that, at whatever period this fern originally made its

appearance in either locality, it unquestionably found the exact thermometric, hygrometric, telluric, and other conditions necessary for the development of its vital germs. Take any accurate, or even half-accurate, chart of plant distribution on the earth's surface, and it will be found that, everywhere, under the same favoring conditions, plants of the same genera and species make their appearance independently of any known processes of dissemination in the case of seeds. The distribution is not one of seeds, but rather of geographical conditions--thermometric, hygrometric, telluric, and possibly chemical. And this is true of all vegetation, whether growing in the same plant zones, in high latitudes, at high altitudes, or under one degree of temperature and moisture or another. Whenever the telluric conditions are the same or similar, in the respective localities named, and the temperature and moisture correspond, the necessary plant distribution follows in obedience to the divine mandate--"Let the earth bring forth." This is the one uniform law that governs everywhere, and the only one that accounts for all the diversified manifestations of plant-life, now, as heretofore, taking place upon our globe. And the same is measurably true of animal life. It accounts for the appearance of every form of life in organic infusions; for _Bacteria_ in the blood, _Torulˆƒ_ in the tissues, plastide particles, morphological cells, and every other vital manifestation, from the smallest conceivable "unit" of life in protaplasmic matter, to the lordliest and most defiant forest oak that ever bared its arms to the storms and tempests of centuries. A purely materialistic science may perk its head with an air of affected incredulity, and superciliously turn aside from this hypothesis, because it does not shock our veneration for the Sacred Scriptures, but let its special advocates advance some more consistent and rational life-theory than that of "molecular machinery worked by molecular force," or content themselves, with Dr. Gull, in confessing that they are unable to draw the first line between "living matter" and "dead matter," as they absurdly use these terms.

It is conceded that much extravagant speculation has been wasted upon this question of the distribution of seeds. The ambition of each new writer has seemingly been to hit upon some new theory of distribution. The "bird theory" is a failure, as we have shown; nor do they invariably fly due east or west, so as to supply the several climatic zones with their respective vegetations. The same is true of the "squirrel theory," for this nimble little rodent is as likely to head north or south as to follow the course of the sun; the "wind theory" is subject to too many shifts and changes to be accounted a reliable agency; the "river-and-ocean-current theories" are still less satisfactory, since rivers flow in diverse directions, and ocean currents bear with safety only their own aquatic plants; the "mummy-case theory" is hardly an accredited agency, and the "war theory" is attended with too much destruction of life to be safely relied on as conserving the vital forces of nature. The climatic zones, and high and low altitudes, have still to be consulted to get at the real causes of distribution, or such as conclusively satisfy the scientific mind. For no single plant is really a cosmopolite. They are simply the habitats of their own separate zones, except as high altitudes are reached, and climatic and other conditions favor the appearance of such vegetation as belongs to other plant zones. If we would find the more common plants and weeds of New England in North Carolina or Tennessee, we

must go into the mountainous regions of those states, at an altitude which compensates for the difference in latitude, and where the influencing conditions of plant-life are essentially the same. In such localities, we shall find the same household plants, garden weeds, and general vegetation, as in higher northern latitudes, not because their seeds have been borne thither from New England or elsewhere, but because the same climatic, telluric and other conditions prevail as in the more northern localities. And these conditions are what determine the development and growth of local vegetations.

And so of the alpine firs, grasses, harebells, lichens, mosses, etc. Their seeds have not been scattered, by any known agencies, over intervening regions, for thousands of miles or more, in order to find lodgment on these lofty mountain cones; but, conditions being the same, the same vegetable growths appear. This is nature's method of propagating "vital units" and diversifying plant-life--geographical conditions everywhere determining the proper distribution. But if nature is so prolific of vital resources, in the propagation of plant-life, what need has she of natural seeds? We anticipate this inquiry only to answer it; for we recognize it as a legitimate one in this connection. Our answer is that the seeds are given for the use of man, that he may control and utilize vegetation, and not have to depend on more or less uncertain conditions. Agricultural chemistry must be carried to a much higher degree of perfection than it is likely to reach in the next ten centuries at least, to determine whether any particular plat of ground has been chemically balanced for the growth of wheat, to the exclusion of other cereal crops. Besides, the process of soil-balancing might be altogether too expensive to be indulged in by judicious husbandry. These chemical conditions admit of too many possible failures, in balancing even the smallest patch of ground, to justify experiments in the direction named. Seeds also subserve the important subsidiary purpose of supplying food for many birds and animals, more or less useful to man.

But chemistry has its limits as to usefulness in all human laboratories. As man's wisdom is limited, so is his power over the elementary forces of nature confined to very narrow boundaries. It is given to him to search out many inventions, and to pry, thus far and no farther, into the secrets of nature, or, more properly speaking, into the secrets of God. There is no doubt that if our chemico-molecular theorists respecting life-phenomena, could produce, in their laboratories, the exact inter-uterine plasma, or plasmic conditions, of an animal--any animal, in fact--and continue these conditions during the proper period of gestation, they _might_ produce life _de novo_.[13] But the most daring physicist would stand aghast at the bare proposal of such an experiment. Neither his knowledge of chemistry, nor the present uncertain value attaching to "molecular machinery," would justify him, for a moment, in entering upon such a purely tentative and empirical an undertaking.

It is hardly necessary to assume that the same law of vital force governs in the appearance and geographical distribution of _fungi_, as universally obtains in the higher and more complex vegetal growths. And although it may be difficult, in some instances, to draw the precise line between certain low mycological forms and the amoeboid and some other primitive

manifestations of animal life, yet all vegetable physiologists agree in assigning a purely vegetable origin to all the primary groups of fungi--their general cellular character determining their proper place in classification. And in all their extended family groups, pervading nature as widely as animal and vegetable life, we find that uniform chemical and other conditions produce uniform mycological results. Spores are no more necessary for their appearance, in the first instance, than acorns are essential to the appearance of an oak forest when it succeeds the pine. Wherever the necessary conditions of moisture and heat are found to obtain, in connection with decayed or decaying substances, the particular form of fungus indicated thereby, whether parasitic or non-parasitic, will make its appearance. Continuously damp walls, or wall-paper, will produce them in specific variety, not because their invisible spores are flying about in the atmosphere to find appropriate lodgment, but because the necessary conditions obtain for their manifestation, or for the development of their vital units--those everywhere diffused, and ready to burgeon forth from the proper matrix, or from certain nutrient conditions to be met with in all vegetable substances, after the process of decay has commenced. Some orders appear only in a single matrix, but the greater part of them flourish on different decaying substances.

Dr. M.C. Cooke, in speaking of non-parasitic fungi, and especially of moulds, says: "It would be far more difficult to mention substances on which they are never developed than to indicate where they have been found." The parasitic fungi, however, generally confine themselves to certain special plants, and rarely to any other. It is only the condition of these special plants, when affected by decay, that seems favorable for their development; not because their spores (assuming that all fungi come from spores,) possess the intelligence to fly about and hunt up the proper nutrient matter on which to subsist during their developmental progress from specific spores into genetic forms of life. The rust or blight of grain is not the cause, therefore, but rather the result, of the common disease known as "blight." Without some excess or deficiency of absorption and elaboration in the growth of grain or plants--something essentially disturbing their normal and harmonious processes of development--no mycological forms would appear on their stems or roots, nor would they develop themselves on their fading leaves or congested and decaying fruit. To say that there is any intelligent preference in these fungi--the different species of _Mucor_, for instance--for disgusting offal over decaying fruit, bread, paste, preserves, etc., is to predicate a higher degree of intelligence of fungus spores than of the average brute creation, with all its wonderful instincts for guidance.

We might refer to other classes of fungi developing themselves in the testa of hard seeds, and in the interior of acorns, sweet chestnuts, etc.,--those in which there is no discoverable external opening by the aid of the microscope--to show the absolute absurdity of the theory that the spores of fungi, including the non-parasitic and other autonomous moulds, go madly foraging about the country in pursuit of decaying cocoanuts, apples, pears, plums, oranges, etc., and even committing their depredations on hermetically canned fruits, the concealed honeycomb of beehives, the pupa of moths, and whatever else they may intelligently select as a desirable matrix or habitat. No such theory as this will stand

the test of thorough research and investigation, in any mycological direction. Fungi everywhere make their initial appearance in the conditions of decay, as plants and trees originally make theirs in the environing conditions of vital manifestation. That our life-giving atmosphere--the "_pater omnipotens ˆ ther_" of Virgil, "descending into the bosom of his joyous spouse (the earth) in fructifying showers, and great himself, mingling with her great body" for the development of all things of life--should be so immeasurably thronged with death-pursuing fungi that myriads of their spores might dance without jostling on the point of a cambric needle, is infinitely more fanciful than the conceptions of the poet, in personifying the atmosphere as "father ˆ ther," and the earth as his "joyous spouse." But life, with its "pardlike spirit, beautiful and swift," has reached its highest conceptions in the mind of the poet, not in the speculations of the scientist. What a "mingled yarn," spun from many-colored yet invisible threads, is it in the creative mind of a Shakespeare, and how it looms up into "a dome of many-colored glass, staining the white radiance of eternity," under the magic touch of a Shelley! And yet how is it dwarfed down to a contemptible piece of "molecular machinery" by the scientist--one so utterly contemptible in its manifestations that it is ordered to take "a back seat" in this universe of all-potential matter and motion!

Dr. Cooke, in his "Handbook of British Fungi," virtually concedes that the spores of the large puff-ball (_Lycoperdon giganteum_), as well as those of mushrooms, truffles, and other edible fungi (those with whose methods of propagation man is best acquainted), may be produced artificially. But the process by which their production is thus effected, is more properly a natural than an artificial one. In speaking of truffle-grounds, he says (quoting from Broome) "that whenever a plantation of beech, or beech and fir, is made in the chalky districts of Salisbury Plain, after the lapse of a few years truffles are produced, and that the plantations continue productive for a period of from ten to fifteen years, after which they cease to be so." No truffle spores were planted in these cases, but the conditions of the soil, interlaced by the roots and shaded by the branches of the young beech trees, or the beech and fir, became favorable for the development of truffle "germs," and they made their appearance just as mushrooms do in caves and other places, where artificial beds are made and chemically balanced for their development and growth. And the reason why they disappeared, after a period of ten or fifteen years, was simply because the proper nutriment of the soil was exhausted, and not in consequence of its being too deeply shaded by the growing trees. One uniform rule would seem to govern in the culture of this much-coveted fungus. Wherever the necessary environing conditions obtain, they _appear_, and wherever these conditions fail, they _disappear_, notwithstanding the most persistent efforts to save them by watering the soil with fresh infusions of the plant. In proof of this, one form of truffle (_Tuber ˆƒstivum_) appears under beech trees, another form (_Tuber macrosporum_) under oak trees, and still a third form (_Tuber brumale_) under oaks and white poplars; showing that so slight a change in soil conditions as that resulting from the presence of poplars among oaks, produces a very material change in the character of the fungus--one amounting to a specific difference in variety.

The process of artificially producing mushroom spores is a very simple one, and may be easily followed. You have only to collect a quantity of horse-droppings, mingle with them some common road sand, place them under cover, see that they are well beaten down in order to prevent over-heating--turning them occasionally for the same purpose--and in due time they will generate sufficient spores for a dozen mushroom beds of the ordinary size. The reason for their appearance is the same as that governing truffle spores--they come whenever conditions favor, that is, whenever the soil is chemically balanced for their development and growth. In other words, they come because it is just as impossible for them not to come, in their proper environing conditions, as it is for the earth, in its present cosmical relations, not to respond to its axial rotation. "Let the earth bring forth" is just as much an outspoken law of nature, and one as inexorably obeyed, as that unerring force of gravity which led Leverrier, in the faith of his inductions, to indicate the precise point in the heavens where the far-off planet, now bearing his name, might be seen by the required telescope.

Dr. Cooke, quoting Mr. Cuthill's directions for producing mushroom spores, says: "These little collections of horse-droppings and road sand, if kept dry in shed, hole, or corner, under cover, will, in a short time, generate plenty of spawn, and will be ready to spread on the surface of the bed in early autumn." The collections should, of course, be made in the early summer. But it is no part of our object to indicate, in this connection, the process of truffle or mushroom culture. We merely refer to the methods to show that the vital units, or germinal principles of life, in the case of fungi, are just as dependent on "conditions" for their development, as were the primordial germs of the gigantic cryptogams of the carboniferous era. These primordial germs, or the _ZRA_ of the Bible genesis, must have preceded the first fungous growth, as they preceded the first spore-bearing cryptogam.

M. Gasparin, in his report on the production of truffles, made to the great "Paris Exposition" of 1855, refers to the "natural truffle-grounds at Vaucluse," where the "common oak produces truffles like the evergreen oak;" although, in other localities, owing no doubt to the different conditions of the soil, those gathered at the base of the one species of oak differ very materially from those gathered at the base of the other. All these experimental results, and many others we might give in connection with the culture of edible fungi, point to the conditions of the soil, produced by natural rather than artificial means, as all-essential for the propagation of fungus spores, as well as their development into full-sized plants. The cultivation of other and minuter fungi, for scientific purposes, need not be referred to in this connection. The same general observations will be found to apply in the case of all the experiments tried, although some very curious and remarkable modifications occur where pseudospores are to be found in the micelium of different plants. Nearly all these fungi have their own parasites, originating undoubtedly in the diseased conditions of the plant from which they derive their nutriment. Indeed, all fungi, whether parasitic or non-parasitic, have their origin, more or less definitely occurring, in decay. It is no more true that death is a necessity of life, than that life is an equal necessity of death. As out of the dead past

springs the eternally living present, so from the "muddy vesture of decay" spring all the marvellous powers of reproduction with which nature was endowed from the beginning.

But it is unnecessary to dwell longer on the spores of fungi. As with the seeds of plants and trees, these spores never had an existence, and never could have had one, before the first independent fungus appeared to produce them. The fungus before the spore is the inevitable induction. No distinction between necessary and contingent truth can ever take a stronger hold than this on the human mind. Whence, then, the _first_ fungus? or whence, rather, all those colonies, families, orders, divisions, and countless distinct individuals, extant everywhere, in the mycological world? The answer we shall give will be anticipated from what we have already so confidently affirmed. Life comes from Life, as spirit comes from God. And when "the spirit of God" moved upon the face of the depths--upon the face of all the earth--at whatever stage in the progress of our planet, from its original form to its present myriad-thronged condition of life, that transcendent event occurred, _Nature_, as we half-idolatrously worship her, received her first baptism of life, and her solemn consecration as "the vicar of God." No wonder, then, that at that ecstatic moment, when the ineffably bright mantle, fringed with "the white radiance of eternity," fell upon her, "the morning stars sang together and all the sons of God shouted for joy." And nature has been true to both her baptism and her consecration. She claims no worship, no adoration, no idolatrous homage from man, but continually sends up her eternal chant and choral anthem of praise to the great Giver of life. Every flower of the field, every blade of grass, every stream that mirrors the heavens above her, every mountain top from which she points an index finger, every breeze in which she whispers, and every cataract in which she speaks, all proclaim the power, the wisdom, the goodness of God--the source of all life in the universe, from the minutest spore to all-inventive, soul-endowed man.

Chapter V.

Plant Migration and Interglacial Periods.

Among the leading propositions laid down by Arthur Renfrey, Esq., F.R.S. etc., etc., in the able article prepared by him for "The Physical Atlas of Natural Phenomena," by Alexander Keith Johnston, Edinburg Edition, 1856, on "The Geographical Distribution of the most Important Plants Yielding Food," are the following:--

1. "The primary condition of the existence of any species of plant, is its absolute creation, of which we know nothing.

2. "But we assume each species to have been _created but once in time and in place_, and that its present diffusion is the result of its own law of

reproduction under the favorable or restrictive influences of laws external to it.[14]

3. "The most important of external laws are those relating to climate, since _any species can flourish only within narrower or wider, but always fixed limits, of temperature, humidity etc_.,

4. "The climate depends primarily on latitude, since this indicates distance from the source of heat, and the degree of obliquity of the heating rays."

There are other governing conditions, of course, such as the average rain-fall, distance from the equator, the elevation above the sea level in the various mountain systems of vegetation, etc., including the hygrometric, thermometric, telluric, and other conditions, of the several localities in which the different species of vegetation make their appearance.

But why should this distinguished naturalist insist upon the specific creation of either plants or animals? No scientific work of any paramount value confines the creative power of the universe to such narrow and restricted limits. Nor is there a particle of evidence to be drawn from the Bible that either plants or animals primarily originated in pairs. "Let the earth bring forth" is a command without limitation, or restriction, as to time, place, or number; and there is no reason to doubt that myriads of living forms swarmed everywhere, at first as now, in nature.

The idea, as expressed by Mr. Renfrey, that they were specifically created at one time and place only, whether in pairs, tens, twenties, or hundreds, is neither a rational one, nor has it any experience-argument or scientific authority on which to stand. Take, for instance, an experience-argument directly in point:--When the salt wells were first bored at Syracuse, N.Y., and the salt water was suffered to flow in waste over the low grounds about the salt-works, the small saline plants peculiar to salt-marshes in the warm temperate zone made their appearance, not in pairs, tens or hundreds, but in thousands rather, and have nourished there ever since. They came because conditions favored; because a salt-marsh had been artificially produced hundreds of miles away from the sea coast. This is only one of a large number of cases--more than we have room to specify in this connection--showing that wherever man, artificially or otherwise, produces the necessary conditions of plant-life, nature responds to the germinal law precisely as she did millions of years ago when the first salt-marsh favored the appearance of these saline plants--such as grow under no other conditions or circumstances.

But this idea of plants coming primarily from a single pair of progenitors, and each primordial pair branching off into diversified offspring, as in the case of the cabbage, assumed to be the original ancestor of all the turnips and ruta-bagas, may be an article of botanical faith, but never of experimental proof. "_Entia non sunt multiplicanda prˆƒter necessitatem_" is an old and well-approved maxim, applicable alike

to the countless myriads of living organisms, as to the innumerable crystalline forms to be found everywhere in nature. Nothing is produced without the necessary conditions on which its production depends. "Necessity," in its primitive signification, is a term of the very widest meaning, and most universal application. It applies as well to the course of nature as to the course of human events--to the laws of vegetable and animal growth as to the inevitable march and order of celestial movements. As applied to any form of life-manifestation it implies a law of development and growth, as well as the physiological conditions without which vital manifestations are impossible. For law, in a physiological sense, is that mode of vital action by which effects are invariably and inevitably produced.[15] And this law is just as dependent on necessary vital conditions as vital manifestations are dependent on a physiological law. There must always be this reciprocal dependence and relationship between conditioning causes and effects. Whenever and wherever the necessary vital conditions exist, the physiological law takes effect, and the requisite vital manifestation is witnessed. And this is no doubt as true of animal as of vegetable life.

The earth's surface has been divided into eight separate zones, each of which is distinguished by its peculiar or characteristic fauna and flora. Their order, measured from the geographical equator, is as follows;

1. The Equatorial Zone, extending from 0´° to 15´°.
2. " Tropical " " " 15´°" 23´°.
3. " Sub-tropical " " " 23´°" 34´°.
4. " Warm Temperate " " " 34´°" 45´°.
5. " Cold " " " 45´°" 58´°.
6. " Sub-arctic " " " 58´°" 66´°.
7. " Arctic " " " 66´°" 72´°.
8. " Polar " " " 72´°" 82´°.

These several zones become sixteen in number when considered with reference to both the northern and southern hemispheres. And a like division of isothermals is made in the case of all our mountain systems, extending in both directions from the equator. In ascending our equatorial, tropical, and sub-tropical mountains, we find, of course, at their several bases, the temperature of the zones in which they respectively lie; from two thousand to three thousand feet, we reach the next higher zone, and so on, at about the same ratio of altitude, until we ascend to the polar zone or the line of perpetual ice and snow. The peak of Teneriffe, for instance, lies in the sub-tropical zone, but, at the elevation named, we meet with the vegetation which characterizes the warm temperate zone. And this holds true of all our mountain systems, in all latitudes, and at all altitudes, in all parts of the globe.

They all present the same or strikingly similar characteristics in plant life, with such variations and modifications only as might be accounted for, were all the influencing conditions and surrounding circumstances, modifying geographical distribution, known to us. From the lowest to the highest regions in which vegetation flourishes, this rule, with slight exceptions only, will be found to obtain, and it is in this direction that the observations of the scientific, as well as practical botanist, should

hereafter be extended.

Humboldt noticed this characteristic feature of the earth's vegetation quite early in his explorations, and accordingly divided the tropical mountains, as the earth's surface was then divided, into three separate zones, the tropical, the temperate, and the frigid. But a closer classification now distinguishes them into the same number of zones as are marked, in approximate isotherms, on the earth's surface. Mr. Renfrey gives us further statistics of great value respecting these several plant zones of the globe, all of which fit so admirably into our theory of plant-distribution, that we can hardly see how the most prejudiced mind can resist the force of its application. Among the most important of these statistical facts are tables giving the comparative rain-falls in the different plant zones of the old and new worlds, and the classes of vegetation peculiar to each of them.

The Equatorial zone, for instance, is characterized by extreme luxuriance in growth, owing no doubt to the great heat and abundant moisture therein, and exhibits a vegetation which is peculiar to itself, and which could only thrive under the hygrometric, thermometric, telluric, and other conditions of that extensive zone.

The Tropical zones (those north and south of the equator) are characterized by a more abundant and diversified underwood, and, while retaining some of the equatorial forms, present fewer parasites and less rapid and luxuriant growths. They contain many plants and trees which are peculiar to their own limits, and these are generally the hardiest and most abundant. All equatorial forms disappear in these zones, that is do not pass into the sub-tropical zones. And these characteristics obtain in both the northern and southern tropical zones, as well as in the mountain systems within the equatorial regions.

The Sub-tropical zones, while retaining some of the more marked forms and general features of the tropical zones, such as palms, bananas, etc., exhibit the most striking characteristics of their own, consisting of a greater abundance of forest trees, especially those having broad, leathery and shining leaves, like the magnolias, the different species of laurels, and plants of the myrtle family. The tropical forms all disappear in these zones, as the equatorial do in the tropical zones.

The Warm Temperate zones exhibit the same disposition to retain some of the hardier and more abundant sub-tropical forms that characterize the other zones, in respect to their adjoining isotherms. But the trees and plants peculiar to this zone north, (and the same is no doubt true of the corresponding zone south), are more numerous, and embrace a wider range of deciduous, as well as evergreen growths. Evergreen shrubs, heaths, cistusses, and leguminous plants are everywhere more abundant. The marked characteristic of these zones is that the trees, plants, and arborescent grasses differ more widely in their general character, as well as run more extensively into varieties.

The Cold Temperate zones retain many of the deciduous trees of the warm temperate, but with less conspicuous blossoms, while a stronger tendency

is shown toward social conifers, and the trunks of the deciduous trees are more profusely overrun with mosses, lichens, etc. These zones are also abundant in grasses.

The Sub-arctic zone north largely retains its hold upon the social conifers, giving place, northward, on this continent, as well as in Europe and Asia, to birch and alder, alternating with willows where the soil is sufficiently moist. Green pastures are still abundant, and showy flowering herbs abound during the brief spring, summer, and autumn months.

The Arctic zone retains few of the sub-arctic forms and its vegetation generally corresponds to what we call alpine shrubs, grasses, etc.

The North Polar zone shows few signs of vegetation and is thought to be entirely devoid of shrubs. A few small herbacious perennials of the most extreme dwarf habit, with a few lichens and mosses, constitute its entire vegetation.

There are some seeming exceptions to these general statements respecting plant-distribution, but they are hardly exceptions when we consider the elevation at which any one species, as the birches for instance, may appear, as they frequently do, in three several zones.

From these facts, gathered from the highest authorities, and well-attested on all hands, what general conclusions, if any, are to be drawn? Before answering this inquiry, let us proceed to state what conclusions _have_ been drawn. According to all the authorities we have examined on the distribution of plant life; on the migration of plants and animals; on climate and time as affecting the transference of isothermal and isochimenal lines; on glacial and inter-glacial periods (with one important exception only), the assumption maintained is substantially that of Mr. Renfrey, that "each species of plant and animal was created but once in time and place," and that its present diffusion is the result of its "own law of reproduction under the favorable or restrictive influences of laws external to it." In other words, they insist upon original plant-centres, without definitely stating when or where they occurred, and that from these centres both plants and animals have migrated to all parts of the globe where they now appear, even crossing the equatorial zones where they could not live for a single day. This migration theory they attempt to explain in a way that is altogether more ingenious than satisfactory.

The important exception to which we refer is that of Professor Agassiz, as reported by his associate professor of Harvard University, Mr. Asa Gray, in his "Essays and Reviews Pertaining to Darwinism." In this work Professor Gray says of his late distinguished associate, that so far as he was aware, Professor Agassiz was the only leading naturalist "who did not take into his very conception of a species, explicitly or by implication, the notion of a material connection resulting from the descent of the individuals composing it from a common stock, of a local origin."

And Professor Gray adds this further testimony to the closeness of his associate’s observations, in considering the very point here under

consideration: "Agassiz wholly eliminates community of descent from his idea of species, and even conceives a species to have been as numerous in individuals, and as widely spread over space, or as segregated in discontinuous spaces, from the first to the later periods." And this view is undoubtedly the correct one. At all events, it entirely harmonizes with the facts of the biblical genesis, and obviates the necessity of accounting for the appearance of the same genera and species of plants or animals in the southern as in the northern hemispheres; in fact, their appearance in all parts of the globe, in corresponding isotherms, and under similar conditions of moisture and soil-constituents.

Wherever the hygrometric, thermometric, telluric, and other conditions favor, the class of vegetation indicated by the presence of these conditions makes its appearance, just as the fire-weed makes its appearance in our warm temperate zone, not from the presence of seed, but simply the presence of "conditions"--the _pro_vision of man harmonizing with the _pre_vision of nature. In the same way the "Japan clover" made its appearance, as Professor Thurber states, "all over the southern states" during the late civil war, not from the migration of plants, but the presence of natural conditions.[16]

The numerous facts we have already given, and many others that might be arrayed in advocacy of our position, taken in connection with the general facts here presented in regard to plant-distribution, all point directly to climatal and soil conditions as the real cause of dissemination, and not to their migration from continent to continent, and across vast intervening seas and oceans, as the theory of Professor Gray and others would require us to believe. Take the case of the _Schizoea pusilla_ of the New Jersey pine barrens, to which we have already referred, growing in similar barrens in New Zealand, and how are we to account for their antipodal appearance upon the globe? Professor Thurber refers to this plant as a "purely local fern" of New Jersey, and says it was for a long time supposed to be peculiar to that state until it was ascertained that it grew in New Zealand. Whether this plant "travelled" from New Zealand to New Jersey, or journeyed in the opposite direction, none of these "specific-centre" gentlemen can well inform us. Professor Agassiz would have said that it might have appeared, in numerous individuals, in both localities at the same time, or at different times, as conditions favored; and this would have been an exact scientific statement, no doubt, of the fact. Mr. Arthur Renfrey, and those who accept his scientific formulˆƒ, must insist that this most beautiful of all our ferns was such a "favorite child of nature" that she condescended to create it _twice_ "in time and place," instead of only _once_. It is a poor rule, they may say, that has no exceptions in phenomenal manifestation.

Professor Gray may insist that such a phenomenon as this requires belief in the supernatural, and that migration by ocean-currents is the more rational theory of the two. But M. Alphonse de Candolle--quite as high authority as we can quote--has come to the conclusion that marine currents, and all other suggested means of distant transportation, "have played only a very small part in the actual dispersion of species," even across narrow channels and the near arms of seas. But why should the appearance of this fern at opposite points of the globe, with thousands of

miles of ocean and continent intervening, be any more supernatural than the presence of _Bacteria_ or _Torulˆƒ_[17] in different organic infusions? If the vital units of these _infusoriˆƒ_, are present in experimental infusion, as Professor Bastian virtually admits, why may not the vital germs or units of this _Schizoea pusilla_ have made their appearance, in developmental forms, both in New Zealand and New Jersey, at the same or different periods of time? If Professor Gray regards the microscopical forms in organic infusions, or the statical forms in inorganic solutions, as supernatural, or as above the powers of nature, then we have no exceptions to make to his position. First, prove that these vital manifestations of nature are above the powers with which she has been endowed, or was originally endowed and we will concede the question of supernaturalness, and drop all exceptions to his line of argument. Whenever a dynamic law, or a statical, is found to be uniformly operative under a given set of conditions, we had supposed the operation not to be above the powers of nature, but in entire accord with them, and hence not supernatural.

But let us see into what an inextricable labyrinth of difficulty we are led by this theory of plant-migration from the equatorial to the sub-arctic zone, and _vice-versa,_ and even beyond the equator to the sub-antarctic zone, and still _vice versa_. Before proceeding to consider the probable duration of the several geographical epochs, called glacial periods, on which their theory of plant-migration depends, or considering the evidence touching these glacial periods, we will state their position in regard to these possible migrations as briefly and concisely as we know how. Mr. Darwin’s solution of this problem is the generally accepted one of the evolutionists, as well as most of the present scientific world. As the truth, or rather the falsity, of his pet theory of evolution depended on the satisfactory solution of this vexed problem, it became necessary for him to give his best and entire mental energies to the gigantic task which was, by universal consent, assigned him. The reader shall see how admirably the thermal equator is crossed by Mr. Darwin, with his vast swarms of flies, mosquitoes, insectivorous and other plants, forest trees, anthropoid apes, and general menagerie of wild animals, such as would gladden the heart of the "great American showman" beyond the most extravagant comparison.

The question, bear in mind, which he was specially called upon to solve, was how the temperate forms north--those, for instance, of the warm and cold temperate zones--managed to cross the thermal equator, and invade the corresponding zones in the southern hemisphere; just as though there was any more necessity of determining this question than the opposite one, of how the southern forms came to invade the northern hemisphere. We will give his solution of this problem in his own language, that we may not be charged with misrepresentation.

He says, in speaking of the glacial periods: "As the cold became more and more intense, we know that arctic forms invaded the temperate regions; and, from the facts just given, there can hardly be a doubt that some of the more vigorous, dominant, and widest-spread temperate forms invaded the equatorial lowlands. The inhabitants (flora and fauna) of these hot lowlands would at the same time have migrated to the tropical and

sub-tropical regions of the south; for the southern hemisphere was at this period warmer. On the decline of the glacial period, as both hemispheres gradually recovered their former temperatures, the northern forms living on the lowlands under the equator would have been driven to their former homes or have been destroyed, being replaced by the equatorial forms returning from the south. Some, however, of the northern temperate forms would almost certainly have ascended any adjoining highland, where, if sufficiently lofty, they would have long survived, like the arctic forms on the mountains of Europe.

"In the regular course of events the southern hemisphere would, in its turn, be subject to a severe glacial period, with the northern hemisphere rendered warmer; and then the southern temperate forms would invade the equatorial lowlands. The northern forms which had before been left on the mountains would now descend and mingle with the southern forms. These latter, when the warmth returned, would return to their former homes, leaving some few species on the mountains, and carrying southward with them some of the northern temperate forms, which had descended from their mountain fastnesses. Thus we should have some few species identically the same in the northern and southern temperate zones, and on the mountains of the intermediate tropical regions."

We are sorry to spoil so ingenious a theory as this to account for plant-migration from the temperate zones north to the corresponding zones south. But in spite of all the great names which will frown down upon us in the attempt, we are obliged to demolish this altitudiness structure, even at the risk of its tumbling about our own ears.

But first let us lay down a few undeniable propositions, on the strength of which this ingenious and purely speculative theory of Mr. Darwin must rest:--

1. It is universally conceded by the scientific world that these glacial epochs, however many of them there may have been in the past and however few there may be in the future, depend, for their occurrence, upon the maxima of eccentricity in the earth’s orbit about the sun.

2. The actual amount of heat which the earth annually receives from the sun is in no way affected by the eccentricity of its orbit. It is a constant quantity, and only unequally distributed on the earth’s surface, being neither increased nor diminished, as our winters occur in aphelion or perihelion.

3. The actual amount of ice-cap accumulated about the two poles of the earth, is also a constant quantity. And to measure the severity of any glacial epoch, we have only to determine the exact amount of ice (not altogether an impossible problem) about the two poles at any given time, and then determine the effect of its entire transference from one pole to the other.

4. It is not probable that the present ice-cap of the south pole extends continuously and permanently much farther north than 80´° or 81´°. Mt. Erebus, in Victoria Land, lies in about this latitude, and it was only a

few years since that the coast line of that island or continent was traversed, by English exploring vessels, from Mt. Erebus to a point some ten or twelve degrees further north. [18]

5. But if we estimate the southern cap as extending continuously to 75´°, what would be the effect of its transference at once to the ice-cap of the north pole? Would it extend it, after assuming its proper glacial slope, below 60´°, a point falling within the present subarctic zone? The utmost limit to which Mr. Croll, in his great work on "Climate and Time," conceives it possible that it should extend, in any glacial epoch, is to 55´°, or about the northern boundary of England.

Now unless the astronomers and physicists are all at sea about the causes of glaciation, the warm temperate zone can never be pushed any further south than the tropical zone, nor the cold temperate any further than the sub-tropical. This would be the extreme limit. Mr. Croll says, in speaking of these glacial periods; "It is, of course, absurd to suppose that an ice-cap could ever actually reach down to the equator. It is probable that the last great ice-cap of the glacial epoch nowhere reached half way to the equator. Our cap (that of Europe) must therefore, terminate at a moderately high latitude." And if the gulf stream flows southward during the glacial period north, as he supposes probable, the cap on this continent would probably terminate at the same moderately high latitude. Assuming that Mr. Croll's estimate is the more probable one, it would only push the cold temperate zone down to the line of the Gulf States; the warm temperate, to the southern line of Mexico; the sub-tropical, to the Central American States, and the tropical to the United States of Columbia, Venezuela, and Guiana.

Suppose, then, that some seven hundred thousand years ago, more or less, when the North Pole had fully donned the earth's ice-cap, with all the isothermal and isochimenal changes thereby effected, what must have been the line of march taken by our northern vegetal and animal forms to escape the cataclysm of ice and snow then impending? Manifestly, they would have flocked, first to the Gulf states, then to Mexico, and afterwards to the Central American states; but none of them could ever have been crowded through the Isthmus of Panama, since at the height of the last glaciation, that portion of the continent must have been the tropical barrier to our northern forms, as it is now the equatorial barrier.

For the sake of the argument, however, we will suppose the northern ice-cap to have been even more imperative in its demands than Mr. Croll has deemed possible, driving some of our warm and cold temperate forms down into the lowlands of Columbia, Venezuela, etc., in the extreme northern portions of South America. But how would these forms have managed, even then, to cross the thermal equator and secure a permanent habitat in the present warm and cold temperate zones of that continent? Manifestly, this question has never been practically solved, nor is it ever likely to be in our day or generation. It is nevertheless susceptible of solution, as Mr. Darwin thinks, by easy mental processes. We have only to take a bird's eye view of the situation, and mentally follow these forms in their long geographical tramp from the northern to the southern hemisphere.

They must have started, of course, some twenty thousand years or more before the earth reached its last superior limit of eccentricity. At that distant epoch the sub-arctic breezes must have been blowing pretty stiffly in our present temperate latitudes, and these forms would have been constrained, in due time, to seek a more congenial isotherm. They must accordingly have set out on their expedition, at about the period indicated, with the prospect of a long and tedious journey before them. Some twenty thousand years must have transpired before they reached the line of the present Gulf states, and it would have taken as many more years for them to deploy to the right and successfully enter the Mexican states. In another twenty thousand years or so they might have doubled Vera Cruz, and headed, in a southeasterly direction, for the Central American states. The thermal equator would by this time have reached a point some thirty degrees south of the geographical equator, while the northern ice-cap would have swept down upon the traditional "hub of the universe," or some ten or twelve degrees in excess of Mr. Croll's calculations.

To have accomplished this grand glaciatorial feat the North Pole must have donned some twenty times the amount of ice now about both poles of the earth, and so changed the earth's centre of gravity as to have inundated every foot of land on its habitable surface. But if this terrible catastrophy had been avoided, and some of our extreme northern forms had forced their way through the Isthmus into the lowlands of Columbia, they must have done so at their greatest possible peril, even if they had reached the base of Old Mt. Tolima in advance of the thermal equator, now fleeing in dismay before the southern Ice-monarch, with all his isochimenal hosts in mad pursuit of their invaders. And if these adventurous northern forms had succeeded in ascending Mt. Tolima, they could never have got down again, with the assistance of forty glaciations.

But we can imagine Mr. Darwin promptly snatching his pen to show the stupidity of these northern forms in not climbing Popocatepetl or some other lofty mountain in Central America or Mexico, on their retreat before the still advancing thermal equator. But how this would have helped them to cross the geographical equator, we fail to see. When Mr. Darwin, and the eminent corps of geologists and physicists accepting his solution of this "vexed question," can make a "warm term" south _succeed_ a "cold term" north, we shall have no difficulty in solving the problem ourself. But, unfortunately, the two terms--the cold one north and the warm one south--are simultaneous in occurrence, and the same causes which forced these northern invaders into the tropics, when they followed _after_ the thermal equator, would have driven them ignominously back again _before_ it. The climbing of mountains would only have prolonged their disaster. For after the glaciation north comes the glaciation south, and unless our cold temperate zone were pushed down beyond the geographical equator, none of its living forms could ever have reached the corresponding zone in the southern hemisphere.

But as this "migration theory" is one of paramount importance to modern science, and especially to "Darwinism," [19] distinctively so called, let us, at the risk of repetition and tediousness, propose a scientific

expedition for the better solution of this problem. To do this, we propose to cut loose from our stupid predecessors, the plants and animals, and invite Mr. Darwin and some of his more distinguished European contemporaries, not omitting Professors Gray, Winchell, Yeomans, and some few other American admirers of his, to accompany us on a fresh expedition from the warm and cold temperate zones north to the corresponding zones south, _purely in the interest of science_. To make it certain that the time fixed upon for this "expedition" to start, will not escape their attention, we will state what many of them already well know, that the present eccentricity of the earth's orbit is very low, being only 0.0168, and that, in the year of our Lord 851,800, it will reach its next superior limit, with a few intervening oscillations of such minimum value as to render it hardly worth our while to start before that time.

We shall be obliged, of course to invite our distinguished European party to join us on this side of the Atlantic, as their own narrow and contracted continent furnishes no proper field for determining the problem in question. We shall insist upon one condition only: "_That they shall never leave the warm temperate zone in which we shall set out on our expedition, except to pass halfway into an adjoining zone as is the habit, at times, with plants and animals_." This condition will have to be rigidly observed, otherwise our expedition would be of no scientific value to future generations. As we shall have plenty of time to provide the necessary outfit, we will appoint Mr. Darwin purveyor-general of the party, and hold him responsible for any misadventure.

We will arrange for the expedition to start in the early autumn of the year of our Lord 831,800, or about twenty thousand years before the earth shall reach its next superior limit of eccentricity,--all of us eager, of course, to brave the climatic vicissitudes of the journey, and to solve the "great problem of the ages," which is, to determine how the gigantic elephantoids of the Eocene period managed to cross the thermal equator, and pass into the present arctic regions of our globe.

As "the king never dies," so the old southern Ice-monarch will be succeeded by the young northern one, at about the period named. We shall then have a decided advantage over our predecessors, the plants and animals, in their journey southward, since we shall know the exact route they took, and need only follow it. Presumably they had no such information, nor had they either chart or compass to guide them,--a circumstance which Mr. Darwin has not sufficiently taken into account in predicating intelligence of his favorite pedestrians. Besides, these vegetal and animal forms had one difficulty to encounter which we shall not experience. With all the northern forms driven down into the Central American states, they must have been sadly crowded for room, especially near the Isthmus. The social conifers must have monopolized all the more favored sites on the mountain sides and tops, while the humbler denizens of the forest must have contented themselves with still more limited quarters. The more impatient animals, for lack of necessary forage, must have crowded through the Isthmus only to be driven back by the tropical heats to their proper isotherms.

But our warm temperate zone is now moving southward, and our scientific

expedition is moving with it. The northern Ice-monarch has resumed absolute sway, and our aphelion distance from the sun has increased some tens millions of miles. We have, in the mean time, moved down to the line of the Gulf states, and are deploying to the right in order to make a triumphant entry into Mexico. Mr. Darwin is daily consulting the isochimenals, and is confident that our northern ice-cap will equal Mr. Croll's highest expectations. The news finally reaches us that the Gulf stream has turned its course southward, and is now pouring its immense treasures of heat into the South Atlantic, if not turning the African "horn" and washing the far-off Australian coast. This fact greatly increases the enthusiasm of our European party, and they hasten forward into the sub-tropical zone, almost "violating conditions" in their haste to enter the tropics.

At length, we crowd the narrow passages of the Isthmus, and the glory of a warm temperate climate bursts upon our view in the Columbian states, of South America. _The expedition promises to be an entire success_. At least, Mr. Darwin thinks so, and he is now the Sir Oracle of our party. We deliberately enter the lowlands of Columbia, and make ready to ascend the sub-tropical mountains--those formerly equatorial--where the "great scientific problem of the ages" is to be demonstrated. But we are measuring time by almost _Sirius_ distances, and vast geologic periods sweep by without apparent record. The northern ice-cap has been a prodigious one, crowding us nearly down to the geographical equator, with the advantage we have of appropriating some five and half degrees of the sub-tropical zone.

But the year Anno Domini 851,800 finally rolls round, and the maximum of the earth's ice-cap is reached. Old Mt. Tolima looms up in the distance, and we soon ascertain that its height is sufficient for all scientific purposes. Its summit displays a glittering ice-cap, and we are certain to find the proper isotherm by climbing its umbrageous sides. We accordingly make haste to reach its base, and get there not a minute too soon; for the young southern Ice-monarch has stolen a march on the thermal equator, and is driving it irresistibly back to its old quarters. His march northward is a continuous triumph and ovation up to 55´°, and the heart of Patagonia is made glad by his near approach. True, the white gates of commerce are closed about the Horn; but that is no concern of these wild Patagonians. The aggressive Britton is driven out of New Zealand, and that is another source of joy to the savage breast. Tasmania would extend a gladder welcome than all to the Ice-crowned monarch, but alas, not a drop of Tasmanian blood runs in human veins! Cape Good Hope has now a sub-arctic climate, and the heart of the wild Kaffir and Zulu rejoices that the sceptre of "perfidious Albion" is broken.

The thermal equator at length reaches the base of Mt. Tolima, and hastens northward to the Isthmus, and thence to Hondurus and New Guatemala, where, by sheer force of exhaustion, it comes to a halt.

But, as the equatorial zone extends fifteen degrees both ways from the thermal equator, its southern limit now rests on the geographical equator, and accordingly encircles the base of our "mount of refuge." We are now up this mountain some sixteen thousand feet above the equatorial lowlands,

with the sub-tropical, tropical, and equatorial zones between us and the possibility of our further migration southward, without violating the express conditions imposed at the outset of our expedition.

The fact soon stares us in the face that we have been no more successful, in our efforts to cross the thermal equator and pass into high southern latitudes, than the stupid plants and animals before us; and Mr Darwin's faith in high mountains springing from equatorial lowlands, disappears in jest and derision as we all good-humoredly agree "to break conditions," and find our way back to the centres of activity and trade in the Old and New Worlds, leaving the great scientific problem of the ages to solve itself as best it may. We accordingly descend from our mountain fastness, hasten to the coast, and take passage by steamer to Manhattan, the great commercial metropolis of the world. Here we find that the barometer of exchange was long ago taken down in London and hung up in New York. The Old Antiquarian Society rooms are the first object of interest sought by us. On making our way thither we look for a copy of the _Herald_, of the date of our departure, in which we find an account of the scientific expedition fitted out by us, facetiously termed "_The Great Wild-Goose Chase after the Thermal Equator_"--presenting one of the most humorous bits of sensational pleasantry ever given to the American public.

But an apology is due the staider reader for the seeming levity of this narrative adventure. The exposition of Mr. Darwin, though widely accepted on both sides of the Atlantic by the scientific world, has seemed to us too trivial for serious reply. If we have leaped over vast periods of time, it makes no difference with the argument. So long as the thermal equator, or more properly the equatorial zone, or any part of it, lies between the warm or cold temperate forms, whether plants or animals, and their point of destination in the southern hemisphere, they can never migrate thither, any more than the right whale of the arctic seas can swim the equatorial oceans. Nothing is gained by going out of the way to climb mountains, except to hopelessly retard the return of both plants and animals to their native zones. If we have not demonstrated this fact to the reader's fullest comprehension, it will be useless for him ever to write a Q.E.D. at the end of any proposition.

It is true that some eminent astronomers and physicists hesitate to accept the theory that these glacial epochs are due to the eccentricity of the earth's orbit. But the argument favoring it is well fortified and ably advanced, and if we add to the astronomical considerations involved, the physical proofs of a change in the earth's centre of gravity, caused by the excessive accumulation of ice about either pole, and the probable shifting of the Gulf stream to a southerly direction during the glacial period north, it is difficult to resist the conviction that the real cause of glaciation has been suggested in this theory. With all the ice now accumulated about the south pole transferred to the north pole, it would make an ice-cap of over thirty miles in thickness at the pole, and one sloping in all directions southward to about 60´°. This accumulation, it is claimed, would so change the earth's centre of gravity as to cause all the equatorial warm waters to flow southward instead of northward, as they now do.

This would certainly seem to be a most wonderful provision of nature, as well as one strongly calculated to impress the human mind with the belief that an Infinite _Pre_vision lies behind all possible _pro_vision, whether witnessed in the heavens or in the earth, in astronomical or physical phenomena. Everywhere we see infinite perfection, combined with infinite beneficence, in the adaptation of means to ends. Nothing runs to waste--all things are conserved for use.

But in all the outspoken grandeur of the universe, there is nothing so grand, in exhibition at least, as the simple faith of a child, that "He who watereth the hills from his chambers," and "causeth the day-spring to know his place," will watch over the trustful little sleeper during the darkness and silence of the night.

Chapter VI.

The Distribution and Premanence of Species.

Professor Gray, in his address before the American Association for the advancement of science, delivered at Dubuque (Ia.) in 1872, while remarking upon the wide extent of similar flora in the same plant zones, says: "If we now compare, as to their flora generally, the Atlantic United States with Japan, Mantchooria and Northern China,--_i.e._ Eastern North America with Eastern North Asia--half the earth’s circumference apart, we find an astonishing similarity." But why astonishing? Had our distinguished botanical professors, in this country and in Europe, thoroughly informed themselves as to the climatic conditions, the general physical features, geographical characteristics, soil-constituents, and other conditional incidences of this Asiatic region, in the light of all the physiological facts before them, the circumstance of this great similarity of flora would have been anything but astonishing. Indeed, the astonishment, if any, would have been expressed at the want of similarity, had it been found to exist.

Ever since 1862, these distinguished professors have had the great plant-charts of Mr. Arthur Renfrey before them, with the warm temperate zone north accurately laid down in its proper isotherms, as well as the different classes of vegetation peculiar to the two regions referred to, and some general conclusions of value to science might have been drawn therefrom. Besides, the fact of these similar antipodal flora was well known to many of them before this chart was issued. They also knew that all along the higher mountain ranges of this country, as well as in Europe, the same alpine flora was to be found under the same or similar alpine conditions. From Mt. St. Elias, in Alaska, to the Central American States, and thence, through the Isthmus, to the southern extremity of the Andes in South Patagonia, there is one unbroken line of alpine vegetation pressing the sides or summits of the loftier mountain ranges, at altitudes correspondingly varying with the latitudes in which they occur. And the

same is true of the Alps in Europe and the Himalaya ranges in Asia, if not of all the mountain systems of the globe.

These, and hundreds of other equally suggestive facts, all pointing to geographical, climatic, and other influencing conditions, as the real objective points of inquiry, have been constantly before our botanical friends; and yet they have been content with Mr. Darwin's theory of climbing mountains to cross the geographical equator, under the impression that an enormous ice-cap, or rather prodigious "ice-ulster," would ultimately drift them into the southern hemisphere, or enable them to "coast" their way thither with the greatest imaginable ease. But why insist upon the migration of plants growing in the lowlands and about the bases and sides of mountains, and not suggest some means of transport for the equally beautiful flora, known as "alpine," on the mountain summits of the earth? These are distributed, as we have before shown, over all our mountain systems, in all latitudes and in all parts of the globe, as well as in the higher regions of vegetation as we approach the north pole. Surely, the delicate little harebells of these alpine regions should attract some interest, if not sympathy, from those who are constantly hunting up means of transport for the more hardy and robust plants that seem able to take care of themselves almost anywhere.

When the next great ice-cap shall sweep down from the north pole upon these beautiful alpine flowers they will have to travel somewhere. There is manifestly as much necessity for them to get out of the way as for the rest of the flora. How will they manage to get down the mountains into the lowlands, and traverse uncongenial plains and deserts, to find other and far-distant alpine homes? They can never, of course, get very far away from the regions skirted by eternal frost, for their cup of joy must be chaliced by the snow-flake, or their beautiful life is soon ended. But if all our alpine flora have traveled from one evolutional centre, or have been "created but once in time and place," how have they managed to cross the thermal equator and spread themselves out over all the alpine regions of the globe? We call upon Mr. Darwin and Professor Gray to rise and explain. Not that we want any explanation, but that their theory of plant-migration stands sadly in need of one.

The theory which the Bible genesis suggests to us is fully adequate to the explanation wanted. It explains not only _why_ these alpine flora appear where they do, but why they cannot appear anywhere else. It also explains all the physiological facts to which we have referred in the foregoing chapters. Wherever the necessary alpine conditions exist the earth responds to the divine command, and the beautiful little alpine harebell is cradled into life, and rejoices in the bright embroidery it wears. And so, wherever streams are turned aside to flow through new meads and sheltered woods, or over broken and swaly places where cowslips never grew before, hardly a year will pass before this "wan flower" will hang therein "its pensive head," while all along the line of the stream the black alder will make its appearance in the lowlands, no matter how far its current may be diverted from its original channel, or how distant the supply of natural seeds. For nature's sternest painter can only delineate her as "instinct with music and _the vital spark_."

If our botanical professors would come forth into the true light of nature, they should accept the position of pupil to her, and not assert that of teacher. So long as they continue to peep and botanize upon her grave, or over ancient mounds and Hadrianic tumuli, they will never find out the cunning of her processes, much less the means she employs to accomplish her perfected ends. This modern idolatry of "hypotheses," with our chronic neglect of what nature _does_, is the great scientific stumbling-block of the age in which we live. Our botanists all agree that certain plants and trees disappear--hopelessly die out--from the _absence_ of "necessary conditions;" when will they come to recognize the reverse of this undeniable proposition, and agree that the _presence_ of necessary conditions may cause the same plants and trees to make their appearance, that is, spring into life in obedience to some great primal law, as unerringly obeyed by nature as the attractive force of the universe itself?

For nearly half a century the fact has been known that the geographical distribution of the European flora, and especially that of the British Islands, was referable to latitude, elevation, and climatic conditions. As early as 1835, Mr. Hewett Watson, a well-known botanist of that day, in his published "Remarks on the Geographical Distribution of Plants, in connection with Latitude, Elevation, and Climate," drew the attention of the botanical world to this remarkable feature of plant distribution; while the late Professor Edward Forbes pursued the same line of thought in his attempt to show how geographical changes had affected plant areas in Great Britain as far back as the last glacial drift. And yet all our botanical writers have been steadily persisting on immense plant-migrations to account for their geographical distribution, and have given us maps without number to show how the vegetal hosts have traversed vast continents, swam multitudinous seas, braved the fiery equator, and scaled the summits of the loftiest Andes. In the mean time, no botanist of any distinguished note, except M. De Candolle, has confidently ventured to question this migration theory, so imposing and formidable has been the array of names which have frowned down, like so many gigantic ghauts, upon the audacious questioner.

But the present actual state of knowledge on this subject forbids us any longer to accept theories for facts, premises for conclusions, or fallacious reasoning for legitimate induction. Truth and daylight never meet in a corner, and no one, in our day, need go to the bottom of a well in search of either. We are forever stumbling over the truth without knowing it, because our old traditional beliefs, like so many superannuated grasshoppers, are constantly springing up in our path and diverting our attention from her. There are physiological facts enough daily obtruding themselves upon our attention, if we would but notice them, in the case of wayside plants, garden and household weeds, and the more aggressive vegetation of worn out pasture-lands, to satisfy us of the truth of our theory, were it not for the swarms of these old traditional grasshoppers continually rising into the air before us, and shutting out the truth as it is in nature. And the worst feature about this whole business is, that we have come to regard these multitudinous insects as a delight instead of a burden.

But it is hardly necessary to pursue this subject further. We have shown, or shall show in the succeeding pages, that all crystalline forms come from necessary or favoring statical conditions; that all infusorial forms come in the same way, only their conditions may be said to be dynamical rather than statical; that all mycological forms (fungi) are dependent, for their primary manifestation, on conditions of moisture and decay; that all plant-life, from the lowest cryptogam to the lordliest conifer, is dependent on some similar incidence of conditions; that the mastodon, now only known by his fossil remains, must have wallowed forth from his "necessary mire" (plasmic conditions) in the Eocene period; and that all animal life must have come from some underlying law of primordial conditions, as impressed upon matter, in harmony with the "Divine Intendment" from the beginning; and that this law is still operative in the production of new forms of life whenever and wherever the same may appear. We shall also show that all living organisms, such as seeds, fungus-spores, morphological cells, etc., perish at a temperature of about 100´° C., and that _Bacteria, Torulˆƒ_, and other infusorial forms, making their appearance in super-heated flasks, originate not from morphological cells, plastide particles, bioplasts, or any other vital organism, but from indestructible vital units, which are everywhere present in the organic matter of our globe, and ready to burgeon forth into life whenever the necessary vital conditions exist, and the proper incidences of environment occur.

We have also shown that the earth still obeys the divine command to bring forth, or--if objection be made to this form of statement as unscientific--still obeys some inexorable underlying law tantamount to such command, and can no more help "bringing forth," when the necessary telluric conditions favor, than the cold can help coming out of the north, or the clouds dropping rain, when the necessary meteorological conditions occur. Give the future American botanist the physical geography of a country--its average rain-fall, temperature, etc., and the plant zone in which it lies, and, whether explored or unexplored, he will give us the general character of its vegetation, and name most of the plants and trees peculiar to its soil. And he will do this, not because he has any faith in the present theories of plant-migration, nor in the necessary distribution of seeds, but because he will study his favorite science with reference to latitude, elevation, climate, physical characteristics, rain-fall, soil-constituents, and other influencing conditions of plant-life.

But we will now proceed to consider the duration of vegetable species, for the purpose of showing that the evolutional changes they are undergoing, if any, must cover infinitely vaster periods of time than we have any data for determining, to say nothing of the unverified theories the evolutionists have been spinning for us.

Our geologic and paleontologic records are becoming richer in materials, more interesting in details, and more authentic in character, every year. We are turning back page after page of these lithographic records, only to find the domain of science widened and deepened in interest as we advance, or as our rocks are being excavated, our mountains tunneled, our vast mines explored, and the beds of our rivers and arms of seas thoroughfared and traversed by the iron rail. Meanwhile, science exhibits

signs of becoming less devoted to new-fangled theories, more exacting in her demands upon her votaries, and more eager to extend the domain of facts as the only true basis on which to rest her claims for future recognition. She is less dogmatic to-day than she was a year ago, and is likely to become less so a year hence than now. And this is largely due to her methods of research and inquiry. She is now everywhere sending out her hardier and more enthusiastic sons into new fields of exploration, to return laden with ampler materials to build, and richer treasures to adorn, a temple worthy of her name. In the field of the fossilized fauna and flora, these treasures are of the highest value and interest, all indicating not only wide areas of distribution, but immense periods of time, in which species have existed without any greater changes in character than the necessary shadings into varieties would seem to require. For nature everywhere characterizes her methods of production and reproduction by a loving tendency to diversify and variously adorn her species, as if to express the infinite conceptions of that power above her, which "spake and it was done, which commanded and it was brought forth."

From the fossilized plants of Atanekerdluk--a flora rich in species and wonderfully preserved in type--and the Miocene flora of Spitzenburg, to the southernmost limits of vegetation on the globe, science has reached out her hands for materials, and gathered them with as much success as avidity. And all scientific botanists agree in referring these fossilized forms from the high northern latitudes, to the Miocene period--one so remote that we can form no adequate conception of it, except as time may be measured by geologic periods. And these materials show that varieties of the _Sequoia_, the tulip-tree, oaks, beeches, walnuts, firs, poplars, hazelnuts, etc., etc., all flourished in these sub-arctic regions during the far-distant period we have named. Many of them must have grown on the spot where their trunks are now to be found, as their roots remain undisturbed in the soil, as well as at a time when these regions enjoyed a warm or cold temperate climate. Many of these fossilized and carbonized forms are identical with the living species of to-day, conclusively showing that neither natural variation, nor any secondary causes, have worked out any changes capable of being scientifically expressed in genetic value.

There is also abundant evidence to show that many of the present tropical forms flourished in central and southern Europe as far back as the warm inter-glacial epoch in the Eocene period. And if these inter-glacial periods occurred at the lowest minimum limits of eccentricity in the earth's orbit, as calculated by Leverrier's formul^f, we can have no conception whatever of the length of time actually intervening the period named and our present era. Mr. Croll has given us the limits of highest glaciation covering the last three million years, and shows that there have been but two periods of superior eccentricity in that time, and can be only one in the next million years, with but two or three intervening maxima and minima that may, or may not have been, of any special value. It is true that he assigns importance to these maxima, as affecting possible glaciations, but there are other eminent astronomers and physicists who differ from him, and really attach little or no importance to these of any other intervening periods of eccentricity. If Mr. Croll is correct in his

theory and estimates, we must separate these superior glacial epochs by an interval of not less than one million seven hundred thousand years; and nearly three of these periods must have intervened since some of the present tropical forms flourished in Europe. And if these forms have undergone no specific change in all this time, how many years will it require to work out even _one_ of Mr. Darwin's many evolutional changes?

The kinship between some of these arctic and sub-arctic fossilized flora and the living forms of to-day, is so near that they cannot be distinguished by a single difference. This is true of some of the varieties of the _Sequoia_ family, the oaks, beeches, firs, hazelnuts, etc., while others are so nearly identical that it would be difficult to classify them as separate varieties. At all events, if they cannot be placed in the list of identical species, they cannot be ruled out of representative types. But why should our speculative botanists insist upon these "evolutional changes" in plant-life--these "derivative forms" of which they are constantly speaking? Paleontological botany has given us the very highest antiquity of species, and the most that can be claimed is that nature was just as prolific of diversified forms millions of years ago as now. Because we, by forcing nature into unnatural, if not repugnant, alliances, can produce

--"Streak'd gillyflowers,
Which some call nature's bastards."

it is no evidence that she commits any such offence against herself. Her alliances are all loving ones. She indulges in no forced methods of propagation. If she produced the _Sequoia gigantea_, or the great redwood tree of our California Sierra, as far back as the Crustaceous period, she has propagated it ever since according to her own loving methods, and it is idle to talk of the _Sequoia Langsdorfii_ as being the original ancestor of this tree, or any other distinguished branch of the sequoias. How much more rational the suggestion of Professor Agassiz that these trees--the entire family of sequoias--were quite as numerous in individual varieties at first as now, and that the fruit of the one can never bear the fruit of the other.

Again, take the still hardier and more numerous branches of the _Quercus_ or oak family. M. De Candolle has expended a vast deal of ingenuity to show that the various members of this old and ancestrally-knotty family have all descended from two or three of the hardier varieties. He arrives at this conclusion from a geographical survey of what he would call the "whole field of distribution," and "the probable historical connection between these congeneric species." But science should deal with as few probabilities as possible, especially where experience furnishes no guide to certainty, and only the remotest clue to likelihood. We should never predicate probabilities except on some degree of actual evidence, or some likelihood of occurrence, falling within the limits, analogically or otherwise, of human observation and experience. In no other way can we determine whether an event is probable or not. But here we have not so much as a probable experience to guide us. Geographical distribution in the past is hardly a safe criterion to go by, because we can never be

absolutely certain that we have the requisite data on which to form a determinate judgment. The _Quercus robur_ may furnish the maximum test to-day, but a few concealed pockets of nature may bring some other variety of the congeneric species to the front to-morrow, requiring M. De Candolle to correct his classification. There are no less than twenty-eight varieties of this one species of oak, all of them conceded to be spontaneous in origin, and it has been on the earth quite as long as the more stately tribe of Sequoias. Besides, not more than one twenty-thousandth part of the earth's surface has been dug over to determine the extent to which any one of its varieties has flourished in the past.

Since these several varieties are only one degree removed from each other, M. De Candolle supposes divergence to be the natural law which has governed their growth, and not hereditary fixity. But here again he has only remote probabilities to work upon, no absolute data. We are still speaking of his fossilized herbaria, not his modern specimens. These may show a large number of genetically-connected individuals, or those claimed to be so connected. And yet no naturalist can be certain that, because they exhibit similarly marked characteristics, the one ever descended from the other; for the universal experience-rule still holds good that "like engenders like," and we search in vain for anything more than a similarity of _idea_, or logical connection, which justifies a recognition of the _individuorum similium_ in Jessieu's definition of species. But similarity must not be mistaken for absolute likeness, which nowhere exists in nature. Infinite diversity is the law, absolute identity the rarest possible exception. No two oak leaves, for instance, in a million will be found actually alike, although taken from the same tree, or trees of the same variety; and the same may be said of the segmentation and branching of their limbs, as well as the striatures of their corticated covering, _Et sic de similibus_ everywhere, and with respect to every thing. Nature is more solicitous of diversity and beauty, than of similarity and tameness of effect, in all her landscape pictures; and the Platonic conception that "contraries spring from contraries," may be only a supplementary truth to that of _de similibus_. In the eye of the soul all objective existences are discerned in their logical order, or as consecutive thoughts of the Divine mind, as outspoken in the material universe. To insist upon cutting down these transcendental forms[20] into the smallest possible number of similar or identical forms, may be all well enough to accomplish scientific classification; but the productive power of nature can never be limited by these mental processes of our own.

The oak family can be traced back to the Miocene period, and consequently enjoys quite as high an antiquity as the sequoias. Professor Gray, in speaking of the _Quercus robur_ and its probable origin, says that it is "traceable in Europe up to the commencement of the present epoch, looks eastward, and far into the past on far-distant shores." By "far-distant shores," he undoubtedly means Northwest America, where its remotest descendants still flourish. But that these trees should have waded the Pacific, or sent their acorns on a voyage of discovery after new habitats on the Asiatic coast, is hardly more probable than Jason's voyage after the golden fleece, in any other than a highly figurative sense. The spontaneous appearance of a forest of oaks on the eastern shores of Asia

was just as probable, under favoring conditions--though occurring subsequently to the time of their appearance on this continent--as that of the miniature forests of "samphire," or small saline plants, which spontaneously made their appearance about the salt-works of Syracuse, when conditions actually favored. The high antiquity of the oak makes no difference in respect to the principle of dispersion, since geographical conditions are what govern, and not the theoretical considerations of the speculative botanist.

Mr. A. R. Wallace's formula concerning the origin of species, that they "have come into existence coincident both in time and place with preˆ«xisting closely-allied species," may or may not be true so far as individual localization is concerned. But it proves nothing in the way of original progeny, nor can we, by any actual data before us, satisfactorily determine, under this formula, which of the two closely-allied species preceded the other. If they came coincidently, both in time and place, their existence must have been concurrent, not separated by preˆ«xistence. The formula may be true to this extent, that the conditions favoring the appearance of one species may have equally favored what we call a closely-allied species. But even in this case, the material sequence is lost, and we have nothing to express a relationship as from parent to progeny. For, however restricted as to localization, each species preserves its own characteristics, the similarities always being less than the dissimilarities. These, and other equally conclusive facts of observation, led Professor Agassiz to question any necessary genetic connection between the different species, or between even the same species, in widely-separated localities; his idea being precisely that advanced by us in connection with the Bible genesis, that localization depended on geographical conditions, not on the migration of plants or the dispersion of seeds.

The actual geographical distribution of species--any species--does not depend solely on lines of ancestry, however great their persistence of specific characters; nor on any principle of natural selection, nor on the possibility of fertile monstrosities, but on the simple incidence of conditions; and M. De Candolle, in his "Geographie Botanique," virtually concedes this, while treating of geographical considerations in connection with distribution. He in fact says, in so many words, that the actual distribution of species in the past "seems to have been a consequence of preceding conditions." [21] And he is forced to this conclusion by his virtual abandonment of plant-migration, and the alleged means of seed-distribution.

The question after all, says Professor Gray, is not "how plants and animals originated, but how they came to exist where they are, and what they are." On only one of these points--that of favoring conditions--can any satisfactory answer be given, except as we defer to the Bible genesis, which explains all. And the reason is, that we can never determine what forms are specific without tracing them back to their origin, and this is impossible. Orders, genera, species, etc., are only so many lines of thought on which we arrange our classifications, just as the parallel wires of an abacus, with their sliding balls, are the lines on which we make our mathematical computations. Agassiz would not allow that varieties

existed in nature, except as man's agency effected them, that is, as they were brought about by artificial processes.

These artificial processes are quite numerous, and many of them have been practised from remote antiquity. But they seem to have no counterpart in nature, except as insects may contribute to modifications by the distribution of pollen. But all modifications of this character tend towards infertility, while few plants accept any fertilizing aid from other and different species. Any break in their hereditary tendencies, resulting in a metamorphosis that involves the integrity of their stamens and pistils, is stoutly resisted by nature. In considering the question of species, therefore, we should confine our observations to those produced by natural, not artificial, methods; to plants as propagated by the loving tendencies of nature, not by the arbitrary and exacting methods of man--those looking to his gratification only. All these fall into the category, of "nature's bastards," as Shakespeare happily defines them. In view of these considerations, and the new methods of classification, such as grouping genera into families or orders, and these into sub-orders, tribes, sub-tribes, etc., we can readily understand why the great Harvard Professor should have wholly eliminated community of descent from his idea of "species," or hesitated to regard varieties otherwise than as the result of man's agency.

Indeed, the whole question of species, as well as varieties, is likely to undergo material modifications in the future. On some points the botanists and zoologists differ widely already, many making likeness among individuals a secondary consideration, and genealogical succession the absolute test of species. Others, on the contrary, make resemblance the fundamental rule, and look upon habitual fecundity within hereditary limits as provisional, or answering to temporary needs only. These differences of opinion would seem to be the more tenaciously held as the question of new varieties presses for solution at the hands of nature, rather than by the agency of man. All these varieties tend less to new races than to cluster about type-centres, and can go no further than certain fixed limits of variation, beyond which all oscillations cease. But none of these questions touch the real marrow of the controversy as to origin, or aid us in determining the duration of species.

The presence of the two great families of trees--the sequoias and the oaks--as far back as the Miocene period, if not extending through the Eocene into the Cretacious, is conclusive of the point we would make, that no great evolutional changes have taken place in the last two or three million years, and none are likely to take place in the next million years, except that the _Sequoia gigantea_ may drop out, from the vandalism of man or the next glacial drift.

M. Ch. Martins, in his "Voyage Botanique ˆ'n Norwege," says "that each species of the vegetable kingdom is a kind of thermometer which has its own zero." It may also be said to have its hygrometric and telluric gauges, or instruments to determine the necessary conditions of moisture and soil-constituents. When the temperature is below zero, the physiological functions of the plant are suspended, either in temporary hybernation or death. And so when the hygrometric gauge falls below the

point of actual sustentation, the plant shrinks and dies; while, without the necessary conditions, it would never have made its appearance. There was nothing more imperative in the command for the earth to bring forth than the necessary conditions on which plant-life depended in the first instance, and still depends, as we have endeavored to show.

Dr. J.G. Cooper, in an interesting article prepared by him at the expense of the Smithsonian Institute, on the distribution of the forests and trees of North America, with notes and observations on the physical geography, climate, etc., of the country, after classifying, arranging, and tabulating the results of the various observations forwarded to that institution, indulges in the following general observations: "We have with a tropical summer a tropical variety of trees, but chiefly of northern forms. Again, with our arctic winters, we have a group of trees, which, though of tropical forms, are so adapted to the climate as to lose their leaves, like the northern forms, in winter. But, here, it must be distinctly understood, is no alteration _produced_ by climate. Trees are made for and not _by_ climate, and they keep their characteristics throughout their whole range, which with some extends through a great variety of climate." The italics are the authors, and we suppose he means by "tropical" and "arctic," the sub-tropical and sub-arctic.

In making his general observations, he had before him large collections of the leaves, fruits, bark, and wood of trees from all parts of the United States, including portions of Mexico, the Canadas and Alaska, and extending from the Atlantic to the Pacific. But one of the most important elements--in fact, the _most_ important--is wanting in the tables before us, and that is, the elevation at which these thousands of specimens were obtained. So great an oversight as this should not have occurred, although it may not have been entirely Dr. Cooper’s fault. He had his materials to work upon, and may have done the best that any one could with them. And yet it is just as important to know at what _elevation_ a particular tree grows in its own plant zone, as to know whether it comes from a sub-arctic or sub-tropical region.

But this was not the comment we designed to make. Dr. Cooper labors, with most professional botanists, under the delusion that all our plants and trees originated in some one "centre of creation," at some period or other in time and place, and have been steadily spreading themselves outward from that centre until they occupy their present areas of distribution. We have no objection to his clinging to this superannuated faith and belief, if he derives any pleasure in flushing up these "traditional grasshoppers." But we have a right to insist that he shall be logical. He wants it distinctly understood that trees are made _for_, and not _by_, climate. Then his "centre of creation" should be everywhere, not a localized one. For he insists that no alteration can be produced by climate, but that the characteristics of each specific form are preserved throughout its entire range of distribution. But if these nomadic and migratory forms have wandered thus far from their centres of creation, it would seem that the trees had either adapted themselves to the climate, or the climate to the trees. But our Smithsonian systematizer will allow us neither horn of this dilemma. He insists that the trees were made for the climate, and that they have preserved their characteristic features during

their entire ambulation upon the earth’s surface.

With the change of a single monosyllabic predicate, this proposition is undoubtedly true. We have never heard that plants or trees were "made." They were ordered "to grow," or rather the earth was commanded to bring them forth, which is an equivalent induction. And the fact that they grow now, renders it absolutely certain that they grew at first, when "out of the ground made the Lord God _to grow_" every plant of the field, and every tree that is pleasant to the sight. We accept this genesis for the want of a better. And if Dr. Cooper will add to his climatic conditions, the hygrometric and other conditions necessary for the development and growth of his plants and trees, we will agree with him to the fullest extent of his novel position--that trees neither adapt themselves to the climate, nor the climate to the trees; although it is true that trees modify climate quite as much as they are modified by it. The true physiological formula is undoubtedly this:--Trees make their appearance _in_ climatic and other environing conditions, and flourish, without material change in characteristics, so long as these conditions favor. _Why_ they make their appearance is not a debatable question, except as we assume a preˆ«xisting vital principle, and apply to its elucidation our subtlest dialectical methods. We are told that God commanded the earth to bring them forth, after _his_ spirit (the animating soul of life) had moved upon the face of the depths--the chaotic and formless mass of the earth in the beginning. Plato has uttered no profounder or more comprehensive truth than this, with all his conceptions of Deity and the perfect archetypal world after which he conceived our own to be modeled. Our preference for the Bible genesis over the Platonic conception is, that it is vastly simpler and constitutes a more objective reality to the human soul. Besides, we find _it true in fact_, since the earth is constantly teeming with life, as if in obedience to some great primal law impressed upon matter by an infinitely superior intelligence to our own.--

"If this faith fail,
The pillar’d firmament is rottenness,
And earth’s base built on stubble."

Chapter VII.

What Is Life? Its Various Theories.

The question, "What is life?" does not lie within the province of human reason, the science of logic, or the intuitions of consciousness, to determine. It furnishes no objective _datum_ on which to predicate attributes that are either congruent or diverse. It can only be defined as the coordination of the _vis vitae_ in nature, which is an undisguised form of reasoning in a circle. We can ascribe to it only such attributes as are utterly inconceivable in any other concept or object of thought. It admits of but one attribution, and that embracing an identical

proposition. To say of life that it is "a coˆ¶rdination of action," might be true as a partial judgment, but not as a comprehensive one; otherwise, crystallization would fall under its category, which is manifestly an illicit induction. It allows, therefore, of no possible explication, analysis, or separate logical predicament. It stands absolutely alone and apart by itself--a positive, self-subsistent vital principle, or process of action, which all physiologists agree, for the sake of convenience and uniformity of expression, in designating as a _power, property, force_, etc., in nature. Whenever questioned as to its origin the subtlest and profoundest intellects, in all ages of the world, have returned but one answer: "I know no possible origin but God"--the great primal source of all life in the universe.

Among the ancients we find an almost equivalent induction in the phrases, borrowed by them from the highest antiquity, "_Jupiter est genitor_," "_Jupiter est quodcunque vivit_," etc., which, although uninspired utterances, strike their roots deeply into the _terra incognita_ of consciousness, wherein we ascribe to God the "issues of life" as a paramount theological conception. When the ingenious and learned Frenchman defined life as "the sum of all the functions by which death is resisted," he was as conclusively indulging in the _argumentum in circulo_ as if he had said, "Life is the antithesis of what is not life." This would be as luminous a definition as that which should make Theism the opposite of Anti-theism, or the Algebraic statement _x-y_ the antithesis of _x+y_--one of no definitional value so long as there is no known quantity expressed in the formula.

To begin with begging the question, and then adroitly whipping the argument about a pivotal point, as a boy would whip a top, may be amusing enough to the childish mind, but is manifestly making no more progress in logic than to substitute an ingenious paraphrase of a term for its real definition. It is a mere verbal feat at best, without the possibility of reaching any determinate judgment. It is like some of the half-circular phrases we are likely to meet with in the categories of modern materialistic science, such as the "correlated correlates of motion," the "potentiated potentialities of sky-mist," the "undifferentiated differentialities of life-stuff," called, by special condescension on the part of the materialists, "life." All of which is an easy logic, but a whimsical enough way of putting it.

According to Leibnitz, everything that exists is replete with life, full of vital activity, if not an actual mass of living individualities. But this daring hypothesis has ceased to attract the attention it once received. There are states and conditions of matter in respect to which it is idle to predicate the _vis vitae_. For the great bulk of our globe is made up of the highly crystallized and non-fossiliferous rocks, which neither contain any elementary principle of life, nor exhibit the slightest trace of vital organism, even to the minutest living speck or plastid. During all those vast periods of uncomputed time, covering the world’s primeval history, there was an utter absence of life until the chief upheavals of the outer strata of our globe, now constituting the principal mountain chains of its well-defined continents, occurred. In whatever atomic or molecular theories, therefore, we may indulge, in

respect to the original formation of the earth, the utmost stretch of empirical science can go no further, in the solution of vital problems, than to touch the threshold of inorganic matter, where, in our backward survey of nature, vegetable life begins and animal life ends. All beyond this point must be given up to other "correlates of motion" than those to which the materialists specifically assign the beginnings of life.

The theory of "panspermism," originating with the Abbˆ' Spallanzani in modern times, and still stoutly advocated by M. Pasteur and some few others, is manifestly defective in this,--that it goes beyond the inorganic limit in assigning vital units to all matter, even to its elemental principles. It is true that they speak of "pre-existing germs"--"primordial forms of life"--that are "many million times smaller than the smallest visible insect." But their assumptions go far beyond the construction we give to the Bible genesis, which merely asserts that the germinal principle of life--that of every living thing--is in the earth, or in "the waters and the earth," which were alone commanded "to bring forth."

Some of the panspermists have gone so far as to assert that everything which exists is referable to the _vis vitˆƒ_--to non-corporeal, yet extended vital units, mere metaphysical points--like Professor Beale's bioplasts in the finer nerve-reticulations--or living things endowed with a greater or less degree of perceptive power. This was the assumption of the great German philosopher, Leibnitz, who carried the panspermic theory so far as to accept the more fanciful one of "monads"--those invisible, ideal, and purely speculative units of Plato, which go to make up the entire universe, extending even to the ultimate elements, or elements of elements. Leibnitz says: "As it is with the human soul, which sympathizes with all the varying states of nature--which mirrors the universe--so it is with the monads universally. Each--and they are infinitely numerous--is also a mirror, a centre of the universe, a microcosm: everything that is, or happens, is reflected in each, but by its own spontaneous power, through which it holds ideally in itself, as in a germ, the totality of things."

But the specific germ theory advanced in the Bible genesis, is capable of being taken out of the purely speculative region in which "panspermism" landed the great German philosopher. It is a simple averment that the animating principle of life is in the earth; that the germs of all living things, vegetal and animal alike, are implanted therein, and that they make their appearance, in obedience to the divine command, whenever and wherever the necessary environing conditions occur. The fact that nature still obeys this command is proof that she has the power to do so--that this indestructible vital principle still animates her breast. Innumerable experiments, as well as phenomenal facts, attest the truth of this genesis of life, while the researches of Professor Bastian and other eminent materialists, made in infusorial and cryptogamic directions, confirm rather than discredit it. The fact that it appears for the first time in this ancient Hebrew text can detract nothing from its value as a scientific statement. Granting that panspermism may rest upon a purely fanciful and unsubstantial basis, it is but fair to concede that its great advocates have honestly attempted to explain by it all the vital phenomena

occurring in nature, as M. Pasteur is conclusively attempting to do now. It is certain that the materialists, who are resolutely antagonizing the panspermic, as well as all other "vital" theories, have not yet gone so deeply into elementary substance as to shut off all further investigation in these directions.[22] Neither the lowest primordial cell, nor the least conceivable molecule, has yet been reached by the aid of the microscope, any more than the outermost circle of the heavens has been penetrated by the aid of the telescope. We must stop somewhere, and when we find a scientifically formulated statement which embraces all vital phenomena, and satisfactorily accounts for them all, whether it originally came from Aristotle, from Plato, or from Moses, is a matter of comparatively slight moment, so far as the scientific world is concerned. At least, it would seem so to us. But to talk of the _de novo_ origin of "living matter" as the result of the dynamic force of molecules--themselves concessively "dead matter"--is to indulge in quite as fanciful a speculation as the advocates of the panspermic hypothesis have ever ventured to suggest. Professor Bastian is forced to go back of his infusorial forms and fungus-germs to a microscopical "pellicle," from which he admits they are "evolved." But why evolved? Does not the principle of vitality lie back of the pellicle, as well as the fungus-germ? How absolutely certain is he that the extremest verge of microscopic investigation has been attained, in what he is pleased to designate "primary organic forms?" "Evolution" is a very potential word, and no one may yet know what boundless stores of absurd theory and metaphysical nonsense are locked up in it![23] He admits that "evolution," as embracing the idea of "natural selection," can have nothing to do with the vast assemblage of infusorial and cryptogamic organisms, until they assume definitely recurring forms, that is, rise into species and breed true to nature. Then, he agrees with Mr. Darwin, that the law of vital polarity or "heredity," as he calls it, may come in and play its part towards effecting evolution, or variability, in both animal and vegetal organisms, but not before. Why then should he lug in, or attempt to lug in, the diverse potentialities of this word "evolution," for the purpose of demonstrating the dynamic law governing the developmental stages of his microscopic pellicle? This, he will agree, lies far below the point, in primary organism, where specific identity, or the law of heredity, asserts its full recognition. All below this developmental point is inconstancy of specific forms, with no line of ancestry to be traced anywhere.

This, Professor Bastian readily concedes, notwithstanding it cuts the Darwinian _plexus_ squarely in the middle. He says: "Both Gruithuisen and Trˆviranus agree that the infusoria met with have never presented similar characters when they have been encountered in different infusions; nor have they been uniform in the same infusion, when different portions of it have been _exposed to the incidence of different conditions_. The slightest variations in the quality or quantity of the materials employed, are invariably accompanied by the appearance of different organisms--these being oftentimes strange and peculiar, and unaccompanied by any of the familiar forms." Other writers of equal eminence in this field of investigation have not only observed the same characteristics, but encountered the same difficulties in classification, from the very great diversity obtaining even in the nearest allied forms. So great is this diversity, and so multitudinous the different forms, that little certainty

or value can be attached to the classifications already made. Even Professor O.F. Mˆ…ller, after he had convinced himself that he had discovered not less than twelve different species belonging to a single genus, was subjected to the mortification of seeing Ehrenberg cut them all down to mere modifications of one and the same species.

We refer to these several statements of fact for the purpose of emphasizing the true genesis of life as supplemented by "the incidence of different conditions," on which all vital manifestations depend. The presence of the germinal principles of life in the earth is emphatically averred in the Bible genesis. And we have only to connect the doctrine of "conditional incidence" with this averment, to account for all the vital phenomena which so profoundly puzzle these gentlemen while prying into the mysteries of the ephemeromorphic world. Whatever may be the character of any infusion, or to whatever incidence of conditions it may be subjected, it will produce _some_ form of life; not because it contains this or that morphological cell, destructible at a temperature of 100´° C--that to which it is experimentally subjected before microscopic examination,--but because every organic infusion, whether undergoing the required heat-test or not, contains vital units--those as indestructible by heat as by glacial drift--which burgeon forth into life whenever the proper conditions of environment obtain. The slightest variation, in either the quantity or quality of the material employed in the infusion, is, as these eminent microscopists agree, invariably accompanied by the appearance of different forms of life, just as the slightest change in soil-conditions, such as that produced by the presence of one species of tree with another in natural truffle-grounds, will result in the appearance of another and altogether different plant, as well as truffle tuber.

But the theory which the vitalists are more particularly called upon to combat is that to which the non-vitalists most rigidly adhere; and we refer to it, in this connection, that the reader may compare its complexity and involution of statement and idea with the extreme simplicity of the biblical genesis, as heretofore presented. We give it in the exact phraseology employed by Professor Bastian: "Living matter is formed by, or is the result of, certain combinations and rearrangements that take place _in invisible colloidal molecules_--a process which is essentially similar to the mode by which higher organisms are derived from lower in the pellicle of an organic infusion." This carefully-worded definition of life, or the origin of "living matter," presents a hypothetical mode of reasoning which is eminently characteristic of all materialists. In the stricter definitional sense of the word, there is no such thing as "living matter" or "dead matter," as we have before claimed. There are "living organisms" in multitudinous abundance--those resulting _from_, not _in_, the _vis vitˆƒ_, or the elementary principle of life in nature--as there are also "dead organisms" in abundance. This materialistic definition of life, which is not so much as a generic one even, begins in an absurdity and ends in one. It is agreed that the "proligerous pellicle" of M. Pouchet, the "plastide particle" of Professor Bastian, the "monas" of O.F. Mˆ…ller, the "bioplast" of Professor Beale, etc., are essentially one and the same thing, except in name. They are mere moving specks, or nearly spherical particles, which exhibit the first active movements in organic solutions. They vary in size from the one

hundred-thousandth to the one twenty-thousandth of a second of an inch in diameter, and appear at first hardly more than moving specks of semi-translucent mucus. Indeed, Burdach calls them "primordial mucous layers." But they move, pulsate, swarm into colonies, and act as if they were guided, not by separate intelligence, but by some master-builder supervising the whole work of organic structure. This master-builder is the one "elementary unit of life," which directs the movements of all the plastide particles, constantly adding to their working force, from the first primordial mucous layer of the superstructure to the majestic dome of thought (in the case of man) which crowns the temple of God on earth.[24]

But this "pellicle" of Professor Bastian is not mere structureless matter, any more than the "bioplast" of Professor Beale. The fact that they move, pulsate, work in all directions, shows that they have the necessary organs with which to work. These organs may be invisible in the field of the microscope, but that is no proof that they do not exist. Organs are as essential for locomotion in a plastide particle as in a mastodon or megatherium, and if the microscope could only give back the proper response, we should see them, if not be filled with wonder at the marvellous perfection of their structure. But into whatever divisions or classifications we may distinguish or generalize the properties of matter, we can never predicate _vitality_ of it, any more than we can predicate _intellectuality_. Indeed, "intellectual matter" presents no greater incongruity or invalidity of conception than "vital matter." These qualifying terms are applied to the known laws and forces of nature, not to insensate matter. To assert that life results _from_ "certain combinations and rearrangements of matter," and not _in_ them, is utterly to confound cause and effect, or so incongruously mingle them together that no logical distinction between the two can exist as an object of perception. Without the _vis vitˆƒ_, or some germinal principle of life, lying back of these "combinations and rearrangements of matter," and determining the movements of their constituent molecules, there could be no vital manifestation, any more than there could be a correlate of a force without the actual existence of the force itself. [25]

The materialists give the name of "protoplasm" to that primitive structureless mass of homogeneous matter in which the lowest living organisms make their appearance. They claim that this generic substance is endowed with the property or power of producing life _de novo_, or, as Professor Bastian puts it, of "unfolding new-born specks of living matter" which subsequently undergo certain evolutional changes; but whether they die in their experimental flasks, or rise into higher and more potentially endowed forms of life, it is difficult for those following their diagnoses to determine. They further claim that the same law of vital manifestation obtains in organic solutions as in the structureless mass they call "protoplasm." Both are essentially endowed with the same potentiality of originating life independently of vital units, or _de novo_, as they more persistently phrase it. But why speak of _unfolding_ "new-born specks of living matter?" "To unfold" means to open the folds of something--to turn them back, get at the processes of their _infoldment_. It implies a pre-existing something, inwrapped as a germ in its environment. If not a germ, what is this pre-existing vital something which their language

implies? Is our scientific technology so destitute of definitional accuracy that they cannot use half a dozen scientific terms without committing half that number of down-right scientific blunders? "New-born specks of living matter" is language that a vitalist might possibly use by sheer inadvertence; but no avowed materialist, like Professor Bastian, should trip in this definitional way.

"Living matter," _born_ of what? Certainly not of _dead_ matter. Death quickens nothing into life, not even the autonomous moulds of the grave. It implies the absence of all vitality--a state or condition of matter in which all vital functions have been suspended, have utterly ceased, if, indeed, they ever existed. It behooves the materialists to use language with more precision and accuracy than this. "Dead matter," whatever the phrase may imply, can bear nothing, produce nothing, quicken nothing. The pangs of death once past, the pangs of life cease. Nor is there any birth from unquickened matter. Animals _bear_ young, trees _bear_ fruit, but force _produces_ results. What then quickens protoplasmic matter? Neither vital force, nor vegetative force, if we are to credit the materialists. They would scorn to postulate such a theory, or accept any such absurd remnant of the old vitalistic school. It is rather "molecular force"--a physical, not a vital unit--that gives us these "new-born specks of living matter." [26] This is what they would all assert at once, in their enthusiasm to enlighten us on a new terminology.

But "molecular force" fails to give us any additional enlightenment on the subject we are investigating. It is even less satisfactory than "atomic force," or "elementary force"--that which may be considered as inhering in the elementary particles from which both atoms and molecules are derived. And since both the ultimate atom and the ultimate molecule lie beyond microscopic reach, the assumption that vital phenomena are the result of either molecular force or atomic force, rests upon no other basis than that of imaginary hypothesis. To postulate any such theory of life, is going beyond the limits of experimental research and inquiry, and hence adopting an unscientific method. At what point the smallest living organism is launched into existence--started on its life-journey--no one is confident enough to assert. The materialist is just as dumb on this subject as the vitalist; and the only advantage he can have over his antagonist is to stand on this extreme verge of attenuated matter, and deny the existence of any force beyond it. The postulation by him of molecular force at this point, is virtually an abandonment of the whole controversy. He ceases to be a materialist the moment he passes the visible boundaries of matter, in search of anything like "undifferentiated sky-mist" beyond it.

All that we definitely know is that certain conditions of protoplasmic matter, of organic solutions, of soil-constituents, etc., produce certain forms of life; and, in the case of solutions, certain low forms of life: But whether the lower rise, by any insensible gradations, into the higher, more complex, and definitely expressed forms of life, is altogether unknown. That any such gradations can be traced from the lowest vital unit, in the alleged collocations of molecules, is not yet claimed. These primordial collocations, like the lowest living organisms, lie beyond the microscopic aids to vision, so that the ultimate genesis of life remains

as much a mystery as ever--becomes, in fact, a mere speculative hypothesis. And when it comes to this sort of speculation, the materialist is just as much in the dark as the vitalist, and neither can have any advantage over the other, except as the one may adopt the analytic, and the other the synthetic method.

This is the materialistic argument covering the _de novo_ origin of living organisms:--There is no greater microscopical evidence, they assert, that these organisms come from pre-existing invisible germs or vital units, than that crystals are produced in a similar manner--that is, come from pre-existing invisible germs of crystals. But this is overlooking all generic distinction in respect to processes or modes of action. Crystals are inorganic matter which _form_, do not _grow_. They are mere symmetrical arrangements, not organic growths; and are produced by some law akin to chemical affinity, acting on the molecules of their constituent mass. They possess no vital function. They show no beginning or cessation of life. But, once locked up in their geometric solids, they remain permanently enduring forms--concessively inorganic, not functionally-endowed, matter. To speak, therefore, of the "germs of crystals," is using language that has no appreciable significance to us. Germs are embryonic, and imply a law of growth--a process of assimilation, not of mere aggregation.

But, at the risk of being tedious, let us extend this argument of the materialists a little further: The only difference, they will still insist, between the preˆ«xisting germs of crystals and plants--or the only difference essentially worth noticing--is that crystalline particles of matter are endowed with much less potentiality of undergoing diversified forms and structural changes than the more highly favored vital particles, such as the proligerous pellicle, the bioplast, the plastide, etc. The one represents mere crystallizable matter, the other the more complex colloidal or albuminoid substance, or that capable of producing a much greater number of aggregates. The analogies, they concede, end here. But the difference is world-wide when we come to processes--the true experimental test in all classification. Crystallizable substances _crystallize_--that is all. They pass into a fixed and immovable state, and mostly into one as enduring as adamant; while colloidal or albuminoid matter (laboratory protoplasm) takes on no fixed forms--only those that are ephemeral, merely transitory. This is so marked a feature, in respect to all the primordial forms of life, that Professor Bastian gives them the more distinctive name of "ephemeromorphs," in place of _infusoria_. But all these primordial forms grow--develop into vital activity. Not so with a solitary crystal. Everywhere the statical unit _forms_, the dynamical unit _grows_; the one aggregates, the other assimilates; the one solidifies, the other opens up into living tissue; the one rests in the embrace of eternal silence, the other breaks the adamantine doors, and makes nature resonant with praise.

Great stress is laid by the materialists on the changeability of certain microscopic forms, and the startling metamorphoses they apparently undergo in different infusions, especially those forms having developmental tendencies towards fungi and certain low forms of algˆƒ. They attribute their different modes of branching, articulation, segmentation of

filaments, etc., both to intrinsic tendencies and extrinsic causes, the latter depending, no doubt, in a great measure upon the chemical changes constantly taking place in their respective infusions. These intrinsic tendencies, they would have us believe, depend upon the dynamic force of molecules, rather than any vital unit, or even change in elementary conditions. But "Dynamism" simply implies that force inheres in, or appertains to, all material substance, without specifically designating either the quantity or quality of the inhering force. If these materialists, therefore, use the terms "dynamic force," in this connection, in the sense in which we use vital force, or in the sense in which they use "statical force" as applied to the formation of crystals, in contradistinction from "dynamical force" as applied to living organisms, we have no special objection to urge against this particular formula. It presents no such formidable antagonism as the vitalists would expect to encounter from them.

M. Dutrochet is approvingly quoted by Professor Bastian, as asserting that he could produce different genera of mouldiness (low mycological forms) _at will_, by simply employing different infusions. This is unquestionably true, with certain limitations. And the chief limitation is as to _his_ (M. Dutrochet's) will. He might "will," for instance, to plant one field with corn and another with potatoes, but if the husbandman he employed to do the planting should happen to plant the one crop where he had willed to plant the other, and corn should grow where potatoes were planted, and _vice versa_, then he might be said to have produced corn _at will_. And so of his infusions. No change in their conditions enabled him to produce one species, much less a genus, of mouldiness in preference to another, by any change in the infusions employed by him. The power which implants life in the mycological world, implants it in every other world, from that without beginning to that without end. And this implanted life is quite as complete in one form as another,--

"As full, as perfect, in vile man that mourns,
As the rapt seraph that adores and burns."

All that the materialists can claim respecting man's agency in the production of life is, that he may take advantage of the uniform laws of nature, so far as they are known to him, planting seeds here, changing chemical conditions there, using different infusions in his experimental flasks,--organic or inorganic, as he may choose--and then await the action of these uniform laws. He will find them operative everywhere, and if he studies them deeply enough, he will find that they are not so much the laws of nature as they are the laws of nature's God.

Professor Bastian thinks he has conclusive evidence that what he calls "new-born specks of living matter" are produced _de novo_, that is, independently of any conceivable germ or germinal principle of life implanted in nature. But he confounds this implanted principle of life with the living organism it produces. His morphological cells, as well as plastide particles, are among these living organisms, as is conclusively shown by his own experiments. These all perish in his super-heated flasks. But the vital principle that produced them--that which becomes germinal under the proper conditional incidences--he can no more destroy by

experimentation than he can create a new world or annihilate the old one. His flask experiments, therefore, prove nothing; and all this talk about _de novo_ production is the sheerest scientific delusion. For, were it possible to destroy every plant, tree, shrub, blade of grass, weed, seed, underground root, nut, and tuber to-day, the earth would teem with just as diversified a vegetation as ever to-morrow. A few trees, like the gigantic conifers of the Pacific slope, might not make their appearance again, and some plants might drop out of the local flora; but the _Pater omnipotens ˆ ther_ of Virgil, would descend into the bosom of his joyous spouse (the earth), and, great himself, mingle with her great body, in all the prodigality, profusion, and wealth of vegetation as before.[27]

But these defiant challengers of the vitalists, who refuse us even the right to assume the existence of a special "vital force" in nature, are anything but consistent in their logical deductions. For while they resolutely deny the invasion of vital germs in their experimental flasks, they talk as flippantly of the "germs of crystals," and their presence in saline and other solutions, as if there were no scientific formula more satisfactorily generalized than that establishing their existence. Even Professor Bastian speaks of "germs," in a general sense, as if they thronged the earth, air, water, and even the stratified rocks, in countless and unlimited numbers. But we fail to see that any of his accurately obtained results determine their exclusion from the experimental media employed by him for that purpose. His unit of value is a morphological cell, a derivative organism rather than a primary vital unit; and all organisms are, as we have before said, destructible by heat. Professor Agassiz is pretty good authority for doubting the existence of such a cell. The difficulty of assigning to it any definitional value is, that it lies too near the ultimate implications of matter--those shadowy and inexplicable confines not yet reached--to admit of any scientific explication necessarily resting on objective data. If they mean by "germs" primary organic cells, then none exist in their super-heated infusions, and they are logical enough in rejecting the idea of their invasion. But in assuming the cell to be the ultimate unit of value, is where they trip in attribution, and stumble upon a partial judgment only.

The only value attaching to their theory of crystalline germs is, that it conclusively establishes the law of uniformity by which all structural forms are determined, whether they originate in organic infusions or inorganic solutions--in protoplasm or protoprism. The crystalline system presents no variability in types, but a rigid adherence to specific forms of definitely determined value. Whatever geometrical figure any particular crystal assumed at first, it has continued to assume ever since, and will forever assume hereafter. As a primary conception of the "Divine Intendment" (to speak after the manner of Leibnitz) it can neither change itself, nor become subject to any law of change, or variability, from eternally fixed types. And this is as demonstrably true of all living types, after reaching the point of heredity, as of the countless crystalline forms that go to make up the principal bulk of our planet. In this light, and as affording this conclusive induction, the crystalline argument of the materialists has its value.

The materialists should not too mincingly chop logic over the validity of

their own reasoning. If they force upon us their conclusions respecting statical aggregates, or crystalline forms, let them accept the inductions that inevitably follow in the case of dynamical aggregates, or living organisms. Beggars of conditions should not be choosers of conditions, nor should they be al lowed to dodge equivalent judgments where the validity of one proposition manifestly rests upon that of another. If they insist upon the presence of a chemical unit, or, worse still, a crystalline "germ" or unit, in the case of statical aggregations, they are effectually estopped from denying the presence of vital units in dynamical aggregations. And if they further force upon us the conviction that the process of aggregation, when once determined, remains in the one case, eternally fixed and certain, they should not be permitted to turn round and insist that, in the other case, there is nothing fixed and certain, but all is variability, change, uncertainty of specific forms. If vital units have only a hypothetical existence, then chemical units, statical units, and morphological units, should fall into the same categories of judgment.

A great deal of needless ingenuity has been wasted, both by the vitalists and materialists, in formulating impossible definitions of life--in attempts to tell us what life is. But Mr. Herbert Spencer is believed, by his many admirers, to have hit upon the precise explanatory phrases necessary to convey its true definitional meaning. He defines it as "_the continuous adjustment of internal relations to external relations_." This definition, when first formulated, was received by all the materialists of Europe with the wildest enthusiasm. It was absolutely perfect. All the phenomenal facts of life fitted into it, as one box, in a nest of them, fitted into another. The universal world was challenged to show that any other phenomenal fact than the one of life would fit into this prodigious formula of Mr. Spencer. The London "Times" tried its hand on it, but only in a playful way. It said: "All the world, or at least all living things, are nothing but large boxes containing an infinite number of little boxes, one within the other, and the least and tiniest box of all contains the germ,"--the elementary principle of life. But this was hardly a legitimate characterization. A nest of boxes presents no idea of "continuous adjustment," nor are the internal relations of one box adjusted to the external relations of another. The definition is really that of a piece of working machinery--any working machinery--and was designed to cover Mr. Spencer’s theory of "molecular machinery" as run by molecular force.

But the earth presents the most perfect adjustment of internal relations to those that are external, and it continuously presents them. Even the upheaval of its fire-spitting mountains affords the highest demonstration of the adjustment of its inner terrestrial forces to those that are purely external; and much more does it show the adjustment of its internal to its external relations. There is a continuous adaptation of means to ends, of causes to effects, of adjustments to re-adjustments, in respect to the characteristics of the earth’s surface--its physical configuration, the distribution of its fluids and solids, its fauna and flora, its hygrometric and thermometric conditions, its ocean, wind, and electro-magnetic currents, and even its meteorological manifestations--all showing a continuous adjustment of interior to exterior conditions or relations. The earth should, therefore, fall under the category of "life,"

according to Herbert Spencer's definitional formula. And so should an automatic dancing-jack that is made to run by internal adjustments to external movements or manifestations. There are any number of Professor Bastian's "ephemoromorphs" that do not live half as long as one of these automatic dancing-jacks will run, and so long as they run, the adjustment of their internal to their external relations is continuous.

The success of Mr. Spencer's definition of "life" encouraged Professor Bastian to try his hand at it, with this definitional result: "Life," he says, "is an unstable collocation of Matter (with a big M), capable of growing by selection and interstitial appropriation of new matter (what new matter?) which then assumes similar qualities, of continually varying in composition in response to variations of its Medium (another big M), and which is capable of self-multiplication by the separation of portions of its own substance."

It shall not be our fault if the reader fails to understand this definition--to untwist this formidable formula of life. And we can best aid him by grammatically analyzing its structure. And,

1. "Life is capable of growing." We are glad to know this. As a vitalist it enables us to take a step towards the front--gets us off the "back seat" to which we were summarily ordered at the outset of this inquiry. We let its "unstable collocation" pass for what it is worth, and stick to our grammatical analysis.

2. "Life grows--is capable of doing something." This assurance positively encourages us.

3. "It grows by selection and interstitial appropriation." This is still more encouraging. It emboldens us to take a second step forward. Life, we feel, is increasing in potentiality.

4. "By appropriation it enables _new matter to assume similar qualities to old matter_." This makes us more confident than ever; we take another step forward--are half disposed to take two of them. Life is getting to be almost a "potentiated potentiality," to adopt the style of materialistic phrases.

5. "It causes matter _to continually vary in composition._" Bravo! we unhesitatingly take two steps forward on the strength of this most comforting assurance. Life is assuredly getting the upperhand of Matter (with a big M.) It is no longer a mere "undiscovered correlate of motion"--a hypothetical slave to matter only. It wrestles with it--throws it into the shade. We involuntarily take several more steps forward.

6. "Life is capable of self-multiplication"--has almost a creative faculty. Here we interject a perfect bravura of "bravoes," and, stepping boldly up to the front, demand of Professor Bastian to "throw up the sponge," take a back seat, and there--formulate us a new definition of "life."

But our London University materialist is not entirely satisfied with his own definition, or at least with the moral effect of it. He thinks that all these attempts to define life as a non-entity only, tend to keep up the demoralizing idea that it is an actual entity. We entirely agree with him in this conclusion. The infelicity and entire inconclusiveness of the definition he has vouchsafed us can hardly have any other effect. He sees this himself, and hence this foot-note to his great work on Ephemeromorphs: "Inasmuch as no life can exist without an organism, of which it is the phenomenal manifestation, so it seems comparatively useless to attempt to define this phenomenal manifestation alone--and, what is worse, such attempts tend to keep up the idea that life is an independent entity."

It may be objected that our grammatical analysis of the professor's definition of life is unfair, since he manifestly intended that it should cover a "living thing," and not "life" as an abstract, term. Our reply to this is, that he makes no distinction between the two. Life, with him, is simply a phenomenal manifestation. The two are correlative terms; so that his definition of the one must necessarily be the definition of the other, either as an identical or partial judgment. But let us take his definition entirely out of its abstract sense, and run it into the concrete. The able pathological anatomist of the London University college is a "living thing." He is, therefore, presumably a phenomenal manifestation. He is capable of growing, by "selection and interstitial appropriation," in reputation at least, if not in the direction of "an independent entity." His work of twelve hundred pages, covering his laborious delvings into the ephemeromorphic world, is conclusive on this point. As a phenomenal manifestation alone, any attempt to define either him or his professional labors, may be worse than useless, since it would tend to keep up the idea that he is an actual London entity. We are very confident that he is not a London non-entity, but are willing to agree that he is either the one or the other. The flaw that we are after lies in his interstitial logic, not in the hallucination in which he indulges respecting nonentities. His assumption that life cannot exist without an organism, of which it is the phenomenal manifestation, is what we propose to deal with.

Now, directly the reverse of this proposition is what is true. An organism cannot exist without life or an independent vital principle in nature, any more than celestial bodies can be held in their place independently of gravitation. The vital principle that organizes must precede the thing organized or the living organism, as the great formative principle of the universe (call it the will of God, gravitation or what you may) must have existed before the first world-aggregation. In logic, we must either advance or fall back--insist upon precedence being given to cause over effect, or deny their relative connection altogether. The organism is the phenomenal manifestation, not the vital principle which organizes it. To say that there can be no _manifestation_ of life without an organism is true; but to assume that the vital principle which organizes is dependent on its own organism for its manifestation is absurd. It would be the lesser fallacy to deny the phenomenal fact altogether, and insist that cause and effect are mere intellectual aberrations, or such absurd mental processes as find no correlative expression in nature, as that embodying the idea of either an antecedent or a consequent.

"Plato lived." He ate, he drank, he talked divinely. He was the occupant of an admirably constructed life-mansion; one that St. Paul would have looked upon as "the temple of God," and all the world would have recognized as a god-like temple. His head was a study for the Greek chisel; none was ever more perfectly modeled, or artistically executed. All agreed in this. And yet it was not the _habitat_ but the _habitant_ that attracted the admiration of the Greek mind; enkindled its highest enthusiasm; drew all the schools of philosophy, about him at once. It was the lordly occupant of the temple, the indwelling _Archeus_, presiding over all the organic phenomena and directing all the dynamic powers therein, which was so profoundly present in the living Plato. Even Professor Haeckel, of the famous University of Jena, would not deny this, with all that his new terms "ontogeny" and "phylogeny" may imply. When potential life passed over into actual life in the individual Plato, it was not the pabulum that assimilated the man, but the man the pabulum. If this were not so, then the mere potentiality of growing, as in the case of plants and animals, would be all there is to distinguish the phenomenal manifestation of a Plato from that of a mole or a cabbage-stalk. In other words, if the animating principle of life--or, as the Bible has it, the "animating soul of life"--is not what manifests itself in material embodiment, but the reverse, what can Professor Haeckel mean by his new term "phylogeny," which ought to cover the lines of descent in all organic beings?

If it be a question of mere pabulum, it is altogether _mal posˆ`_. Pabulum is nothing without a preˆ«xisting "something" to dispose of it. It is not so much as a jelly-mass breakfast for one of Professor Haeckel's "protamoebˆƒ;" for if it were served up in advance, there would be none of his little non-nucleated jelly-eaters to partake of it, much less any of his "protogenes." As the famous Mrs. Glass would say, in her "hand-book of cookery," if you want a delightful "curry," first catch your hare. But our ingenious professor of Jena dispenses with both the hare and the curry, in serving up his pabulum to the "protamoebˆƒ." The improvident pabulum "evolves" its own eaters, and then, spider-like, is eviscerated by them, as was Actaeon by his own hounds. As Life, therefore, begins in the tragedy of Mount Cithˆƒron, it is to be hoped it will end in the delights of Artemis and her bathing nymphs.

Chapter VIII.

Materialistic Theories of Life Refuted.

The methods by which the advocates of a purely physical origin of life seek to establish the correctness of their conclusions, are unfortunately not always attended by uniform results in experimentation. They subject their solutions of organic matter to a very high temperature by means of super-heated flasks, the tubes to which are so packed in red-hot materials

that whatever air may enter them shall encounter a much greater degree of heat than that indicated by boiling water. At this temperature (100´° C--212´° F) they assume that all living organisms perish, especially when the solutions containing them have been kept, for the space of fifteen or twenty minutes, at this standard point of heat. But, in the light of all the experiments which have been made in this direction, there is some doubt as to the entire correctness of their assumption. That many, if not most living organisms, perish at a temperature of 100´° C, there is little or no doubt; but that there are some which are much more tenacious of life, that is, possess greater vital resistance to heat, is equally unquestionable.

M. Pasteur, for instance, mentions the spores of certain fungi which are capable of germinating after an exposure of some minutes to a temperature of 120´° to 125´° C. (248-257´° F), while the same spores entirely lose their germinating power after an exposure for half an hour or more to a slightly higher temperature. Dr. Grace-Calvert, in a paper on "The Action of Heat on Protoplasmic Life," recently published in the proceedings of the Royal Society, asserts that certain "black vibrios" are capable of resisting the action of fluids at a temperature as high as 300´° F, although exposed therein for half an hour or more. But none of these crucial tests, however diverse in experimental results, really touch the all-important question in controversy. They all relate either to living organisms, or to the seeds and spores of vegetation, not to living indestructible "germs"--invisible vital units--declared to be in the earth itself.

We use the term "vital unit" in the same restricted sense in which the materialists speak of "chemical units," "morphological units," etc., which they admit are invisible in the microscopic field, and hence they can have no positive information as to their destructibility or indestructibility by heat. That this vital unit lies, in its true functional tendencies, between the chemical and morphological units--manifesting itself in the conditions of the one and resulting in the structural development of the other--is no new or startling theory, but one that has been more or less obscurely hinted at by Leibnitz, and even acknowledged as possible by Herbert Spencer. It is this vital unit that assimilates or aggregates protoplasmic matter into the morphological cell, or the initial organism in a vital structure, or an approach towards structural form. Morphological cells are not therefore "units," considered as the least of any given whole, nor are they mere structureless matter, or any more homogeneous in character than in substance. Different chemical solutions give rise to different morphological cells, as differently constituted soils produce different vegetal growths. Change the chemical conditions in any solution or infusion, and you change the entire morphological character of the infusoria appearing therein.[28] The cells are living organisms springing from vital units, and can no more manifest themselves independently of these units than life can manifest itself independently of an actual organism. And they make their appearance in the proper environing conditions, just as the oak comes from its primordial germ or vital unit in the chemically changed conditions of the soil. Everywhere the vital germ or unit precedes the vital growth as the plant or tree precedes the natural seeds it bears.

This is not only the logical order, but the exact scientific method of vital manifestation and growth. In this truth lies the whole mystery of vegetal and animal life as hitherto manifested on our globe, with the single exception of man whose crowning distinction it was to receive "a living soul." This may be rejected as a scientific statement, but its verification will appear in the very act of its rejection. Pry as deeply as we may into the _arcana_ of nature in search of exact scientific truth, and we shall ultimately land in one or the other of these propositions,--either that nature was originally endowed with some occult and unknown power "to bring forth," which power is either continuously inherent or continuously imparted, or else "specific creation" was the predetermined plan and purpose, with no higher or more specialized animal or vegetal forms than were specifically created in the beginning. Otherwise, we are inevitably forced back, by our mental processes, which we cannot resist, upon an effect without a cause--a physical law of the universe without any conceivable law-giver--an all-pervading, all-energizing principle of matter which must have existed as a cause infinitely anterior to its first effect. And this is forcing language into such crazy and paralytic conclusions as to utterly destroy its efficiency as a vehicle of thought.

To conceive of the existence of the universe, or of any possible law that may be operative therein, without an adequate antecedent cause, is as metaphysically impossible as to conceive of substance without form, space without extension, or a God who has been superceded in the universe by the operation of his own laws. For if the world-ordaining and world-arranging intelligence of the universe has ceased to ordain and arrange,--if all things therein have been left to the operation of fixed and eternally unchangeable laws--then no further supervisional direction is required on the part of either an infinite or a finite intelligence, and our idea of a God must disappear in the paramount induction of a universe which has successfully risen up in insurrection against its own maker and lawgiver, if it has not remorselessly consigned him to some inconceivable limbo outside of the universe itself. But this Titanic, and worse than satanic, insurrection on the part of a universe of matter and motion, is only the conjectural coinage of the human brain--the wild supposition hazarded by the materialistic mind--and fortunately has no conceivable counterpart outside of it.

But the palpable blunder, in materialistic science, consists in its overlooking the necessary outgrowth of theological ideas in the human mind--as conclusively a phenomenal fact of nature as the invariable uniformity of astronomical movements, the ebb and flow of the tides, or the electro-magnetic waves of the earth itself. And nature furnishes no greater clue to the one set of phenomena than the other. For when we say that bodies act one upon another by the force of gravity, we are no nearer an explication of the force itself, than we should be were we to allege any corresponding manifestation on the part of the human mind. Kant says; "We cannot conceive of the existence of matter without the forces of attraction and repulsion--the conflict of two elementary forces in the universe;" much less can we have any conception of the elementary forces themselves. Science can, therefore, assign no more conclusive reason for overlooking psychical manifestations than physical phenomena. Nor is the

one set of phenomena any more marvellous in its manifestations than the other. They may both furnish food for speculative thought and inquiry, and yet the nearer we get to the ultimate implications of either, the more completely are we lost in Professor Tyndall's "primordial haze," from which he assumes that the universe, and all the phenomenal manifestations therein, originally came.

But however rapidly these materialistic theories may disappear in the scientific waste-basket of the future, there is one sublime verity that will stand the test of all time, and that is, that the moral universe of God is no less complete, in the Divine Intendment, than the physical universe, while the latter is so inter-correlated and inter-tissued with the former, in all its conceivable relations, that it can no more exist independently of its correlative, than matter can exist independently of space, or time independently of eternity. [29]

According to this view of Leibnitz, all living organisms have their own essence, or essential qualities and characteristics. They have been from all eternity in the "Divine Intendment," and can undergo no changes or modifications which shall make them essentially different from what they were in the beginning, or are now. This is not only true of the "germs" that are "in themselves upon the earth," but of every living thing, whether lying within or beyond the telescopic or microscopic limits. As a law of causation, as well as of consecutive thought, there must be in the order of life (all life) a continuous chain of ideas linking the past to the present, the present to the future, and the future to eternity. But that this continuous chain is dependent on mere physical changes or manifestations, is a logical induction utterly incapable of being exhibited in scientific formul^ƒ. The higher and more satisfactory induction is that which places cause before effect, the Maker before the made, the Creator before the creature, and so on, in the analogical order, till the smallest conceivable "vital unit" is reached in the universe of organic matter. To begin, therefore, with microscopic observation, at a point in the ephemeromorphic world where that optical instrument fails to give back any intelligible answer, and synthetically follow this chain of causation upward and outward to Dr. Tyndall's "fiery cloud of mist," in which it is assumed that all the diversified possibilities and potentialities of the universe once lay latent, may answer the logical necessities of the "Evolution" theory, but will never satisfy the inductive processes of a Plato, a Leibnitz, or a Newton.

Professor Tyndall, in speaking of his "fiery-cloud" theory, says: "Many who hold the hypothesis of natural evolution would probably assent to the position (his position) that at the present moment all our philosophy, all our poetry, all our science, all our art,--Plato, Shakespeare, Newton, and a Da Vinci--are potential in the fires of the sun." But, to be consistent in their inductions, they should proclaim themselves sun-worshippers at once, and ascribe to that transcendent luminary all the potentialities of a universe

"Fresh-teeming from the hand of God."

But what possible advantage, we would ask, can this physical hypothesis of

life have over that which ascribes to God the issues of all life in the universe, from the highest to the lowest living organism? We can positively conceive of none but that of placing the cosmological cart before the horse, and so harnessing "cause and effect" _in tandem_, that the latter shall uniformly precede the former in the chain of logical induction. As a dialectical feat, in exhibiting the higher possibilities of logic, it may have its advantages in subordinating the facts of science to the higher illuminations of fancy, and thus resting the basis of reality on the ever-changing and ever-shifting assumptions of the human mind. For the materialistic theories of to-day are not those of yesterday, nor is there any certainty that they will be those of to-morrow. They are almost as fantastic and variable as the forms of the kaleidoscope, although, as a general rule, they lack the symmetrical arrangements and proportions of that scientific toy.

Professor Bastian, in considering the heterogenetic phenomena of "living matter," is obliged to fall back, near the end of his great work, on "the countless myriads of living units which have been evolved (?) in the different ages of the world's history." But by what process a "vital unit" can be _evolved_, he does not condescend to tell us. He has no "primordial formless fog" to fall back upon as has Professor Tyndall, nor can he imagine anything beyond the least of possible conceptions in a chemical, morphological, or vital unit. A "unit" can neither be evolved nor involved; it admits of no square, no multiple, no differentiation; it is simply the ever-potent unit of "organic polarity," by which it multiplies effects, but can never be multiplied itself. The chief fault that we have to find with the London University professor is that he confounds a morphological cell with a morphological unit, and insists upon drawing unwarrantable conclusions therefrom. His "countless myriads of living units" are all well enough in their way. That they exist in the earth, and are constantly developed into innumerable multitudes of living organisms, of almost inconceivable variety, in both the animal and vegetal world, is true, as he half-reluctantly admits in almost the identical language we here use.

And he also admits that morphological cells, when once formed, continue to grow by their own individual power or inherent tendency. But before they can manifest any such inherent tendency, they must be developed from the vital units that lie back of them, and on which their manifestation unquestionably depends. The only doubt that can possibly exist on this point is, that the process of development cannot be determined by microscopic examination. But we may as well assume the presence of vital units in the case of dynamical aggregates, as for Professor Bastian to insist upon crystalline units in the case of statical aggregates or crystals. Both processes, in their initial stages of development, lie beyond the reach of human scrutiny, and all that we know, or possibly can know, is, that certain inorganic conditions are favorable for the development of crystals, as certain organic conditions are favorable for the development of morphological cells. Beyond this Professor Bastian knows nothing--we know nothing.

Professor Beale, in his recent work on "the Mystery of Life"--one that is now justly attracting very wide attention--says: "Between the two sets of

phenomena, physical and vital, not the faintest analogy can be shown to exist. The idea of a particle of muscular or nerve tissue being formed by a process akin to crystallization, appears ridiculous to any one who has studied the two classes of phenomena, or is acquainted with the structure of these tissues." And he quietly, yet effectively, ridicules the idea that the ultimate molecules of matter--substantially the same matter, in fact--have the power to arrange themselves, independently of vital tendency, alternately into a dog-cell or a man-cell, according to the specific direction they may take, or the incidence of conditions they may undergo, in their primary movement. And for the benefit of Professor Beale, behind whose "bioplasts," we place the "vital unit"--not a variable but a constant unit--we would have him bear in mind (what he so well knows) that the finest fibres that go to make up these tissues lie quite beyond the microscopic limit in their interlaced and spirally-coiled reticulations, so that nothing can be predicated of their ultimate contexture, any more than of the ultimate distribution of matter itself. He has himself traced these wonderfully minute nerve-ramifications under glasses of the highest magnifying power, and knows that their ultimate distribution cannot be reached. Let him come out then, as the ablest vitalist now living, and boldly assert the presence of the man-_unit_ and the dog-_unit,_ instead of falling back on his bioplastic spinners and weavers of tissue, which are only the servants and willing workers of the one integral unit, or life-directing force, within. It is far more rational, and, at the same time, more accordant with strict scientific methods, to attribute these muscular and nerve reticulations to a single direct cause, than to a multitude of secondary causes.

There is a world-wide difference between the dog-_ego_ and the man-_ego;_ but the physical differences are not by any means the greatest. The bioplastic spinners and weavers work as obediently for the one master-_ego_ as the other. They never stop to inquire how far they shall differentiate this vital tissue or that, or in what direction even they shall work. Not a thread is spun nor a shuttle thrown that is not directed by the one head-webster of vital tissue. These obedient bioplasts determine nothing, direct nothing. Each works in his own cell as obediently as a galley-slave. All specific modifications, all determinate movements, all molecular arrangements, all multiplications of bioplastic force, are the work of the one vital webster, or principle of life, within--that which shapes all, directs all, determines all. And this is true from the first or embryological inception of the dog-unit or "germ," until the real occupant of the dog-tenement dismisses his bioplastic weavers, and lies down to die. And so of all vital units. Each determines its own structural form, and unchangeably retains it to the end, even to the slightest impression of a scar inflicted years and years before. The occupant of this dog-mansion has dismissed one set of bioplastic weavers after another; has thrown aside this spun tissue and that warp and woof of woven texture, time and time again, so that the dog of to-day is not the same _physical_ dog of a year ago; and yet he has the same affection for his master, carries with him the same scar received twenty years before in the chase, gives the same glad bark of welcome as his owner nears home, exhibits the same characteristic wag in his tail, and, lying down to sleep, dreams of the once happy chase in which he is no longer able to engage. This continuous presence of the same dog, through all these twenty

years of physical change--the old dog reappearing in the new, a dozen times over--is what we mean by the constantly differentiating yet undifferentiated "dog-unit."

Those who attempt to bisect this vital unit, divide it up into one fractional part after another, until it shall represent a million bioplastic workers in as many different cells, are committing the same sort of folly--in principle at least, if not in practice--as that which led the simple-minded daughters of Pelias to cut up their father, in the expectation of boiling the old bioplasts into new, and then, by the cunning aid of Medea, who directed the operation, reuniting them into the one Peliastic-unit they so much delighted to honor. But this first and only recorded attempt at differentiating a vital unit disastrously failed, as the reader of ancient myths well knows, although the experiment was conducted by the most careful and loving hands. The necessary chemical re-agents to reproduce life, as well as the necessary processes of producing it _de novo_ have not yet been ascertained, nor is it likely they ever will be. And herein lies the most marked distinction between crystallizable matter and living substance.

And yet there is no evidence that the vital principle perishes in the destruction of its temporary organism. It is not the material seed that germinates, but the vital principle it contains, bursting forth from its environment into newness of life. All that can be alleged of either boiled or calcined seeds is, that the material substances of which they were composed are so changed in their chemical constituents, or molecular adjustment, that they are no longer capable of developing, or being developed, into a living organism. "Principles never die," and this is as true of the vital principles in nature, as those obtaining in ethics and morals. Were it possible to restore the exact chemical conditions and constituent particles of the boiled or calcined seed, there is no more doubt that nature would respond to the environing conditions, and give forth the proper expression of plant-life, than there is that crystals of spar would make their appearance in an overcharged bath chemically prepared for that purpose. It is not the albuminous substance enclosed in the seed, but the vital principle therein--that continuously imparted to nature from the great vital fountain of the universe--which burgeons forth into life whenever and wherever the required conditions obtain.

In proof of this statement, we might instance any number of cases where recently abandoned brick-yards and other clayey excavations, were situated at considerable distances from any natural water-courses, or fish-stocked ponds, from which spawn could have been derived, and yet these excavations have no sooner been filled with permanently standing rain water, than certain small fishes of the _Cyprinidae_ and other families, have made their appearance therein.[30] Nobody has thought of stocking these standing pools of water with the fish in question, nor has there been any surface overflow to account for their presence, nor any other apparent means of transportation, if we except the fish-catching birds, and they generally swallow their food in the water or on the nearest tree to the point of capture. Any theory accounting for the presence of spawn is, therefore, out of the question. This spawn must have traversed hard clay deposits for the distance of half a mile or more to make their appearance

in these waters. The only possible explanation of this class of phenomena, and they are by no means infrequent, is to be found in "favoring conditions" and the "presence of vital units." They are primordial manifestations of life, and such as would have made their appearance in any corresponding latitude of the southern hemisphere, under the same favoring conditions.

And this is true of all living organisms from the lowest morphological cell, in the ichthyologic world, to the highest and lordliest conifer that grows. Their spawn and seeds are perishable by heat, but the vital principle that organizes them is as imperishable in one element as another. No seven-times heated furnace, much less the experimental flasks of the physicist, will affect a vital principle of nature any more than a May-morning puff of the east wind would shake Olympus. And all the countless myriads of vital units in nature are now manifesting themselves in animal and vegetal forms, under favoring conditions, the same as in those far-distant epochs of the world's history when a more exuberant vegetation prevailed, if not a more abounding animal life. The same persistent, ever-acting law of vital development and growth has been present, in all conditions and circumstances of matter, ever since the detritus of the silicious rocks felt the first influence of the rains, the dews, and the sunlight. Then the earth commenced "to bring forth the grass, the herb yielding seed, and the fruit-trees yielding fruit, after his kind;" and in their growth was laid the foundation of animal life. Whether there was any audible or inaudible command of God uttered at the time, is not the question. It is the _fact_ of vital growth that we are after, and not the command. The geologic records attest the fact, as well as the ever-acting vital law; and it is enough for us to know, with sturdy old Richard Hooker, that all law--and especially all _vital_ law--"has her seat in the bosom of God, and her voice is the harmony of the world."

Professor Beale, while resolutely combating the physical hypothesis of life, is not a little unfortunate in his use of scientific terms. He is constantly using those of "living matter" and "dead matter," as if they contained no fatal concession to the materialists, with which to completely overthrow his own ultimate conclusions as to life. For he gains nothing by merely substituting "bioplasm" and "bioplasts" for "protoplasm" and "plastide particles." The essential plasma in both cases is the same, and behind each lies the vital unit or principle therein manifested--the invisible, indestructible germ or ZRA of the Bible genesis. Living organisms come, of course, from this essential plasma, but without an elementary principle or vital unit therein, there would be no "bioplasts," in the sense in which Professor Beale uses this term. These bioplasts are living organisms which take up nutrient matter and convert it by assimilation into tissues, nerves, fibres, bones, etc.--into the higher and more complex organs that go to make up living structure. This mysterious transmutation of one thing into another, as organic matter into living organisms, is due to a vitally implanted principle, not to these little bioplasts, or mere epithelial and other tools with which the vital principle works. To apply the term "living matter" to the tools with which a living structure is built up, is to lose sight of the master-mechanic using them for an apparently intelligent purpose. The microscope may demonstrate that these little bioplasts throb--have life; but there is no

intelligent purpose manifested by them except as they are moved by an unseen hand that conclusively directs the whole structural work--builds up the one complete symmetrical structure, not its thousand independent parts having no relation to a general plan. The future lord and occupant of the mansion is presumably present, and if he uses tools that "throb and have life," it is because everything he touches is quickened into life that it may be the more obedient to his will. If this structure be the soul-endowed one of man, the vital principle imparted is that which fashions the epithelial tools, and uses them, as well in laying the embryological foundation, as in crowning its work with that many-colored "dome of thought flashing the white radiance of eternity."

Mr. Joseph Cook, who enthusiastically follows Professor Beale in his theory of life, in one of his "Boston Monday Lectures," says; "It is beyond contradiction that we know that these little points (’bioplasts’) of structureless matter spin the threads, and weave the warp and woof, of organisms." With all due respect to this distinguished lecturer, we must except to not less than three points in as many lines of his over-confident statement. In the first place, we know nothing respecting the "beginnings of life," which may not be contradicted with some show of reason. Take his own definition of "bioplasts," as copied from Professor Beale, coupled with what they both term "nutrient matter" and "germinal matter," or bioplasm, and this confident assertion of his will land him at once where the highest powers of the microscope fail to give back any intelligible answer, or where neither assertion nor contradiction avails anything. A bioplast, they tell us, is a germinal point in germinal matter or bioplasm. It is also assumed that the central portion of every cell in an organic tissue is a bioplast. Here this wonderful little weaver of tissue sits spinning his threads and weaving them into the warp and woof of "formed matter"--that which, according to Professor Beale, becomes "dead matter" as soon as it is woven! But it is admitted that the nerve fibres constitute an uninterrupted network which admits of no endings--that is, whose ultimate reticulations lie beyond the microscopic limit. But there is a cell in every hundredth part of an inch of these ultimate reticulations, in each of which one of these bioplastic weavers sits plying his threads into the warp and woof of nerve tissue, if not of nerve force. What is known of these little weavers, either by Mr. Joseph Cook or Professor Lionel S. Beale? Manifestly nothing, unless they have been specially favored with microscopes of over 2,800 diameters--the highest yet made,--and have fathomed the ultimate implications of nerve force; an assumption on the part of the Boston lecturer to which we are bound to except.

Nor are these "bioplasts" mere structureless matter, however minute they may be as "little points." They differ only from "morphological cells," in the definitional language employed by different theorists, and lack the all-essential accuracy of distinction necessary to scientific classification. To define a bioplast as a germinal point in germinal matter, or bioplasm, is to draw no satisfactory line of distinction between the two, except that the one is a mere aggregation of the other. A germinal mass is only made up of germinal points--those considered as the least of any given whole--however infinitesimal they may be in theoretical statement. If any germinal point in germinal matter, therefore, be a

bioplast, then every germinal point, to the extent of making up its entire mass, must be a bioplast; and the distinction between the two becomes merely verbal, and without generic signification. But every morphological cell is conceded to be an organism, whether it lie within or beyond the microscopic limit. And it invariably exhibits a greater or less amount of cellular activity at its centre. It grows rather than spins; it builds up tissue, rather than weaves it into warp and woof; it assimilates nutritive matter rather than plies a loom in any conceivable sense in which we may view that industrial machine. No matter what we may call this point of vital activity in a cell--whether it be a bioplast, a plastid, a physiological unit, or a granule of "elementary life-stuff"--it simply performs the one single function of life to which it is specifically assigned in the process of "building up" any one identical individual of a species, whether it be a man, an ape, a tree, or a parasitic fungus. The very admission that the bioplast spins, makes it an organism, and not mere structureless matter. For the first thread it spins is manifestly for its own covering or the ornamentation of its own cell-walls. And to speak of these as "structureless matter" is to confound all scientific sense, as well as meaning.

The third objection to Mr. Cook's statement is, that if bioplasts spin, it is as dependent, and not as independent machines or agencies. There are millions of these bioplasts--taking the word in the sense in which Professor Beale uses it--in every living organism considered as a biological whole. In the case of man, there are millions of them within a comparatively small compass; and each has its own cell to which its specific work is assigned. Now, these germinal points, or bioplasts, in each of these myriads of cells, work, not separately and independently, like so many oysters in their respective shells, but harmoniously and together, as if under the supervisional direction of one supreme architect and builder. This builder is that one elementary principle of life, appertaining to each specific individual as a species, with which nature was endowed from the beginning, and which, in the case of man, was a direct emanation from Deity. It is this vital principle manifesting itself _in_ all living organisms, not _from_ them; directing Professor Beale's "bioplastic weavers," not directed by them; availing itself of necessary plasmic conditions, if not giving rise to them in the first instance; observing no developmental processes by which one form of life laps over upon another, and following no order but that of universal harmony in the Divine intendment. There is struggle and rivalry for existence, even among the same classes, orders, genera, and species, and the smallest and weakest must give place to the largest and strongest everywhere, and _vice versa_, as Time, the greatest of all rodents, gnaws away at the mystical tree of life. But in every living organism, from the lowest and simplest to the highest and most complex, all bioplastic spinners of filamentous tissue, all plastide weavers of membranous or spun matter, all epithelial bobbin-runners, and other anatomical helpers and workers, perform their respective tasks under the special supervision we have named, that is, under the higher unit of life. They all work for the advancement and well-being of the higher organism of which they form a component and necessarily subordinate part.

The fact that Professor Beale has discovered that what he calls bioplasm

and germinal points or bioplasts may take on a distinct and separate color from tissue, when subjected to a solution of carmine in ammonia, is no evidence that he has penetrated the adytum of this sacred temple of Life, wherein lies the "mystery of mysteries." It is an important discovery so far as tracing tissue is concerned, but it admits him into no higher mystery within the temple built by God than another may attain to by the accidental discovery that the tissues may take on the same color in some other solution--by no means an improbable discovery. Carmine in ammonia is not the only solution that may aid science in the investigations now being carried forward by the vitalists and non-vitalists with so much bitterness and asperity of feeling between them; and now that Professor Beale has made _his_ happy discovery, it is by no means certain that some other equally persistent worker in this interesting field of inquiry may not hit upon quite as happy a discovery in the same or some equivalent direction--one that shall throw the bioplasmic theory as far into the shade as Mr. Cook thinks the bioplasts have already thrown the cells.

But decidedly the most objectionable statement of Professor Beale, although one confidently re-affirmed by our "Boston Monday Lecturer," is that which makes bioplasm and bioplasts the only "living matter." We have already referred to the phrases "living matter" and "non-living matter" as altogether objectionable in biological statement, since they are more than half-way concessions to the materialists, who contemptuously order the vitalists to take a "back seat" in the discussions now going forward as to the true origin of life. But the objection we here make is less technical, and touches a far more vital point in the inquiry. It is true that Professor Beale speaks of "formed matter," as if it were a peculiar something--a sort of _tertium quid_--between living and non-living matter. But he distinctly avers that the substance which turns red in his carmine solutions is the "only living matter," and hence asserts, inferentially at least, that all other matter, in any and every living organism, is "dead matter." But we may just as confidently aver that no matter is living in any vital organism which has not been assimilated and built up into living membranous tissue capable of responding (in the case of man) to his will, as well as performing the autonomous functions of plants and the lower animals. For all these membranous tissues are innumerably thronged with bioplasts or plastide particles, not for the purposes of obedience to man’s will, or of performing any autonomous function, but simply to supply the tissues with the necessary nutrient matter to make up for the constant waste that is going on in a healthy living organ. This waste is very much greater than has heretofore been supposed, so that the man or animal of to-day may be an entirely distinct and separate one, considered materially, from that of a year or more ago. And this averment would have a decided advantage over Professor Beale’s, since, in meeting a friend, we might be certain that four-fifths of him at least was alive, while the other one-fifth was industriously at work to keep him alive, instead of a stalking corpse, as he would otherwise be, upon the street. Besides, it would obviate the necessity, on the part of the vitalists, of giving themselves four-fifths away to the materialists, as Professor Beale virtually does in the argument.

The too rude touch of a child’s hand will rob the canary bird of its life--stifle its musical throat, hush its most ecstatic note, still its

exquisite song, and render forever mute and silent its voice. But where are Professor Beale's bioplasts which, but a moment before, were not only weaving the nerves, tissues, muscles, bones, and even the wonderful plumage of this canary bird, but plying the invisible threads of song--throwing off its chirps, carols, trills, quavers, airs, overtures and brilliant _roulades_, as if the little vocalist had caught its inspiration from the very skies? Where, we repeat, are these bioplasts now? They are all quietly and industriously at work as before. The occupant of the song-mansion is gone, but not one of these bioplasts has dropped a clew, thrown down a shuttle, abandoned a loom, or fled in dismay to the core of its cell. They still pulsate, throb, throw off tissue. No chemical change has yet intervened to break down their cell-walls, or interfere with the occupations assigned them. The machinery that ran their looms is stopped--that is all. The invisible shuttles have ceased to ply--the meshes of their tangled webs are broken--the more delicate threads of song are snapped in sunder, but the bioplastic spinners and weavers are all there. Not one of them has been displaced from its seat, nor in any way disturbed or molested in its work. If they are conscious of any danger, it is that the occupant of this little song-mansion has suddenly stepped out--is no longer present to direct their tasks. The icy hand of decay and death will soon be upon them--these poor bioplastic weavers of tissue--but the vocal spark, the "bright gem instinct with music," is beyond the reach of these dusky messengers. _Where_ it is, not man, but the Giver of all life knows. We only know, when our faith is uplifted by inspiration, that--

"The soul of music never dies,
Nor slumbers in its shell;
'Tis sphere-descended from the skies,
And thence returns to dwell."

Chapter IX.

Force-Correlation, Differentiation and Other Life Theories.

Among the more startling, if not decidedly brilliant, vital theories which have been advanced within the last few years, is that which makes life an "undiscovered correlative of force." Those who have the reputation of being the profoundest thinkers and delvers in the newly-discovered realm of Force-correlation in Europe, and who have more or less modestly contributed to that reputation themselves, have evidently thought to eclipse, if not to entirely throw into the shade, the great exploit of Leverrier, in pointing out the exact place in their empirical heavens where the superior optics of some future observer shall behold, in all its glory, this "undiscovered correlative of force," which they have indicated as lying within the higher possibilities and potentialities of matter. Precisely what they mean by this undiscovered correlate, is what puzzles us quite as much to determine as it does the materialists to explain. Were

they to define life as an "undiscovered force" simply, their definition would manifestly lack in brilliancy what it would conclusively make up in precision and accuracy of definitional statement. But such a poor metaphrastic and half-circular exposition of vital force would never answer the necessities of that profounder profundity required for the success of modern scientific treatises. Hence the interpolation of this "correlative" of theirs. Let us ascertain, if we can, what it means, since they are so chary of informing us themselves.

A "correlate" of a thing--any thing--simply implies the reciprocal relation it bears to some other thing. As a cognate term it expresses nothing, can express nothing, but reciprocity of relationship, such as father to son, brother to sister, uncle to aunt, nephews to nieces, etc. As applied to vital force, it means nothing more nor less than that this particular force stands in some sort of relationship to the other forces of nature, or, as they would have us believe, the _material_ forces of nature. And the simple strength or potentiality of this relationship is what makes all the difference between the severally related forces of the universe, since it would be as impossible to differentiate a fixed relationship as to change the nature of vital units. But whether vital force, as a distinct correlate, is paternal or filial, brotherly or sisterly, avuncular or amital in its relationship, is not stated. The scientific formula, however, may be stated thus: As A (chemical force) is to B (molecular force) so is C (a third known force) to _x_ (the vital or unknown force); so that, by multiplying the antecedents and consequents together, and eliminating the value of _x_, we may mathematically obtain the value of vital force.

But to eliminate the value of _x_ is what troubles them. Herbert Spencer has tried his hand at it, but failed to express life under any higher correlation than "molecular force;" nor can he definitely inform us whether either force is third or fourth cousin to the other. But he manifestly regards their relationship as constituting either a very attractive or highly repulsive force. In his vexation at not finding the value of _x_, he is driven from mathematical to mechanical biology, and gives us this new definitional value of life--that singularly contumacious quantity which so persistently refuses to be eliminated in scientific equations: "Life is molecular machinery worked by molecular force." But as Professor Beale has utterly demoralized, if not demolished, this machinery, in his recent treatise on "The Mystery of Life," we will spare it any further blows, and proceed to the consideration of "molecular force."

Before we proceed however, to the consideration of this force, let us definitely understand the meaning of the terms we shall be called upon to use. We can have no difficulty in understanding the meaning of "molecular attraction," or that force acting immediately on the integrant molecules or particles of a body, as distinguished from the attraction of gravitation which acts at unlimited distances. But when it comes to ascribing other and higher manifestations of power to molecules, such as have not been scientifically shown to exist, we must feel our way with caution, and demand of these pretentious molecules, or rather of their materialistic backers, a reason for the faith, or rather

force, that is in them.

It is agreed by all physicists, as well as chemists, that a "molecule" is the smallest conceivable quantity of a simple or compound substance, as an "atom" is the smallest conceivable quantity of an element which enters into combination with other elements to form material substance. For instance, the smallest conceivable quantity of water is a molecule, while the smallest conceivable quantity of either of the two elements of which water is composed, is an atom. In every molecule of water, therefore, there are three elementary atoms, two of hydrogen and one of oxygen. And since a molecule, as a general rule, contains two or more atoms, and may contain many of them, why not predicate dynamic force of the atoms, which lie one step nearer the elementary forces of nature? For the mightiest forces of nature lie in these elements, when forced into unnatural alliances, or chained up in durance vile. It is in the elements of matter, and not in its molecules, that this tremendous dynamic force resides. Man, knowing this, harnesses them into his service, first by forcing them into unnatural alliances, as in the case of charcoal, sulphur and saltpetre, and then successfully pitting them in conflict against the rocks and the general inertia of matter. To charge all the destructive work they do on the innocent and harmless molecules, which are two steps removed from the actual force expended, is drawing conclusions from the sheerest hypothetical data. It is the office of "molecular force," if there is any meaning to the term beyond what is expressed by "molecular attraction," to conserve matter--bind rocks together, not rend them in sunder.

If the dynamic forces of nature lie pent up in the molecules, then man must array molecular force against molecular force in order to rend rocks and tear mountains in sunder. This theory of molecular force, as extended to vital physics in the force-doctrine of life, is irreconcilably at war with the principal phenomena of life, and should be classed with the other undiscovered correlates of force, which Professor Beale speaks of as "the fictions of a mechanical imagination." The truth is that these much abused and much slandered molecules are the most innocent and harmless things in nature. They never become destructive unless some other force than that inhering in themselves drags them into its service and hurls them along a devastating path. Of themselves, they are the very quintessence of quiessence in the universe, and, when formed in nature’s laboratory, at once seek quiet and loving companionship with kindred molecules, and retain it forever afterwards. The idea that they should break away from their loving molecular embrace, and, by any process of differentiation or constructive agency of their own, seek an alliance with some living dog-germ in order to be built up into living dog-tissue, presents about as perverse and wayward an impulse on the part of matter as can well be imagined by the scientific mind. That the dog-germ should seek to get hold of, and differentiate them, we can well understand. The Circean witchery and enticement is all on the part of the dog-germ, not in the inclination of the molecules.

If there is any truth in this molecular-force-theory of life, it is about time for us to discard some of the old categories respecting matter, motion, and life, and substitute new ones in their place. In the multiplicity of new scientific terms constantly springing up for

recognition in these days, there ought to be no difficulty in expressing the true categories, and assigning to them their proper definitional value. To include physical force, chemical force, molecular force, and vital force all under one and the same category, and then interpret their several modes of action on any theory of force-correlation, is not emancipating language from the gross thraldom into which their "molecular machinery" has driven it. Besides, there is moral force, mental force, the force of will, the force of reason, the force of honesty, the force of fraud, etc., and any number of other forces, all possessing more or less impetus or momentum, and capable of binding or coercing persons and things, in all their diversified relations, correlations, incidences, coincidences, affinities, antagonisms, and so on through an interminable chapter of interchangeable predications. All these different expressions of force are to be tethered together--definitionally bound hand and foot--under the one explanatory head of "force-correlation." We protest against the labor of thus unifying all the natural forces of the universe, even if it were practicable under scientific methods.

But Professor Tyndall denies that "molecular groupings" and "molecular motions" explain anything--account for anything--in the way of explicating life-manifestations, or determining what life is.[31] And it would be difficult to cite a stronger and more determined materialist as authority on the point we are considering. He says: "If love were known to be associated with a right-handed spiral motion of the molecules of the brain, and hate with the left-handed, we should remain as ignorant as before, as to the cause of motion." But there is no proof that the molecules of the brain manifest any other motions than those necessary for keeping up the normal condition of health and vital activity in the brain itself. No one can be certain that he has seen these molecules in a state of mental activity; for where portions of the human brain have been exposed to microscopic examination, even in perfect states of consciousness on the part of those whose brains have been laid bare, there can be no certainty that the molecular action, if any, is referable to one set of movements more than another. And even in the case of animalcules, as seen in the object glass of the microscope, there is no absolute certainty that their quick, darting or jerking movements are due to any life-manifestation, as heretofore assumed. Some quite as well defined forms are entirely motionless, and if all were so, it would be idle to predicate vitality of them.[32] These infinitessimal and constantly varying forms, many of them not the one hundred-thousandth part of an inch in length, to say nothing of their other dimensions, may owe their oscillations, wave movements, darting and other manifestations, and even their molecular arrangements and rearrangements, to other causes than those strictly "vital." And it should be borne in mind that their actual movements are just as much exaggerated under the microscope as their real dimensions. But as they make their appearance in organic infusions only, they are presumably vital organisms rather than fomentative or mere filamentous yeast-manifestations.

Professor Huxley, while conceding that molecular changes may take place under environing life-conditions, or in protoplasmic matter, denies that the "primordial cells" possesses in any degree the characteristics of a "machine," nor can they undergo any differentiating process by which the

character of their manifestations can be changed. And he even denies to them the poor right to originate or in any way modify their own plasma. He says: "They are no more the producers of vital phenomena, than the shells scattered in orderly line along the sea-beach are the instruments by which the gravitative force of the moon acts upon the ocean. Like these, the cells mark only where the vital tides have been, and how they have acted." This is undoubtedly true of all cells in which the vital or functional office has ceased, as in the case of Professor Beale's "formed matter." The cells are the result of the vital principle that lies behind them, and simply indicate where life exists, or has manifestly ceased to exist. Where the vital currents have ceased to flow, the wreck of primordial cells is quite as wide and disastrous as where millions of sea-shells have been strewn along a desolated and storm-swept sea-beach. They all come, both the cells and shells, from the preˆ«xisting vital units, or determinate germs, that fall into their own incidences of movement, without any concurrence of physical conditions beyond their own inherent tendency to development. For "conditions" do not determine life; they only favor its manifestation.

But some of the materialists claim that what we call "vital units," or invisible, indestructible germs,[33] are at best only "physical relations;" that they have nothing more than a hypothetical existence, without any independent recognizable quality justifying our conclusions respecting them. But may not this identical language be retortively suggested in the case of their "correlates of force?" What more than a hypothetical existence have they? Certainly their enthusiasm to get rid of all vital conditions or manifestations, is quite as marked a feature in their speculations respecting life as any enthusiasm we have shown in the verification of vital phenomena, on the established law of cause and effect. They insist upon this law in the case of statical aggregates, and even assign absolute identity of attributes; but when it comes to dynamical aggregates, they fall back on partial identity only, and deny the presence of the law altogether.

Nor are they any more felicitous in their treatment of other points in controversy. In speaking of his "plastide particles," Professor Bastian, the most defiant challenger of vitalistic propositions now living, says: "Certain of these particles, through default of _necessary conditions,_ never actually develop into higher modes of being." Here he makes the absence of "necessary conditions" the cause of non-development, while he stoutly denies that the presence of such "conditions" give rise to the development of a pre-existing vital unit. And yet, strange to say, he speaks of the elemental origin of "living matter" as "having probably taken place on the surface of our globe since the far-remote period when such matter was first engendered." But how his "sum-total of external conditions," acting upon _dead_ matter, can "engender" _living_ matter, is one of those "related heterogenetic phenomena" which he does not condescend to explain. It is by this sort of scientific verbiage that he gets rid of the pre-existing vital principle, or germinal principle of life, which the biblical genesis declares to be in the earth itself.

To be entirely consistent with himself, he should deny the existence of this germinal principle in the seeds of plants themselves, and insist upon

the sum-total of external conditions as the cause of all life-manifestations, in the vegetal as in the animal world. There can be no inherent tendency, he should insist, in the seed itself towards structural development, but only external conditions acting upon "dead matter," in heterogentic directions. The shooting down of the radicle or undeveloped root, and the springing up of the plumule or undeveloped stalk, is accordingly due to no vital principle in the seed, but to the complexity or entanglement of the molecules wrapped up in their integumentary environment. And this, or some similar fortuitous entanglement of molecules, should account for all life-manifestations, as well as all life-tendencies, in nature. These molecular entanglements should, therefore, be infinite in number, as well as in fortuitous complexity, to account for all the myriad forms of life "engendered from dead matter" in the material universe.

For if there is any one thing that the materialists insist upon more resolutely than another, it is the fortuitousness of nature--the happening by chance of whatever she does. Formerly it used to be the "fortuitous concourse of atoms;" now it is the "fortuitous aggregate of molecules." By what accidental or fortuitous happening the atoms have dropped out of their scientific categories, and the molecules have been advanced to their commanding place in _absolute accidentalness_, is one of those unassignable causes in which they apparently so much delight. We can only account for it on the supposition that they have all become worshippers of that blind and accidental Greek goddess, who bore the horn of Amalthea and plentifully endowed her followers with a wealth of language and other much-coveted gifts, but not with the most desirable knack at disposing of them.

The true cause of vital phenomena manifestly depends on these two conditions--the presence of the specific vital unit, and the necessary environing plasma, or nutrient matter, for its primary development. Without the presence of both of these conditions, or conditioning incidences, there can be no life-manifestation anywhere. And we do not see that anything is gained, even in the matter of scientific nomenclature, by merely substituting "molecular force" for "vital force," in the explication of vital phenomena. Even granting that molecular changes do take place during the development of the vital units in their necessary plasmic environment; it by no means follows that these changes are not dependent on the vital principle _as it acts_, rather than on the molecules _as they act_,[34] The higher force should always subordinate the lower in all metamorphic, as well as other processes, of nature. It is the vital principle that differentiates matter--the aggregate of molecules--not matter differentiating the vital principle. No "molˆcules organiques" can ever differentiate an ape-unit into a man-unit, any more than Professor Tyndall can fetch a Plato out of mere sky-mist. Once an ape-unit, always an ape-unit; once a man-unit, eternally a man-unit.

Let the vitalists stick to this proposition--this eternally fixed _unit_ as "_une idˆe dans l’entendement de Dieu," _ (to use a better French expression than English)--and they can fight the materialists off their own ground anywhere. The one sublime verity of the universe is that "life exists," and that it has existed from all eternity _as possible_

in the Divine mind, and in the Divine mind alone. If materialistic science is disposed to butt its head against this impregnable proposition, it can do so. The proposition will stand, whatever may happen to the inconsiderate head.

For science may press her devotees into as many different pursuits as there are starting-points to an azimuth circle, and command them to search and find out the ultimate causes of things in the universe, but the forever narrowing circle in one direction, and the forever widening one in the other, would utterly baffle all their attempted research. Whether they descended into the microscopic world, with its myriad-thronged conditions of life, or passed upward and outward, in _Sirius-_distances, to the irresolvable nebulˆƒ, where other and perhaps brighter stars might burst upon their view--gleaming coldly and silently down the still enormous fissures and chasms in the heavens--the result would be the same. Wider and wider fields of observation might open upon their view, as the stellar swarms thickened and the power of human vision failed, but the uranological expedition would return no wiser than when it started, and Science would still be confronted with the same illimitability of space, the same infinitude of matter, and the same incomprehensibility of the world-arranging intelligence that lies beyond. For He who hath garnished the heavens by his spirit--who divideth the sea with his power, and hangeth the earth upon nothing--"_holdeth back the face of his throne and spreadeth his cloud upon it_."

What if, in one direction, we should find those inconceivably small specks, or mere bioplastic points, which we call "living matter," or, in the other direction, those inconceivably vast world-forming masses which we call "dead matter," who shall say that "the secret places of the Most High" are not hidden from us, or that when the spirit of God first moved through these vast fissures and chasms in the heavens upon the face of all matter, there was not imparted to it that "animating principle of life" of which the biblical genesis speaks, and which we everywhere see manifesting itself in nature? Surely this inquiry is not one to be superciliously set aside by the materialists, after the failure of their uranological expedition, on the ground that it does not furnish food enough for scientific contemplation, without such physiological fancies as their specialists have been giving us in the shape of force-correlations and molecular theories of life.

But speaking of the higher forces as subordinating the lower, suggests that there should be something more definitely explained regarding the hypothesis of "differentiation," on which Mr. Herbert Spencer hangs so much of his mathematical faith in the true explication of vital phenomena. The term "differentiation" is not so formidable as it might seem to the general reader at first sight. As applied to physiological problems it should have the same determinate value, in expressing functional differences, as in the higher operations of mathematics. Nothing can, of course, differentiate itself, nor can any two things differentiate each other, even when functionally allied. The actual coˆ«fficient sought is the difference effected, in functional value, in one of two independent variables. For all formulˆƒ in differentiation are constructed on the hypothesis that only one of two variables suffers

change. The differential coˆ«fficient has yet to be determined which shall express the developmental changes in two variables at once. When, therefore, we attempt to extend the formulˆƒ of differentiation to plant and animal life, we are confronted by a very formidable difficulty at the outset--the impossibility of determining an invariable coˆ«fficient for any two variables. Besides, all attempts at differentiating an ape-unit into anything else than an ape-unit would be as impossible as to multiply or divide cabbages by turnips, or sparrows by sparrowhawks. Such divisions would give us no quotients, any more than their differentiations would give us a coˆ«fficient. Physiological differentiation will, therefore, never help us out of fixed species or nearly allied types. We can bridge no specific differences by it. In the differentiation of the horse and the ass for instance, the superior blood will predominate in the preservation of types, and even the mule will kick against further differentiation. Nature would so utterly abhor the practice as resolutely to slam the door in Mr. Spencer's face, if the obstinacy of the mule did not kick it off its hinges.

And nature would be quite as intractable in the case of "force-correlation," another of Mr. Spencer's redoubtable phrases. This term is quite recent in its application to animate objects, nor has it been long applied to inanimate. It is claimed to be a recently discovered force, and is one that the materialists have seized upon as the Herculean club with which to smite all vital theories to the earth. Its meaning, so far as it has any, is not difficult to get at. The simplest way to explain it, however, is the best. The reader is to understand that when he rubs two flat sticks together, the heat thereby engendered is not the result of friction, as all the world has heretofore supposed, but that the amount of force expended in rubbing the right-hand stick against the left-hand stick, is, by some law of versability, not over-well defined, transferred to the two sticks, and gets so entangled between their surfaces that it can only reappear in another and altogether different kind of force. When it leaves the hands and passes into the two sticks, it is, as the materialists assert, vital force. But as no force can be annihilated, the conclusive assumption is that it still exists somewhere. All of it, in the first place, went into the two flat sticks, and, when there, _ceased to be vital force._ Some of it disappeared, of course, in overcoming the inertia of the sticks, but the bulk of it became entangled with the superficial molecules of the two sticks, and reappeared as _heat_--another name for molecular force.

This is what is meant by the "differentiation" of vital force into molecular force, and _vice versa_. But by what process of rubbing, under this law of versability, molecular force can be reversed, or differentiated back into vital force, Mr. Spencer has not condescended to inform us. The simple truth is, and the materialists will be forced to admit it in the end, that there is no verification of this theory beyond that of mere force-equivalence. For instance, it has been experimentally determined that a certain amount of fuel expended in heat is equivalent to a certain amount of mechanical force, not mechanical _work_, as M. Carnot puts it. For force is not expended in work until it is actually generated, and the amount generated, not that expended in work, is the real equivalence of the heat produced from fuel.

Another problem is presented when it comes to determining the amount of generated force necessary to run a piece of machinery which shall accomplish a given amount of mechanical work.

A far better phrase to express this equivalence of force has been suggested and used by several writers in what is called the "Transmutation of Force." For there is no correlation, or reciprocal relation, between heat as originally produced by the consumption of fuel and the force as engendered in steam before it is transmuted into work. Nor is there any real equivalence as between the two forces after its transmutation. A very large per centage of heat is lost in its transmutation from a latent form in fuel to an active or available form in steam, and a still greater loss in its transmission into work by machinery. Theoretically, there may be such an equivalence as that named, but practically it is impossible to realize it. And a theory that is impossible of realization is of no practical utility in itself, and of little value as the basis of further theory. If, then, the theory of force equivalence is a failure in practical application, it furnishes a very poor basis on which to predicate force-correlation, or the doctrine of reciprocal forces. It is estimated, for instance, that a pound weight falling seven hundred and seventy-two feet, will, in striking the earth, impart to it a degree of heat equivalent to raising one pound of water 1´° F. But the heat thus imparted can never be so utilized as to raise a pound weight seven hundred and seventy-two feet into the air.

This shows that there is no actual reciprocity of relationship between the force as originally engendered and finally expended in work. Nor can it be shown that the original force is transmuted or changed into another and different kind of force by the operation. The force generated and the force expended are essentially one and the same, as much so as that transmitted from the power to the weight by means of a rope and pulley. And the quality of the force is not changed, whether the weight be lifted by machinery or the human hand. Force, in its mechanical sense, is that power which produces motion, or an alteration in the direction of motion, and is incapable of being specialized, except in a highly figurative sense, into a thousand and one correlates of motion. But these miscellaneous and figurative forces are not what we are considering. The doctrine of force-correlation takes no such wide and comprehensive sweep. It embraces neither the force of wit, nor the force of folly; but mechanical force and its equivalents. The force exercised by the human hand in lifting a weight either with or without rope and pulley is, in every definitional sense of the word, mechanical force. For the arm and hand are only the implements, or mechanical contrivances of nature, by which the will-power transmutes itself into work, or, more properly speaking, transmits itself from the point of force-generation to that of force-expenditure. And this is precisely the office performed by all mechanical contrivances for the transmission--not transmutation--of force. And the most perfect machine is that which transmits the engendered force, with the least possible waste or abandonment, to its point of ultimate expenditure in work.

All these hypothetical correlates of force, therefore, predicated upon the

doctrine of force-transmutation, have no foundation in fact, since the force transmitted from the point of generation to the point of expenditure undergoes no change but that of direction, in its passage along rope, wire, belt, pulley, shafting, etc. A man whose limbs have been paralyzed, may still will to remove mountains. The will-power is the same, but the mechanical contrivances for its transmission are wanting. Of the actual point or centre of this force-generation, in the case of the will-power, we know nothing; but the moment the power is started on its way towards the point of force-expenditure, whether it traverses the nerves and tissues of the brain, or the right arm or the left, or a crowbar or pickaxe, it is in no sense distinguishable from the force that traverses a rope and pulley. Nor is there any evidence that it undergoes molecular changes, or becomes modified or conditioned by any nearly or remotely related force, as it darts along the nerves, runs through the contracted tissues, electrifies the crowbar, or flashes into work from the point of a pickaxe. Whatever produces, or tends to produce, motion, or an alteration in its direction, is mechanical force, no matter from what force-centre it may start. When we can definitely determine the centre of vital force, as exercised in building up vital structure, _not in wielding pickaxes_, it is to be hoped we shall be able to distinguish, by the proper correlates, vital force from that which is mechanical. But the task is manifestly a hopeless one with the materialists.

Professor Beale positively denies that there are any such physical force-relations as those claimed by the materialists, and asserts that vital force bears no relation, or correlation, to either chemical or physical force; that the one is a distinct and separate factor from the other, and cannot be interpreted in the same force-formul^ƒ. He says: "The idea of motion, or heat, or light, or electricity _forming_ or _building_ up, or _constructing_ any texture capable of fulfilling a definite purpose, seems absurd, and opposed to all that is known, and yet is the notion continually forced upon us, that vitality, which does construct, is but a correlate of ordinary energy or motion."

But after devoting so much time to "force-correlation," and "force-differentiation," the advocates of "molecular-machinery" may feel themselves neglected if we dismiss their favorite hobby without further notice. The precise parentage of this term is disputed, but it has any number of _putative_ fathers. We have spoken of the size of the molecules themselves, and the numbers of them that might be huddled together on the point of a cambric needle without jostling. Let us now consider the size of a molecular machine. For each molecule runs its own machine, and is provident enough to see that they do not jostle. In fact, it is a very nice question in physics, whether the machines do not run the molecules, instead of the prevailing opposite opinion that the molecules run the machines. Unfortunately, the question is one that can never be determined. The requisite scientific data will forever be wanting.

But Professor James C. Maxwell, now, or quite recently, filling the chair of experimental physics in the University of Cambridge, England, has furnished us with _approximate_ calculations. On the strength of his approximations we will proceed to consider the dimensions of these wonderful little machines. And first, it may be axiomatically laid down

that these molecular machines, which either run the molecules or are run by them, can never exceed the size of their respective molecules. Conceding, then, that each one of these machines exactly fits into its own molecule, so as to present identically the same dimensions--as well as their largest possible dimensions--it would require two millions of them, placed in a row, to make one millimetre, or the one three hundred and ninety-four thousandths of an inch in length, or seven hundred and eighty-eight billions of them to make one inch! Who will ever be staggered at _Sirius_-distances, after this? And who will deny that an infinite world lies below the point of our microscopic vision, if not an Infinite kingdom and throne beyond our telescopic glance?

But, following the same high authority in experimental physics, let us consider the aggregate weight of these molecular machines. We will not marshal their aggregate numbers in a row, for an array of forty billions of them would make too insignificant a figure for inspection; but simply give their actual weight as computed under the French or metric system. Take, then, a million million million million of these machines, throwing in molecules and all, and they will weigh, if there is no indiscreet kicking of the beam, just a fraction between four and five grammes, or--to differentiate the weights--a small fraction over one-tenth of an ounce!

But why not get down to the atoms, of which the molecules are only the theoretical congeries, and marshal the "atomic forces" into line? These embryonic atoms are much the braver warriors, and, when summoned to do battle, spring, lithe and light-armed, against the elemental foe. They are no cowardly molecules, these atoms, but make war against Titans, as well as Titanic thrones and powers. The elements recognize them as their body guardsmen, their corps of invincible lancers, their bravest and best soldiers in fight. And they are wholly indifferent as to the legions of molecules arrayed against them, and would as soon hurl a mountain of them into the sea as to sport with a zephyr or caper with the east wind. Why not summon these countless myriads of bright and invincible spearmen, to batter down the walls of this Cretan labyrinth of Life? An army of these would be worth all the molecules that Professor Maxwell could array in line, in a thousand years. No life-problem need remain unsolved with their bright spears to drive the tenebrious mists before them. Even Professor Tyndall’s "fog-banks of primordial haze" would be ignominiously scattered in flight before these atomic legions. Let our materialistic friends summon them, then, to their aid. The field of controversy will never be won by their molecular "Hessians." The ineffably bright lancers that stand guard over the elemental hosts are the light brigade with which to rout the vitalistic enemy. Advance them then to the front, and, beneath the shadowy wing of pestilence or some other appalling ensign of destruction, the abashed vital squadrons will flee in dismay.

But let us pass from scientific speculations to alleged scientific facts. In a paper read by Dr. Hughes Bennett before the Royal Society of Edinburgh, in 1861, its author says: "The first step, in the process of organic formation, is the production of an organic fluid; the second, the precipitation of organic molecules, from which, according to the molecular law of growth, all other textures are derived either directly or indirectly." Here again the molecules, and not the elementary atoms, are

advanced to the front, and not a little anxiety is shown, in a definitional way, to identify vital processes of growth with crystalline processes of formation. But Dr. Bennett entirely mistakes, as well as misstates, the process of vital development, if he does not overlook the law governing the formation of crystals. There can be no symmetrically arranged solids in an inorganic fluid without the presence of some law, or principle, definitely determining, not the "precipitation," but the "formation," of crystals. The inorganic particles are not precipitated or thrown downward, any more than they are sublevated or thrown upward. The process is one of formation, not precipitation. Every crystallographer, not hampered by materialistic views and anti-vital theories, admits the presence of a fixed and determinate law governing each crystalline system, whatever may be the homologous parts or the unequal axes it represents.

And so of the equally undeviating law of vital growth. Life comes from no mere "precipitation of organic molecules," as Dr. Bennett would have us believe. If so, what is it that precipitates the molecules? They can hardly be said to precipitate themselves. To precipitate, in a chemical sense, is to be thrown down, or caused to be thrown down, as a substance from its solution. What, then, causes the molecules to be thus precipitously thrown down from a fluid to a solid, or a semi-solid, state? It cannot be from any blind or inconsiderate haste on the part of the molecules themselves. There must be some independent principle, or law of nature--one presupposing an intelligent law-giver--to effect the "precipitating process," if any such really exists.

But it does not exist. The first step is one of development and growth--the manifestation of functional activity--the building up of organic or cellular tissue. The exact process, in the case of seed-bearing plants and trees, is well known. All those familiar with the characteristic differences of seeds, their chemical constituents, their tegumentary coverings, rudimentary parts, etc., thoroughly understand the process in its outward manifestation. There is no precipitation of molecules as in an organic fluid, unless the albumen lying between the embryo and testa of the seeds, and constituting the nutriment on which the plant feeds during its primary stages of growth, can be called a fluid. It throws none of its characteristic ingredients downward any more than upward. Indeed the greater tendency of its molecules is upward rather than downward, in the "molecular processes" (vital ones) by which the embryonic cell is started upon its career of plant-life. The celebrated Dr. Liebig says of this albuminous environment: "It is the foundation, the starting-point, of the whole series of peculiar tissues which constitute those organs which are the seat of all vital actions." In the case of animal life, this albumen abounds in the serum of the blood, enters largely into the chyle and lymph, goes to build up the tissues and muscles, and is the chief ingredient of the nerves, glands, and even the brain itself. And in all these developmental stages, its tendency is to coagulate rather than precipitate. In its coagulated condition, it dries to a hard, partially translucent and friable state, and is more or less insoluble in water, and entirely so at a temperature from 140´° to 160´° F.

When the seed is planted or placed in water, it first commences to swell from the absorption of the water or moisture of the ground by the pores of

its external covering, the favorable temperature being from 60´° to 80´° F. It gradually expands until its outer membranes burst, and its initial rootlets clasp their hold upon the earth. From this point its several stages of development are well known to the ordinary observer. Here the first step is absorption and expansion, not precipitation. There is also a change in chemical conditions, the water at least being decomposed. For it would seem to be a law of vegetal growth that reproduction should begin in decomposition and decay. The Apostle's description of the "death of the grain," as symbolizing the death of man, in his first Epistle to the Corinthians, points conclusively in this direction. It is in the decomposition and decay of the grain that the implanted germ is quickened into life--ascends into the bright light, the warm sunshine, the refreshing presence of showers and dews. In this way it fulfils its providential purpose of yielding to the sower the more munificent life which he is forever seeking to attain.

Its germination is the springing up of the inner living principle of the grain, not its outer envelope or dead husk. This disappears in decay, except the small nutrient portion within which the germinal principle of life would seem to reside, and which undergoes a thorough chemical change in the process of passing from death unto life, or being assimilated and taken up into the new living structure. The Apostle's comparison distinctly marks these several changes as the one process of passing from death unto life. He saw in this wonderful provision of nature, the still more wonderful prevision of God. To his mind it was over the debris of the dead past that the living present is constantly marching towards a higher and more perfect life--the ultimate fruition and joy of an eternal home in the skies! And he saw that the two grand instrumentalities and co-accessory agencies to this end, were Life and Death, both equally constant and active, like all the other instrumentalities and governing agencies of the universe. Life is forever unlocking the portals of the present to youth and vigor; Death is forever closing them to age and decrepitude. This divine prevision thus becomes the wisest and most beneficent provision. Without life there would be no such thing as death, and without death no such thing as this grand succession and march of life--this passing from out the Shadow into the Day.

Chapter X.

Darwinism Considered from a Vitalistic Stand-Point.

Granting that the assumption of Darwinism rests, as claimed, on the fixed and inflexible adaptation of means to ends, in the diversified yet measurably specialized processes of nature, there is no logical deduction to be drawn therefrom but that which traces the representatives of all the great types of the animal kingdom to one single source, and that not the Sovereign Intelligence of the Universe, but a mere "ovule in protoplasm," or what may be defined, in its unaggregated form, as an inconceivably

small whirligig, having motion on a central axis, but whether an independent motion of its own, or one derived from an Infinite Intelligence, the Darwinian systematizers are not bold enough to aver. They have too many _a priori_ scruples either to assert the one proposition or to deny the other. What set this little whirligig in motion is a mystery that lies beyond the purview of science, so called, and into the depths of this infinitessimal and most mysterious little chamber they refuse to go.

They search not for the evidence of an Infinite Intelligence in the outermost circle of the heavens where the highest is to be found, and where a bound is set that we may not pass, but shutting their eyes to all the grander evidences of such an Intelligence, they dive down into the infinitessimal realm of nature and assume to dig out the sublimer secrets of the universe there. And this is their grand discovery: That this infinitessimal whirligig of theirs has not only whirled man into existence, but the entire circle of the heavens, with the innumerable host of stars that march therein, and all the boundless systems of worlds that roll in space. With this subordination of the Infinite to the infinitessimal, of intelligence to insensate matter, of divine energy, so to speak, to blind molecular force, they are satisfied; and, like the mole in the fable, conceive their little molecule to be the only possible creator of a stupendous universe.

Scrutinize my propositions closely, and see if I am guilty of misstating theirs. Their new theory is only a slight modification of an old one, or the old adage, _omne vivum ex ovo_--all life is from an egg. For they assert that every living thing primordially proceeds from an ovule in protoplasm, the essential part of the protoplasmic egg, so to speak, being this little _ovum_ or cellule, from which have issued all possible organisms in both the vegetable and animal kingdoms. Nor is this theory essentially confined to organic matter. A scientific coˆ¶rdination of its several known parts, or alleged functions, extends the operations of this infinitessimal whirligig to the plastic or uniformly diffused state of all matter, from which has been evolved, in an infinite duration of past time, not only life in its highest manifestations, but a universe so stupendously grand that no amount of human intelligence can grasp the first conception of it.

Mr. Emerson--our Ralph Waldo--virtually accepts this theory of development, substituting, however, a stomach for an ovule, and the reverse of the Darwinian proposition, in what he is pleased to call "the incessant opposition of nature to everything hurtful." It is not the "selection of the fittest" but the "rejection of the unfit," by which "a beneficent necessity (I use his language) is always bringing things right." "It is in the stomach of plants," he says, "that development begins, and ends in the circles of the universe." "'Tis a long way," he admits, "from the gorilla to the gentleman--from the gorilla to Plato, Newton, Shakespeare--to the sanctities of religion, the refinements of legislation, the summits of science, art, poetry."

Few persons, I take it, will dispute this proposition. The road is a long one and beset with all sorts of thorns and briars, such as Mr. Emerson’s

philosophy will hardly eradicate from the wayside. Even the most refined empiricism will find it difficult to stomach his stomachic theory of the universe, which lands all atomic or corpuscular philosophy in a digestive sac, such as Jack Falstaff bore about him with its measureless capacity for potations and Eastcheap fare. It is a road too in which Mr. Emerson's philosophy will get many sharp raps from an external world of phenomena, in the futility of both his and the Darwinian hypothesis to explain away the independent origination of certain species of plants and animals--new varieties still springing into existence, under favorable conditions, in obedience to the divine fiat, "Let the earth bring forth."

In laying the foundations of this new science, if science it shall be called, we must insist that the course of nature is uniform, and that, however extended our generalizations in any one of her lines of uniformity, all intermediate, as well as ultimate propositions, must not only be stated with the utmost scientific accuracy, but the logical deductions therefrom must also be uniform, or lie in the path of uniformity. The earliest and latest inductions must either coincide or approximate the same end. No links must be broken, no chasms bridged, in the scientific series. There must be a distinct and separate link connecting each preceding and each succeeding one in the chain. The lowest known mammal must be found in immediate relationship with his higher congener or brother, not in any remote cousinship. There must be no saltatory progress--no leaping over intermediate steps or degrees. The heights of science are not to be scaled _per saltum_, except as degrees may sometimes be conferred by our universities.[35]

There are some fish-like animals, say our Darwinian systematizers, like the Lepidosirens and their congeners, with the characteristics of amphibians; and hence they infer that by successive deviations and improvements the lower order has risen into the higher. But out of what page in the volume of nature, in the countless leaves we have turned back, has the immediate congener dropped, that we are obliged to look for the relationship in thirty-fourth cousins? We might as well say that some of the _Infusoria_ possess the same or similar characteristics, and predicate relationship between them and the amphibians; for giants sometimes spring from dwarfs and dwarfs from giants. At all events, our diagnoses must be freed from these intermediate breaks or failures in the chain of continuity, or the doctrine of descent must tumble with the imaginary foundations on which it is built. And bear in mind that the most enthusiastic Darwinist is forced to admit that there are still rigid partitions between the lower and higher organisms that have not been pierced by the light of scientific truth, but they assume that future discoveries and investigations will solve the difficulty. But science, inflexible as she is, or ought to be, in her demands, admits of no assumptions, much less sanctions such exceptions and deviations as we constantly find in the Darwinian path of continuity. The eye of imagination can supply nothing to her vision. She is eagle-eyed, and soars into the bright empyrean--does not dive into quagmires and the slime of creation after truth.

But let us see how Mr. Darwin bridges one of the very first chasms he meets with in constructing his chain of generation. He goes back to the

first link, or to what he calls primordial generation. Here the leap is from inorganic matter to the lowest form of organic life--from inanimate to animate dust. The chasm is immense, as all will agree. But he bridges it by falling back on his infinitessimal whirligig--his _primum mobile_--or on the motions of elements as yet inaccessible, except to the eye of imagination. For even Plato's monad, or ultimate atom, was not matter itself, being indivisible, but rather a formal unit or primary constituent of matter, which, like Mr. Darwin's whirligig in its unaggregated form, admits of neither a maximum nor a minimum of comprehension; but rests entirely on imaginary hypothesis. And we may here add that a system which begins in imaginary hypotheses and ends in them--as that of bridging the chasmal difference between a gorilla and a Plato--can be dignified into a science only by a still greater stretch of the imagination--that of bridging the difference between the Darwinian zero and his ninety degrees of development in a Darwin himself!

Bear in mind, as we proceed, that the function of an argument in philosophy, as in logic, is to prove that a certain relation exists between two concepts or objects of thought, when that relation is not self-evident. In the Darwinian chain we have, as the first link, organic life springing from inorganic matter, without the slightest relation existing between the two, except what may be universally predicated of matter itself, whether animate or inanimate, organic or inorganic; and there is no other affirmative premise, expressing their agreement as extremes, that can possibly admit of an affirmative conclusion. The parts are so separated in thought that no metaphysical or ideal distinction exists to coordinate them in classification. We are simply forced back, in our attempt at classification, upon the intuitions of consciousness, where reason manifestly ceases to enforce its inductions.

And here the human mind intuitively springs an objection which is at once aimed at the very citadel of Darwinism. On what rests the validity of these intuitions except it be that "breath of life," which, as we have before said, was breathed into man when he became a living soul? If we follow the divine record, instead of these blind systematizers leading the blind, we shall have no difficulty in establishing the validity of these intuitions--the highest potential factors this side of Deity to be found anywhere in the universe. For if our intuitions are not to be relied upon--if their objects and perceptions are to be discarded as unreliable--then there can be no agreement or disagreement between any two ideas presented, objectively or subjectively, to the human mind. No processes of mental analysis or ratiocination, like those pursued in the elementary methods of Euclid, can present the basis of an intellectual judgment, or lay the foundation of the slightest faith or belief in the world. To deny the primary perception of truth by intuition is as fatal to "Evolution" as to the sublimer teachings of the Bible Genesis.

But from the very nature of our being, as well as the primary _datum_ of consciousness itself, we must rest the validity of these intuitions on something, and that, something more than a finite intelligence; and since science, with all her knowledge methodically digested and arranged, furnishes no clue to the mystery, we are left to the higher sources of inspiration to reach it. And this inspiration, however it may be derived,

necessarily becomes a part of our intuitions, since it addresses itself to the strongest possible cravings of the human soul, and is accepted as its inseparable companion and guest.

Shall we build our faith then on the Divine Word,--on the Word that was in the beginning with God, and, when incarnate, _was_ God,--or on Mr. Darwin's little whirligig that originally set everything in motion, and has only to go on _ad infinitum_ to whirl us out a God, as it has already whirled us out a Darwinian universe without one. For if this ovulistic whirligig has bridged the chasmal difference between protoplasm and man, since the transition from inorganic matter to organic life, the process has only to be indefinitely extended to bridge the chasm between man and Deity, or between finite and infinite intelligence. This gives us nature evolving a God, instead of the doctrine of the old Theogonies, of a God presiding from all eternity over nature; one "who laid the foundations of the earth that it should not be removed forever; who stretchest out the heavens like a curtain; who layeth the beams of his chambers in the waters; who maketh his angels spirits; his ministers a flaming fire."

These evolutionists manifestly get the cart before the horse in their category of cosmological events. It is not inert matter organizing itself into life, nor any mode of physical or chemical action, nor any mere manifestation of motion or of heat, nor any other conceivable correlation of natural forces. None of these has enabled us to penetrate the mysterious _inner-chamber_ of life itself. For reasons obviously connected with our own welfare, He, from whom alone are "the issues of life," seems to have ordained that we should fathom the depths of both physical and chemical force, and beneficently wield and direct them to our own uses. But this vital force; this something that stands apart from and is essentially different from all other kinds of force, is of a nature that baffles all our efforts to approach. The power to grasp it, or even to penetrate in the slightest degree its mysteries, is delegated to none. All attempts to lay bare this principle of vitality, or level the barriers that separate it from physical or chemical action, have utterly failed. We know no more of its essence now than was known a thousand years ago, and know no less than will be known a thousand years hence. To become masters of the mystery, we must enter the impenetrable veil within which the Infinite Intelligence of the universe presides,--who, we are told, "sendeth forth his spirit, and we are created, who taketh away our breath, we die and return to our dust." [36]

We are just as much bewildered in respect to this vital principle in our classifications of the myriads of little creatures careering over the field of the microscope, as when we turn to the most marked formations of genera and species in geological distribution. The great trouble with Mr. Darwin's _vinculum_ is, that its weakest links are precisely where the strongest should be found, and _vice versa_. With a candor rarely displayed by a writer who is spinning a theory, he admits this. The geological record is not what he would have it to be. Whole chapters are gone where they are most needed, and nature's lithography seems constantly at fault. Independent species are now and then springing up where derivatives should be looked for, while derivatives are everywhere disappearing in non-derivatives. Many of the middle Tertiary _molusca_,

and a large proportion of the later Tertiary period, are specifically identical with the living species, of to-day. What has "natural selection" been doing for this family in the last million years or more? Manifestly nothing, and less than nothing, for some of the species have dropped out altogether.

These facts, and hundreds of others like them, are constantly obtruding themselves upon our attention to show, in harmony with the Bible Genesis, the immutability of species--the absolute fixity of types--rather than their variability, as claimed. If nature abhors anything more than a _vacuum_, it is manifestly any marked transition from fixed types, and she thunders her edicts against it in the non-fertility of all hybrids. The doctrine of variation lacks the all-essential element of continuity, and is oftener at war with the theory of the "selection of the fittest," than it is with the selection of the "unfit." The leap from Lepidosirens to Amphibians is no greater than the interval between any two species of animals or plants yet discovered, either fossil or living. The intervals are as numerous as the species themselves, and everywhere constitute great and sudden leaps, or such transitional changes as "natural selection" could not have effected independently of intervening forms--those that nowhere exist in nature, and never have existed, if we are to credit geologic and paleontologic records. There is everywhere similarity of structure, but not identity; and the nearer we approach to identity of structure the wider the divergence in similarity of characteristics. A bird may be taught to talk and sing snatches of music. But no monkey has ever been able to articulate human sounds, much less give them rhythmical utterance.

Take the case of the wild pigeon, a subject that especially delights Mr. Darwin. Most of the deviations are confined to the domesticated breeds, and none of these rank in strength, hardiness, capability of flight, or symmetry of structure, with the wild or typical bird. There are well-defined deviations, but no sensible improvements, except to the eye of the bird-fancier. The deviations are simply entailed weaknesses, or the very reverse of what should appear from the "selection of the fittest." The fact undeniably is, that these variations are almost wholly abnormal--mere exaggerated characteristics, induced in the first instance, perhaps, by high cultivation and close in-and-in breeding.

Turn these abnormal varieties loose, let them go back to the aboriginal stock, and these characteristics will rapidly disappear; that is, they will ultimately lose themselves or melt away in the original type. Mr. Darwin admits that the tendency will be to reversion, but he insists, manifestly without any positive proof therefor, that the greater tendency is to new centres of attraction, and not necessarily the primitive one. But this is mere assumption--sheer begging the question on his part,--since all the oscillations are incontestibly about the original or type centre.

The same may be said of the typical races of men, like the negro and wild Indian of our prairies. You may lift them out of their primitive condition--temporarily suspend, if you please so to put it, their primordial attraction,--but, left again to themselves, they will go back

to the original type; that is, their offspring will again infest the jungles and roam their native hunting-grounds. The process here is the very reverse of the Darwinian theory. Reversion, as a rule, follows the degeneracy of types, instead of there being any favorable homogeneous result, springing from a new centre of attraction. The Indian makes a splendid savage, but a very poor white man. Think of Red Jacket taking the part of Mercutio in the play or enacting the more valiant _role_ of Falstaff in King Henry the Fourth. An infusion of white blood does not help the matter, but rather makes it worse. Generally, the meanest Indian on the continent is your half-breed, and among the negroes there is no term so expressive of the contempt of that race, as that applied by them to a mulatto. The present condition of Mexico affords a striking exemplification of this law of reversion. The inheritable characteristics or variations, produced from an infusion of Spanish blood, are rapidly disappearing--the native blood whipping out the European. The potency is in the inferior blood, simply because it is the predominating one. The result has been no homogeneous new race, but a reversion, now manifestly in progress, to the type centre or aboriginal stock. And the curse pronounced by Ezekiel upon mongrel tribes--"woe unto the mingled peoples" may have a significance in this connection worth considering; but it manifestly falls outside the scope of our present inquiry.

In considering the embryological structure of man, and the homologies he therein presents to the lower animals, Mr. Darwin thus conclusively (in his judgment) remarks: "We thus learn that man is descended from a hairy quadruped, furnished with a tail and pointed ears, probably arboreal in his habits, and an inhabitant of the Old World."

But Mr. Darwin’s pronominal "we," in this connection, admits of qualification. He can hardly speak for all the scientific world at once. The philosophical maxim of Sir Isaac Newton--_hypotheses non fingo_--I build no hypotheses, make no suppositions, but adhere to facts--has a few followers still left. But what are Mr. Darwin’s facts? Has he yet discovered the caudal man, except as the ever-fertile Mr. Stanley heard of one in Africa? And where is his monkey that first lost the prehensile power to climb trees? For bear in mind that it was the loss of this prehensile power that resulted in the caudal atrophy of our monkey progenitors, _who became men simply because they were tailless monkeys!_ They had lost their power to climb trees, and accordingly had no longer any use for tails to let themselves down from the limbs. A "beneficent necessity" therefore, according to Mr. Emerson, dropped the tail as something decidedly "unfit." For the simplest tyro in Darwinian philosophy will see that the loss of the Catarrhine monkey’s tail, if it ever occurred, could not have resulted from the "selection of the fittest." The deeper Emersonian philosophy of the "rejection of the unfit," affords the only solution of the difficulty, and then only on the assumption that the tail is an unfit appendage for the monkey.

With the loss of his tail, in the light of this new genesis, the monkey necessarily ceased to be arboreal in his habits. He could no longer subsist on the fruits and nuts of trees, or take refuge therein from his enemies. He had to go to work and make weapons to defend himself--to construct tools--make and set traps, live on his wits, and not on his

prehensile power to climb trees. He soon discovered, of course, that the longest pole knocked the persimmon. This was his first intellectual stride towards the future Edison. From the simplest sort of Grahamitic philosopher he passed into the robust, beef-eating Englishman. But this was not all. As an arboreal gymnast, he was manifestly on his way to more masterly feats of agility than ever,--those dependent, not on muscular function, but on the nervous action of the brain and spinal marrow. Necessity became with him the "mother of invention," and how admirably he improved under this maternal instructor we are left to infer from the paramount conclusion of Mr. Darwin, _that the demoralized monkey became the incipient man_!

But this conclusively accounts for only one of the many anatomical differences between man and his caudal progenitor. For why should the loss of his tail have resulted in the changed chemistry of the monkey's brain? or in the increased involutions of his brain even? The specific differences between the present and ancestral types are very numerous and demand separate classification. Their variability runs through every bone, muscle, tissue, fibre, nerve. Their blood corpuscles are not the same. The chemistry of their bones essentially differs. The nerves are differently bundled and differently strung. In intonations of voice--symmetry of arms, legs, chest--hairlessness of body, and aquatic and land habits, the frog is a much nearer approach to man than the monkey, as all caricaturists, delineating aldermanic proportions, will agree. And Mr. Darwin might have immortalized himself by deriving the builders of the ancient pile-habitations and other primitive water-rats and croakers of the Swiss lakes, from this tailless batrachian. For everybody knows, or thinks he knows, how the frog lost his tail. If he didn't wag it off, he certainly absorbed its waggishness as a distinguishing characteristic of the "coming man"--the future Artemas Wards and Mark Twains of the race. This ancestral origin will also account for the otherwise unaccountable proclivity of all human juveniles to play at the game of leap-frog! Besides, it would have relieved Mr. Darwin from one of the greatest perplexities he has had to encounter. As he derives man from a hairy quadruped, the absence of hair on the human body, is a phenomenal fact that gives him great trouble. He agrees that it does not result from "natural selection," as he says "the loss of hair is an inconvenience and probably an injury to man." Nor does he suppose it to result from what he calls "correlated development." He is more puzzled over this problem of divestiture than any other, and finds the solution of it only in "sexual selection." That is, he assumes that among our semi-human progenitors, far back in the Tertiary or some other period, some female monkeys were less hirsute than others, and that they naturally preferred males possessing similar characteristics. These divergencies were thus commenced, and, by continuous "sexual selection," the infirmity (for such he regards the loss of hair) was propagated until the race was almost entirely denuded or bereft of this covering. In the same way he accounts for nearly all the differentiations of the race, among the various tribes now or formerly inhabiting the earth. All have sprung from the same semi-human progenitors--_apes that lost their capacity to subsist as apes, and hence found it necessary to subsist as men_!

The law of degeneracy has, therefore, had quite as much to do with human origins as that of progressive development. In fact, it is the paramount law from a Darwinian stand-point. For the loss of hair and of the prehensile power to climb trees are both conceded by Mr. Darwin to be serious defects and drawbacks in the ape family.

But the law of sexual selection, as treated by the evolutionists, is not scientifically accurate, nor is it true in fact. The loving tendency of nature is to opposites, not likes. The positive and negative poles are those that play into each other with most marvellous effect. Each repels its like and rushes to the embrace of its opposite. Extremes lovingly meet everywhere. A brunette selects a blonde and a blonde a brunette, as a general rule in matrimony. A tall man or woman, with rare exceptions, chooses a short companion for life. Dark eyes delight in those that are light, and _vice-versa_. Everywhere nature seeks diversity, not similitude. The gayest and brightest feathered songster craves companionship in modest and unobtrusive colors. Diversity is the law of life, as equality, or versimilitude, is that of death. Neither natural selection, nor sexual selection, runs counter to this law. If Mr. Darwin's theory were true, that likes selected likes, then the two marked extremes which should have characterized the race, soon after its emergence from the semi-human state, should have been giants and pigmies, Gargantuas and Lilliputs. Otherwise "sexual selection," as treated by its author, plays no intelligible part in the economy of nature, except to counterbalance variability, not to propagate it.

But the Darwinian assumption that the primeval man, or his immediate ape-like progenitor, came through "natural selection," that is, through the "survival of the fittest," is subject to one or two other objections which we shall briefly notice. And the first objection is not altogether a technical one. The term "fittest," as applied to a monkey, has at once a definite and comprehensive significance to us. It implies the presence of whatever is most perfect of its kind in the monkey _as_ a monkey, and not in the monkey _as_ something else than a monkey. They are all admirably adapted for climbing trees; and it is this adaptation that secures them safety, or complete immunity, in shelter from their enemies. To say that nature selects the fittest for them--for any species of monkey--by converting their forefeet into rudimentary hands, with a loss of prehension and no corresponding advantages in locomotion, is to use language without any appreciable significance to us. We can only say that what is fittest for the monkey is ill-fitted for man, and the reverse. This is all we can definitely predicate of them, from what we know of their anatomical structure, and the diversified uses to which it may be put.

The fact is, as the Bible genesis shows, that every living thing is perfect of its kind, and whatever is perfect admits of no Darwinian variations or improvements for the better. And the simple statement of this undeniable proposition is, we submit, a complete refutation of Darwinism. When the waters and the earth were commanded to bring forth abundantly of every living creature and every living thing, "it was so, and God saw that it was good," that is, everything perfect of its kind, and in its kind. With this single limitation as to kind, a rattlesnake is

no less perfect than a Plato or a John Howard.

When we consider man's upright position; the firmness and steadiness with which he plants his foot upon the earth; when we examine the mechanism of his hand, and the wonderful and almost unlimited range it possesses for diversified use; when we see how ill-fitted he is for climbing trees, yet how express and admirable for climbing among the stars, even to the outermost milky-way, the idea that what is fittest for him is fit for the chattering monkey, is too absurd to give us pause. And yet how does Mr. Darwin know that the monkey has been climbing up, all these hundred thousand or million years, into man, as one of the congenital freaks of nature, and not man shambling down into the monkey as a reverse congenital freak. Children have sometimes been born with a singular resemblance to the ape family, but no ape has ever, to Mr. Darwin's knowledge, produced issue more manlike than itself. The divergencies run the wrong way to meet the conditions of the development theory. We have had nearly five thousand years in which to mark these transitional changes, and yet the monkey of to-day is identical with that painted on the walls of ancient Meroe. In all this time he has made no advance in the genetic relation; and if we turn back the lithographic pages of nature for a hundred times five thousand years, we shall find no essential departure from aboriginal types.

But the Darwinian hypothesis admits of a more conclusive answer than we have yet given. Past time, it will be conceded, is theoretically if not actually infinite; and in all past time, nature has been tugging away at Mr. Darwin's problem of the "survival of the fittest." It is no two hundred and fifty thousand years, nor two hundred and fifty millions, but an infinite duration of past time that covers the period in which she has been wrestling with this problem. How successfully has she solved it? In the Darwinian sense of the term "fittest," she has not so much as stated her first equation or extracted the root of her first power. She is manifestly as much puzzled over the problem as Mr. Darwin himself. He fails to see that the "survival of the fittest," necessarily implies, or carries with it, the correlative proposition,--the "non-survival of the unfit." And when such a law has been operative for an infinite duration of past time, the "unfit," however infinitely distributed at first, should have disappeared altogether, many thousands, if not millions, of years ago. If the evolutionists are dealing with vast problems, and assigning to nature, unlimited factors to express the totality of her unerring operations, they must be careful to limit the time in which any one of her given labors is to be accomplished. If she makes any progress at all, an infinite duration of past time should enable her to complete her work just as effectually as an infinite duration of time to come.

But by what law of "natural selection," appertaining to a single pair of old world monkeys, have their offspring advanced to this regal state of manhood, while all other pairs have remained stationary, or precisely where they were two hundred and fifty thousand years ago or more? Why this exceptional divergence in the case of a single pair of monkeys? Why this anomalous, aberrant, and thoroughly eccentric movement on the part of nature? We had supposed that her operations were uniform--conformable to fixed laws of movement. The doctrine of the "survival of the fittest"

implies this. Why then, should nature, in her unerring operations, have selected the fittest in respect to a single pair of Catarrhine monkeys, and at the same time rejected the fittest in the case of a million other pairs? If she had selected only the fittest in respect to this old world stock of monkeys, the entire Catarrhine family should have disappeared in the next higher or fitter group--a group nowhere to be found in geological distribution. The break between man and this Catarrhine monkey covers quite a series of links in the genetic vinculum;[37] and yet between the two we find no high form of a low type fitting into a low form of a high type, as we manifestly should, to account for all the diversified changes that must have taken place in the interim. And what is true of the types is measurably true of the classes within the types, as well as of the orders within the classes. Wide deviations in forms, as in characteristics, would seem to be the invariable rule; the blending of type into type, except perhaps in remote relationships, is nowhere visible.

But if "variation" and "natural selection" have played important parts in the economy of nature, why may not "specific creation" have played _its_ part also? Positive science can hardly flatter itself with the belief that it is rolling back the mystery of the universe to a point beyond which "specific creation" might not have commenced, or the divine fiat been put forth. To believe in the possibility of a rational synthesis, limited to sensible experience, or phenomenal facts within our reach, that shall climb from law to law, or from concrete fact to abstract conception, until it shall reach the _Ultima Thule_ of all law, is to carry the faith of the scientist beyond the most transcendental belief of the theologian, and make him a greater dupe to his illusions than was ever cloistered in a monastery or affected austerity therein as a balm to the flesh. We may substitute new dogmatisms for old ones, but we can never postulate a principle that shall make the general laws of nature any less mysterious than the partial or exceptional, or that shall in the long run, render "natural selection" any more comprehensible, or acceptable to the rational intuition, than "specific creation." For while one class of scientists is climbing the ladder of synthesis, by assigning a reason for a higher law that may be predicated of a lower, we shall find the broader and more analytical mind accepting the higher mystery for the lower, and, by divesting its faith of all metaphysical incumbrance, landing in the belief of an all-encompassing law, which shall comprehend the entire assemblage of known laws and facts in the universe. And the natural drift of the human mind is ever towards this abstract conception--this one all-encompassing law of the universe. It steadily speculates in this direction, and some of the highest triumphs of our age, in physical as well as metaphysical science, are measurably due to this tendency. The scientific mind is not confined wholly to experimental research. It is stimulated to higher contemplations, and is constantly disposed to make larger and more comprehensive groupings of analogous facts. It is fast coming to regard light, heat, electricity, magnetism, gravitation, chemical affinity, molecular force, and even Mr. Darwin’s little whirligig, as only so many manifestations or expressions of one and the same force in the universe--that ultimate, all-encompassing, divine force (not to speak unscientifically) that upholds the order of the heavens, "binds the sweet influences of the Pleiades, brings forth Mazzaroth in his

season, and guides Arcturus with his suns."

It is the boast of the Darwinian systematizers that their development theory not only harmonizes with, but admirably supplements and out-rounds the grander speculation of Laplace, termed the "Nebular Hypothesis," which regards the universe as having originally consisted of uniformly diffused matter, filling all space, which subsequently became aggregated by gravitation, much after the manner of Mr. Darwin's little whirligig, into an infinite number of sun-systems, occupying inconceivably vast areas in space. Of the correctness of this hypothesis it is unnecessary to speak. It is to the Darwinian speculation what the infinite is to the infinitessimal, and we only refer to it to bring out the vastness of the conception as compared to the latter theory, and to predicate thereon the more conclusive induction that an Infinite Intelligence directs and superintends all.

In an area in the Milky-way not exceeding one-tenth of the moon's disc, Mr. Herschel computes the number of stars at not less than twenty thousand, with clusters of nebulae lying still beyond. As we know that no bodies shining by reflected light could be visible at such enormous distances, we are left to conclude that each of these twinkling points is a sun, dispensing light and heat to probably as many planets as hold their courses about the central orb in our own system. From the superior magnitude of many of the stars, as compared with the sun, we may reasonably infer that many of these vast sun-systems occupy a much larger field in space than our own. This would give an area in space of not less than six thousand millions of miles as the field occupied by each of these sun-systems. And as the distance between each of these systems and its nearest neighbor is probably not less than that of our sun from the nearest star, we have the enormous and inconceivable distance of not less than nineteen billions of miles separating each one of these twenty thousand stars or sun-systems, occupying a space in the heavens apparently no bigger than a man's hand. And yet Infinity, as we apprehend the term, lies beyond this vast cluster of constellated worlds! Where is Mr. Darwin's little whirligig in the comparison, or Mr. Emerson's vegetal stomach, or Mr. Herbert Spencer's "potential factors," to express the sum-total of all this totality,--this gigantic assemblage of stars clustered about a single point in the Milky-way? The human mind absolutely reels--staggers bewildered and amazed--under the load of conceptions imposed by these few twinkling stars, and is ready to exclaim,--

"Oh, star-eyed Science, hast thou wandered there,
To waft us back a message of despair?"

But when we reflect that all this vast aggregation of sun systems, visible in the telescopic field, is not stationary, but is revolving with inconceivable rapidity about some unknown and infinitely remote centre of the universe, how immeasurably vast does the conception become, and how unutterably puerile and fatuous the thought of _Mr. Darwin's little whirligig as the author of it all!_ No wonder the inspired Psalmist exclaims; "The heavens declare the glory of God, and the firmament showeth his handiwork." But listen to the Darwinian exclamation: "The heavens declare the glory of my little whirligig, and the firmament showeth the

immensity of my little ovules." With the veil of faith and inspiration lifted, the words of the Psalmist swell into the highest cherubic anthem, while those of Mr. Darwin hardly rise above the squeak of a mole burrowing beneath the glebe!

And what presumptuous mortal shall say that this infinitely remote centre of the universe, around which revolves this infinite number of sun-systems, is not the seat and throne of the Infinite One himself--the Sovereign Intelligence and Power of the universe, directing and upholding all? We know that some of the stars are travelling about this central point of the heavens at a pace exceeding 194,000 miles an hour, or with nearly three times the rapidity of our earth in its orbit. That there must be infinite power, not physical, at this unknown centre of the universe, to hold these myriads of sun-systems in their courses, is a logical induction as irrefragable as that the sun holds his planets in their orbits. And if infinite power is predicable upon this central point, why not infinite intelligence also? Intelligence, we know, controls and utilizes all power in this world; why not all power in the universe? It can utilize every drop of water that thunders down Niagara to-day, as it has already seized upon the lightnings of heaven to make them our post-boy. This is what finite intelligence--that insignificant factor that science would eliminate from the universe--can do; then what may not Infinite Intelligence accomplish?

But the Darwinian systematizers object that science must limit itself to a coordination of the known relations of things in the universe, or deal only with phenomenal facts, not dogmatisms; forgetting that they dogmatize quite as extensively, in constructing their chain of generation, as the theologians do in adhering to the Bible genesis. No theologian objects to a rational synthesis of phenomena, limited to sensible experience; but, in climbing from law to law, he reasonably enough insists, that, when concrete facts rise into abstract conceptions, the highest round in the ladder shall not be knocked out for the accommodation of Robert G. Ingersoll or any other boasted descendant of a gorilla. And he also insists that when _a priori_ speculation is lost in abstract conceptions, the highest must necessarily press alone upon the intuitions of consciousness, where all generalizations cease, and all synthesis is undeniably at an end. Here, in this mysterious chamber of the soul, we stand silent and alone, with only dim and shadowy phantoms about us, as if in the august presence of Deity itself.

But how does scientific speculation propose to stifle these intuitions of consciousness--reduce them to the least of all potential factors in the universe? We will take the very latest of these speculations. In supplementing both the Darwinian theory and the grander speculation of Laplace, the scientists, so called, tell us that the process of aggregation, or the turning out of new worlds in the universe, is still going on; but that the time is coming when all the primeval potency or energy, originally inhering in diffused matter, will have exhausted itself in actual energy, and that then all light, life and motion in the universe, will cease and be at an end. This dissipation of potential energy is to result, they say, in a played-out universe, as it has already resulted, they claim, in a played-out moon, if not countless other

heavenly bodies.[38] All the exterior planets, or a majority of them at least, are to be placed in this category of dismantled worlds, or those in which all life has hopelessly ceased and become extinct. All has utterly disappeared, or, to paraphrase one of Pope's couplets,

"Beast, bird, fish, insect--what no eye can scan,
Nor glass can reach--from zoophyte to man."

All these dismantled planets, and satellites to planets, are only so many immense cinders--mere refuse slag--of no conceivable interest to science, except to predicate the ultimate conclusion--"a played-out universe, resulting from a played-out potency within the universe." The magnificent clockwork of the heavens will then have run down, with no Darwinian whirligig to wind it up again, and the terrible reality of Byron's dream, which it would seem was not all a dream, be realized in the bright sun extinguished, the stars darkling the eternal space, rayless and pathless, and the icy earth swung blind and blackening in the moonless air.

Oh, if this be star-eyed science, give us anything in place of it! Blear-eyed bigotry in his cloistered den, mumbling unintelligible prayers, and believing that man is to be saved, not by what he does, but by a _credo_ only, is far preferable to it. But oh, how unspeakably preferable the simple faith of the star-led Magi, who

"Deeming the light that in the east was seen
An earnest and a prophecy of rest
To weary wanderers, such as they had been,"

came on that bleak December night, 1880 years ago, to pay their homage to the Christ-child--the long expected Messiah--the Redeemer of the world!

Footnotes

[1]: It may be proper, however, to state that the tenth and concluding chapter was originally written as a lecture, and delivered about a year ago in New Haven, Boston, and at other points. A request for its publication has induced the author to place it in this volume, with the portion referring to the Bible genesis omitted. It will be found germane to the general subject.

[2]: "Without this latent presence of the 'I am,' all modes of existence in the external world flit before us as colored shadows, with no greater depth, root, or fixure, than the image of a rock hath in the gliding stream, or the rainbow on the fast-sailing rain storm."--_Coleridge's_ "_Comments on Essays_."

[3]: And science that is not purely inductive--i.e. primarily based on the inviolability of our intuitions--is no science at all, but the sheerest possible speculation.

[4]: This presence of an active living principle in nature, one originally assigned as the "_divina particula aurˆƒ_" of every living thing, is frequently referred to in the higher inspirational moods of our poets. Wordsworth exquisitely refers to it in the following lines of his "Excursion:"--

"To every form of being is assigned
An _active_ principle: howe'er removed
From sense and observation, it subsists
In all things, in all nature, in the stars
Of azure heaven, the unenduring clouds;
In flower and tree, in every pebbly stone
That paves the brooks."

[5]: The existence of vital units is conceded by some of the staunchest materialists, such as Herbert Spencer, Professor Bastian and others. Professor Bastian says: "The countless myriads of living units which have been evolved in different ages of the world's history, must, in each period, have given rise to innumerable multitudes of what have been called 'trees of life.'" He insists, however, that they have been "evolved" from something, or by some unknown process. But we shall show further on that a "unit" can neither be _evolved_ nor _involved_, and that this is as true of vital units as of the mathematical or chemical unit. Neither evolution nor involution will ever effect the value of a unit.

[6]: According to Aristotle, the great world-_ordainer_ is the constant world-_sustainer_.

[7]: The definition which Professor Robinson, in his Lexicon of the New Testament, gives of the word ˇ ˇ ¸›ˇ ¸…¸–, as connected with the "divine life," entirely harmonizes with this view of the subject. He says: Trop. ˇ ¸µ‰¸µÆ‰¶ _i.e._ the germ or principle of divine life through which he is begotten of god, ˇ ¸¿ ˇ ¸‰¸µÆ‰ ¸…¸–.

[8]: Professor Schmidt, of the University of Strasburg, who insists that species are only relatively stable, admits that they remain persistent as long as they exist under the same external conditions. Time is, therefore, not a factor in the mutation of species. Nor are environing conditions factors, except as a failure of conditions results in the disappearance of species, as the presence of conditions results in their appearance.

[9]: Says M. Ch. Bonnet, in his "La Palingˆ'uˆ'sie Philosophique;" "Il est de la plus parfaite ˆ'vidence que la matiere est susceptible d'une infinitˆ' de mouvemens divers, et de modifications diverses," and this is the universal claim of the materialists.

[10]: Professor Burdach (as trad, par Jourdan), in speaking of the

productive power of nature, says, "Limitˆ'e quant ˆ¡ l' ˆ'tendue de ses manifestations, elle continue toujottrs d' agir pour la conservation de ce qui a ˆ'tˆ' crˆ'ˆ', et, quoiqu' elle ne maintenue les formes organiques supˆ'rieures que par la seule propagation, il ne rˆ'pugne point au bon sens de penser qu' aujourd' hui encore elle a la puissance de produire les formes infˆ'rieures avec des elˆ'ments hˆ'tˆ'rogˆ'nes, comme elle a crˆ'ˆ' originairement tout ce qui possˆ'de l' organisation." This shows that its author believed in the possibility of the "superior organic forms," like the mastodon, megatherium, etc. from the "heterogenetic elements"--those undergoing every conceivable change--as well as the "inferior forms." At all events, it is a legitimate induction from materialistic premises.

[11]: This point is conclusively made by Professor Burdach, who says (we quote from Jourdan); "La tendance interieure ˆ¡ la configuration existe avant sa manifestation." And by his _tendance interieure_ he must mean some vital or other law, equivalent to an _entia_ in matter, which results _in_, not _from_ manifestation.

[12]: Goethe borrowed his idea of an archetypal world from Plato and the Eleatic school. They held that the world was originated, and not eternal; that it was framed by the Creator after a perfect archetype, one eternally existing in the divine mind, if not an actual soul-world of which our own is but the reflex.

[13]: In a note to Prof. Bastian's "Beginnings of Life" (vol II. p. 537) an important fact is mentioned as obtained from the writings of Dr. Schneider, to wit, that _Nematoids_ (microscopical forms) may be "obtained at will," almost as readily as mushrooms, by a process entirely independent of spores. For instance, small pieces of beef were carefully examined to see if they contained any of the ova of Nematoids, and, finding none, they were buried in a small quantity of earth (also carefully examined for the presence of Nematoids or their ova) in a gallipot. "After three weeks," says Prof. B. "this earth was found to be absolutely swarming with two kinds of Nematoids--quite different from any forms which I had previously, seen, although I had been seeking them for more than two years previously in all sorts of situations." The reason why he had not found them previously, was because the "necessary conditions" for their appearance had not been obtained by him, or he had not sought for them in their proper environment. They were not produced "at will," but were the natural outgrowth of conditions, as much so as the spores of fungi, which make their appearance whenever and wherever the necessary environing conditions exist. According to Dr. Gros, it takes about three weeks for these Nematoid forms to develop into a reproductive state.

[14]: The necessity of turning plants and animals into "tramps" is just as great in the case of "Evolution" as in that of "specific creation in pairs." In both cases, we must insist upon geneological consanguinity. For the chances of any two highly specialized forms, originally starting on different lines of divergence, and ultimately

reaching individual identity, both in form and characteristics, is an impossible problem in the determination of chances. Consequently, Mr. Darwin finds the necessity of accounting for the presence of northern forms in the southern hemisphere, and the reverse, just as great as in the Linnˆƒan theory, which was fully accepted by Cuvier.

[15]: Burdach, in his "_Traitˆ' Physiologie" (Trad. par Jourdan_. 1837) says: "Effectivement nous rencontrons des traces de vie dans toute existence quelconque." This is as broad a panspermic statement as can be made, and is only true of inorganic matter so far as vegetable life is concerned, including such infusorial, mycologic, and cryptogamic forms as may lie so near to the "force vegetative" of Needham as to be indistinguishable from it.

[16]: In the case of volcanic islands, the upheavals were undoubtedly accompanied by deposits of mud, sand (ocean detritus), marine vegetation, and more or less animal matter, and these organic substances were washed down by the rains into the broken valleys and plains below, when land vegetation almost immediately made its appearance; not because seeds may have drifted thither by any of the different agencies that have been mentioned, but because organic matter can no more help bringing forth life in some form, when conditions favor, than salt water, when exposed to evaporation, can help crystallizing into its symmetrically-arranged salts. And the same would be true of all the coral islands, bringing up the organic matter of the sea to the influence of the light, the rains, and the dews. The islands thus formed in the Pacific Ocean begin to exhibit vegetable life almost as soon as they make their appearance above the reefs, and a line of sea-beach is formed about them.

[17]: These, while presenting the most varied and diverse forms of infusorial life, are nevertheless the most constant and abundant type. They abound more or less in all organic infusions. Ehrenberg, however, holds that they are no more animal than vegetal forms. They vary in length from 1/15000 to 1/2000 of an inch, and are consequently too minute to be satisfactorily classified in respect to all their diversified characteristics.

[18]: The extent of the southern ice-cap may at least be approximately reached from explorations already made. Capt. Weddell, in 1823, extended his explorations southward to within about 15´° of the south pole, where he found an open sea. Capt. Ross, in 1842, approached to within about 13´° of the same pole, without serious obstruction. It is true that, in the following year, he encountered ice barriers near the line of the antarctic circle, but they were floating barriers coming down from Weddell’s open sea. Capt. Wilkes, in 1840, explored a considerable portion of the Antarctic Continent, lying almost entirely within the antarctic circle. Other explorations have been made, showing that the southern ice-cap does not probably extend, continuously at least, much farther north than 78´° or 80´°, or to within some ten or twelve degrees of the south pole, independently of the packs of drifting ice in the otherwise open seas.

[19]: The truth or falsity of "Evolution" depends entirely on the successful solution of this problem, for the chances are quintillions to ones that no two identical forms could have originated from different centres, or from the same centre on divergent lines, and ever reached identically the same results. And how any two forms should happen to be sexually paired, on the same or different lines of divergence, is one of those inexplicable mysteries which must puzzle Herbert Spencer in all his labyrinthian searches into "Force-correlation," "Differentiation," "the Dynamic Force of Molecules," etc., etc. However successful he may be in other directions, he will inevitably fail in this. We must fall back on the grand Old Bible genesis for the solution of this difficulty, where every living thing was commanded to produce seed, or multiply and replenish the waters and the earth with offspring.

[20]: These transcendental or ideal forms may be said to correspond to the "spiritual essences" of Plato. They are the eternal, immutable principles which are discernible to the eye of the soul, as the sensible objects they represent are discernible to the eye of the body. Modern metaphysics may deem them mere abstractions, but a higher realistic philosophy will treat them as substantive forms, of which the objective reality is but the shadow.

[21]: Herbert Spencer may be quoted as authority on this point. He says: "There is invariably, and necessarily, a conformity between the vital functions of any organism, and the _conditions_ in which it is placed ... We find that every animal is limited to a certain range of climate; every plant to certain zones of latitude and elevation." And the same law holds good as to the marine fauna and flora, each specific form being confined to its own sea-depth, or distance north or south from the thermal equator.

[22]: Speaking of the ultimate principles or elements of matter, Plato is quoted by Humboldt as exclaiming with modest diffidence, "God alone, and those whom he loves among men, know what they are." It is only those who seek to eliminate God from the universe that speak with confident flippancy on the subject of molecular machinery and force-correlations.

[23]: As long as the evolutionists cannot agree among themselves as to what constitutes the process of evolution, it can hardly be expected that the public will accept their speculations as conclusive inductions. Professor Bastian, who strongly commits himself to the doctrine, thinks the word "evolution" arbitrary and open to many objections, while Mr. Herbert Spencer says;--"The antithetical word Involution would much more truly express the nature of the process."

[24]: "Know ye not that ye are the temple of God, and that the spirit of God dwelleth in you?" 1 Cor. 3. xvi.

[25]: Dr. Drysdale, in his work on the "Protoplasmic Theory of Life," says: "Matter cannot change its state of motion or rest without the

influence of some force from without. True spontaneity of movement is, therefore, just as impossible to it as to what we call dead matter.... So we are compelled to admit the existence of an exciting cause in the form of some force from without to give the initial impulse in all vital actions." In all life-manifestations, this "force from without," must be a pre-existing vital principle operating to effect the otherwise impossible change in matter.

[26]: A favorite set-phrase of Professor Bastian in speaking of morphological cells or "units," as he sometimes calls them.

[27]: That great and justly celebrated naturalist, Buffon, in speaking of the universal origination of the lower forms of animal life by a process termed, in his time, "spontaneous generation," says: "There are, perhaps, as many living things, both animal and vegetable, which are produced by the fortuitous aggregations of ’molˆ'cules organiques,’ as there are others which reproduce themselves by a constant succession of generations." It is said that Buffon was for some time associated with the Abbˆ' Needham in his experiments in vital directions, and was much influenced by them. So that it is by no means certain that he did not accept the Abbˆ''s "force vˆ'gˆ'tative" in place of his more materialistic views respecting "molˆ'cules organiques." At all events, his statement that as many living things appear in nature independently of reproducing causes as by successive generation, is no doubt true.

[28]: M. Trˆ'viranus, who followed Spallanzani and M. Bonnet in these flask experimentations, first noticed the important fact that the animalculˆƒ appearing in different organic infusions, depended on the nature and quality of the infusions themselves, and that the changed conditions of the same infusion produced new and independent forms of life.

[29]: Leibnitz, as quoted by M. Bonnet, says:--"Que l’Entendement Divin ˆ'toit la religion ˆ'ternelle des Essences; parce que tout ce qui existe existoit comme de toute ˆ'ternitˆ' comme possible ou en idˆ'e dans l’entendement de Dieu. J’exprimerai cette vˆ'ritˆ' sublime en d’autres termes: le plan entier d’univers existoit de toute Eternitˆ' dans l’entendement du Suprˆ“me Architecte. Tou tes les parties de l’univers et jusqu’ an moindre atome ˆ'toient deffinˆ's dans ce plan. Tous les changemens qui devoient survenir aux diffˆ'rentes pieces de ce Tout immense y avoient aussi leurs reprˆ'sentations. Chaque etre y ˆ'toit figurˆ' par ses characteres propres: et l’acte par lequel la Souveraine Puissance a rˆ'alisˆ' ce plan, est ce que nous nommons la Crˆ'ation."

[30]: Here is a fact given us by Dr. F. Hall, of Wallingford, Conn.: In a peat meadow in that town, owned by him, which was at no time subject to overflow, a large quantity of peat had been removed at different intervals of time, when the excavations naturally filled with water. In these excavations there appeared not only the _Cyprinidae_ in considerable numbers, but fresh water clams which grew to be as large as those in the most favored streams. They made their

appearance the very first season after the peat was removed, and have flourished there ever since. In no other portions of the meadow were there any fish or clams ever noticed before, nor was there any other source of water-supply than the rain-falls in that locality.

[31]: Professor Beale, in one of his very latest works says: "Of the chemical and physical forms of energy something is known, but of the relationship of the so called _vital_ energy, nothing has been proved. We only know that the influence it exerts is altogether different from that which has been traced to physical and chemical energy."

[32]: It is admitted, even in the case of _Bacteria_, whose movements are the most uniform, that they are sometimes so inert and languid as to show no movements at all; while, at other times, they exhibit mere Brownian movements or those no more nearly allied to "life" than the minute particles of carbon escaping from the flame of a kerosene lamp. And among the most distinguished microscopists, it is a question whether these infusorial forms, those exhibiting the most active oscillations, are really vegetal or animal in origin; in other words, whether they are _Fungus-spores_ or _Torula_-cells, or whether they may not be some intermediate forms.

[33]: The difficulty of assigning any definitional value to a "primordial germ" is due to the vagueness of idea attached to it in the popular mind, as well as to the diversified theories and speculations of the scientists concerning the origin of life. We can only define it as a "vital unit," as the chemist defines his smallest conceivable quantity--his "primary least"--of an element, as a "chemical unit."

[34]: Let two comrades be shot at the same instant in battle, the one through the heart, and the other through the arm, shattering it badly. What is there to prevent the surgeon from taking a piece of bone out of the arm of the man shot through the heart and instantly killed, and using it to make good the arm of the man still living? Apparently nothing but that the dead man’s bone will not knit. He may not have been dead five minutes, and Professor Beale’s bioplasts might still be at work spinning matter and weaving tissue for the integrity of the displaced bone. Why will it not knit? Simply because the vital principle that differentiates matter is gone--can no longer act. If the integrity of the bone depended on the action of the molecules, and not on the vital principle, there is no reason why this experiment should not be a success. For the molecules are all there, and their action will not be disturbed for hours after the death of the man shot through the heart.

[35]: It is safe to adhere to the Leibnitzian axiom, _Natura non agit saltatim_.

[36]: One of the most cultured classes of Christian believers in our day, holds that "all life is from the Lord;" that "He is the fountain, and we only the streams thence." And this, they claim, is true of all life. To "take away our breath," therefore, is to cut off this

stream perpetually flowing from its invisible source--the fountain of all Life. When scientific methods substitute for a first cause a mere resultant effect, all primary principles disappear in their intermediates.

[37]: Professor Marsh, of Yale College, has predicted that the "missing link" will be found in Borneo--evidently not crediting Mr. Stanley's statement about its presence in the interior of Africa. But one "missing link" is hardly enough; there ought to be an extensive family of them to complete Mr. Darwin's plexus. From the lowest genetic form to the anthropoid ape is a distance which does not half cover the length of this plexus--the immense gap between the monkey and the man being decidedly the greater length of chain. And yet the first half of the chain is traversed by innumerable forms--millions of links, so to speak. How, then, is the greater length of the plexus to be covered by a single "missing link?" A long line of caudal ancestry must be dug up, therefore, in Borneo, and shipped to the Peabody Museum, before this tremendous stretch in the chain of animated nature is satisfactorily accounted for. Borneo must be exceedingly rich in osteologic remains, even to bridge the chasm between its own ourang-outangs and the Dyaks, or aboriginal inhabitants, of that island.

[38]: This daring hypothesis of the materialists is so utterly repugnant to all our ideas of a perfected Cosmos, that we have no patience with those advancing it. It is, at best, speculation run mad, and is based on no other assumption than that of the inherent imperfectibility of the universe as it came from the hand of God, or from the dynamic play of molecules extending throughout vast geognostic epochs.

From a materialistic stand-point this assumption of imperfectibility inevitably runs into the _reductio ad absurdum_. For if, in the play of the material forces of the universe, an infinite duration of past time has effected nothing but mutually disturbing and re-adjusting movements and relations among cosmical bodies, then an infinite duration of time to come can effect nothing but similarly mutual adjustments and re-adjustments in respect to such bodies. With an infinity of time, space, matter and motion, everywhere presenting a unity of phenomena in the universe, "there can never be anything," according to the great Stagirite, "unconnected or out of place, as in a bad tragedy." Conservation must, therefore, be the rule, and desinence the impossible exception.

But these adherents of inherent imperfectibility instance the fact of vanished and variable stars, as well as those that have suddenly appeared, and, after brief periods of intense brilliancy, as suddenly disappeared, to show that there are mighty disturbances in the sidereal heavens which entirely negative the idea of "conservation" as a geognostic law. But the phenomena of variable stars, with all their apparent irregularity of motion and fluctuations in luminosity, are now being traced to definite and well-determined laws of motion, if not of light, while the theory of

extinguished and disappearing stars belongs exclusive to the age of Tycho Brahe. Where there is one self-luminious body (or sun) in the interstellary spaces, there are probably not less than forty non-luminous or dark cosmical bodies revolving about their respective centres of light and heat, as the attending planets revolve about the common centre of gravity in our own system. And this is especially true of that vast and fathomless star-stratum, called the Milky-way, in which most of these peculiar phenomena occur, with the exception of the variable stars only.

That stars should vary in their intensity of light by the probable transits of these dark cosmical bodies across their discs, is no matter of wonder or astonishment: on the contrary, it is surprising that these sidereal phenomena do not occur with much greater frequency. This would inevitably be the case if the planes of revolution, in the case of these non-luminous bodies about their central orbs, were coincident with the lines of vision from our own planet--a circumstance by no means improbable from the vastness of the sidereal heavens and the innumerable hosts of stars marching therein. Besides, these periodical variations may be accounted for in part--especially in the case of double stars--from their apparent rather than real change of place in the heavens. For if our sun-system is travelling towards a point in the constellation Hercules at the rate of 194 thousand miles an hour (the rapidity of Arcturus' flight), it is impossible to determine, in the present state of astronomical knowledge, whether the apparent change of place in any star is real or merely optical. But, in the case of double stars, each is travelling (independently of its other motions) about the common centre of gravity obtaining in its own system, and these relative movements may account for the greater or less intensity of light as the two stars, viewed as one, present a greater or less area of luminosity in their united surfaces.

The assumed revolution of one of these stars about the other--thus destroying all the known analogies of the universe, as exemplified in our own system--may be accounted for in the same way. With stupendous planetary systems revolving about each of these apparently double stars, they must respectively have a revolution, real as well as apparent, about their own centres of gravity--not one and the same centre, but different and far distant centres. Lying in nearly the same line of vision, with planes of movement at right angles with it, they would necessarily present the appearance of one star revolving about the other--an _apparent_ motion only.

And the writer here ventures an explanation of the phenomena of _temporary_ stars, or those making their appearance in the heavens, flaming up into stars of the first, second and third magnitudes, and then disappearing altogether. The most remarkable of these stars, or _apparent_ stars, was that of Tycho Brahe in 1572, presenting its maximum brilliancy at the very first, but gradually diminishing in size until the end of seventeen months, when it disappeared, without change of place, from the heavens. This temporary star was visible in Cassiopeia, on the verge of the Milky-way, within whose swarm of

stellar worlds most of these apparent stars have made their appearance. Tycho Brahe, in seeking to account for this stellar phenomenon, advanced the theory that stars might be "formed and molded out of cosmical vapor," or "vapory celestial matter," as the elder Herschel put it, "which becomes luminous as it condenses (conglomerates) into fixed stars." But any such rapid condensation of "vapory matter," in the light of Laplace's "nebular theory," is manifestly too absurd for scientific recognition. A more satisfactory explanation may be here suggested:--Supposing the apparent relative position of any six or seven stars of the sixth magnitude in the Milky-way, should be so changed by the combined motions of our sun-system and of the stars themselves, as to throw them into one and the same line of vision, but so clustered together as to show their several star-discs as one, we should unquestionably have a star of the first magnitude, which would continue as long as this extraordinary stellar conjunction should last. As one after another of these stars should fall out of line, by reason of the combined motions named, the apparent star would be diminished from the first to the second magnitude, and so on until it reached the sixth magnitude, when it would pass beyond the reach of unaided human vision. But as the star of Tycho Brahe suddenly appeared at its fullest brilliancy, it may be objected that this suggested theory fails to meet the required conditions.

As 18,000,000, out of the 20,000,000, of telescopic stars lie in the Milky-way, it is not by any means improbable that such a conjunction of stars may occur therein as often at least as once or twice in a century. We certainly see brilliant patches of closely-crowded stars, in great numbers, in this galactic zone, and the fact that these temporary stars almost uniformly appear in that zone renders the suggestion here made quite as rational, in the way of speculation at least, as that of "vapory celestial matter" suddenly condensed into a star of the first magnitude, as Sir. William Herschel would have us believe was possible, if not probable.

Besides, it is a definitely ascertained fact that such clusters of stars, lying in almost the same line of vision, exist in various parts of the heavens, which present to the naked eye the appearance of a star of the fourth or fifth magnitude, and probably would, if more thickly clustered, present that of a star of the first magnitude. But powerful telescopes resolve them into a large number of stars, from the thirteenth to the fifteenth magnitude. One such cluster in Andromeda's girdle has been resolved into not less than fifteen hundred small stars of very low magnitude, and pretty widely scattered in the telescopic field. Alexander Von Humboldt, in speaking of stars that have thus disappeared, says that "their disappearance may be the result of their motion as much as of any diminution of their photometric processes (whether on their surfaces or in their photospheres), as would render the waves of light too weak too excite the organs of sight." And he adds: "What we no longer see is not necessarily annihilation," repeating at the same time the question of Pliny--"_Stellˆƒ an obirent nascerenturve?_"

But another, and (to our mind) more satisfactory, explanation of these stellar phenomena, may be hazarded in this connection: There are, for instance, in the Milky-way, among the more brilliant clusters of stars, dark granular spots, of greater or less magnitude, in which the most powerful telescopes show no glints or traces of stars. They are among Humboldt's smaller "fissures or chasms in the heavens," in which he asserts that there is a great paucity of stars, or none at all. Now, if one of these thick stellar clusters, which show to the naked eye as a single star, should, by the combined cosmical movements of our sun-system and the stellar group in question, pass into the field of one of these small rents or "fissures" in the galactic curtain--that lying in front of the stellar cluster--it would immediately show as a star of possibly the first magnitude, and would continue to shine as a star of that magnitude so long as it remained in the field of the narrow rent or fissure. It would shine out suddenly like a star through a rift in the clouds of a dark night, and disappear as soon as it had traversed, or apparently traversed, the rift in question. This galactic curtain, it should be borne in mind, is made up of 18,000,000 of stars, or sun-systems, and not less than 720,000,000 dark cosmical bodies revolving about their respective centres of gravity. If the "nebular theory" of the universe be true, this is unquestionably the exact condition of things in the Milky-way. Of the more distant stars in this crowded galaxy, we can only catch, even in the telescopic field, mere glints of light as the intervening swarms of stellar and planetary worlds thicken in the foreground and shut out the more distant view. It is only through these rents and fissures in this great galactic curtain that the brighter stellar clusters beyond can ever be seen; and these glints of far distant light, showing dimly through this curtain, may account for the peculiar _milky_ appearance of the galaxy, arising from the loss of chromatic power in the full beams themselves. It was undoubtedly through one of these rents in the galactic curtain that the condensed starry cluster of Tycho Brahe suddenly made its appearance in the outer fringes of the Milky-way, and remained visible for a period of seventeen months.

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