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LESSONS IN
SCHOLASTIC PHILOSOPHY

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WITH AN OUTLINE
HISTORY OF PHILOSOPHY

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attained, and of the various relations existing between the elements to be co-ordinated or subordinated in order to attain it

Hence, a *constant ordered* arrangement of many distinct elements, *of themselves* unintelligent, and indifferent to this arrangement or another, requires intelligence as its proportionate efficient cause. This is a simple metaphysical principle universally recognized by the common sense of mankind. It is, in fact, an immediate application of the Principle of Causality.

Supplementary Article.—Beauty.

85. Beauty is that property or perfection in things, on account of which their *mere perception,* apart from *use, possession* or other advantages, *pleases;* "perfection giving pleasure to the *beholder."*

That an object be beautiful, therefore, it must be (1) perfect in entity and action; (2) all its elements, really or virtually distinct must be duly proportioned and harmoniously related to each other; (3) this perfection and harmony of parts must clearly manifest itself to the beholder.

Wherever, therefore, these three elements are found in any object, whether of the spiritual or material order, there we have beauty, the "splendide perfectum."

86. As only intelligence can apprehend *completeness* and *harmony* of elements, it follows that the intellect is strictly the aesthetic faculty; as our power of reasoning may be cultivated and perfected, so our *taste* or power of apprehending and enjoying beauty may be perfected by culture.

PART THREE

COSMOLOGY

I. Cosmology is, The science of the material universe. Its material object is corporeal substance and its nroperties. Its formal objects are the ultimate supra-sensible causes of the same. As the ultimate escient, *final* and *exemplary* Cause of all finite Beings is the subject-matter of Natural Theology, we shall confine ourselves here mainly to the investigation of the ultimate *material* and *formal* causes of corporeal substances, their properties and phenomena.

We start with the data of observation and experiment, and applying rational principles to these we shall deduce a systematic body of ultimate truth in regard to the nature and properties of corporeal substance in general and of the three highest genera into which it is divided, viz.: the mineral, vegetable and animal kingdoms of nature.

We may conveniently divide our subject into three Chapters:—

I. The General Properties of Corporeal Substance.
II. The Intrinsic Constituents of Corporeal Substance.
III. Organic Life.

CHAPTER I.

General Properties of Corporeal Substance.

We may group what we have to say on this subject under two heads, viz.: I, Quantity; II, Motion.

Article I.—Quantity.

2. Quantity.—The most obviously manifested property of bodies is *quantity,* i. e., that property in virtue of which they are extended, have parts outside parts, are divisible and occupy space; so that different parts of the occupying body correspond to different parts of the occupied space^

Omitting other senses in which the word *quantity* may be used, we speak here only of continuous quantity. This is had when the extraposited parts are bounded by common limits, that is to say, the parts into which the extended substance is *divisible,* but *not* divided have, antecedently to division, no extremities of their own distinct from those of the whole^.. We have in reality but *one* thing, though that one thing is *divisible* into many parts, i. e., it is *actually* one; *potentially* many.

3. That we have the concept of such continuous quantity is undisputed: the whole science of geometry is based upon it. Let us briefly analyze its contents. Take, for instance, a cubic foot of continuous extension, prescinding from.the particular substance to which it belong. Extension thus conceived is *mathematical* quantity. It has three dimensions: length, breadth, and depth, or thickness. The *solid* is bounded or terminated by *surfaces;* the surface, by *lines;* the line, by *points.* A point has no extension; a line, neither breadth nor depth; a surface, no depth. Points, lines and surfaces, then, are but the *limits* or extremities of linear, superficial and solid extension, respectively, and have no positive entity of their own apart from that of the extension they terminate.

Note.—All actual extension, therefore, is represented by lines, surfaces, or solids, i. e., extension of one. two or three dimensions. This may be expressed algebraically by the symbols x, x^2, x^3 *e. g,t* 'an inch long,' 'an inch square,' 'a cubic inch.' Bm if we go on, in the same sense of the terms, to write

it becomes impossible to realize or to conceive a

geometric figure which such a symbol might represent. Hence, the *N-dimensional* extension of the non-Euclidean geometry becomes when applied to continuous quantity a mere *algebraic illusion.*

4. Continuous extension of whatever kind is necessarily *divisible.* But how far is it divisible? Take a line an inch long, for instance, halve it, take half of that half again, and so on, as often as you please. Shall you ever reach a part which is incapable of further division, that is to say, unextended? Clearly no; for, if you could divide the line into unextended points, then the sum of these points should give you the line, and you should have O, O, O, etc., equals 1 inch. In the same way, it is obvious that a surface cannot be divided into a sum of lines ; or a solid into a sum of surfaces. Hence, continuous extension is divisible into parts which are themselvesextended and, therefore, *indefinitely* divisible.

Note.—In the preceding paragraph we have been speaking of the divisibility of continuous quantity *as such,* i. e., considered in itself and without regard to.the *substance* to which it belongs. If we consider, however, the *quantified* corporeal *substance,* then we admit that there is a *minimum* beyond which division cannot go, atoms in the literal sense of the word. Thus, there is a *minimum quantity* of material substance required for the smallest existible portion of O-, C., H., etc. But in all these cases the indivisibility is due, not to the *quantity* as such, but to the *nature* of the *substance.* "Corpus *mathematice* acceptum divisible in infinitum; corpus *naturale* non est divisible in infinitum * ♦ * sed requirit determinatam quantitatem."

5. But, again, we may ask: In what sense are the parts into which it is divisible contained in the undivided continuous whole? A quantitative part implies two things, viz. : (1) a positive extended reality, (2) with limits or extremities of its own so that it is impossible to conceive a part without conceiving it as terminated by limits of its own independent

of those of the whole of which it is part. Now, in continuous extension we have the *positive reality,* but not the independent boundaries; consequently, we have no *actual* parts; we have *actual* unity and only *potential* plurality. Hence, if we are asked how many parts are there in a given continuous line, we answer there *are no* parts; there *may be* more than you can think.

6. But now we go on to ask, Is continuous extension a real property of bodies in the world around us *(physical* quantity)? or are the bodies we see and touch made up of a multitude of unextended mathematical points? The question is general; nor do we care for the moment to inquire whether the larger tangible masses around us are themselves continuously extended, or merely composed of contiguous smaller masses which are so continuously extended. We are satisfied here, if it be admitted that there is in nature an objective reality corresponding to our concept of continuous quantity. Now, we say it is absurd to maintain that the extension and the extended resistance which our senses perceive in the material world can arise from a multitude of unextended points. For, either these points are contiguous, and then, as they have no extension either of length, breadth or solidity, any number of them touching each other will give us, as far as extension is concerned, only O, O, O, etc.=O; or they are not contiguous, but separated from each other by an interval, and then, as unextended points do not occupy space, the visible tangible universe becomes in reality an unoccupied vacuum; and extension a subjective illusion projected upon a background of nothingness. Nor will it help to say that it is the motion of these points, in space which furnishes the basis of our perception of continuous extension. For, to perceive the motion of an object is simply to perceive the object itself as it moves from place to place; but here the object is imperceptible, and, consequently, its motion and the path in which it moves are imperceptible. We conclude, therefore, that our concept of

continuous extension is verified in the corporeal substances around us, i. e., that bodies have continuous extension of dimensions.

Note.—Some have supposed that the continuous extension we perceive can be accounted for by supposing that bodies are made up of unextended points of *force* separated off from one another and acting across the interval which divides them.

In this supposition, we ask what sort of a being is it that bridges over the vacuum between unextended force centers and gives us the continuity we perceive in our own bodies and in the material world around us? *A substance?* Then we have real extension. An *accident?* Then we have an accident self-supporting, an accident which is not an accident but a substance and extended so as to fill the interval. *Nothing?* Then the continuous extension which our senses, whether alone or when aided by the most powerful physical instruments, cannot help perceiving is merely an inevitable *illusion,* and idealism and scepticism are the necessary logical consequence.

It is true that science reveals that many bodies which seem to be continuous to the unaided senses are in reality *porous.* But science, too, reveals and requires true continuity, and in order to account for the propagation of light, etc., fills all those ultimate pores with hypothetical *ether,* itself a continuously extended and highly elastic material substance.

7. Continuous quantity, then, is a real property of bodies. In what does it formally consist?

In corporeal substance we may consider many characteristics, all of which are more or less closely connected with that actual extension in space from which we derive our concept of continuous extension. Thus (a) we may consider the corporeal substance in itself; and this of its very nature, as distinguished from spiritual substance, implies entitative parts and parts; (b) we may consider this multiplicity of parts as continuously connected and extraposited in a certain determinate order in relation to each other; (c) we may consider this

internally quantified body as actually occupying a definite portion of space.

Now, the mere multiplicity of parts included in the essential concept of corporeal substance in no way corresponds with our concept of continuous quantity. On the other hand, the actual extraposition of continuous parts in a definite order in relation to space implies as *prior* to itself their extraposition in a definite order in relation *to each other.*

Hence we say that the *formal* or *primary* effect of quantity consists in the continuous extraposition of the parts of a substance in *relation to each other* whence flows its connatural aptitude and capacity to occupy space. Hence, quantity may be described as a property which gives to corporeal substance *internal* continuous extension in virtue of which it becomes *capable* of occupying space and *actually* does occupy space unless the ordinary laws of nature are interfered with.

8. That this property must be conceived as a positive perfection not included in the adequate essential concept of corporeal substance is clear from what we have just said. But we may go further and ask, If the *substance* and the quantity of a body are *two distinct things?* Long ago the old Greek philosophers by mere "discourse of reason" arrived at the conclusion that the substance of a body is one thing; its quantity, quite another. For, as they said, the *corporeal substance, e. g.,* of a fig-tree or of a crystal of sulphur, is certainly something different from the *property* which extraposits their entitative parts in the *order* which they naturally take and gives them the *power* of occupying a definitely outlined portion of space.

This property would then be an *absolute accident* of corporeal substance, nor could any valid reason be assigned why it could not be *miraculously* sustained in existence from the corporeal substance in which it connaturally inheres.

9- Variability of Volume.—*External local extension,* we have said (6), is a connatural result of quantity. Now, is this external extension—this *actuation* of the quantified body's

aptitude to occupy space—*constant* under all. circumstances? Or is it *variable* within certain limits under the influence of natural agencies, *e. g.,* heat, pressure, etc.? The latter is the view of the plain common sense of mankind, and, philosophically speaking, seems altogether necessary to account for some of the commonest phenomena in nature, *e. g.,* 'the contraction and extension of bodies,' 'elasticity,' 'universal attraction,' 'the transmission of sound,' 'heat,' etc., etc. Indeed, if we deny this variableness of *real* volume, we must ultimately assume the existence of action at a distance, i. e., across a vacuum—"an assumption which may be made to account for anything; but it is impossible, as Newton long ago pointed out, for any one who has in philosophical matters a competent faculty of thinking to admit for a moment the possibility of such action."*

If, then, there are good reasons for maintaining that external local extension as a secondary effect of quantity is *naturally* variable within certain limits, there can be little difficulty in admitting that a quantified body may *miraculously* exist without any external local extension, i. e., with merely *aptitudinal* or *potential* external extension.

10. Impenetrability is that, *power* by which an actually extended body maintains its possession of the portion of space it occupies and hinders another actually extended body from simultaneously occupying it. But here again we must distinguish the *power* from its actual *exercise;* just as we distinguish between the power of thinking and its actual exercise. The *power* of excluding other bodies from the same place is an essential concomitant of quantity; but, though its actual exercise *naturally* follows upon its possession, just as actual local extension is a natural consequence of quantity; yet, there is no ground for denying that its exercise may be prenaturally modified or suspended by the all-controlling power of God. No power can be exercised without His free concurrence, and there is no reason why He should not modify or suspend this

* Tait & Stewart, "The Unseen Universe," p. 146.

concurrence in a particular case, when His Wisdom sees fit to do so.

II. Space.—From the actually extended bodies around us, we easily derive the concept of *abstract* continuous extension indefinite in length, breadth and depth, and this we can further conceive as of itself *unoccupied*—a sort of *receptacle of* an exhaustible capacity capable of containing extended bodies. This is the concept of *absolute* or *ideal space.*

In as far as it is conceived as occupied by extended bodies at rest or in motion/it gives us what is called *actual* or *real space,* which may, therefore, be described as the Interval of absolute space included within the ultimate limits of the existing corporeal universe.

Now, as it would be absurd to say with Kant that our concept of space is a mere arbitrary fiction of the imagination, without any sort of foundation in objective reality, so it would be no less absurd to say that space as such, i. e., considered as a mere receptacle of extended bodies really distinct from them, and independent of their presence or absence, is something real in itself and actually existing.

The true view avoids both extremes and holds that *what is conceived, i.* e., actual or possible extension, is real and objectively realized or realizable; though it is not realized or realizable *in the manner in which it is conceived,* i. e., as a mere independent capacity or receptacle.

If, then, we must answer the question, What is space? we answer that, in reality *actual* space is the total extension of the existing universe, conceived as one continuous container or receptacle of that which occupies it; *possible or ideal or absolute* space is the total possible extension of all existible bodies, conceived as one continuous container or receptacle in which they would exist and move, if they existed.

Note (i).—When absolute space is conceived as eternal, indestructible, limitless, etc., it is clear that these are attributes not of *actual* but of *possible* extension.

(2).—To avoid confusion of thought, we must take care to distinguish accurately between the *concept* of space as above described and the image which accompanies it in the *imagination.* The imagination being an organic faculty can represent objects only in terms of sensual perception, and so cannot represent, purely abstract notes, such as mere abstract extension; hence, it pictures space as a sort of phantom substance perfectly permeable and extending indefinitely in all directions.

12. Place.—Akin to the idea of space is that of *place.* When a body moves from one portion of space to another, we say it changes its place. It leaves the place it occupied and passes to another; but the place itself remains immovable: we never speak of a place as moving. Place, then, is an immovable portion of space shut off, as it were, from the rest of space by definite bounding surfaces in which the occupying body is contained as in a perfectly fitting receptacle.

Fixity, then, is a characteristic of place. But how can there be fixity where everything is in motion? For us, there can be only relative immobility, i. e., a constant relation of distance is preserved in regard to certain definite points on the earth or outside of it. Thus New York and San Francisco, though in motion with the earth and with the whole solar system, yet in regard to certain fixed points, *e. g.,* 'the equator, 'the poles,' etc., are immovable; and this *relative* fixity suffices to verify our idea of place.

The place of a body, then, may be described as, The voluminal interval enclosed within the bounding surfaces which immediately surround it, considered as immovable.

13. A *pinite substance* may be said to be ubicated or *in a place* in two ways, viz.: (a) *Commensurably,* when the dimensions of the occupying body correspond to and are measured by those of the occupied space so that the whole body occupies the whole place and different parts of the body different parts of the place. It is in this way that *corporeal* substances *naturally* exist in place.

(b) *Incommensurably* when the whole substance is whole in the whole place and whole in each and every part of it. It is only in this way that a finite spiritual substance, *e. g.,* 'the human soul,' can be said tp be in place.

Note (i).—Hence an actually extended *body* is referred to place by its *quantity,* which occupies a definite determinate amount of space. A finite *spirit,* on the contrary, is related to place not by its quantity (for it has hone), but by its energy or *activity,* which can be exercised within certain limits but not beyond them.

(2).—There is another mode of presence in a place, which we know of only through revelation. It may be called *sacramental* ubication and is realized in the Blessed Eucharist. The Body of Our Lord is not referred to place by its *own* quantity or activities, but by the quantity (miraculously sustained) of the bread which has been trans-substantiated. How this is accomplished we do not know. Reason is simply silent in presence of the mystery and has nothing to say for or against it.

(3).—Whatever may be said in favor of the *intrinsic possibility* of an absolute *vacuum,* it seems sufficiently certain that no such thing exists in the *actual* universe; else we could not rationally account for universal attraction, the diffusion of heat, light, electricity, etc.

Article II.—Motion.

14. Change.—(a) A thing is said to be *changed* when it has become in some way different from what it was before, i. e., when it has gained or lost some perfection. Hence the idea of *change* implies three elements, viz.: a previous condition of the thing, a new condition, the thing itself which has passed from the one condition to the other; or, as they say, a term *from* which, a term *to* which, and a *subject* which passes from the one to the other. In every change, then, we conceive something which ceases to be; something which begins to be;

and something which remains constant and common to both tenus.

(b) If one *complete substance* wholly ceases to be in order to give place to another and only the same *accidents* remain constant, the change is called Trans-substantiation. If one substantial *form* gives place to another in the same primordial matter, we have what is called a Substantial Change. If the same complete substance remains and the difference regards only its *accidents,* we have an Accidental Change.

(c) Again, when the terms, from one to the other of which, the subject passes, are *contradictorily* opposed—A and not-A—the passage from the one to the other is called an Instantaneous Change; inasmuch, as on merely leaving one term, the subject must necessarily be in the other. On the other hand, if the opposition between the terms is merely one of *contrariety,* and that in a broad sensé of the word, i. e., so that there is an assignable mean between them, *e. g.,* '10 deg. C., and 20 deg. C.,' the change is called Successive; inasmuch as the subjection leaving 10 deg. C., must pass through all the grades of the interval one after another before reaching 20 deg. C. Now this successive change, if *continuous, !,* e., without stop or break from starting point to goal, is what is called Movement or Motion.

(d) But before going on to analyze more fully this idea of motion we must notice one or two axioms which hold true of every changeable Being:—

1st—Every mutable Being is of. its nature a potential Being; for it is of its nature in a state of potency as to the possession or privation of a given perfection.

2d—Every mutable Being is, so far forth, an imperfect Being; inasmuch as it either has not the perfection in question; or if it has it is at least capable of losing it.

3d—That a mutable Being may pass from the state of privation to the possession of a given perfection, the *positive action* of an efficient cause is needed; else, we should have an

effect without a cause; while, on the contrary, to pass from possession to privation, it would suffice that the causal action which maintained the given perfection in existence be suspended.

15. Motion.—(a) All change then involves a *transition from potentiality to act;* and, if this transition is *successive* and *continuous,* we have *Movement.* Hence, Aristotle defines motion as 'The act of that which is potential, inasmuch as it is potential.' The Being in process of change has left the state of mere potency, but has not yet arrived at the term toward which it is unceasingly advancing; and, therefore, its motionis but a partial and incomplete actuation of its potentiality in regard to that term. When, then, motion is said to be an *Act,* our attention is called to the prior state of potentiality which is constantly being left behind; while, the words, of a Being in potency inasmuch as it is in potency, remind us that, though our subject has emerged from a mere state of potentiality, its actuation in regard to the term toward which it is tending is not yet complete.

(b) The two characteristics, then, of motion are *succession* and *continuity;* it is the passage of a thing successively, i. e., one after another, through «all the parts of the interval 'between two terms without break or halt. Hence, the difference and the similarity between continuous quantity and motion. They differ in this, that the parts into which extension is divisible exist *simultaneously;* while the parts into which motion is divisible exist *successively.* They are alike in this, that as it is impossible to assign, even in thought, a minimum of extension which is not conceivable as capable of still further division, so it is impossible to conceive a minimum of motion which is not further divisible : a *point,* if we may say so, of *motion,* like a *point* of *extension,* has no entity of its own apart from that of the preceding and succeeding parts which it connects or terminates.

16. Time.—(a) As for the perception of continuous extension in the world around us, we rise to the concept of *space;* so from the perception of motion within and without us, we elaborate our idea of *time.* What, then, is time?

Duration, in general, is defined as Permanence or perseverance in existence. Now, we can conceive a Being as existing without beginning, without end and without change or possibility of change in its substance or action so that it is absolutely, and in every sense .the same forever without any shadow of difference in-its full and simultaneous possession of all-perfect life. This duration is *eternity* in the strict sense of the word; and it belongs to God alone.

On the other hand, we can conceive a thing whose existence is rather a continuous *becoming and ceasing* than an abiding fact, i. e., whose existence is had only by parts, and in such a way that each preceding part ceases to be, just as the succeeding part begins, yet without break or interruption in the continuous succession of Before and After. Such is the *successive duration of* motion which gives us oùr idea of time.

Now, the whole corporeal universe and everything in it is inacontinual state of change or motion. From the perception of this concrete motion we naturally rise to the abstract concept of one uniformly flowing motion whose successive duration is conceived as co-existing with and measuring the various motions of all actual or possible moving things. This is the concept *of absolute or* ideal time.

That portion of this *ideal* evenly flowing successive duration which has been, or is, or will be co-existent with the *actual* motion of concrete existing things is what is called *real* time.

Time, then, as we have already said of space, is neither a mere baseless fiction of the imagination; nor yet, on the other hand, is it an independent entity in itself standing out apart from the concrete motion of actual or possible moving substances. *IVhat is conceived,* i. e., actual or possible successive duration, is real and objectively realized or realizable, but not

precisely in *the manner in which it is conceived,* i. e., as a mere successive duration whose onward uninterrupted flow is independent of and embraces and measures the concrete duration of all moving things.

(b) Wherever, then, there is continuous change or movement, there is successive duration; and, wherever there is successive duration, there is real time; and hence, as each changing moving thing in the corporeal universe has its own changes and motion, so *it* has its own intrinsic time. But just as we take one fixed standard of extension to measure the extension of other things, so we can take one particular actual motion to measure the duration of all other motion that takes place around us. Hence, as the motion of the heavenly bodies is the most even and uninterrupted we can find, we take its regular succession as the measure of our time.

Note (i).—A being is said to eixist *in* time inasmuch as it undergoes successive change or motion.

A being which endures unchanged along with other beings which are *in* time may be said to *co-exist with* time. It has and is (all that it has and is) unchangeably without any succession in itself, and its simple unaltered duration is *virtually* equivalent to the imperfect successive duration of all possible changing things.

(2).—The word Present is used in many senses in regard to time. Sometimes we mean an interval of time part of which is past and part of which is yet to follow, *e. g.,* the present century, 'year/ 'day/ etc. Sometimes we mean that small portion of time which passes while we think or say Now. In strictness, however, the present is that indivisible point which has itself no duration, but is conceived as a limit connecting the past and future. "Time speeds onward," says Seneca, "what is past is not mine, nor what is future; all of existence that is really mine consists of a point of fleeting time."

If we find it hard to explain to ourselves or to another, what time is, St. Augustine's words may console us: "What

is time? If no one asks me, I know: but if I am asked, and I try to explain, then I know not."

17. Turning now from motion in the abstract to the actual world of corporeal things in which we live, we find that it is a world of ceaseless change and motion. The *material* of which it is made is in constant circulation, now borne upwards to become living rosebuds or human hearts and brains and then, as if by an inevitable law, returning to the lowly condition of dead dust. Take any one of the most familiar substances around us, *e. g.,* 'the post to which you tie your horse'; what a volume it would take to chronicle the changes it undergoes in a single day! How much space it has passed through, as it moves forwards with the moving earth! how persistently it has been enticed to move this way and that by the manifold attractions of its fellow bodies! how it has been affected and modified by their chemical activities! how it has expanded and contracted in the heat and cold, etc, etc.!

All these changes that take place in corporeal substance, as such, may be grouped under two general heads, viz.; Substantial and Accidental Changes; and these latter again may be subdivided into Local, Qualitative and Quantitative changes.

A brief word, then on each of these four kinds of change, and we shall dismiss the subject of corporeal motion.

18. Substantial Change.—The ultimate inner nature of a Being is manifested to us by its properties and actions, as the source is revealed by the stream. Hence chemistry, as well as the common sense of mankind, makes similarity or difference in specific properties the test of similarity or difference in substance. Now, it is a matter of every-day experience that certain substances may be so transformed as to acquire wholly different properties, so that no trace of their former specific character remains, *e. g.,* to take a most obvious instance, 'hydrogen burns readily in the air, and oxygen supports combustion better than the air; while the properties of water into which they may be transformed are quite different and even

opposite.' Hence, we argue that since the specific properties are different, the sources from which they flow are different; and that, therefore, the substantial natures are different; and consequently that in such transformations we have true *substantial* changes.

Here, then, as in every change, something has passed from one condition to another—something from being one substance has become another—the source of the old *specific properties* has given place to a new one from which new specific properties proceed. Now, that determinable *potential* constituent which remains constant and common in both substances is called *Primordial* or Ultimate Matter, while the old determining *actuating* constituent that has passed away and the new one that has taken its place are called *Substantial Forms.*

Whatever may be said of the characters of these two intrinsic constituents of corporeal substance—and we are not concerned *to say* anything here—their *existence* is a fact which we cannot ignore; there is a Material Cause which remains constant in both terms of a substantial change, and there is a Formal Cause which is different in each.

Note (1).—It is not necessary to call attention to the difference between a Mixture, *e. g.,* 'gun powder,' and a Compound, *e.g.,* 'water'; the former *is a* mere aggregate, or collection of heterogeneous substances; the latter is strictly *one* homogeneous substance.

(3).—When chemistry writes, *e. g.,* 'Water as H,O,' the meaning is not that these substances are *actually* there, whidj. would be contrary *to all* experience, but that they are *potentially,* or better, *virtually there.* Just as when some misfortune befalls a newly-sown field which destroys the seed, the farmer may complain that he has lost his crop, though, in strict truth, he has lost not an actual, but only a potential or virtual crop.

(3).-—Composite bodies have spectra of their own different from those of their components. In the cases where the spectra of the original elements are clearly detected, the conditiens are such (extreme heat, etc.) that we are justified in saying that the compound substance, *as such,* has ceased to exist, i. e., that it has been decomposed into the primitive substances from whose substantial transformation it originated.

(4).—Substantial change is effected in two ways, viz: *by combination* when two substances, *e. g.,* 'H and O,' unite to form a third substance, water, different from either; or by *assimilation,* when a living being transforms by its nutritive powers other substances into its *own.*

(5).—The transformed substances are said to exist *virtually* in the compound, i. e., the compound has been formed *from* them and can be resolved *into* them.

19, Quantitative Change.—Actual extension we have already said is a connatural property of all corporeal substances. In virtue of this property and of the cohesive and resistive forces which accompany it, the parts into which a body is divisible are held together in continuous unity and maintain their occupation of a portion of space against each other and against all other bodies. Now, apart from these changes of *real* volume in *living* Beings consequent on nutrition, etc., it is necessary, as we have already said (8) to admit not merely *apparent* but *real* rarefaction and condensation, i. e., of a perfectly continuous solid, in organic substances in order to account, on the one hand, for the possibility of rectilinear motion, and, on the other, for the propagation of light, for universal attraction, elasticity, etc.

For either the corporeal universe is a perfect *Plenum of* inelastic particles; and then how account for the possibility of free rectilinear motion? Or there are parts of actual space *perfectly vacant;* and then how account for universal attraction for the propagation of light, etc., across the Vacua?

Here Quantitative Change, or *real* rarefaction and condensation, is one of the commonest phenomena in nature, and, as might naturally be supposed, accompanies more or less all other accidental modifications of quantified corporeal sub-

stances. Indeed, it is clear that an extended substance cannot be intrinsically modified without having its extension in some way or other affected by the change.

20. Local Motion.—The passage of a body from one *place* (n) to another is called *local* motion. If the whole body changes its place, we have what is called Molar Motion. If the whole body maintains the same relative place, while only its continuous parts are rarefied and condensed successively, and so change their relative places, we have what is called Molecular Motion.

Now, apart from the Spontaneous Motion of the animal world—obvious sufficient reason of which is found in faculties of the living Being, which are clearly distinct from the mere change of place—we say that, even in inorganic bodies, local motion is inexplicable, unless we admit the existence, in the moving body, of a real physical quality which is not the mere change of place, but its efficient cause.

Let us roughly illustrate what we mean. Take a baseball lying at rest in the field. It will never move itself, but it has the capacity or potentiality to be moved; and if you once actuate that potentiality, it will, if unhindered, keep the even tenor of its way long after the pitcher's name is forgotten. An *impulse,* or force, or quality has been actuated in it which will bear it on in a straight line forever with a steady velocity, unless some opposing force intervene to stop it or turn it aside.

Now, this impulse, or propelling force is something intrinsic in the moving body which is the immediate efficient cause of its continuous change of place. Hence, local motion, whether molar or molecular, implies an active force actuated in the moving body which is not local motion, but its cause. "Motion," as Silliman puts it, "requires a force to *maintain* it, as well as to produce it."

21. Qualitative Change.—All the remaining absolute accidents (Gen. Met. 50) of corporeal substances as such may be classed under one common head as *Qualities, e. g.,* 'shape,'

'color/ 'taste/ 'heat/ 'electricity/ etc. Now, if these things are objectively what our normally disposed faculties perceive them to be—and we cannot deny it without taking up a position which leads to absolute scepticism—then the existence of Qualitative Changes in the corporeal world is an obvious fact.

That these changes affecting as they do extended bodies in space should be accompanied by local change, molecular or molar, in the modified body, is, as we have said (18), to be expected. Nay, that to every *qualitative* change a certain measure of *quantitative* or *local* change should so exactly correspond, that the measure of one may be taken as the symbol of the other, is but what we should anticipate. But if one should go on to confound the two and say, *e. g.,* that different colors are *merely* different modes of local motion, he would be perpetrating the puerile sophism, that because two things are invariably associated, therefore one of them is the other.

For the rest, we might ask him, how does he know of the existence of the local motion? If he will not trust his senses when they tell him of the objectivity of light, color and heat, why should he trust their testimony to the existence of local motion?

Hence, as we do not object to a chemist using a certain formula for a compound substance, which expresses not what it is, but what it *may be resolved into;* so we do not object to a physicist expressing the various *qualities* of bodies, as far as may be *in terms of local motion,* provided it be understood that the formula represents, not the *quality* in question, but its invariable *concomitant,* or, perhaps, we might better say, *effect.*

22. So much then for the four kinds of change or motion. (Though substantial changes are not strictly Motion, still they imply motion, or successive Qualitative change, preparatory to the education of the new Substantial form.)

Now, as all change implies a transition from potentiality to act, and as such transition can only be effected by *active forces* actually exercising their energies, it follows that therç

are constantly at work in the corporeal world a variety of active forces as different in their specific character as these changes are.

On the other hand, these active forces could effect nothing, if there were not corresponding capacities or *potentialities* in material substances, reducible to act; the greatest artist cannot make a statue out of mere water.

Hence, recalling what we said in General Metaphysics (67 c) about the efficiency of Secondary Causes, we conclude that the corporeal substances around us are really endowed with a vast variety of *active* and *passive* properties by the *efficiency* and *actuation* of which all the wonderful cosmic changes we behold are produced.

But though all these cosmic phenomena result immediately from the *efficiency* of material forces; *yet* the measure, harmony, uniformity and constancy—the *finality,* in a word—of the *world's* motion as a whole can find its *sufficient reason* only in an Intelligence which has so adapted these blind activities and potentialities and so ordered their mutual relations that all work together for the universal good (Metaphysic, 71).

23. The Laws of Nature.—A law is primarily, A permanent rule of action. Now, ordinary experience shows us that the irrational natures around us follow uniformly and constantly each its own fixed mode of action, and hence, these constant uniform modes of action are called Laws of Nature. That many of these laws are known to us with certainty is also clear.

But we may ask further, how far are these laws necessary? As the very *existence of* finite beings is *contingent,* of course *their action is* also, absolutely speaking, a *contingent fact.* But supposing their existence and the existence of a *final* cosmic order *freely* determined by the Creator, how far is their mode of action necessary? To this we may answer again, that *supposing certain conditions present, the* mode of action of irrational beings is necessary, i. e., the laws of nature

are *conditionally* necessary. The conditions of which we speak are chiefly—(1) the *absence* of impediment to or interference with the natural action of the agent, (2) the *presence* of the ordinary divine preserving and concurring influence. Hence in a *particular* case the free Omnipotence of God can hinder, neutralize, elevate or otherwise modify the action of the creature for wise and worthy ends. Such a particular instance of deviation from the ordinary rule of action of a corporeal being can be recognized as easily as any other obvious fact, and upon proper examination of all the circumstances, can be known to be due to divine interference, on the principle that every effect must have a proportionate cause.

CHAPTER II.

The Intrinsic Constituents of Corporeal Substance.

This chapter may be divided into three_articles, viz.:

I. The State of the Question;
II. Unsatisfactory Theories;
III. Hylomorphism.

Article I.—State of the Question.

24. From what we have said in the preceding chapter, we may, in general, describe a body as a substance which connaturally possesses continuous extension of three dimensions, and is endowed with certain activities of powers of producing change in other Beings like itself. But reason will not rest satisfied with a mere generic description; it seeks a Real Definition. A knowledge of properties will not suffice: we want to know what the *substantial thing* is to which the properties belong; seeing the stream we wish to know its source.

We are in search, then, of a theory as to the ultimate inner nature of corporeal substance, as such. Now, it

would seem *to be* sufficiently obvious that we are not at liberty to construct a theory of the nature of bodies *a priori,* and then to force the facts with which all men are familiar into harmony with it; rather surely, the other way about, the familiar facts are the secure fixed data, while the value of a theory will depend wholly on its capacity rationally to account for them. Yet this plain rule is only too often forgotten. -Theories are daily invented and obtruded upon us, in regard to the intrinsic nature of corporeal substances, which, far from explaining, contradict the manifest facts; and when the plain man remonstrates that he with the rest of mankind is conscious of perceiving the facts he is calmly told, "So much the worse for the facts and for mankind that perceives them: they are mere illusions of sense."

25. Before proposing, then, any theory as to the ultimate forces corresponding to the various changes taking place, and intrinsic nature of bodies, let us set before us clearly and briefly one or two classes of facts which such a theory is bound to harmonize with and explain.

(a) We have first, what we may call the Antinomies of corporeal substances, *e. g.,* in one and the same substance, the unity and multiplicity involved in its continuous extension; its elective affinities and antipathies; its inertia and passivity on the one hand and its aggressive activity on the other, etc., etc.

(b) We have cohesion, elasticity, gravitation, universal attraction and the other physical properties common to all bodies to account for.

(c) We have, again, what are called Chemically Simple substances, i. e., those which are not chemically resolvable into specifically different substances, *e. g.,* 'H.,' 'O.,' 'C.,' etc., which though generally alike in possessing extension, divisibility, mobility and many other properties common to all bodies; yet are specifically different in density, affinities, active and passive properties, etc.

(d) Lastly, we have substantial changes (18) of two or more chemically simple substances into a new compound substance wholly different in specific properties from any or all of the components, yet resolvable into them and into them alone by chemical analysis, and so *virtually,* though not *formerly,* containing them. "Bear in mind that when we say that water is composed of H. and O., we mean no more than this, that by various chemical processes these two substances can be produced from water. * * * We cannot say that water consists of H. and O. * * * In all instances of true chemical union and decomposition, the qualities of the substances concerned in the process entirely disappear, and wholly different substances with new qualities appear in their place."*

Finally, these substantial changes are not effected at random, but require the combination of certain determinate substances according to fixed invariable laws of Definite Proportions, Multiple Proportion, etc.

26. Independently, then, of any hypothesis, we are safe in making the following syllogisms as to the ultimate nature of all corporeal substances.

(a) Properties which are not only different, but diametrically opposite, imply a difference in the substantial sources from which they flow. But the unity and multiplicity, the activity and passivity, etc., which are characteristic of every corporeal substance, etc., are properties not only different but mutually contradictory. Therefore, there is a certain *dualism* or *composition* in the ultimate intrinsic nature of every corporeal substance which a satisfactory theory of the nature of bodies must account for.

(b) If in a given class of substances there are certain properties *common* and constant in *every* individual of the class, while certain other properties are *peculiar* and constant in different *groups* of these individuals, then, the inner sub-

♦Cooke, "The New Chemistry," p. 98-99.

stantial nature of all these substances is composed of two principles, one of which is (homogeneous and the source of their *generic* likeness {the other,|heterogeneous and the source of their *specific* difference.| But it is a fact, that there are certain properties common to all corporeal substances, and certain others peculiar in different species of them. Therefore, all corporeal substances are composed of two principles, etc.

(c) In every substantial change, we must account for two distinct *substantial* principles, one of which is generic and constant in both terms of the change, the other differential and specific, which in union with the generic common element constitutes *a complete substance* of this or that peculiar species. But all corporeal substances are susceptible of substantial change. Therefore, in all corporeal substances we must account for the existence of two distinct substantial components.

27. To account for this *substantial dualism* in the nature of bodies is a problem which has occupied the attention of thinking men as far back as the history of philosophy extends; and well it may; for the answer to it will express the relation in which the Mind and Matter of which man himself is composed stand to each other.

Setting aside the Idealism which would make the whole substantial universe a mere illusory projection of the Ego upon a background of nothingness, and the Pantheism which maintains that all bodies are nothing but one eternal substance of God evolving, modifying and variously manifesting itself, all views on the subject may be reduced to one or other of the three famous theories: Atomism, Dynamism and Hylomorphism. If antiquity be a fault or newness a merit in a theory, all three have about equal claims on our consideration; for all three come to us from Ancient Greece.

The *Atomic* theory may be said to have been first proposed as a system of Democritus (about 400 B. C.) ; and Tait tells us that, as to what corporeal substance is, modem Atom-

ism "knows no more than Democritus or Lucretius did." The origin of the *Dynamic* theory is ascribed to Pythagoras (about 550 B. C.); it has never been popular, "rather a hobby of esoteric circles, than an accepted theory in schools of science." *Hylomorphism* dates from Plato and Aristotle (about 350 B. C.). Evolved and perfected by SS. Augustine and Thomas this theory has always held a prominent place in the history of philosophy.

We now proceed to examine briefly these various theories.

Article II.—Atomism and Dynamism.

28. Both these systems agree in supporting all bodies to be mere aggregations of immutable indivisible units, but they differ in the account they give of the character of these ultimate units. Atomism postulates atoms of *mass;* while Dynamism would construct the material universe out of atoms of mere *force.*

29. Pure Atomism, or as Tyndall calls it, "the mechanically intelligent theory of Dalton," supposes all bodies to consist of very minute, perfectly hard particles, "extended pieces of matter," in fact, "with shape and motion, intelligible subjects of scientific investigation." These particles, or mass atoms, have no inherent forces or activities of their own: they are merely the passive subjects or recipients of local motion of great velocity and complexity. Tait, for instance, tells us that in a mass of H, at ordinary temperature and pressure, each of these minute particles is moving at the rate of seventy miles a minute and collides with other particles and, therefore, changes its direction 17,700,000,000 times in a second. Where this motion comes from, we are not told, except that it does not come from the particle itself, but is communicated to it from without.

As to the nature of these particles there has been much variety of opinion among atomists. ^The common tendency at present is to regard them as perfectly *homogeneous,* either

all of hydrogen, or all of ether, or of some other kind of Cosmic Vapor, or Cosmic Dust, or Perfect Fluid, which is supposed to fill all space. All the various so-called substances in nature, simple as well as compound, all their differences, and all their physical and chemical properties "results," Herbert Spencer says, "from differences of arrangement (and local motion) arising from the compounding and recompounding of ultimate homogeneous units."

Sir John Herschel describes the whole theory briefly, as "one that resolves the entire assemblage of natural phenomena into the mere knocking about of inconceivably minute billiard balls (or cubes, or tetrahedrons, if that be preferred) which once set in motion and abandoned to their mutual encounters and impacts work out the totality of natural phenomena."*

Note (1).—This theory, when it is assumed, as is often the case, to account for *all the* phenomena, material, vital and intellectual, with which we are familiar, is called *Materialism.* It is the starting-point and fundamental assumption of all thorough-going evolution. "As we now understand it," writes H. Spencer, "evolution is definable as a change from an incoherent homogeneity to a coherent heterogeneity accompanying the dissipation of motion and integration of matter."

(2).—The reader will observe the vast difference between the Philosophical Atomism and the Atomic Theory with which he is familiar in the common text books of chemistry. Of this latter we shall have a word to say presently.

30. Now, setting aside for the moment all vital phenomena, is this theory, with its inert homogeneous atoms and purely passive local motion, a satisfactory explanation even of the inanimate material world in which we live? We think not; and, for the following out of many reasons which will naturally suggest themselves to any one who gives any thought to the question..

♦"Familiar Lectures on Scientific Subjects," p. 463.

1st—It does not answer Our question, what are the mtnnsic constituents of corporeal substances? It tells us that all bodies are made up of what? Of other little bodies, each of which, as being *an extended piece of matter,* exhibits in its unity, and divisibility, i. e., its continuous quantity, in its cohesion and resistive force, the intrinsic dualism of corporeal substance just as truly as a mountain does.

2d.—It explains all the manifold properties and *activities* of things by mere varieties in the position and motion of the *inactive* particles of the homogeneous atomic mass, i. e., its explanation is a denial of what it undertakes to explain. "The Kinetic theory," says W. Thompson, "gives not even a suggestion toward explaining the properties in virtue of which the atoms or molecules influence, one another." And, in another place, the same great physicist declares that the theory "is a dream and can be nothing else until it can explain chemical affinity, electricity, magnetism, gravitation," etc., which it is plain it cannot do ; for, no number of inactive zeros, arrange them as you will, will ever give you an active unit.

3d.—In like manner it explains away all the substantial differences between bodies by simply denying them. Gold and iron, water and coal-oil, sugar and strychnine, chalk and cheese are simply one and the same substance, with the slight *accidental* difference that the particles are variously grouped and are "knocked about" in various directions and with various velocities. Finally, we are left without *even a suggestion* as to why each chemical element is limited by nature to a select list of admissible companions; and the terms of its partnership (as io definite proportions, etc.) with every one of them are so strictly prescribed that no power in nature can alter them by the most trivial fraction.

31. If one asks how such a theory could ever be accepted, and become popular among reasonable men, the reason may be found:

1st.—In the natural tendency of the mind to reduce all things to some sort of unity and harmony;

2d.—In the tendency, equally strong, in our modern minds to do so in the easiest possible way without any very serious regard to the strictness of our method; hence, as the knocking about of billiard balls is a phenomenon familiar to most people, the formula Matter and Motion is a *delightfully* simple synthesis of all physical and chemical knowledge;

3d.—Lastly, the fact that *it is not* unpleasant for a troubled conscience to be permitted to hope that perhaps itself and its bad thoughts and deeds as well as its good ones are mere "modes of atomic motion over *which no fellow* has any control," may have contributed somewhat to the popularity of materialism.

32. As pure Atomism admits matter only and no force, so Dynamism will have *force* only and *no matter*. *Instead* of solid particles with mass, shape and size, it recognizes only *mathematical* points or force-centers dotted about in space and influencing one another, not by impact, but by action at a distance. If you can imagine an attraction (or repulsion) without any solid thing which attracts or is repelled; if you can localize this disembodied attraction in a mathematical point, and make it subject to the influence of other similar attractions; you can have some idea of a dynamical force-atom.

If you can make up your mind that such unextended force-atoms actually exist, and that all that we call corporeal substance is a mere aggregation of them; and that the difference between one body (simple or compound) and another, arises from a mere difference in the grouping and interplay of these mathematical force-atoms; then, you are a dynamist.

Your explanation of bodies refines away from the universe everything corresponding to our notion of corporeal substance: you deny extension and all substantial differences and changes: you reduce all our sense-perceptions to illusions; and hence, we cannot accept your theory. Though we may not enter with full sympathy into the first two items of Bossuet's criticism of it, we cannot help agreeing with the last when he says that it is "nova, pulchra, falsa."

33. We are compelled, therefore, to reject the purely Atomic and Dynamic hypotheses; because both fail to account for the substantial difference of bodies and for the substantial changes which are patent facts in nature; and because, moreover, the former denies all activities in corporeal substances, while the latter denies its extension and, we might almost say, its very existence. In a word, both fail to account for the essential dualism manifested in every body, great and small.

Yet both have a certain value, as seeking to express half truths. Atomism errs by attending only to the characteristics of bodies which are on the side of the passive homogeneous element in them: Dynamism attends solely to those which are on the side of the active element in them. When you synthesize both theories by assigning substantial sources of both orders of phenomena in the intrinsic nature of corporeal substance as such, you are at least on the way to a true theory of bodies. Now, this is precisely what Hylomorphism does, as we shall try to show briefly in the following article. But first a word on Chemical Atomism, as it is called.

\ 34. Chemistry recognizes the existence of some sixty-five or seventy specifically different bodies which, so far at least, have resisted all attempts to analyze them into chemically simpler bodies. Besides these, it recognizes a vast number of other specifically different substances each of which on analysis, i. e., by the destruction of the compound as such, yields two or more of the elemental substances in certain fixed proportions. Now, it is assumed and on good grounds that in the act of synthesis or analysis, each of the combining elements is divided up into the smallest quantitative parts in which it is naturally capable of existing. Immediately before actual

combination, these *atoms,* as they are called, are, at first, true substances of the same nature as the original masses of which *they* are parts, *e. g.,* 'an atom of H is as truly H as a gallon of *it.'* These specifically different particles under the influence of external agents act and react on one another in virtue of their mutual affinities until at *length the* nature of both *is* so altered that we have no longer distinct *atoms* of different substances, but perfectly homogeneous *molecules* of a new substance wholly different in properties from any of the original components. Hence, the chemist knowing the elemental substances from which these products spring names them after their ancestors, and thus expresses every compound substance in terms of two or more of the *sixty-seven elements.*

35. So far, we are all with the chemist. But should he go on to conclude, that since all bodies can be thus expressed in terms of his sixty-seven elements, therefore, the corporeal universe is nothing but a vast collection of very small bodies of sixty-seven different kinds and that all compound substances are mere groups of these small bodies; then, we tell him that his conclusion is not philosophical:

1st.—Because it explains an obvious fact (substantial change) *by* gratuitously denying it; and

2d.—That, even omitting this decisive objection, his explanation of the nature of bodies is, at best, *penultimate;* for, each of his sixty-seven elemental bodies exhibits all the dualism of an essentially composite substance; and the question is, what are its substantial components?

Of course, it is quite allowable and very convenient for the chemist to express a compound substance in terms of the elements from whose chemical combination it is derived: but it must always be remembered that in this, Chemical Atomism is, as Cooke says, "only a temporary *expedient* for representing the facts of chemistry to the mind:"* and that, as another

* The New Chemistry, p. 103.

great modern chemist adds, its symbolism is a device of language, not a representation of actual facts.

Article III.—Hylomorphism.

36. As has been said, every phenomenon of the corporeal universe asserts the intrinsic dualism of corporeal substance and manifests the presence in all bodies of two essential physical constituents really distinct from each other, viz.: *a homogeneous material principle* which is the source of their divisibility, mass, inertia and other generic properties, and *a differential dynamic principle,* which is the source of their unity, activity, specific properties, etc.

The former or homogeneous mass-principle, is of itself indifferent, potential, determinable as to being this specific substance or that, and is that constituent of bodies which remains common and constant in all substantial changes. The latter, or differential specific principle, determines the specific principle, determines the specific nature of the substance and varies in the various substantial changes which bodies undergo. Both are *incomplete* substances from whose intrinsic union a complete corporeal substance or body of this or that specific nature results.

Now if you call the former element Primal or Primordial or Ultimate Matter; and, the latter Substantial Form, you have in brief the hylomorphic ("matter-and-form") theory of the nature of bodies.

Of course, many questions remain as to the peculiar characteristics of each of these two ultimate constituents of bodies, their mutual relations, the passing away of old and the origin of new substantial forms, etc., etc.; but the existence, in bodies of a constant and a variable substantial element will not be

* Berthelot, Synthese Chimique, pp. 167-69.

questioned by any one who analyzes the idea of substantial change.

The *argument^ then,* for hylomorphism is based on the facts and reasoning given above (25, 26), and it is needless to repeat it here. Substantial changes are a fact. In a substantial change the *subject* is something substantial, and so are the constituents lost and gained; else, the change would be merely accidental. That the constant *subject* and the variable *terms* are really distinct is also clear, since the same *matter* is actuated successively by different forms.

37. As far as the general answer to the question, What are the intrinsic constituents of bodies? is concerned, we might safely leave the matter here; but the mind will feel more satisfied if we can determine a little more precisely the character of this Primal Matter and Substantial Form, their relation to each- other, etc. This we shall try to do very briefly, leaving a large unexplored field for the genius of the philosophic student to work in.

38. As to the ultimate -*material* element of bodies. It is not a complete substance, but an *incomplete* constituent of substance, the primal, constant, fundamental subject of substantia! changes. It is a positive reality; yet it cannot exist *alone* unactuated by any form any more than extension can exist without a definite shape and figure. It is indestructible except by annihilation: no force in nature can do more than substantially change it; hence, the law, as it is called, of Conservation of Matter, i. e., whatever the change, the *new* being will always give the exact *weight* of the elements from which it is derived. Of itself considered apart from the forms which differentiate it, it is perfectly inert and homogeneous, essentially needing *some* form, yet indifferent *to* all forms and always in potency and ready to receive the proportionate action which would substantially transform it. It is neither C. nor fruit or flesh, but is successively the material basis of them. alL The senses cannot perceive it: imagination cannot picture

it: reason alone can apprehend it, and is compelled to recognize it as the constant, passive, inert element in the constitution of bodies.

39. As to the *formal* element.

(a) It, too, is clearly a constituent of corporeal substance, not a *complete* substance in itself. It may be described as The ultimate substantial determinant which actuates and differentiates primal matter and, by its union with it, constitutes a complete substance of this or that specific nature. All the specific differences with which we are familiar in the actions, properties and nature of bodies come from differences in their *substantial forms.* As matter passes up the line of corporeal being from the state of a simple elemental body to the condition of living sensitive flesh, it is *informed* successively by a series of substantial forms each of which contains virtually and excels by a new degree the perfections of the lower forms which have gone before it, whose place it takes; just as a higher number contains and excels those below it. Hence, we have a sort of hierachy in substantial forms according to which the various grades of perfection in corporeal substances are determined.

(b) In the entire cosmic order we can distinguish four broad generic grades of substantial forms, viz.:

1st.—Those of inanimate bodies; *2d,* the vital principle in plants; 3d, the animal soul; 4th, the spiritual soul of Man. Of these four orders of substantial forms, the first three, as being wholly dependent on matter in their action and, consequently, in their existence and origin are called *material* forms. In each of these three orders of forms are included innumerable *specific* diversities in ascending degrees so that the highest species of a lower order just touches the boundary-line which separates it from the lowest species of the order above.

The human soul, on the contrary, as being independent of matter in its higher characteristic operations and, therefore, in its existence, its origin and its destiny is called a *spiritual*

form. Hence, in the human body, primordial matter reaches its highest level. Here it is *informed* and constituted a complete substance by its immediate union with a spiritual soul "a little less than the angels," proceeding immediately from the creative hand of God; so that the resultant compound, Man, unites within himself the two great words of Spirit and Matter into which all creation is divided, and, hence, is well styled a Microcosmus or Little Universe.

(c) The spiritual soul, or substantial form of man, needs, as we shall see later on, the immediate creative action of God to bring it into existence. But, leaving man out of the question, it is clear that in the three lower kingdoms of the irrational world, new substantial forms are constantly coming into existence, while others are as constantly disappearing.

Now, whence do these forms come? whither do they go? how are they produced in matter? An analogy drawn from a common accidental change will help us to understand the answer. Take a cube of soft wax and carefully model it into the shape of a rose. The new shape is something; for, it has cost you labor to produce it, and, if you are only skilful enough, it has given the wax a market value much greater than it had before. Now, whence this new perfection? You will say and rightly that the aptitude or *passive potency of* the wax and the *action* of the artist are sufficient to account for the new figure; or, in technical language, if you prefer it, that the rose-shape lias been *educed* out of the *potentiality* of the wax by the action of a competent efficient cause. If, again, I ask you, what has become of the cubic form which the wax originally had and lament that you have annihilated it, you will answer that you have done nothing of the kind, that though it is not actually there—since wax cannot, at the same time, be rose-shaped and cubic—yet it is *potentially* there and can be had back again by a little effort on the part of an efficient cause.

Finally, before leaving our simile, notice (1) that the wax is of its nature *indigerent* as to what shape it may have; (2)

that it must always have *some* shape; (3) that it cannot have *two* different shapes, *e. g.,* 'of a rose and a cube,' at the same time; (4) that, while *actually* in any given shape, it is still in *potency* to receive any of the other innumerable shapes which the artist's skill can give it; (5) that the change from one shape to another may require more or less manipulation on the part of the *efficient cause, e. g.,* 'it is easier to change our cube into a tetrahedron than into the figure of a rose'; (6) that the wax needs the action of a competent efficient cause external to itself to effect any change in its shape.

Now we can apply all this to what it called the Passive Evolution of Matter, if we only bear in mind that, in substantial changes, there is question of the *ultimate inner nature* of the body, not of its outer visible accidents.

Primal matter, of itself and theoretically considered, is indifferent to any of the innumerable substantial forms which can complete it as a substance and make it a body of this or that specific nature, *e. g.,* 'C' or 'human flesh. Yet it never exi'ts alone, but is always actuated by *some* form. It cannot, however, be at once actuated by *two forms;* else, it would be two specifically different substances at the same time. But while actuated by one form it is still *in potency* to receive any other form. Yet it is not always in *proximate* potency to receive *every form, e. g.,* 'matter under the pure elemental forms of C. Hi O. and N. without intermediate substantial changes, would be but doubtful nourishment for man or beast.' Hence, there is a fixed order in nature, according to which matter is gradually elevated from lower to higher substances. Again, even when matter is in proximate potency (owing to the substantial form by which it is actuated) for a new substantial form, it is not by every *agent* that the new form can be *educed, e. g.,* 'only a horse can transform barley into horse-flesh.' Lastly, when in matter thus proximately disposed, a new and higher form takes the place of the lower one preceding it through the action of proportionate natural causes, the new

form is not *created,* but *educed* from the potentiality of the matter so disposed. Nor is the old form which passed away *annihilated,* but reduced to *potency,* and it, with all its characteristic properties and activities, can again be actuated by efficiency of proportionate causes.

40. Such, in very brief outline, is the scholastic theory of the nature of bodies. It may seem, at first sight, subtle and hard to grasp, but when we come to examine it closely and, especially, to apply it to the solution of the great problems connected with vegetative, animal and Tinman life, we shall find that it is forced upon us with overwhelming cogency by the inexorable facts of nature.

CHAPTER HL

Organic Life.

" Article I.—Organic Life in General.

41. Definition of Life.—A *living* being is one which *moves itself,* which acts upon and perfects itself; one whose action as a living being begins and ends in itself.

The essential characteristics of vital action are, therefore, *spontaneity* and *immanence* as opposed respectively to the *inertia* and *transitive activity* of inanimate things.

42. Division.—Hence, we may classify the various *grades* of life with which we are familiar in the'world around us under three general heads according to the different degrees of *spontaneity* manifested in their vital action:—

(a) The vital activity may be exercised without cognition of any kind on the part of the living being, *e. g.,* 'a *plant simply assimilates* material substances,' i. e., changes them into its own living substances and thus develops and reproduces itself.

(b) Or the self-motion may imply cognition and appetition of *individual material objects* on the part of the living

being, but without *liberty,* or power of consciously determining the *end* of perceptions, desires, local motion, etc., in regard to the individual material objects around it.

(c) Or finally, the living being ,may be capable of cognition and appetition of *abstract, universalized* or *wholly immaterial objects,* and, consequently, endowed with liberty and with the power of apprehending and determinig the end of its actions. This "perfecta suique potens spontanéités"—this *self-controlled* spontaneity—is the characteristic excellence of *human life.*

43. Organic Life; i. e., *vegetative* and *sensitive* life, is exercised *in* and *by* a material organism. An *organism* is a *natural* material structure composed of various parts (organs) each of which exercises a special function in relation to the life of self-motion of the whole. The organism at first consists of a single cell of protoplasm which nourishes and increases itself by *assimilation* of external substances and then divides so as to form two connected cells. Each of these again in turn increases, divides, etc., until the whole organism of cellular tissue is built up according to a fixed specific type.

44. Essential Difference between living organisms and non-living bodies.

(a) In *Origin.* Living organisms are produced only by *living bodies of* their own specific type.

(b) In *Development.* By nutrition and growth they construct and preserve themselves according to a certain morphological type within certain limits of size and during a certain limited time, after which, they decay and disintegrate, even though all external conditions remain the same.

(c) In the *variety of functions* exercised by different parts of the same organic body.

(d) In the mutual *interdependence* of the different parts of the organism, so that all the organs *constantly* and *per sc* act for *one* ultimate result—the development, preservation and propagation of the whole organic being.

(e) Lastly and chiefly, in the character of the *action* of the organic being, which is *spontaneous* and *immanent* and tends, not to equilibrium or rest, but to continual self-perfective motion.

Note.—The formal or dynamic principle of organic life is called a *soul.*

Article II.—Vegetative Life.

45. This is the lowest, and in the visible world the most universal grade of life. The *lowest* because least independent of matter in its exercise, which consists in the development, conservation and propagation of a material organism. The *most universal, as being* common to plants, animals and men. Its chief functions are *nutrition, increase* and *propagation of* the organism.

46. Nutrition is that function by which a living organism converts external substances into its own. This implies various operations on the part of the living organism: *absorption* of external substances by roots, leaves, mouth, etc.; *digestion,* or preparation of these raw materials by various elaborate chemical processes; *circulation* of the food thus elaborated throughout the organism; and finally, *assimilation* or conversion of the food into the living substance of the organism. This last is strictly the act of *nutrition* or the *vital* act. The previous preparations may be called Vital actions, only inasmuch as they are accomplished under the influence and directive power of the living organism and for its benefit.

The purpose and necessity of the nutritive activity in the organism is clear. A microscopic germ cannot grow and evolve itself into a perfect plant or animal without assimilation or intussusception of new material.

47. Growth or increase is that function by which the living being builds up its complete organic structure according

to à definite morphological type out of the nutriment assimilated.

48. Generation is that function by which the living organism produces out of its own living substance a *germ* or *seed* capable of evolving itself into a new living organism similar in specific nature to the parent.

49. Vegetative Life, therefore, requires a dynamic principle in the organism which:

(a) *Modifies, elevates* and *controls* the physico-chemical properties of the anorganic matter absorbed, as it passes through the various channels which fit it for immediate assimilation;

(b) Makes the living organism capable of constant, self-perfective action, *e. g.,* 'development,' 'continual change and renovation of itself';

(c) Enables the living organism to communicate to a special portion of its own substance a *formative* power which makes the microscopic germ capable of building itself up into a complete living organism of the parent type of preserving and restoring its integrity, and of propagating itself indefinitely.

But such a principle is essentially different from and superior to the dynamic principle in anorganic bodies.

Therefore, there is in every living vegetative organism a dynamic principle essentially different from and superior to the Forms of anorganic substances, i. e., a Vital Principle or *soul.*

Note (1).—Hence, a living vegetative organism is essentially different from a *crystal.* In the latter there is no nutrition, growth or generation, as explained above—no *immanent* action of any kind: its development is the result of mere external *accretion,* not of *assimilation.*

(2).—*Organicism* pretends to account for the phenomena of vegetable life by the *mere grouping* and interplay of inanimate atoms. But, no mere arrangement of a multitude of dead

particles can account for one constant, spontaneous, immanent, self-perfecting activity. It would not help us at all to account for life to give us a piece of *dead* protoplasm, even if chemistry could succeed in producing it (which it cannot). We can get a whole perfectly organized dead ox any day in the meat market. What we want is protoplasm with the *power* of nutrition, growth and reproduction, i. e., besides organized matter, we want a special dynamic principle within it, *animating* it, in order to account for the phenomena of vegetative life.

Again, it is not the organism that produces life, but life that produces, develops, preserves and propagates the organism. It is as if a little particle of matter should build itself up into a perfect watch, keeping itself in constant repair and be able to detach from itself little specks of matter, each capable of growing into, and reproducing the parent type indefinitely. *Organization,* therefore, far from being the *cause,* is the *effect* of life.

(3).—The physical and chemical forces of matter are undoubtedly at work in the living organism, but they can account neither for the organism itself nor for its vital action, unless a special vital principle be admitted which permanently modifies, elevates, controls their action fot a fixed end, viz.: the development, preservation and reproduction of a living organism of a specific type. As a matter of fact, all scientists are agreed that no force of chemistry can combine anorganic elements so as to form a single cell of *protoplasm;* much less a *living cell;* much less an *organism* capable of developing, preserving and propagating itself. "It is futile to attempt by chemistry to bridge over the chasm between the living and the non-living."—Du Bois Reymond. "Chemistry can never produce a leaf, a fruit, a muscle, an organ."—Berthelot. "All scientific experience tells us that life can be produced from a living being only."—Stewart and Tait. See Maher, Psychology, P· 547 seqq.)

(4).—Within each living organism there is a non-living

liquid (blood or sap) in continual circulation to nourish the organism, and to carry away the material continually being detached from the organism.. What is called *organic* or *synthetic chanistry has* succeeded with, difficulty in producing some of the non-living elements thus carried upwards or downwards by the non-living stream, *e. g.,* 'formic acid,' 'urea,' etc. This is the utmost that chemistry has been able to accomplish in regard even to the external products of life, and it does so only by méans of powerful electric currents or enormous temperatures.

50. In *plants* there are no *organs of* sensation, no evidences of perception, feeling, emotion or spontaneous local motion. Hence, we are justified in saying that plants have no power of sensation.

The motions of the sensitive plant, fly-trap, etc., are due to physical contractility of fibre, etc., under the influence of heat, light, friction, etc. The motions of zoospores, antherozoids, etc., have not that irregularity, intermittence and arbitrary change of direction which indicate *spontaneous* local motion.

51. *A fortiori* the dynamic principle of merely vegetative life is not spiritual, i. e., capable of acting and existing by itself apart from matter. For, all the vital operations of plant are essentially dependent on the material organism, i. e., nutrition, growth and generation are exercised in and through the material organism.

Note.—Hence, the Soul of the plant is not created by a special action of God, but *educed* from the potentiality of matter by the action of a proportionate natural cause, i. e., by a living being of the same species, and ceases to exist on the destruction of the organism.

52. Natural corporeal substances are specifically distinguished from each other, not by the uiasr-principle in them, but by the *active* or dynamic principle. Plants are natural corporeal substances, and the matter of which they are composed

does not distinguish them from other corporeal substances. In fact, it may become C, O, H, N, as simple elements, or any of their combinations. Hence, plants are distinguished by the dynamic or life-principle in them, from other corporeal substances. Hence, the vegetative soul is truly a substantial form —the *differentiating* substantial constituent of the living body.

Note (i).—Take care not to imagine the plant soul as one *complete* substance indwelling in the organism as in another *complete* substance. In that case the organism would not be a living body endowed with immanent activity. The soul of the living plant must therefore be conceived as a substantial constituent pervading and vivifying the whole organism whence flows the unity, activity and specific properties of the plant.

(2).—In general, therefore, a Soul may be defined as The substantial form of an organized body capable of spontaneous immanent action. We say, *capable* of vital action: because a thing may be a living body even though it does not actually *exercise* any vital function, *e. g.,* 'hybemating animals,' 'frozen fish,' 'frogs,' etc.

53. In each individual plant there is but one vital principle or soul, for, *one* vital *activity* manifests one vital *principle.* But in each separate plant all vital activity *constantly, naturally* and *per se* tends to one definite result—the development, preservation and reproduction of one living organism of a fixed specific type. Amid all the variety of parts and functions in the plant, *one* immanent result is steadily aimed at and procured; and this constant ultimate unity of *effect* demands unity of *principle* as its proportionate cause.

Note. (i).—We said above, each individual plant, because we have many instances of numbers of both plants and animals living together in connected clusters or colonies, *e. g.,* 'corals,' 'mosses,' etc.

(2).—The phenomena that sometimes take place on the separation of parts from a living organism require a word of explanation here. In some cases the separated parts, if cared

for in a special way, can continue to exercise indefinitely *some,* though not all, of the functions of the original organism, *e. g.,* 'a graft of a pear tree, if planted in the earth, will die, but if properly inserted in another suitable tree it will live, grow and produce its own species of leaves, fruit, etc.' In other cases the separated parts can live on by themselves and exercise all the functions of the original organism, *e. g.,* 'branches of the vine,' 'poplar,' etc.

The explanation is this. Each organism begins as a simple living cell of protoplasm. This Mother Cell, as it is called, increases by nutrition and divides into two cells; these again increase, divide, etc., until a whole organism of the parent type is built up. These Derived or Daughter-Cells, as they are called, are all *living matter,* but incomplete in themselves and destined to form part of some organ, *e. g.,* 'root,' 'fibre,' etc. In the lower grades of plants and animals the whole organism is very simple, and when such plants have built up all the organs of their simple structure their further growth is but a *repetition* of the whole previous structure. If, then, one of these living *sections, e. g., 'of a vine,'* is separated, it possesses a complete organism and can put forth roots, etc., and live on alone. The vital principle of such a plant is *actually one,* but *potentially* as *manifold* as there are completely organized *sections* in it, i. e., while the parts are united there is but one vital principle in the whole plant, as is evidenced in the mutual interdependence of all the parts upon each other, and upon the whole; but when the parts are separated each has enough of organization to sustain the vital principle and to live an independent life of its own.

Sometimes no one section is quite complete in itself. It may lack, for instance, the power of putting forth roots and thus acquiring nutriment for itself. But if this deficiency can be artificially supplied, *e. g.,* by properly grafting it on a suitable rooted stem from which it can receive its nutritive material, it can do all the rest for itself. It will assimilate the nutriment

and change it into, *e. g.,* pear-wood, produce pears, etc., though grafted on quite a different tree. And here again we have an instance of "anima vegetatrix, *actu* una *potentia* multiplex."

54. As to the origin of organic life upon the earth, the doctrine of Abiogenesis or Spontaneous Generation, i. e., the origin of life from the mere grouping and interplay of inanimate anorganic atoms has been sufficiently refuted above (49). No grouping or multiplication of o's, no matter how long you may continue the process, will give you 1 ; and in the same way no mere grouping of inanimate particles will give you a living, self-perfective organism. Reason cannot admit an effect without a proportionate cause.

Moreover, all the elaborate experiments cf Pasteur, Tyndall, etc., have shown to a certainty that, as Huxley says, "the doctrine of *biogenesis,* 'life from life/ is victorious all along the line."

On the other hand, it is certain from Geogony, or the science of the formation of the earth, and from Geology, or the science of the material substances of which the crust of the earth is composed, that there was a time when organic life did not exist upon the earth, and was in fact impossible.

Hence, all life that has appeared since, from monera to man, is a *caused* thing, an effect, and requires a proportionate *cause.* Very little reflection will show us that the ultimate living cause of life must be itself *uncaused*—a self-existent eternal life.

55·: Organic life is transmitted by generation, i. e., the production by a living organism out of its own living substance of a new living being specifically similar to itself, i. e, of a new being having within itself the power of developing itself into a complete organism specifically similar to the parent type-

Sometimes the new organism may be had by taking cuttings or bulbs from the parent stem. The formation of such parts by the parent organism is called Aggeneration.

Usually, however, the new being produced by *generation* is a highly specialized particle containing within its small dimensions the power of building itself up into a complete organism (a fly or an elephant, an oak tree or a fern) according to the nature of the parent.

Again, there are some cases where the complete life-germ is wholly the product of a *single* organism without any influence from without This is called Asexual Generation.

More frequently, however, the living germ is the product of *two factors.* One plant, for instance, produces Ovules, another plant of the same *species* produces Pollen. Neither of these elements separately, but the combination of the two, will give us the complete life-germ or seed. Naturally, the new being, as it is produced by two distinct causes, will tend to possess the characteristics of both, a fact which the gardener takes advantage of to produce new *varieties* of the *same species* of flower. The union of pollen and ovule is called Fertilization or Fecundation of the ovule, and it results in an internal substantial modification by which the life-principle of the new plant is *educed from the potentiality of matter.*

Note.—We have said that both ovule and pollen must come from plants of the *same species.* If they are taken from plants of different species, the great universal law is that their union will give no result; both ovule and pollen will simply decay. In exceptional cases, when the two species from which these elements are derived are very similar, fecundation may take place, in which case the seed will produce neither of the parent types, but a cross between the two, called a *hybrid.* These hybrids cannot perpetuate their new type. 'As a rule they are altogether *sterile,* or incapable of reproduction. In the few cases where they produce offspring, these after a few generations either die out or return to one or other of the two original types. This law, which is absolutely universal in nature, is called the Law of Reversion, and is the great safeguard of the permanence or *fixity* of specific types in nature.

56. The fecundated life-germ produced by generation will give us an individual living being of a definite specific type, possessing in itself the power to build up by slow degrees a fixed type of organism and no other. The order and the path it must follow in its development are defined for it beforehand, and no power in nature can change them. You may destroy the germ or embryo, but you cannot alter its powers or its destiny. "It is possible that at the first moment of their existence all animals resemble each other as spheres of protoplasm, but the specific type of each is fixed from the first and governs all its development. The embryo of a vertebrate is a vertebrate (potentially) from the start, and never corresponds to an invertebrate."—Von Baer, Agassiz, etc.

Note.—Of course *accidental* modifications may result from food, climate and other external circumstances; but they can never *substantially* alter the fixed specific type.

57. Finally as our life-germ has to build up gradually into a complete organism, *e. g.,* 'of an oak,' 'a horse' or 'an elephant,' it is no wonder that on its passage to perfection it should exhibit many strange-shapes and appearances more or less resembling creatures lower than itself. In some cases these successive changes take place while the new being is still enclosed in the egg or within the organism of the parent. In other cases the changes take place after the *birth* of the new being, but are all accomplished within the lifetime of a single individual, *e.g.,* 'a butterfly.' These changes of form are called *Mctamorphoses.* Lastly, we have cases where it would appear that the lives of several successive individuals are required to bring the offspring to the full parental type; so that "the parent finds no resemblance to herself in her offspring till she comes down to the great-grandchild"; *e. g.,* 'the medusa.' This is called the phenomenon of Alternate Generation.

But whatever the mode of development may be, it is as fixed for each type as natural law can make it.

58. Not only, then, is Life only from Life, or "Biogene-

sis," a fundamental law of nature, but "Like from Like," or "Homogenesis," is a law equally universal. All *observations* and *experiments* affirm it. *Reason* itself requires it on the principle that *every effect must have a proportionate cause.* If a living being communicates vitality to a portion of its own substance, that vitality cannot be superior to or of a different nature from that which the parent itself possesses.

Heterogenesis, therefore, or Equivocal Generation, i. e., offspring of a different type from parent, in whatever form it may be proposed, is inadmissible.

Article III.—Sensitive Life.

ÇQ. Sensitive Life implies a living organism capable of perceiving individual material objects, of feeling, desire and aversion and of spontaneous local motion. In the present article we shall consider briefly these *functions* of animal life, and the *nature* of the animal soul from which they proceed.

(i) *Functions of Sensitive Life.*

60. Sensitive Cognition in General may be described as a *vital reaction* by which a sentient faculty, in response to an impression received from an individual material object, produces within itself *an intentional representation* (78, below) of the object. Hence, there are four elements to be considered in sensation, viz.: (a) the sentient faculty, (b) the sensile object, (c) the impression produced by the sensile object in the sentient faculty (technically called Impressed Image or Species), (d) the formal act of perception or the actual representation of the object (technically called the Expressed Image or Species). We may illustrate this by a rough analogy; thus. Given a substance on the one hand, a seal on the other, it is required to stamp the seal on the substance. In the first place, the substance must be in a condition to receive the impression, and the seal must be in a condition to give the impression. Again, the

substance of itself is indifferent as to what impression it shall receive; it can receive the impression of this seal, or that, or the other. That it express one rather than the other depends upon which acts upon it or determines it to a particular representation; hence, the seal must act upon the substance in order to produce an impression of itself. But this is not enough. The seal may act forever and produce no image of-itself unless the substance *reacts;* but when the substance acted upon by the seal reacts it becomes a re-presentation of the seal. If, finally, we can imagine the substance thus *informed* with the image of the seal, as *perceiving,* not the image, but the seal itself which helped to produce it, we shall have a rough illustration which will help us to form an idea of sensation and, indeed, of cognition generally.

¶ 61. Applying the preceding analogy to our present subject and remembering that (according to the axioms, "quidquid recipitur secundum modum recipientis recipitur," and "agere sequitur esse") the *impression* received in and the *reaction of the* sentient organ are not merely physical, but *psychophysical* phenomena, we may gather up, the general doctrine of sense-perception in the following brief statements.

(a) In all sensitive cognition the object must be united to the faculty by its *impressed* image or species, else, as the cognitive faculty is indifferent and undetermined of itself, it will not represent any one object rather than another.

(b) Sensation is not the mere *reception of* an impression of the object in the living organic faculty; for, sensation is a vital immanent *action,* while the *mere* impression of the object is nothing more than a transient action of the object by which the faculty *suffers* an intrinsic modification.

(c) The impression received from the object *determines* the vital faculty and thus enables it to produce the *expressed* image or vital representation; for, the formal act of sensation is such that it can proceed from neither independently of the other. The faculty is incapable of producing it without a deter-

mination received from the object; and, on the other hand, as we have said above, the mere passive reception of the determination is not a vital act of perception.

(d) The *subjective* image or species is not *that which* is perceived in sensation, but that *by which* the cognitive faculty directly and immediately perceives the object. It is essentially a *formal* sign by which not itself but the thing signified is directly and immediately perceived.

(e) Hence, the fundamental difference between *cognitive* and non-cognitive natures; the latter possesses only their own proper form; the former, besides their own form, acquire also *intentional* or representative forms of the objects of their actual cognition.

Note.—"The *organic* constituents of the sentient faculties, generally, consists of the *nervous system.* This is composed of two parts, the central mass and the branches which ramify throughout the body. The central mass, called the *cerebro-spinal axis,* is made up of the brain and the spinal cord passing from it down through the backbone. The brain consists of a soft, convoluted substance of mixed grey and white matter. The spinal cord consists of a column of the white fibrous matter, enclosing a core of grey cellular substance. From the spinal cord between every two vertebrae there issues forth two pairs of *nerves.* The nerves proceeding from the front of the spinal column are called anterior, *efferent* or *motor* nerves, as they transmit impulses outwards, and are the organic instruments of muscular movement. The nerves coming from the back of the spine are called *afferent,* or *sensory* nerves, because by their means the organic impressions which accompany sensations are conveyed inwards from the various external sense-organs of the body. In the several external sense-organs these nerves are arranged and modified in various ways to suit the various psychic faculties and to respond to their external stimuli."

It is hardly necessary to remark that the perfection and

differentiation of the nervous system varies according to the grade of the sentient being in the scale of animal life.

62. As we have already said, the sphere of sensitive cognition is limited to *material objects as affected by material individuating notes.* Hence, the first great division of the sensitive faculties of cognition is into those which perceives material objects external to the sentient subject and those which perceive, retain or recall the sensations of the external senses, or perceive certain other concrete material aspects of external objects which do not fall within the sphere of the five external senses, and yet are necessarily connected with the preservation and perfection of animal life. The former are called *external* senses, the latter *internal.*

63. The External Senses.—These are sight, hearing, smell, taste and touch. The peripheral extremities of the nervous system immediately concerned in the operations of these five senses are, respectively, the *rods and cones* of the retina of the eye, the *Cortian organ of* the ear, the *mucous membrane* of the upper cavity of the nose, the *gustative papillae* of the tongue and palate, and the *tactile papillae of* the dermis, or under-skin.

64. The *formal objects* of these senses are (following the order above) colored extension, sound, odor, sapidity and extended pressure or resistance.

Note (i).—*Temperature* in so far as it is perceived as an objective quality of bodies, may be considered (like soft; ness, roughness, etc.) as a secondary modification of the proper object of touch.

(2) —The five external senses are found only in the higher or more perfect animals. The lower types have only the sense of *touch* and probably of *taste.* Yet even some of these lower types manifest a certain vague sensibility to light and sound which is often spoken of as Dermatoptic Sensibility.

65. As to the *objectivity of* the perception of the external senses, see Logic, n. 104, etc.

66. The Internal Senses.—The immediate and direct objects of external sense-perception are individual facts and phenomena *external* to the sentient subject as such. The immediate and direct objects of the *internal* senses, on the contrary, are the present or past sensations, or subjective states of the sentient subject, as well as certain concrete aspects of the objects perceived by the external senses, which, however, do not fall within the sphere of any of the five external senses. These internal senses are four: the *common* or *central* sense, the *imagination,* the *sensuous memory* and the *estimative sense* or *instinct.* The organs of these senses are situated in the hemispheres of the brain.

67. The *central* or *common sense* is an internal organic faculty which perceives, distinguishes and synthesizes the actual operations and affections of the various sensitive organs which ramify from the brain. Thus, the sense of sight may perceive a certain object as white; the sense of touch, as hard; and the sense of taste, as sweet. When these several data are referred on to the *central* sense, the sentient subject becomes aware that it is in the presence of one external object which is white, sweet and hard, pleasant to sight and taste, but painful to the touch.

As the central sense is thus the *terminus* to which all our external sense-perceptions are referred, so it is also the *source* from which all the sensitive activity of the peripheral senses is derived. "Vis sentiendi diffunditur in organa quinque sensuum ab aliqua una radice communi, ad quam etiam *terminantur* omnes immutationes singulorum sensuum." Hence, when the central sense is rendered inactive, as in sleep, or by nerve-poison, *e.* «/./chloroform, all the external senses become inoperative.

68. *The imagination* is an internal sensitive faculty which retains and reproduces the past experiences of the central and external senses It may recall these representations singly, or combine them to form entirely new images. Thus it can recall the sensations of sight, sound, etc., which have been expe-

rienced, and it can also form new representations by combining them, *e. g.,* 'representations of mountains of gold,' 'walking trees,' 'rivers of blood,' etc.

69. The causes which determine the imagination to reproduce the sensile representations it retains are mainly:

(a) The association which exists between the objects whose images are recalled, *e. g.,* 'co-existence or succession in time and space,' 'relations of whole and part,' 'relations of similarity and contrariety,' etc. On account of this association, an object will naturally recall those related to it in past experience;

(b) The internal condition of the body, inasmuch'as it affects the brain. The brain is the organ of this faculty; hence, an impression, however produced on the living brain, similar to that which accompanied a given imaginative sensation, is likely to recall that sensation. Hence, the varied unconnected series of imaginative representations which occur in dreams or in cases of violent fever; hence, too, the predominance of sad or pleasant *phantasms* according to the various states of the nervous system.

Note (i).—The state of *sleep,* as we have said, results from the temporary suspension of the activity of the *central* sense (caused either by natural fatigue or by artificial means) and the consequent inactivity of the other sensitive faculties. During the time of sleep the nutritive functions are exercised more regularly and. perfectly, and the wear and tear of the nervous system, occasioned by sensuous activity, is repaired. Hence, natural sleep has been described as "vinculum sensorii primi quod fit gratia salutis."

If, however, during this state of sleep, any impression, whether from within the organism or from without, should reach that portion of the brain which is the organ of the imagination and arouse this faculty to action, it will reproduce some of the many images of past experience of which it is the storehouse; and these, in turn, will recall others in a series according to the nature of the present impression and the laws of

association, etc., spoken of above. This activity of the imagination partially arouses the *central* sense to action: and as the primary function of the latter faculty in the normal waking state is to refer the various impressions passed on to it from the external senses tp the external objects which produced them, so now abnormally stimulated to action and without the influence of the external senses to guide it, it refers the phantasms of the imagination to the external world and "gives to airy nothing a local habitation and a name."

This projection into the outer, world of the phantasms of the imaginaiton when it occurs in sleep is called a *dream.*

(2).—In *somnambulism* some of the external senses seem to be open to impressions from without which are woven into thé texture of the dream, and this serves to intensify the illusion and to call even the *motor* faculties into play.

(3) A-A *hallucination* may be called a *-waking dream.* In some case of hyperaesthesia, or exceptional morbid excitement of the nervous system, the representations of the imagination become so extremely vivid as even to counterfeit and overbalance the normal external sensations. The whole sensitive energy of the soul is, as it were, absorbed by the phantasmal image, and the waking sufferer regards it as an *external reality.* It is even said that, at times, the internal disturbance may be so great as to produce modifications in the peripheral organs similar to those that are normally produced by external objects.

(4).—"*Hypnosis* is a species of artificial sleep in which some of the sentient organs are inhibited, while others are overstimulated. When induced by human agency this state involves a dependent condition of the subject which makes him responsive to the *suggestions* (by words or other signs) of the hypnotizer. The secret of this strange power of suggestion is probably to be found in the fact that the last and strongest impression left in the central sense and imagination just before the inhibition and hyperesthesia are affected, is produced by the commands and personality of the hypnotizer. His image

will then occupy all the energies of the imagination and central sense and his suggestions will, as a general rule, be followed and obeyed with almost automatic precision, while the subject remains insensible to all other external impressions."

70. The *sensitive memory* retains, recalls and recognizes, *as perceived before,* the representations of the various internal and external senses. In this it differs from the imagination, that while the latter merely reproduces objects of past experience, the memory also recognizes them as old acquaintances that have been met before. *Recognition* of past objects of internal or external sense-perception is therefore the characteristic function of the sensitive memory.

Note.—"The tendency of an experience to lapse out of memory is in proportion to the feebleness of the original impression and the infrequency of its repetition."

"A past experience becomes unrecognizable in proportion to the length of time and the number and vivacity of the experiences which have intervened since its last occurrence or reproduction."

71. The estimative sense or instinct, as it is commonly called, is an internal organic faculty which apprehends certain individual concrete notes of material objects which do not come within the sphere of any or all of the external senses. Thus, "the lamb does not flee because the color or form of the wolf is disagreeable to the external senses, and the bird does not collect twigs for its nest because they are attractive in themselves, but both animals are endowed with a faculty which, under appropriate conditions, is determined by the apprehension of these objects to guide them in the mere execution, without foresight or reflection, of operations beneficial to their specific natures respectively."

72. The organic character of all the faculties enumerated above is manifest, as their objects do not transcend the sphere of individual concrete material facts and "phenomena—singularia qualia-quanta." In man, as in the lower animals,

these faculties are organic, but their operations are more perfect, inasmuch as they are subject to the guidance of intellect and free will.

73. The Sensuous Appetites.—The term *appetite* is used in a very wide sense. It denotes all forms of internal inclination, comprehending alike (1) the natural tendencies or affinities implanted in all finite beings, even plants and inanimate substances, which impel them blindly towards what is suitable to and perfective of their nature, independently of all cognition on their part; and (2) the attractions and aversions which follow upon cognition in sentient and rational beings..

The former class of inclinations or tendencies are called *natural* appetites, inasmuch as they flow from the very *nature* of the being, i. e., from the dynamic element, or *form* which constitutes it the being it is. To this class of appetites, belong the natural tendencies or *nisus* in the various powers and faculties of beings to fulfill the function for which they are by their nature and constitution destined.

The latter class of tendencies arr called Elicited Appetites, because they are aroused to vital action by cognition. Elicited appetition is again of two kinds, *rational* or *sensuous,* according to the character of the cognitive faculty by which their objects are perceived and proposed.

74. That the *sensuous* appetite is an *organic* faculty follows from the nature of the *objects* in regard to which it is. exercised, viz., those presented by the.external and internal senses, i. e., concrete individual material things. As to the *organ of* this faculty, however, opinions are divided. Some hold that it is the *brain,* others, on the contrary, maintain that it is the ganglia and nervous fibres of the *heart.* In favor of the latter opinion it may be said, (1) that it is the common usage of men to attribute the feelings, *e. g.,of* 'love,' 'hatred,' 'fear,' etc., to the heart; (2) that no part of the organism is so much modified by these feelings as the heart, so that as CL

Bernard has said, it may be considered the organic index of their intensity.

75. The various forms of sensitive appetition may be classified as follows: the object presented by cognition may be, (1) suitable or repugnant *in itself* simply and just as it stands; or (2) it may be a suitable object difficult to obtain, or a repugnant object difficult to avoid. The former would be the object of what is called the *concupiscible appetite;* the latter, of the *irascible appetite.* In other words, the object of the *concupiscible* appetite is the *good* or *evil* to be attained or avoided: the object of the *irascible* appetite is the *difficulty to* be overcome in attaining the good or avoiding the evil.

The acts of the *concupiscible* appetite are *love* and *haired, desire* and *aversion, joy* and *sadness.*

The acts of the *irascible* appetite are *hope* and *despair, courage* and *fear, anger.*

Note.—*Sensuous Pleasure and Pain. Sensuous pleasure* is the satisfaction or repose which the faculties of a sentiment being finds in the possession or enjoyment of their proper objects. It is, therefore, an accompaniment of the natural normal exercise of these faculties. In proportion as the energy of the faculty is greater and the object more fitted to call forth and satisfy that energy, so is the pleasure more intense. *Pain,* on the other hand, arises from *excess* or *defect* in the exercise of a faculty, or from imperfection or unsuitability in the object presented to it

Both pain and pleasure are therefore dependent on, (1) the natural scope and efficiency of the faculty, its acquired habits and its actual condition of health and energy; and (2) the suitable presence of an object in harmony with the energies of the faculty. ...

76. Locomotion.—Every sentient being is capable of some kind of exterior spontaneous local motion. In fact, it is by the exterior motion that they manifest to us their sensitive faculties of cognition and appetition. Perception of agreeable

or disagreeable objects is followed by desire or aversion; and this, in turn, gives rise to movement toward or from the object The special organ of this faculty of movement is considered to be the *efferent* nerves which terminate in the muscles.

Note.—The vital movements, *e. g., of* the heart, lungs, etc., which are effected independently of cognition, are called *automatic;* those which result from cognition and appetition are called *autonomic.* These latter, again, are either *instinctive* or *volitional,* according as they are determined by the *sensuous appetites* (as in *brutes'), or* by the *free will* (as in man).

(ii) *Nature of the Animal Soul.*

yy. That the brute animals around us possess powers of perception, appetition and autonomic locomotion is the unanimous verdict of the common sense of mankind. These animals have various organs of sense perception more or less similar in structure and function to our own, and, on the other hand, they exhibit in their exterior action generally, all the signs of true perception, feeling and autonomic movement.

The higher animals, at least, also clearly manifest by their actions that they possess the four *internal,* as well as the five *external* senses.

78. Now, if we consider the character of the chief and fundamental operation of sensuous activity, i. e., perception, or cognition, we shall see clearly that it differs essentially from the activities of merely inanimate bodies on the one hand and from those of merely vegetative activities, on the other.

For, on the one hand, all the activities of *inanimate* substances, *e. g.,* their power of attraction, of producing motion, heat, chemical changes, etc., are merely *transitive,* i..e., they are capable of producing changes in *other* bodies but not in themselves. As to bodies at a distance, they affect them only, inasmuch as having first affected the intervening media, the energy thus transmitted produces *physical change* in the distant object

The *vegetative* activities, on the other hand, are merely *immanent;* the term of their action is change in the *organism* of the agent, i. e., its nutrition, development, etc.

Cognitive activity, on the contrary, is, at the same time under different respects, *both* immanent and transitive, subjective and objective. The action is *entitatively* immanent and does not emerge from the sentient faculty which produces *it;* and it is at the same time *representatively* transitive, i. e., it is wholly occupied upon an external object. For instance, the action by which the sense of sight perceives the sun does not issue forth from the eye or produce any change in the sun or in the intervening ether, and yet *it is* wholly engaged upon an object 93,000,000 of miles away. Hence it is that we speak of *the scope which is* aimed at and reached by mechanical, physico-chemical and vegetative activity, or the *term of their* efficiency, i. e., the effect produced by them; while the scope aimed at and reached by cognitive and appetitive activity, is called their *object,* i. e., that external *thing* upon which thar immanent action is occupied. Hence, the actions of cognitive and appetitive faculties *are sui generis* and eventually different from and superior to the action of mere physico-chemical or vegetative powers.

Note.—Hence, the cognitive act is called *intentional,* i. e., an *immanent* act with a *transitive* or *objective* reference or efficacy.

There is also another aspect of *sensitive cognition* and appetition which deserves consideration. On the one hand, the *objects* of our sensations are *extended* material *things.* These make an extended impression on the extended peripheral sense-organs, and these, in turn, transmit thar impressions to the extended nerve-centres, which are the organs of the internal senses, and hence, the objects are perceived, imagined, etc., as individual extended things or as qualities or properties of individual extended things. On the other hand, experience shows us that these objects are perceived as units.

Now, it is a contradiction to say that an extended organ can perceive an extended object as a unit, unless the organ be *informed* by a simple dynamic principle which is itself not made up of parts. Take for instance, a marble in your hand. Your sense of touch apprehends it as one thing. But it is impossible that the different parts of the marble which make different impressions, *e. g.,* on the different tactile papillæ distributed over your hand should be apprehended as *one* thing unless the hand is *informed* by a *simple* perceptive principle.

And this becomes more manifest still, if we go on to consider that while the sight apprehends the marble as a colored thing; the touch, as a cold thing; the taste, as an insipid thing; the smell, as an odorless thing, etc., it is apprehended by the central sense, recalled by the imagination, recognized by the memory, etc., as *one* colored, cold, tasteless, odorless thing.

79. From the preceding considerations it is evident that no aggregation of merely inanimate, or merely vegetative forces, can give us the cognitive and appetitive faculties which manifest themselves in the operations of what is called the *animal* kingdom; unless, indeed, we are prepared to admit that a sum of zeros can give us a positive number. An *animal* is, therefore, an organism *informed* by a dynamic principle *sui generis,* esentially different from and superior to the *substantial forms oi* merely vegetative or anorganic substances.

80. Brute cognition and appetition, however, are strictly limited to certain concrete aspects of individual material things. Even the *estimative* sense never rises above the apprehension of the concrete suitableness or repugnance, here and now, of individual material objects to the actual, needs of the sentient organism. This estimate or instinctive apprehension is the same in all individuals of the same species and differs according to difference of species. Just as each plant builds up its own organism according to a fixed type without cognition of any kind, so "omnis hirunda *similiter*

nidificat" guided solely by the concrete sense-perception which excites the impulse to act in a fixed, determinate way according to the specific nature of the sentient being.

Note.—Hence, in all the phenomena, of animal life there is no trace of any perception of abstract\miversal truths and principies. There is no progress or change of any kind in the instinctive action of animals. They make no use of instruments, fire, etc., to aid them in their work. They have no scientific, moral or spiritual notions of any kind., "Instinct *is* perfect in its narrow sphere, but it cannot rise beyond this into X^the sphere of unlimited thought and contrivance."—Dawson.

81. Brute cognition and appetition, therefore, is essentially sensuous, the action neither of the dynamic principle alone, nor of the organism alone, but of the *animated organism {psycho-physical action). Now* the *action of* a being manifests its nature, and hence, as the *action of* the brute soul is intrinsically and essentially dependent on the material organism and inseparable from it; the brute soul is therefore, *completely immersed ia the organism* which it animates. It is incapable of acting or existing apart from the body and perishes with, the disintegration of the latter. Accordingly it does not need *annihilation* to account for its destruction, nor *creation* to account for its *origin.* It is a product of *substantial transformation* effected by *generation by* which an existing vital energy educes from the potentiality of matter a new principle of activity similar to itself.

82. In the animal the vegetative functions produce, preserve and develop an organism adapted for sensation; and, on the other hand, the sensitive faculties are chiefly exercised for the preservation, development and reproduction of the organism. Again, every modification of the sensitive activity (anger, fear, etc.) involves a corresponding modification of the vegetative activities; and, on the other hand, ill-health, disease, etc., of the organism affect the sensuous perceptions, desires, feelings, etc., of the animat But such mutual interdependence

of the various vital functions, sensitive and vegetative, of the animal organism can only be accounted for by recognizing that all these various activities have their source in one and the same dynamic principle. Hence, the brute soul is a substantial *dynamic principle,* or *form,* which immediately actuates *primal matter* and is the ultimate source of all the specific properties and activities of the living, sentient coiporeal substance.

Note (1).—As to the *divisibility* of the brute soul, the *origin, transmission,* etc.; of animal life, see above, n. 54.

(2).—On the subjects so briefly treated in the present article, see Maher, especially chapters 7, 9, 10 and 12; also the supplementary chapter on Animal Psychology.

Art. IV.—Origin of Species in the Organic World.

83. As we have already more than once seen, the *specific nature of* a corporeal substance is determined by the substantial dynamic principle, or *form,* which actuates and completes *primal matter.* For our present purpose, however, it will suffice to *describe* a species in the living organic world; A collection of living organisms (a) essentially similar in structure and function and (b) productive of offspring by their union with each other, so that the collection can be indefinitely perpetuated in nature by *generation;* and hence, such that the whole collection might have sprung originally from a single pair. Or more briefly: A collection of individuals of one essentially similar inalienable type, capable of indefinite perpetuation by generation. *Similarity* and *filiation* are therefore the chief *indications* of *specific unity.*

Note (1).—*Accidental* diversities of color, size, eta, give us *varieties* within the *same species.* When these are perpetuated by artificial selection on the part of gardeners, breeders, eta, or by other causes, we have *races* or *breeds.* Hence, difference of *race* between parents in no way hinders offspring. But even here, "Domestic varieties, on returning to savage

life, gradually, but invariably, assume the characters of the original type."—Darwin.

(2).—The offspring that *occasionally* results from the union of individuals of different *species* is called a *hybrid.* In the rare cases of hybrid fecundity, the inevitable return of the offspring to one or other of the original specific types is called *reversion.* The offspring of individuals of different *races* of the *same species* is called a *mongrel.* The casual appearance in a descendent of such mongrels of one or other of the *external racial* characteristics of either of the primitive parents is called *atavism.*

84. That there is in the organic world such collections of individuals as we have described is a manifest fact, *e. g.,* the various *races* or *breeds of* horses are like each other in fundamental structure and function; they differ essentially in structure and function from other groups of animals, *e. g.,* 'dogs'; and finally, the union of individuals of these different races or breeds with one another is capable of perpetuating the species indefinitely, while their union with individuals of other groups is either not fruitful or produces a hybrid offspring incapable of perpetuating itself. Hence, our description of species is *objective,* i. e., realized in the actual world around us.

85. Most of the *species* both of plants and animals with which we are familiar are comparatively *new* in the history of life upon the earth. From the first appearance of organic life upon the earth to the present time, many *species* of both plants and animals have disappeared and many new ones have been introduced. The question before us is, How is the origin of these various species of living organisms to be accounted for? Various hypotheses have been proposed to solve the problem. All the different views on the subject, however, may be classified under two heads:—the theory of *independent formations,* and the theory of *descent* or *derivation.*

86. The Theory of Independent Formations, holding to the principle of *causality,* the essential immutability of species

and the absence of connecting links by which one species can be shown to have been gradually transformed into another, maintains that the *first* beings (few or many) of each species were produced by the Creator at the period of the world's history when the earth was fitted to receive them and the well-being of the whole would be benefited by their presence.

They would thus have been produced from pre-existing material by the immediate action of the Creator. This action could not strictly be called either *creative,* or *miraculous.* Not *creative,* as it would not imply the production of the *whole* new being out of *nothing,* but the *eduction* of a new *substantial form* in matter, by a proportionate cause. Not *miraculous,* because it would not be *against* any *law* of nature, nor beyond the *course* of nature as designed by the Creator, any more than the creation of matter itself, or of each individual human soul, is *beyond* the *order of* nature.

Note.—The vague term Evolution may be applied to this view in so far as the word can express the gradual working out of a predetermined creative plan. In a somewhat similar sense we speak of the *evolution* of the steam engine, of the bicycle, without at all implying that the perfect machines of our day are connected by any bond of *filiation* with their ri^der predecessors.

87. The Theory of Descent or Derivation maintains, in general, that many organic species are derived or descended from one common parental stock. This hypothesis has been proposed in various forms, differing from one another as to (a) the *extent* of the field covered by the transformation; (b) the *manner* in which the transformation was effected. It will suffice for our purpose, however, to classify the views of *transformists* under the following four heads:—

88. Monistic Evolution is simply the extreme *materialistic atomism* alluded to above (n. 29, Note 1). It starts with a vast cloud of homogeneous atoms, each atom standing in a definite position relatively to all others, so that the existing

order of the world "lay potentially in the cosmic vapor." To these atoms at a certain definite *tinte,* a certain definite *measure* of motion in a certain definite *direction,* was communicated; and the actual solar system and all being therein, great and small, living and not living, have been the result. The motion of the homogeneous cosmic dust gave, first the simple chemical elements, then various chemical compounds, then the simplest living organisms, and these, in turn, advanced from stage to stage, radiate, mollusc, articulate, vertebrate, fish, serpent, bird, mammal, man. There is no telling where the cosmic dust came from, or whence the primitive arrangement of its particles, which yet contained potentially the actual cosmic order. We are not told when the motion came, or why in such a definite measure and direction. There is no substantial difference between bodies simple or compound, between plants and animals, animals and men. There is no such thing as soul, or mind, or free-will. All things are simply groups of homogeneous atoms in motion. There is an accidental difference in the *grouping of the* atoms and in the *mode* of motion; that is all

89. In the preceding chapter, we have shown (n. 30) that this system is in open contradiction with the most obvious facts of experience which clearly manifest the existence of different substances in the anorganic world. In the preceding articles of the present chapter we have also shown that as Tait says, "to say that even the lowest forms of life can be explained by the mere relations, motions and interactions of inanimate matter is simply unscientific." It is needless, therefore, to attempt further refutation of the system.

It is well to remark, however, that (a) as to its *starting point* it assumes uncaused matter, an uncaused orderly arrangement of the particles of this matter and an uncaused motion of a definite intensity and direction, communicated to this matter at a definite time. (b) In its *progress* it assumes that inanimate matter can produce life, and that lower vital principles can produce higher, (c) *Finally,* it assumes that the irrational

and material can change itself into the rational and immaterial and spiritual, and that inert extended matter can give us the intelligent free soul of man. It is, therefore, from first to last, a gratuitous and absurd hypothesis.

90. Darwinian Evolution holds that all the forms of life that have appeared upon the earth have sprung from one or two of the lowest types of organisms. Organic life originated with a few specimens of, *e. g.,* amoeba or myxomycètes or something lower still. Offspring differs from parent, and, in this case of course, was an improvement on parent according to the *laws of variation.* As generation followed generation and variations multiplied and were transmitted according to the *law of heredity, & struggle for existence* ensued which resulted in *the survival of the fittest* which is another name for *natural selection.}* Add to these factors the necessity each living organism would be under to *adapt itself to its environment,* the *use* and *disuse* of different parts of its body according to circumstances and finally, the *sexual selection* by which the most highly gifted males and females would seek and win each other, and you have all the machinery which the Darwinian theorist requires to obtain from his bit of slime-mould, grass, wheat, the rose, oak, sequoia, etc.; and from his primitive amoeba, oysters, crocodiles, bees, eagles, elephants and men. Of course time was needed to accomplish all these wonderful changes—more time in fact than geology or physics can afford to grant Of course, too, these changes were gradual, generation after generation slowly accumulating the infinitesimal links of the chain which unites monera with man, and consequently, the strata of the earth must be stored with fossil remains of the Intermediate or Transitional forms.

91. As to this Darwinian evolution, we say, that it is an hypothesis in manifest contradiction with reason and fact,

(a) It is repugnant to *reason* to attribute stupendous effects to wholly disproportionate causes. Now, Darwinism attributes the production of all the manifold forms of life that

have ever peopled the earth to one or two types of the very lowest grade under the influence of the so-called laws of *variability, heredity,* etc. But these agencies, if they can be called so, at work to-day with all the ingenuity and skill of man to control and apply them, are wholly incapable of producing more than slight *varietal* changes in living species. Therefore, much less, when left to *chance,* are they capable of effecting *specific* changes, and still less of producing from *a few of* the lowest forms of living matter all the vast and wonderful variety of plant and animal life which has appeared upon the earth.

The slightest reflection will convince us that Darwin's so-called laws are neither universal laws of nature nor even remotely adequate to accomplish the task which he assigns to them. It is not true, that the accidental *variations of* offspring from parent always imply an improvement on parental characters. It is not true, that parents always transmit to offspring by a law of *heredity,* all the minute points of excellence which they themselves have inherited or acquired. It is not true that only the more perfect among the offspring of each plant and animal are *selected by nature* (whatever that may mean) to survive and propagate the race. *Environment* may *accidentally* affect the organism, but, it is gratuitous and contrary to all experience, to say that it can effect a *specific* change. The moderate *use* of an organ will doubtless strengthen and perfect it, but it is nonsense to talk of the use of an organ *producing* the organ itself.

Realizing the inadequacy of the causes assigned by their leader, later Darwinians are satisfied with simply maintaining that transformism is a *fact,* though we are yet unable to determine the causes which effected it

(b) We, therefore, take up the second part of our proposition: Darwinian evolution is in contradiction with all known *facts* of the past or present history of life upon the earth. Known facts are: (i) Those which are verified by present observation and experiment (2) Those which are recorded in

trustworthy history. (3) Those which are recorded in the strata of which the earth's surface is composed.

Now as to the *first class of facts.* Present observation and experiment proves: (i) That no *new species* of plants or animals can be produced from individuals of the *same specific type* by the most careful *artificial selection* bn the part of gardeners, breeders, etc. Innumerable *varieties* have been so produced, but not a single new *species,* (ii) That no *new species* is produced by the numerous generations of microscopic plants and animals which succeed each other withsuch astonishing rapidity all around us, "Koch took specimens of the phthisis microbe and placed them in a medium where they could increase and multiply without restraint. He cultivated the microbe most carefully, while modifying its surroundings in various ways to see what would become of it, and whether perhaps it would turn into something else. The stock multiplied prodigiously, but remained absolutely unchanged in species to the end." (iii) That no new species can be produced by *cross-breeding* between *different species.* This is shown by the *sterility* of hybrid offspring and in the rare cases of their fecundity by'the ultimate *reversion* of the new offspring to one or other of the original parental types.

As to the *second class of facts.* "The crocodiles, ibises, oxen, cats and various other creatures that were embalmed among the mummies of Egypt were animals such as still live dn the earth without having undergone any change. The same fact is shown by the Assyrian sculptures, etc. Here, then, we have proof that external influences acting through thousands of years have failed to modify the living organisms that flourish around us." Williamson, etc. One might catalogue a long list of plants and animals described by ancient writers, sculptured on ancient monuments, preserved in tombs, ruins, etc., but in no case is there a trace of difference between them and those of the present day. Three thousand years is a long time in the life of a species: and one may be permitted in reason to

calculate what a longer time would accomplish by multiplying what 3,000 years has accomplished in modifying any known species. But three thousand years has done *nothing* in this respect. Therefore, etc.

As to the *third class of facts.* Huxley tells us that "the only perfectly safe foundation for the doctrine of evolution lies in the historical or rather archaeological evidence that particplar organisms have originated by the *gradual modification*^ of their predecessors which is furnished by fossil remains. Now here is the latest testimony of palaeontology on the subject in thé words of one of the great *makers* as distinguished from the *retailers* of science—Sir G. W. Dawson writing in 1893.

"Palaeontology (i) furnished no direct evidence as to the actual transformation of one species into another; but the drift of its testimony is to show that species came in per saltum (i. e., suddenly and without connection with preceding species) rather than by any slow or gradual process, (ii) In so far as we can trace their history, specific types are permanent in their characters from their introduction to their extinction, and their earlier varietal forms are similar to the later ones, (iii) We are now prepared to say that the Struggle for Existence has *not* been the determining cause of the introduction of new species. The periods of rapid introduction of new forms of *marine* life were no periods of struggle, but of expansion, i. e., periods in which the *submergence of* continents afforded new and large space for their extension and comfortable subsistence. In like manner it was continental *emergence* that afforded the opportunity for the introduction of *land* animals and plants, (iv) Another important palaeontological fact is the remarkable *fixity* of certain types of living beings in geological times, especially in the case of many low types of life, through vicissitudes of physical conditions of the most stupendous character and over a lapse of time scarcely conceivable. And this holds true in groups which, within certain limits, are the most variable of all.

In the present world, no creatures are more variable than the protozoa, *e. g.,* 'foraminifera and sponges.' Yet these groups are fundamentally the same from the beginning of the palaeozoic until now; and modern species scarcely seem to differ from specimens taken from rocks at least half way back to the beginning of the geological record."

As to this last fact (the permanence throughout vast periods of specific types) many instances might be cited. Thus of forty-six species of mammals of the quaternary and glacial period, thirty-nine have survived down to our own times without any appreciable change; the other seven have become extinct rather than changed. The common sand-clam and the short dam now abounding on our shores are identical with those of the crag of the Pleistocene. The oyster is substantially the same to-day as when first introduced in the Carboniferous. "The corals of the Gulf of Mexico have been the same for over 200,000 years."—Agassiz. Of the trilobites which suddenly appeared in the lower Silurian in vast number and very high perfection, Barrande, the great discoverer and authority on the subject, says, "throughout a series of strata 5,000 meters in thickness they remained specifically unchanged until their complete disappearance." And he adds; "The study of the primordial Silurian shows that modem theoretical calculations are quite contrary to facts: so much so, indeed, that the *real* fauna would seem to have been calculated designedly to contradict evolutionist *theories"*

92. Darwinian evolution is, therefore, in contradiction with palæontological facts. Hence, even supposing (as Christian evolutionists do) that the first lowly forms of plant and animal life were produced by the Creator in the beginning, and supposing that each human soul, as being a spiritual substance beyond the causality of matter, is directly created by God—even, on this supposition, this second form of the doctrine of *descent,* or Darwinian evolution, is an untenable hypothesis in contradiction with observation and experiment, with the facts

of history, with the discoveries of palæontology and with the first principles of rational science, *e. g.,* 'the Principle of Proportionate Causality.'

Note.—Some have felt so much the force of the argument from palæontology that they have abandoned the notion of slow insensible changes and have adopted the view that the transition from lower to higher forms was effected suddenly and *by great jumps.* This, of course, saves them the trouble of finding the Missing Links of Darwin's finely graduated chain; but it only increases the violence done to the testimony of actual and historical experience and to the first and most imperative principles of rational science. It was just to avoid this outrage on common sense that the Darwinian hypothesis was proposed, so that by bridging the interval between lower and higher types of life, by a continuous procession of gradually changing organisms, the transition from one species to another might be more easily accepted. It would be too glaring an absurdity, to say, *e. g.,* that a man who had absolutely no money gave at once $10,000 to another, but the absurdity would be less noticed (though not less real) if it were said that he gave it gradually, *e. g.,* in small fractions of a cent at a time.

A third form of derivation theory would suppose that the Creator, at certain periods when new forms were to be introduced, either directly transformed pre-existing species into new ones, or in some way enabled them to produce the germs of new species. This is certainly possible hypothesis inasmuch as a proportionate cause of the new species is assigned. Yet the philosopher must consider it as arbitrary and gratuitous—an interference with the ordinary laws of organic nature—and hence, far less philosophical than the theory of *independent formations* which are a part of the order of the nature, not an interference with it.

93. The fourth form of the derivation theory supposes that in the beginning God created all specific forms of plant and animal life that have ever appeared upon the earth, but in

a condition suited to the circumstances of the time. Outwardly they would all appear more or less alike, just as, in the embryonic stage, all animals now resemble one another. In one, however, there was the Substantial Form or dynamic principle of a horse; in another, the form of an eagle, etc. These higher forms could not at first develop themselves into full perfection, owing to the conditions of the time. Each could only reach some low stage of embryonic development and reproduce its kind before passing away. Gradually as conditions changed each specific type in succeeding generations would be enabled to manifest its innate specific power either by slow imperceptible degrees, or suddenly and "per saltus." In this view again there is no violation of the law of causality. Species are distinct from the first, only the embryonic development which is now accomplished in one individual life would then have taken perhaps thousands of individual lives to reach its maturity.

The objection to this view, and it is a strong one, is that it is hard to see why the Creator should create high specific types in circumstances in which it was impossible for them to attain their natural perfection. Moreover, there is no animal known to palaeontologists which would represent, *e. g.,* "a horse" at any period of its present embryonic development.

Note (i).—This last theory differs from *Darwinian* evolution in two essential points: (i) Darwinism supposes nothing to start with but the simplest forms of almost undifferentiated living protoplasm. This acted upon by external physical agencies would give all the varied life of the past and present world. This theory, on the contrary, supposes that the different organisms are, from the first, differentiated by different dynamic principles, but that the organisms were unable to attain their full development until suitable surrounding circumstances occurred. (ii) Darwinism holds that the human soul is merely a development of the animal life-principle. This theory, on the contrary, holds that the human soul is in every case a spiritual substance directly created by God.

(2).—"The term 'evolution,' has been employed in so many senses, as to have become nearly useless for any scientific purpose."—Dawson. The word is used in all the senses considered above, and in many more. When, then, a man says he is an Evolutionist, or asks you if you admit the doctrine of Evolution, you will do well to ask what he means by the word, where his evolution begins, where it ends, how it is accomplished, etc

(3).—What has *revealed religion* to say as to the origin of species? Very little, (i) God is the Author and Creator mediately or immediately of all finite beings, (ii) Each individual *human* soul is directly and immediately created by God. (iii) As to the origin of the *first human body,* Holy Scripture says that God formed it from the earth. Hence the words *literally* imply an immediate action of God in the formation of the first human body. Now it is a canon of all interpretation that the words of a document are to be taken literally, unless there is a cogent reason for taking them in a figurative sense. In the present case no such reason exists. Therefore, etc. Again, it is a rule of interpretation in the Church, that it is not permissible to interpret a statement of Scripture in a sense opposed to that in which it has been unanimously understood from the beginning by all the great doctors and theologians of the Church. But the Scripture narrative of the formation of the body of Adam has always been taken in thé *literal* sense of the words by the great doctors and theologians. Therefore, etc.

Hence, as the matter is so closely connected with some of the fundamental truths of revelation, *e. g., the* unity and original state of the human race, etc., it would be rash and imprudent on the part of a Christian to admit that the first human body was in any way evolved from a brute organism; all the more so, as there is not a shadow of a scientific reason for doing so.

(4) —Why have so many scientific men (they will be found to be, generally speaking, the popular *retailers* rather than the great *makers ai* science) accepted the theory of Evolution?

The reasons given above, (n. 31) will hold here also, (i) A want of grasp of logical and metaphysical principles. The law of Proportionate Causality is lost sight of in hasty efforts to classify isolated facts, (ii) A desire, it would seem, to push the Creator as far back as possible from the affairs of the world He made and governs, if not to get rid of the thought of God altogether.

In this connection it is worth while to draw attention to two significant passages quoted by Lord Salisbury in his address, as president of the British Association, delivered at Oxford before the assembled scientific representatives of America and Europe, August, 1894.

Lord Kelvin, "the greatest living master of science among us" is quoted as saying: "I feel profoundly convinced that the argument of *design* has been greatly too much lost sight of in recent zoological speculations. Overwhelmingly strong proof of intelligent and beneficent design lie around us, and if ever perplexities, whether metaphysical or scientific, turn us away from them for a time, they come back upon us with irresistible force, showing to us, through nature, the influence of a Free Will and teaching us that all living things depend on one Everlasting Creator and Ruler."

Prof. Weismann, a prominent evolutionist authority, is quoted as follows: "We accept Natural Selection, not because we are able to demonstrate the process in detail, not even because we can imagine it; but simply because it is the only explanation we can conceive * * * without assuming the help of a *principle of design.*"

For a clear and authoritative exposition of Evolution and allied topics see the article by Herman Muckennann, S. J., in the Catholic Encyclopedia.

94. Objections.

(a) From *Palaontology.*

(i) —Geology shows that the order in which the various forms of organic life were introduced was one of gradual prog-

ress from lower to higher types. But this proves that higher types are descended from lower.

Answer (1).—T. maj. N. Min. Fallacy, Post Hoc; ergo Propter Hoc.

(2).—T. maj. D. min.; If transitional forms connect the various types, this would give *probability* to some *rational* hypothesis of descent, c. min. If no such forms exist, the mere fact of ascending series of types would justify any hypothesis of descent, n. min.

(3).—N. maj. An ascending series would be protozoa, coelenterates, echinoderms, worms, molluscs, arthropodes, tunicates, vertebrates. Now all these *sub-kingdoms* are found in the lower palaeozoic and all are found together in all the eras. Nor is there an ascending series in the *classes of* these sub-kingdoms, except reptiles, birds and animals of vertebrates. Nor is there an ascending series in *specific* representatives of these classes. The trilobites, cuttle-fishes and ganoid fishes oi the Silurian and Devonian—the amphibians of the Carboniferous—the reptiles of the Mesozoic, etc., are as a rule, far superior to the corresponding types of later times.

(ii) Geology gives us *transitional forms, e. g.,* ganoid fish of the Devonian join teleost fish and reptiles. Ichthyosaurs (swimming reptiles), Dinosaurs (walking reptiles), Pterosaurs (flying reptiles), show the connection between fish, birds, amphibians, etc.

Answer.—These are the Transitional Forms required to prove descent, N. assert. You might as well say that our *bat* is a bird on its way to become a mouse.

These are distinct specific types intermediate between other species, and permanent in their own, just as the *bat* is, C. assert.

Note.—The forms just mentioned may be called *generalized* types suited to a mixed land and water and aerial existence, such as the condition of the earth at the time of their introduction required. But there is no trace of genealogical connection between them and more specialized forms.

(iii)—At least we can trace the transformation of the *horse* from a little four-toed animal about the size of a fox in the Eocene.—(See Leconte, Compend, p. 361).

Answer.—N. assert. The best palæonotologists, even among those who favor the doctrine of *derivation, e. g.,* Gaudry, etc., reject this argument for transformism. The various animals mentioned as ancestors of the horse are too different in structure to suggest connection by descent; and the Transitional Forms to bridge over the intervals are, as usual, missing. "If the horse is evolved out of Hipparion, myriads of individuals must have existed to effect this gradual change."—Williamson, etc. If we begin with Anchitherium or Miohippus, three-toed animals, as Marsh and Cope do, the difficulty remains the same.

Note.—The Plasticity of species, within the limits of *varietal* changes, is very great, *e. g.,* 'pigeons,' 'dogs,' 'horses,' eta Geologists justly complain of the tendency among fossil discoverers and naturalists, for every trifling difference in structure, to multiply *species;* while the animals in question may well be merely *varieties* of the same species.

(iv)—The geological record is incomplete, and therefore, it furnishes no argument against evolution. (See Leconte, *fassim).*

Answer (1).—"The geological record is much more complete than is generally supposed. Over long periods of time and many lines of being, we have a nearly continuous chain of facts, and if these do not show the desired tendency, the fault is as likely to be in the *theory* as in the record."—Dawson.

(2).—This is a strange method of argument. Evolution depends on Palaeontology as its "only perfectly safe foundation." The "foundation" refuses to support the airy superstructure. Therefore evolution is "exact science," etc.

(b) From *Anatomy.*

(i).—*Similarity of structure* shows descent from a com-

mon stock. But all plants and animals are similar in structure, *e. g.,* 'the limbs of a fish, a bird and a horse.' Therefore, etc

Answer (i).—The argument may be retorted. *Dissimilarity* of structure shows descent from different stocks. But all species of animals differ in structure and function from their neighbors, e. g., 'the limbs of fish, bird, etc.,' as above.

(2).—*Specific* similarity in structure and function shows descent from a common stock, c. maj. *Generic* similarity shows, etc., n. maj. But all animals are *specifically* similar in structure, n. min.; all animals are *generically* similar, L min.

Note.—The fallacy here is in the transmission from the *abstract* to the *concrete.* *We* can form the abstract concept of a backboned warm-blooded four-limbed being; and this concept, so far as it goes, represents all such things. But when we come to the actual concrete world we find that the abstract notes are realized in essentially different ways. The abstract similarity is modified in the concrete by decided differences as essential as itself.

(ii).—In many organisms we find certain organs *atrophied, rudimentary* organs—useless to their possessors, but fully developed and useful in other animals, *e. g.,* 'the wings of the apteryx,' 'ostrich,' etc. Now, such rudimentary organs show genealogical relationship between their possessors and those organisms in which they are found fully developed.

Answer.—To say that these so-called rudimentary organs are *useless* is altogether gratuitous. "There is no organ of the body, however small, however seemingly unimportant, which we can presume to neglect. It may be that the balance of assimilation and nutrition, upon which the health of the whole organism depends, hinges upon the integrity of such obscure structures: and it is the maintenance of this balance which constitutes health; its disturbance, disease."—Schafer.

Note.—The law of Correlation of Parts for the Perfection of the Whole governs all perfect work in nature as in art. To construct, *e. g.,* a vertebrae of some *particular* specific

type, the general *parts* essential to all vertebrates must be arranged and developed in subordination to the idea of *this particular whole.* Some of the *parts* will be more developed, some less, than in other species of the class, in order that the *whole may* be a perfectly balanced structure; and any modification of any of these parts, for better or for worse, will injure the whole. Hence, it is misleading to speak of the normally developed parts of any specific type as Rudimentary. They *would* be rudimentary, in other types, just as the *spring* of a lady's watch would be *rudimentary* in a town clock.

(c) From *Embryology.*

(i).—Every day the most varied organisms are evolved out of similar cells of protoplasm. Therefore, all organisms have arisen from a primeval, undifferentiated mass of protoplasm.

Answer.—From cells similar in *origin, internal energy* and *outward* appearance, n. anteced. Similar in outward appearance but different in origin and internal energy, t. anteced.

(ii).—*Ontogenesis* is a summary of *phylogenesis.* But the history of the embryonic development of each individual of a higher species exhibits a series of transformations from a simple cell through all the types of life inferior to its own.

Answer.—N. major. It is a mere fanciful and gratuitous assertion. Also, n. min. Von Baer, on whose authority Haeckel tries to base this assertion, calls it flatly a *falsification of science.* So, too, the greatest biologists, *e. g.,* Milne-Edwards, "There is never a complete likeness between any adult animal and the embryo of another at any period of the latter's development." Thus at a certain period the vertebrate embryo has something of the appearance of an arthopode; but closer examination shows "that the vertebrate has its nerve-centers in the *dorsal side;* the arthropodes, in the *ventral.* Indeed, all the organs are oppositely situated."—Von Baer.

Note.—It is the dynamic principle within that differentiates one form of life from another, and this is fully manifested only in the mature definite stage of a being's development.

Hence the present objection, as well as those drawn from metamorphosis, alternate generation, etc., do not really touch the question.

(d) From *Philosophy*.

The theory of Immediate Formation is an interference with, while that of Evolution is in accordance with, the laws of nature.

Answer.—As to the first part of this assertion, see n. 86. As to the second part, it must be clear from what has been said that fixity and immutability of species is the law of nature as revealed to us by the facts of present, historical and geological time. Hence, the transformation of species would be an interference with law, and as such a true miracle.

PART FOUR

RATIONAL PSYCHOLOGY.

I. Rational Psychology is, The science of the human soul, i. e., of that principle in man by which he lives, feels, thinks and wills. Here, however, we take account only of those vital acts which are *characteristic of man* and distinguish him from all other living things in the visible world around us. We start, then, with the data which consciousness (our own, and that of other men), expressed in their life and language, furnishes as to the characters of the vital acts of *thought* and *volition;* and from these we reason back to the *nature* of the ultimate principle from which they proceed, its relation to the body, its .origin, etc. From what the soul *does* we gather what it must *be.* Thus, our natural knowledge of the essence, origin, destiny, etc., of our souls is not arrived at by *intuition,* but by *deduction.*

The subject may be divided into two Chapters :—

I. Intellect and Will;

II. The Nature of the Soul.

CHAPTER I.

Intellect and Will.

Article I.—Intellect.

2. We have already shown in Logic (n. 113 exists in a man a cognitive faculty far higher and grasp than sense, whose perceptions, as Huxley