

## CHAPTER ONE

# THE STUFF OF THE UNIVERSE

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TO PUSH anything back into the past is equivalent to reducing it to its simplest elements. Traced as far as possible in the direction of their origins, the last fibres of the human aggregate are lost to view and are merged in our eyes with the very stuff of the universe.

As for the stuff of the universe—the ultimate residue of the ever more advanced analyses of science—I have not cultivated that direct and familiar contact with it which would enable me to do it justice, that contact which comes from experiment and not from reading and makes all the difference. Besides, I know the danger of trying to construct a lasting edifice with hypotheses which are only expected to last for a day, even in the minds of those who originate them.

To a considerable extent, the representation of the atom accepted at this moment is nothing more than a simple means, graphic even while subject to revision, enabling the scientist to put together and to show the non-contradiction of the ever more various 'effects' manifested by matter—many of which, moreover, have still no recognisable prolongation in man.

As I am a naturalist rather than a physicist, obviously I shall avoid dealing at length with or placing undue reliance upon these complicated and fragile edifices.

On the other hand, among the variety of overlapping theories, a certain number of characteristics emerge which are inevitable in any suggested explanation of the universe. It is of these 'imposed' factors that it is not unbecoming for a naturalist to speak when engaged on a general study of the phenomenon of man. In fact,

inasmuch as they express the conditions belonging to all natural change, even biological, he is bound to take them as his point of departure.

## I. ELEMENTAL MATTER

Observed from this special angle, and considered at the outset in its elemental state (by which I mean at any moment, at any point, and in any volume), the stuff of tangible things reveals itself with increasing insistence as radically particulate yet essentially related, and lastly, prodigiously active.

Plurality, unity, energy : the three faces of matter.

### A. Plurality

The profoundly 'atomic'<sup>1</sup> character of the universe is visible in everyday experience, in raindrops and grains of sand, in the hosts of the living, and the multitude of stars ; even in the ashes of the dead. Man has needed neither microscope nor electronic analysis in order to suspect that he lives surrounded by and resting on dust. But to count the grains and describe them, all the patient craft of modern science was necessary. The atoms of Epicurus were inert and indivisible. And the infinitesimal worlds of Pascal could still possess their animalcules. Today we have gone far beyond such instinctive or inspired guesswork both in certainty and precision. The scaling down is unlimited. Like the tiny diatom shells whose markings, however magnified, change almost indefinitely into new patterns, so each particle of matter, ever smaller and smaller, under the physicist's analysis tends to reduce itself into something yet more finely granulated. And at each new step in this progressive approach to the infinitely small the whole configuration of the world is for a moment blurred and then renewed.

<sup>1</sup> [Atomicité.]

When we probe beyond a certain degree of depth and dilution, the familiar properties of our bodies—light, colour, warmth, impenetrability, etc.—lose their meaning.

Indeed our sensory experience turns out to be a floating condensation on a swarm of the undefinable. Bewildering in its multiplicity and its minuteness, the substratum of the tangible universe is in an unending state of disintegration as it goes downward.

### B. Unity

On the other hand the more we split and pulverise matter artificially, the more insistently it proclaims its *fundamental unity*.

In its most imperfect form, but the simplest to imagine, this unity reveals itself in the astonishing similarity of the elements met with. Molecules, atoms, electrons—whatever the name, whatever the scale—these minute units (at any rate when viewed from our distance) manifest a perfect identity of mass and of behaviour. In their dimensions and actions they seem astonishingly calibrated—and monotonous. It is almost as if all that surface play which charms our lives tends to disappear at deeper levels. It is almost as if the stuff of which all stuff is made were reducible in the end to some simple and unique kind of substance.

Thus the *unity of homogeneity*. To the cosmic corpuscles we should find it natural to attribute an individual radius of action as limited as their dimensions. We find, on the contrary, that each of them can only be defined by virtue of its influence on all around it. Whatever space we suppose it to be in, each cosmic element radiates in it and entirely fills it. However narrowly the 'heart' of an atom may be circumscribed, its realm is co-extensive, at least potentially, with that of every other atom. This strange property we will come across again, even in the human molecule.

We add : *collective unity*. The innumerable foci which share a given volume of matter are not therefore independent of each other. Something holds them together. Far from behaving as a

mere inert receptacle, the space filled by their multitude operates upon it like an active centre of direction and transmission in which their plurality is organised. We do not get what we call matter as a result of the simple aggregation and juxtaposition of atoms. For that, a mysterious identity must absorb and cement them, an influence at which our mind rebels in bewilderment at first but which in the end it must perforce accept.

We mean the sphere above the centres and enveloping them.

Throughout these pages, in each new phase of anthropogenesis, we shall find ourselves faced by the unimaginable reality of collective bonds, and we shall have to struggle with them without ceasing until we succeed in recognising and defining their true nature. Here in the beginning it is sufficient to include them all under the empirical name given by science to their common initial principle, namely *energy*.

### c. Energy

Under this name, which conveys the experience of effort with which we are familiar in ourselves, physics has introduced the precise formulation of a capacity for action or, more exactly, for interaction. Energy is the measure of that which passes from one atom to another in the course of their transformations. A unifying power, then, but also, because the atom appears to become enriched or exhausted in the course of the exchange, the expression of structure.

From the aspect of energy, renewed by radio-active phenomena, material corpuscles may now be treated as transient reservoirs of concentrated power. Though never found in a state of purity, but always more or less granulated (even in light) energy nowadays represents for science the most primitive form of universal stuff. Hence we find our minds instinctively tending to represent energy as a kind of homogeneous, primordial flux in which all that has shape in the world is but a series of fleeting 'vortices'. From this point of view, the universe would find its

stability and final unity *at the end of its decomposition. It would be held together from below.*

Let us keep the discoveries and indisputable measurements of physics. But let us not become bound and fettered to the perspective of final equilibrium that they seem to suggest. A more complete study of the movements of the world will oblige us, little by little, to turn it upside down ; in other words, to discover that if things hold and hold together, it is only by reason of complexity, *from above.*

## 2. TOTAL MATTER

Up to now we have been looking at matter as such, that is to say according to its qualities and in any given volume—as though it were permissible for us to break off a fragment and study this sample apart from the rest. It is time to point out that this procedure is merely an intellectual dodge. Considered in its physical, concrete reality, the stuff of the universe cannot divide itself but, as a kind of gigantic 'atom', it forms in its totality (apart from thought on which it is centred and concentrated at the other end) the only real indivisible. The history of consciousness and its place in the world remain incomprehensible to anyone who has not seen first of all that the cosmos in which man finds himself caught up constitutes, by reason of the unimpeachable wholeness of its whole, a *system*, a *totum* and a *quantum* : a system by its plurality, a totum by its unity, a quantum by its energy ; all three within a boundless contour.

Let us try to make this clear.

### A. The System

The existence of 'system' in the world is at once obvious to every observer of nature, no matter whom.

The arrangement of the parts of the universe has always been



a source of amazement to men. But this disposition proves itself more and more astonishing as, every day, our science is able to make a more precise and penetrating study of the facts. The farther and more deeply we penetrate into matter, by means of increasingly powerful methods, the more we are confounded by the interdependence of its parts. Each element of the cosmos is positively woven from all the others : from beneath itself by the mysterious phenomenon of 'composition', which makes it subsistent through the apex of an organised whole; and from above through the influence of unities of a higher order which incorporate and dominate it for their own ends.

It is impossible to cut into this network, to isolate a portion without it becoming frayed and unravelled at all its edges.

All around us, as far as the eye can see, the universe holds together, and only one way of considering it is really possible, that is, to take it as a whole, in one piece.

### B. *The Totum*

Now, if we consider this whole more attentively, we quickly see that it is something quite other than a mere entanglement of articulated inter-connections. If one says fabric or network, one thinks of a homogeneous plexus of similar units which it may indeed be impossible to section, but of which it is sufficient to have recognised the basic unit and to have defined the law to be able to understand the whole by repetition : a crystal or arabesque whose laws are valid for whatever space it fills, but which is wholly contained in a single mesh.

Between such a structure and the structure of matter there is nothing in common.

In its different orders of magnitude, matter never repeats its different combinations. For expedience and simplicity we sometimes like to imagine the world as being a series of planetary systems superimposed, the one on the other, and grading from the infinitely small to the infinitely big : Pascal's two abysses

once again. This is only an illusion. The envelopes composing matter are thoroughly heterogeneous the one with regard to the other. First we have a vague circle of electrons and other inferior units ; then a better-defined circle of simple bodies in which the elements are distributed as periodic functions of the atom of hydrogen ; farther on another circle, of inexhaustible molecular combinations ; and lastly, jumping or recoiling from the infinitesimal to the infinite, a circle of stars and galaxies. These multiple zones of the cosmos envelop without imitating each other in such a way that we cannot pass from one to another by a simple change of coefficients. Here is no repetition of the same theme on a different scale. The order and the design do not appear except in the whole. The mesh of the universe is the universe itself.

Thus it is not enough merely to assert that matter forms a block or whole.

The stuff of the universe, woven in a single piece according to one and the same system,<sup>1</sup> but never repeating itself from one point to another, represents a single figure. Structurally, it forms a Whole.

### C. *The Quantum*

Now, if the natural unity of concrete space indeed coincides with the totality of space itself, we must try to re-define energy with reference to space as a whole.

This leads us to two conclusions.

The first is that the radius of action proper to each cosmic element must be prolonged in theory to the utmost limits of the world itself. As we said above, since the atom is naturally co-extensive with the whole of the space in which it is situated—and since, on the other hand, we have just seen that a universal space is *the only space there is*—we are bound to admit that this immensity represents the sphere of action common to all atoms. The volume of each of them is the volume of the universe. The

<sup>1</sup> Which we shall call later on 'the Law of Consciousness and Complexity'.

atom is no longer the microscopic, closed world we may have imagined to ourselves. It is the infinitesimal centre of the world itself.

Now, on the other hand, let us turn our attention to the entirety of the infinitesimal centres which share the universal sphere among themselves. Indefinite though their number may be, they constitute in their multitude a group which has precise effects. For the whole, because it exists, must express itself in a global capacity for action of which we find the partial resultant in each one of us. Thus we find ourselves led on to envisage and conceive a dynamic standard of the world.

True the world has apparently limitless contours. To use varying metaphors: it behaves to our senses, either as a progressively attenuated environment which vanishes without a limital surface in an infinitely decreasing gradation, or as a curved and closed space within which all the lines of our experience turn back upon themselves, in which case matter only appears boundless to us because we cannot emerge from it.

This is no reason for refusing it a quantum of energy, which the physicists, incidentally, already think they are in a position to measure.

But this quantum only takes on its full significance when we try to define it with regard to a concrete natural movement—that is to say, in *duration*.

### 3. THE EVOLUTION OF MATTER

Physics was born, in the last century, under the double sign of fixity and geometry. Its ideal, in its youth, was to find a mathematical explanation of a world imagined as a system of stable elements in a closed equilibrium. Then, following all science of the real, it was inevitably drawn by its own progress into becoming a history. Today, positive knowledge of things is identified with the study of their development. Farther on, in the chapter on Thought, we shall have to describe and interpret the vital

revolution in human consciousness brought about by the quite modern discovery of duration. Here we need only ask ourselves how our views about matter are enlarged by the introduction of this new dimension.

In essence, the change wrought in our experience by the appearance of what we shall soon call space-time is this, that everything that up to then we regarded and treated as points in our cosmological constructions became instantaneous sections of indefinite temporal fibres. To our opened eyes each element of things is henceforth extended backwards (and tends to be continued forwards) as far as the eye can see in such a way that the entire spatial immensity is no more than a section 'at the time  $t$ ' of a trunk whose roots plunge down into the abyss of an unfathomable past, and whose branches rise up somewhere to a future that, at first sight, has no limit. In this new perspective the world appears like a mass in process of transformation. The universal totum and quantum tend to express and define themselves in cosmogenesis. What at this moment are the appearance (qualitative) assumed from the point of view of the physicists and the rules followed (quantitative) by this evolution of matter?

#### A. The Appearance

As seen in its central portion, which is the most distinct, the evolution of matter, in current theory, comes back to the gradual building up by growing complication of the various elements recognised by physical chemistry. To begin with, at the very bottom there is a still unresolved simplicity, luminous in nature and not to be defined in terms of figures. Then, suddenly(?)<sup>1</sup>

<sup>1</sup> Some years ago this first birth of the corpuscles was imagined rather as a sudden *condensation* (as in a saturated environment) of a primordial substance or stuff, diffused throughout limitless space. Nowadays, for various convergent reasons, notably Relativity combined with the centrifugal retreat of the galaxies, physicists prefer to turn to the idea of an *explosion* pulverising a primitive quasi-atom within which space-time would be strangulated (in a



came a swarming of elementary corpuscles, both positive and negative (protons, neutrons, electrons, photons): the list increases incessantly. Then the harmonic series of simple bodies, strung out from hydrogen to uranium on the notes of the atomic scale. Next follows the immense variety of compound bodies in which the molecular weights go on increasing up to a certain critical value above which, as we shall see, we pass on to life. There is not one term in this long series but must be regarded, from sound experimental proofs, as being composed of nuclei and electrons. This fundamental discovery that all bodies owe their origin to arrangements of a single initial corpuscular type is the beacon that lights the history of the universe to our eyes. In its own way, matter has obeyed from the beginning that great law of biology to which we shall have to recur time and time again, the law of 'complexification'.<sup>1</sup>

I say in its own way because, at the stage of the atom, we are still ignorant of many points in the history of the world.

First of all, must all the elements mount each successive rung of the ladder from the most simple to the most complicated by a kind of onto- or phylo-genesis in order to raise themselves in the series of simple bodies? Or do the atomic numbers only represent a rhythmic series of states of equilibrium, sets of pigeon-holes, as it were, into which nuclei and electrons fall in rough assemblages? Moreover, in the one instance as in the other, must we regard the various combinations of nuclei as being equally possible at any one time? Or, on the other hand, must we suppose that on the whole, statistically, the heavy atoms only appear in a determinate order, after the lighter ones?

<sup>1</sup> [*Complexification* in the original: taken over here as the substantival form of the very rare English verb 'complexify'—to make complex.]

sort of natural absolute zero) at only some milliards of years behind us. For understanding the following pages, the two hypotheses are equivalent, in the sense that they put us, the one just as much as the other, in the midst of a corpuscular multitude from which we cannot escape in any direction; neither round about nor behind—but possibly forwards (cf. Part 4, chapter 2) through a singular point of interiorisation.

It does not appear that science is at present able to give definitive answers to these questions, or to others like them. At the present time we are less well informed about the ascending evolution of atoms (I do not say 'the disintegration') than we are about the pre-living and living molecules. It is none the less true, and this is the only point of real importance that concerns us here, that from its most distant formulations matter reveals itself to us in a *state of genesis* or becoming—this genesis allowing us to distinguish two of the aspects most characteristic of it in its subsequent stages. First of all, to begin with a critical phase, that of *granulation*, which abruptly and once and for all gave birth to the constituents of the atom and perhaps to the atom itself. Next, at least from the molecular level, of going on additively by a process of growing complexity.

Everything does not happen continuously at any one moment in the universe. Neither does everything happen everywhere in it.

So we may summarise in a few lines the ideas about the transformations of matter accepted by science today: but only by considering the latter in their temporal succession, and without as yet putting them anywhere within the cosmic expanse. Historically, the stuff of the universe goes on becoming concentrated into ever more organised forms of matter. But *where*, then, do these metamorphoses take place, beginning, let us say, with the framework of molecules? Is it indifferently at any point in space? Not at all, as we all know, but only in the heart and on the surface of the stars. From having considered the infinitely small elements we are abruptly compelled to raise our eyes to infinitely great sidereal masses.

The sidereal masses... Our science is at the same time troubled and fascinated by these colossal unities, which in some ways behave like atoms, but whose constitution baffles us by its enormous and—in appearance only?—irregular complexity. Perhaps the day will come when some arrangement or periodicity will become apparent in the stellar distribution both as regards their composition and their position. Do not a 'stratigraphy'

and a 'chemistry' of the heavens inevitably extend the story of the atoms ?

We have not to entangle ourselves in these still misty perspectives. No matter how fascinating they may be, they surround man rather than lead up to him. On the other hand, because of its consequences even up to the genesis of the intellect, we must notice and record the definite connection which, genetically, associates the atom with the star. For a long time yet physics may hesitate over the structure to be assigned to the astral immensities. In the meantime one thing is certain and is enough to guide our steps along the ways of anthropogenesis. That is that the making of greater material complexes can only take place under cover of a previous concentration of the stuff of the universe in nebulae and suns. Whatever the overall figure of the worlds may be, the chemical function of each one of them already has a definable meaning for us. The stars are laboratories in which the evolution of matter proceeds in the direction of large molecules, and that according to determinate quantitative rules which we must now discuss.

### B. *The Numerical Laws*

What ancient thought half perceived and imagined as a natural harmony of numbers, modern science has grasped and realised in the precision of formulae dependent on measurement. Indeed, we owe our knowledge of the macro-structure and micro-structure of the universe far more to increasingly accurate measurements than to direct observations. And, again, it is ever bolder measurements that have revealed to us the calculable conditions to which every transformation of matter is subject according to the force it calls into play.

This is not the place for me to embark on a critical discussion of the laws of energy. That part of them that is indispensable and accessible to every world-historian may be simply summarised. Considered from this biological aspect, broadly speaking, they may be reduced to the two following principles :

*First Principle.* During changes of a physico-chemical type we do not detect any measurable emergence of new energy.

Every synthesis costs something. That is a fundamental condition of things which persists, as we know, even into the spiritual zones of being. In every domain, the achievement of progress requires an excess of effort and therefore of force. Now whence does this increase come ?

In the abstract, one might assume an internal growth of the world's resources, an absolute increase in mechanical wealth corresponding to the expanding needs of evolution ; but, in fact, things seem to happen otherwise. In no case does the energy required for synthesis appear to be provided by an influx of fresh capital, but by expenditure. What is gained on one side is lost on the other. Nothing is constructed except at the price of an equivalent destruction.

Experimentally and at first sight, when we consider the universe in its mechanical functions, it does not reveal itself to us as an open quantum capable of containing an ever greater reality within its embrace, but as a closed quantum, within which nothing progresses except by exchange of that which was given in the beginning.

That is a first appearance.

*Second Principle.* In every physico-chemical change, adds thermodynamics, a fraction of the available energy is irrecoverably 'entropised', lost, that is to say, in the form of heat. Doubtless it is possible to retain this degraded fraction symbolically in equations, so as to express that in the operations of matter nothing is lost any more than anything is created, but that is merely a mathematical trick. As a matter of fact, from the real evolutionary standpoint, something is finally burned in the course of every synthesis in order to pay for that synthesis. The more the energy-quantum of the world comes into play, the more it is consumed. Within the scope of our experience, the material concrete universe seems to be unable to continue on its way indefinitely in a closed cycle, but traces out irreversibly a curve of obviously limited development. And thus it is that this universe differ-



entiate itself from purely abstract magnitudes and places itself among the realities which are born, which grow, and which die. From time it passes into duration ; and finally escapes from geometry dramatically to become, in its totality as in its parts, an object of history.<sup>1</sup>

Let us translate into images the natural significance of these two principles of the Conservation and Dissipation of Energy.

We said above that qualitatively the evolution of matter reveals itself to us, *hic et nunc*, as a process during which the constituents of the atom are inter-combined and ultra-condensed. Quantitatively, this transformation now appears to us as a definite, but costly, operation in which an original impetus slowly becomes exhausted. Laboriously, step by step, the atomic and molecular structures become higher and more complex, but the upward force is lost on the way. Moreover, the same wearing away that is gradually consuming the cosmos in its totality is at work within the terms of the synthesis, and the higher the terms the quicker this action takes place. Little by little, the *improbable* combinations that they represent become broken down again into more simple components, which fall back and are disaggregated in the shapelessness of *probable* distributions.

A rocket rising in the wake of time's arrow, that only bursts to be extinguished ; an eddy rising on the bosom of a descending current—such then must be our picture of the world.

So says science : and I believe in science : but up to now has science ever troubled to look at the world other than from *without*?

<sup>1</sup> [cf. concluding sections of R. G. Collingwood : *Idea of Nature* (O.U.P. 1944).]

## CHAPTER TWO

## THE WITHIN OF THINGS

ON THE scientific plane, the quarrel between materialists and the upholders of a spiritual interpretation, between finalists and determinists, still endures. After a century of disputation each side remains in its original position and gives its adversaries solid reasons for remaining there.

So far as I understand the struggle, in which I have found myself involved, it seems to me that its prolongation depends less on the difficulty that the human mind finds in reconciling certain apparent contradictions in nature—such as mechanism and liberty, or death and immortality—as in the difficulty experienced by two schools of thought in finding a common ground. On the one hand the materialists insist on talking about objects as though they only consisted of external actions in transient relationships. On the other hand the upholders of a spiritual interpretation are obstinately determined not to go outside a kind of solitary introspection in which things are only looked upon as being shut in upon themselves in their 'immanent' workings. Both fight on different planes and do not meet ; each only sees half the problem.

I am convinced that the two points of view require to be brought into union, and that they soon will unite in a kind of phenomenology or generalised physics in which the internal aspect of things as well as the external aspect of the world will be taken into account. Otherwise, so it seems to me, it is impossible to cover the totality of the cosmic phenomenon by one coherent explanation such as science must try to construct.



We have just described the *without* of matter in its connections and its measurable dimensions. Now, in order to advance still farther in the direction of man, we must extend the bases of our future edifices into the *within* of that same matter.

Things have their *within* ; their 'reserve', one might say ; and this appears to stand in definite *qualitative* or *quantitative* connections with the developments that science recognises in the cosmic energy. These three statements [i.e., that there is a *within*, that some connections are *qualitative*, that others are *quantitative*] are the basis of the three sections of this new chapter. To deal with them, as here I must, obliges me to overlap 'Before Life' and somewhat to anticipate 'Life' and 'Thought'. However, is not the peculiar difficulty of every synthesis that its end is already implicit in its beginnings ?

## 1. EXISTENCE

If there is one thing that has been clearly brought out by the latest advances in physics, it is that in our experience there are 'spheres' or 'levels' of different kinds in the unity of nature, each of them distinguished by the dominance of certain factors which are imperceptible or negligible in a neighbouring sphere or on an adjacent level. On the middle scale of our organisms and of our constructions velocity does not seem to change the nature of matter. None the less, we now know that at the extreme values reached by atomic movements it profoundly modifies the mass of bodies. Among 'normal' chemical elements, stability and longevity appear to be the rule : but that illusion has been destroyed by the discovery of radio-active substances. By the standards of our human existence, the mountains and stars are a model of majestic changelessness. Now we discover that, observed over a sufficiently great duration of time, the earth's crust changes ceaselessly under our feet, while the heavens sweep us along in a cyclone of stars.

In all these instances, and in others like to them, there is no

absolute appearance of a new dimension. *Every* mass is modified by its velocity. *Every* body radiates. *Every* movement is veiled in immobility when sufficiently slowed down. But on a different scale, or at a different intensity, there will become visible some phenomenon that spreads over the horizon, blots out the other distinctions, and gives its own particular tonality to the whole picture.

It is the same with the *within* of things.

For a reason that will soon appear, objects in the realm of physico-chemistry are only made manifest by their outward determinisms.

In the eyes of the physicist, nothing exists legitimately, at least up to now, except the *without* of things. The same intellectual attitude is still permissible in the bacteriologist, whose cultures (apart from some substantial difficulties) are treated as laboratory reagents. But it is already more difficult in the realm of plants. It tends to become a gamble in the case of a biologist studying the behaviour of insects or coelenterates. It seems merely futile with regard to the vertebrates. Finally, it breaks down completely with man, in whom the existence of a *within* can no longer be evaded, because it is the object of a direct intuition and the substance of all knowledge.

The apparent restriction of the phenomenon of consciousness to the higher forms of life has long served science as an excuse for eliminating it from its models of the universe. A queer exception, an aberrant function, an epiphenomenon—thought was classed under one or other of these heads in order to get rid of it. But what would have happened to modern physics if radium had been classified as an 'abnormal substance' without further ado ? Clearly, the activity of radium had not been neglected, and could not be neglected, because, being measurable, it forced its way into the external web of matter—whereas consciousness, in order to be integrated into a world-system, necessitates consideration of the existence of a new aspect or dimension in the stuff of the universe. We shrink from the attempt, but which of us does not in both cases see an identical problem facing research workers,

which have to be solved by the same method, namely, *to discover the universal hidden beneath the exceptional*?

Latterly we have experienced it too often to admit of any further doubt: an irregularity in nature is only the sharp exacerbation, to the point of perceptible disclosure, of a property of things diffused throughout the universe, in a state which eludes our recognition of its presence. Properly observed, even if only in one spot, a phenomenon necessarily has an omnipresent value and roots by reason of the fundamental unity of the world. Whither does this rule lead us if we apply it to the instance of human 'self-knowledge'?

'Consciousness is completely evident only in man' we are tempted to say, 'therefore it is an isolated instance of no interest to science.'

'Consciousness is evident in man,' we must continue, correcting ourselves, 'therefore, half-seen in this one flash of light, it has a cosmic extension, and as such is surrounded by an aura of indefinite spatial and temporal extensions.'

The conclusion is pregnant with consequences, and yet I cannot see how, by sound analogy with all the rest of science, we can escape from it.

It is impossible to deny that, deep within ourselves, an 'interior' appears at the heart of beings, as it were seen through a rent. This is enough to ensure that, in one degree or another, this 'interior' should obtrude itself as existing everywhere in nature from all time. Since the stuff of the universe has an inner aspect at one point of itself, there is necessarily a *double aspect to its structure*, that is to say in every region of space and time—in the same way, for instance, as it is granular: *co-extensive with their Without, there is a Within to things*.

The consequent picture of the world daunts our imagination, but it is in fact the only one acceptable to our reason. Taken at its lowest point, exactly where we put ourselves at the beginning of these pages, primitive matter is something more than the particulate swarming so marvellously analysed by modern physics. Beneath this mechanical layer we must think of a 'biological'

layer that is attenuated to the uttermost, but yet is absolutely necessary to explain the cosmos in succeeding ages. The *within*, *consciousness*<sup>1</sup> and then *spontaneity*—three expressions for the same thing. It is no more legitimate for us experimentally to fix an absolute beginning to these three expressions of one and the same thing than to any other lines of the universe.

*In a coherent perspective of the world: life inevitably assumes a 'pre-life' for as far back before it as the eye can see.*<sup>2</sup>

In that case—and the objection will come from materialists and upholders of spirituality alike—if everything in nature is basically living, or at least pre-living, how is it possible for a mechanistic science of matter to be built up and to triumph?

Determinate *without*, and 'free' *within*—would the two aspects of things be irreducible and incommensurable? If so, where is your solution?

The answer to this difficulty is already implicit in what we

<sup>1</sup> Here, and throughout this book, the term 'consciousness' is taken in its widest sense to indicate every kind of psychism, from the most rudimentary forms of interior perception imaginable to the human phenomenon of reflective thought.

<sup>2</sup> These pages had been written for some time when I was surprised to find their substance in some masterly lines recently written by J. B. S. Haldane:

'We do not find obvious evidence of life or mind in so-called inert matter, and we naturally study them most easily where they are most completely manifested; but if the scientific point of view is correct, we shall ultimately find them, at least in rudimentary forms, all through the universe.'

And he goes on to add these words which my readers would do well to recall when I come to unveil (with all due reservations and corrections) the perspective of the 'Omega Point':

'Now, if the co-operation of some thousands of millions of cells in our brain can produce our consciousness, the idea becomes vastly more plausible that the co-operation of humanity, or some sections of it, may determine what Comte calls a Great Being.' (Essay on Science and Ethics in *The Inequality of Man*, Chatto, 1932, p. 113.)

What I say is thus not absurd. Moreover, any metaphysician must rejoice to discover that even in the eyes of physics the idea of absolutely brute matter (that is to say, of a pure 'transient') is only a first very rough approximation of our experience.



have said above about the diversity of 'spheres of experience' superposed in the interior of the world. It will appear more clearly when we have discerned the qualitative laws that govern in their growth and variation the manifestations of what we have just called the *within* of things.

## 2. THE QUALITATIVE LAWS OF GROWTH

To harmonise objects in time and space, without presuming to determine the conditions that can rule their deepest being : to establish an experimental chain of succession in nature, not a union of 'ontological' causality ; to see, in other words, and not to explain—this, let it not be forgotten, is the sole aim of the present study.

From this phenomenal point of view (which is *the* scientific point of view) can one go beyond the position where our analysis of the stuff of the universe has just stopped ? In this last we have recognised the existence of a conscious inner face that everywhere duplicates the 'material' external face, which alone is commonly considered by science. Can we go further and define the rules according to which this second face, for the most part entirely hidden, suddenly shows itself, and then as suddenly bursts through into certain other regions of our experience ?

Yes, so it seems, and even quite easily, provided there are placed one after the other three observations that each one of us could have made, but which do not take on their true value until we think of linking them together.

### A. First Observation

Considered in its pre-vital state, the *within* of things, whose reality even in the nascent forms of matter we have just admitted, must not be thought of as forming a continuous film, but as assuming the same granulation as matter itself.

Soon we shall have to return to this essential point. As far back as we began to descry them, *the first living things* reveal themselves to our experience as kinds of 'mega-' or 'ultra-' molecules, both in size and in number: a bewildering multitude of microscopic nuclei. Which means that for reasons of homogeneity and continuity, the pre-living can be divined, below the horizon, as an object sharing in the *corpuscular* structure and properties of the world. Looked at from *within*, as well as observed from *without*, the stuff of the universe thus tends likewise to be resolved backwardly into a dust of particles that are (i) perfectly alike among themselves (at least if they are observed from a great distance) ; (ii) each co-extensive with the whole of the cosmic realm ; (iii) mysteriously connected among themselves, finally, by a global energy. In these depths the world's two aspects, external and internal, correspond point by point. So much is this so that one may pass from the one to the other on the sole condition that 'mechanical interaction' in the definition of the partial centres of the universe given above is replaced by 'consciousness'.

*Atomicity is a common property of the Within and the Without of things.*

### B. Second Observation

Virtually homogeneous among themselves in the beginning, the elements of consciousness, exactly as the elements of matter which they subtend, complicate and differentiate their nature, little by little, with the passage of duration. From this point of view and considered solely from the experimental aspect, consciousness reveals itself as a cosmic property of variable size subject to a global transformation. Taken on the ascent, this huge phenomenon that we shall have to follow all along the development of life right up to the appearance of thought, has ended by appearing commonplace. Followed in the opposite direction, it leads us, as we have already seen, to the less familiar idea of



inferior states that are ever less well defined and, as it were, distended.

*Refracted rearwards along the course of evolution, consciousness displays itself qualitatively as a spectrum of shifting shades whose lower terms are lost in the night.*

### C. Third Observation

Finally, let us take from two different regions of this spectrum two particles of consciousness that are at unlike stages of evolution. As we have seen, there corresponds to each of them, by construction, a certain definite material grouping of which they form the *within*. Let us compare these two external groupings the one with the other and ask ourselves how they are arranged with regard to each other and with regard to the portion of consciousness that each of them encloses.

The answer comes at once.

Whatever instance we may think of, we may be sure that every time a richer and better organised structure will correspond to the more developed consciousness.

The simplest form of protoplasm is already a substance of unheard-of complexity. This complexity increases in geometrical progression as we pass from the protozoon higher and higher up the scale of the metazoa. And so it is for all the rest always and everywhere. Here again, the phenomenon is so obvious that we have long since ceased to be astonished by it. Yet its importance is decisive. For thanks to it we possess a tangible 'parameter' allowing us to connect both the internal and the external films of the world, not only *in their position* (point by point), but also, as we shall verify later on, *in their motion*.

The degree of concentration of a consciousness varies in inverse ratio to the *simplicity* of the material compound lined by it. Or again : a consciousness is that much more perfected according as it lines a richer and better organised material edifice.

*Spiritual perfection (or conscious 'centreity') and material syn-*

*thesis (or complexity) are but the two aspects or connected parts of one and the same phenomenon.*<sup>1</sup>

And now we have arrived, *ipso facto*, at the solution of the problem posed for us. We are seeking a qualitative law of development that from sphere to sphere should be capable of explaining, first of all the invisibility, then the appearance, and then the gradual dominance of the *within* in comparison to the *without* of things. This law reveals itself once the universe is thought of as passing from *State A*, characterised by a very large number of very simple material elements (that is to say, with a very poor *within*), to *State B* defined by a smaller number of very complex groupings (that is to say, with a much richer *within*).

In *State A*, the centres of consciousness, because they are extremely numerous and extremely loose at the same time, only reveal themselves by overall effects which are subject to the laws of statistics. Collectively, that is, they obey the laws of mathematics. This is the proper field of physico-chemistry.

In *State B*, on the other hand, these less numerous<sup>2</sup> and at the same time more highly individualised elements gradually escape from the slavery of large numbers. They allow their basic non-measurable spontaneity to break through and reveal itself. We can begin to see them and follow them one by one, and in so doing we have access to the world of biology.

In sum, all the rest of this essay will be nothing but the story of the struggle in the universe between the unified *multiple* and the unorganised *multitude* : the application throughout of the great *Law of complexity and consciousness* : a law that itself implies a psychically convergent structure and curvature of the world.

But we must not go too quickly, and since we are still con-

<sup>1</sup> From this aspect one might say that, on the phenomenal plane, each being is constructed like an ellipse on two conjugate foci : a focus of material organisation and a focus of psychic centering—the two foci varying solidarily and in the same sense.

<sup>2</sup> As we shall see, this is despite the specifically vital mechanism of *multiplication*.

cerned with pre-life let us only keep in mind that, from the qualitative viewpoint, there is no kind of contradiction involved in admitting that a universe of mechanistic appearance may be built up of 'liberties'—provided that the liberties are therein contained in a sufficiently fine state of division and imperfection.

### 3. SPIRITUAL ENERGY

There is no concept more familiar to us than that of spiritual energy, yet there is none that is more opaque scientifically. On the one hand the objective reality of psychical effort and work is so well established that the whole of ethics rests on it and, on the other hand, the nature of this inner power is so intangible that the whole description of the universe in mechanical terms has had no need to take account of it, but has been successfully completed in deliberate disregard of its reality.

The difficulties we still encounter in trying to hold together spirit and matter in a reasonable perspective are nowhere more harshly revealed. Nowhere either is the need more urgent of building a bridge between the two banks of our existence—the physical and the moral—if we wish the material and spiritual sides of our activities to be mutually enlivened.

To connect the two energies, of the body and the soul, in a coherent manner: science has provisionally decided to ignore the question, and it would be very convenient for us to do the same. Unfortunately, or fortunately, caught up as we are here in the logic of a system where the *within* of things has just as much or even more value than their *without*, we collide with the difficulty head on. It is impossible to avoid the clash: we must advance.

Naturally the following considerations do not pretend to be a truly satisfactory solution of the problem of spiritual energy. Their aim is merely to show by means of one example what, in my opinion, an integral science of nature should adopt as its line of research and the kind of interpretation it should follow.

#### A. The Problem of the Two Energies

Since the inner face of the world is manifest deep within our human consciousness, and there reflects upon itself, it would seem that we have only got to look at ourselves in order to understand the dynamic relationships existing between the *within* and the *without* of things at a given point in the universe.

In fact so to do is one of the most difficult of all things.

We are perfectly well aware in our concrete actions that the two opposite forces combine. The motor works, but we cannot make out the method, which seems to be contradictory. What makes the crux—and an irritating one at that—of the problem of spiritual energy for our reason is the heightened sense that we bear without ceasing in ourselves that our action seems at once to depend on, and yet to be independent of, material forces.

First of all, the dependence. This is depressingly and magnificently obvious. 'To think, we must eat.' That blunt statement expresses a whole economy, and reveals, according to the way we look at it, either the tyranny of matter or its spiritual power. The loftiest speculation, the most burning love are, as we know only too well, accompanied and paid for by an expenditure of physical energy. Sometimes we need bread, sometimes wine, sometimes a drug or a hormone injection, sometimes the stimulation of a colour, sometimes the magic of a sound which goes in at our ears as a vibration and reaches our brains in the form of inspiration.

Without the slightest doubt *there is something* through which material and spiritual energy hold together and are complementary. In last analysis, *somehow or other*, there must be a single energy operating in the world. And the first idea that occurs to us is that the 'soul' must be as it were a focal point of transformation at which, from all the points of nature, the forces of bodies converge, to become interiorised and sublimated in beauty and truth.

Yet, seductive though it be, the idea of the *direct* transforma-



tion of one of these two energies into the other is no sooner glimpsed than it has to be abandoned. As soon as we try to couple them together, their mutual independence becomes as clear as their interrelation.

Once again : 'To think, we must eat.' But what a variety of thoughts we get out of one slice of bread ! Like the letters of the alphabet, which can equally well be assembled into nonsense as into the most beautiful poem, the same calories seem as indifferent as they are necessary to the spiritual values they nourish.

The two energies—of mind and matter—spread respectively through the two layers of the world (the *within* and the *without*) have, taken as a whole, much the same demeanour. They are constantly associated and in some way pass into each other. But it seems impossible to establish a simple correspondence between their curves. On the one hand, only a minute fraction of 'physical' energy is used up in the highest exercise of spiritual energy ; on the other, this minute fraction, once absorbed, results on the internal scale in the most extraordinary oscillations.

A quantitative disproportion of this kind is enough to make us reject the naïve notion of 'change of form' (or direct transformation)—and hence all hope of discovering a 'mechanical equivalent' for will or thought. Between the *within* and the *without* of things, the interdependence of energy is incontestable. But it can in all probability only be expressed by a complex symbolism in which terms of a different order are employed.

### B. A Line of Solution

To avoid a fundamental dualism, at once impossible and anti-scientific, and at the same time to safeguard the natural complexity of the stuff of the universe, I accordingly propose the following as a basis for all that is to emerge later.

We shall assume that, essentially, all energy is psychic in nature ; but add that in each particular element this fundamental energy is divided into two distinct components : a *tangential*

energy which links the element with all others of the same order (that is to say, of the same complexity and the same centricity) as itself in the universe ; and a *radial energy* which draws it towards ever greater complexity and centricity—in other words forwards.<sup>1</sup>

From this initial state, and supposing that it disposes of a certain free tangential energy, the particle thus constituted must obviously be in a position to increase its internal complexity in association with neighbouring particles, and thereupon (since its centricity is automatically increased) to augment its radial energy. The latter will then be able to react in its turn in the form of a new arrangement in the tangential field. And so on.

In this view, whereby tangential energy represents 'energy' as such, as generally understood by science, the only difficulty is to explain the interplay of tangential arrangements in terms of the laws of thermo-dynamics. As regards this we may remark the following :

a. First of all, since the variation of radial energy in function of tangential energy is effected, according to our hypothesis, *by the intervention of an arrangement*, it follows that as much as you like of the first may be linked with as little as you like of the second—for a highly perfected arrangement may only require an extremely small amount of work. This fits in with the facts noted in section A above.

b. Moreover, in the system here proposed, we are paradoxically led to admit that cosmic energy is constantly increasing, not only in its radial form, but—which is much more serious—in its tangential one (for the tension between elements increases with

<sup>1</sup> Let it be noted in passing that the less an element is 'centred' (i.e. the feebler its radial energy) the more will its tangential energy reveal itself in powerful mechanical effects. Between strongly 'centred' particles (i.e. of high radial energy) the tangential seems to become 'interiorised' and to disappear from the physicist's view. Probably we have here an auxiliary principle which could help to explain the apparent conservation of energy in the universe (see para. b. below). We probably ought to recognise *two* sorts of tangential energy, one of *radiation* (at its maximum with the lowest radial values, as in the atom), the other of *arrangement* (only appreciable with the highest radial values, as in living creatures, man in particular).



their centricity itself). This would seem to be in direct contradiction with the law of conservation of energy. It must be noted, however, that this increase of the tangential of the second kind (the only one troublesome for physics) only becomes appreciable with very high radial values (as in man, for instance, and social tensions). Below this level, and for an approximately constant number of initial particles in the universe, the sum of the cosmic tangential energies remains practically and statistically invariable in the course of transformations. And this is all that science requires.

c. Lastly, since according to our reading, the entire edifice of the universe is constantly supported at every phase of its progressive 'centration' by its primary arrangements, it is plain that its achievement will be conditioned up to the highest stages by a certain primordial quantum of free tangential energy, which will gradually exhaust itself, following the principle of entropy.

Looked at as a whole, this picture satisfies the requirements of reality.

Three questions remain still unanswered, however :

- a. By virtue of what special energy does the universe propagate itself along its main axis in the less probable direction of the higher forms of complexity and centricity ?
- b. Is there a definite limit and end to the 'elemental' value and to the sum total of the radial energies developed in the course of transformation ?
- c. Is this final and resultant form of radial energies, supposing it exists, subject to reversal? Is it destined one day to start disintegrating so as to satisfy the principle of entropy, and fall back indefinitely into pre-living and still lower centres, by the exhaustion and gradual levelling-down of the free tangential energy contained in the successive envelopes of the universe from which it has emerged ?

To be answered satisfactorily, these three questions must await a much later chapter, when the study of man will have led us to the concept of a superior pole to the world—the *omega point*.

## CHAPTER THREE

## THE EARTH IN ITS EARLY STAGES

SOME THOUSANDS of millions of years ago, not, it would appear, by a regular process of astral evolution, but as the result of some unbelievable accident (a brush with another star? an internal upheaval ?) a fragment of matter composed of particularly stable atoms was detached from the surface of the sun. Without breaking the bonds attaching it to the rest, and just at the right distance from the mother-star to receive a moderate radiation, this fragment began to condense, to roll itself up, to take shape.<sup>1</sup> Containing within its globe and orbit the future of man, another heavenly body—a planet this time—had been born.

So far our eyes have been straying over the unlimited layers in which the stuff of the universe is deployed.

From now on let us concentrate our attention on this diminutive, obscure, but fascinating object which had just appeared. *It is the only place* in the world in which we are so far able to study the evolution of matter in its ultimate phases, and as far as ourselves.

Let us have a look at the earth in its early stages, so fresh yet charged with latent powers, as it balances in the chasms of the past.

<sup>1</sup> Once again astronomers seem to be returning to a more Laplacean concept of the birth of planets by the effect of knots and bulges in the cloud of cosmic dust originally floating round each star.

## I. THE WITHOUT

What arouses the physicist's interest in this globe—new-born, it would seem, by a stroke of chance in the cosmic mass—is the presence of composite chemical bodies not to be observed anywhere else.<sup>1</sup> At the extreme temperature occurring in the stars, matter can only survive in its most dissociated states. Only simple bodies exist on these incandescent stars. On the earth this simplicity of the elements still obtains at the periphery, in the more or less ionised gases of the atmosphere and the stratosphere and, probably, far below, in the metals of the 'barysphere'. But between these two extremes comes a long series of complex substances, harboured and produced only by stars that have 'gone out'. Arranged in successive zones, they demonstrate from the start the powers of synthesis contained in the universe. First the siliceous zone, preparing the solid crust of the planet. Next the zone of water and carbonic acid, enclosing the silicates in an unstable, mobile and penetrating envelope.

In other words we have the barysphere, lithosphere, hydrosphere, atmosphere and stratosphere.

This fundamental composition may have varied and become elaborated in detail, but by and large it can be said to have established itself from the beginning. And it is from it that geochemistry develops progressively in two different directions.

A. *The Crystallising World*

In one direction, much the more common, terrestrial energy has tended from the outset to be given off and liberated. Silicates, water, carbon dioxide—these essential oxides were formed by burning up and neutralising (alone or in association with other simple bodies) the affinities of their elements. Carrying the

<sup>1</sup> Except, though very fugitively, in the atmosphere of the planets nearest to our own.

scheme progressively further, the result is the rich variety of the 'mineral world'.

The mineral world is a much more supple and mobile world than could be imagined by the science of the ancients. Vaguely analogous to the metamorphoses of living creatures, there occurs in the most solid rocks, as we now know, perpetual transformation of a mineral species.

But it is a world relatively poor in compounds, because of the narrow limit to the internal architecture of its elements. According to latest estimates, we have found only a few hundred silicates in nature.

Looking at them 'biologically' we may say it is the characteristic of minerals (as of so many other organisms that have become incurably fixed) to have chosen a road which closed them prematurely in upon themselves. By their innate structure the molecules are unfitted for growth. To develop beyond a certain size they have in a way to get out of themselves, to have recourse to a trick of purely external association, whereby the atoms are linked together without true combination or union. Sometimes we find them in strings as in jade, sometimes in planes as in mica, and sometimes in a solid quincunx as in garnet.

In this way, by simple juxtaposition of atoms or relatively simple atomic groups in geometrical patterns, regular aggregates may be produced whose level of composition is often very high, but they correspond to no properly centred units; they are an indefinitely extended mosaic of small elements—such as we know to be the structure of a crystal, which, thanks to X-rays, can now be photographed. And such is the organisation, simple and stable, which the condensed matter around us has by and large perforce adopted from its origins.

Considered in the mass, the earth is veiled in geometry as far back as we can see. It crystallises.

But not completely.



B. *The Polymerising World*

In the course of and by virtue of the initial advance of the elements on earth towards the crystalline state, energy was constantly released and liberated (just as, today, it is released by mankind as a result of machinery). This was constantly augmented by energy furnished by the atomic decomposition of radio-active substances and by that given off by solar rays. Where could this surplus energy, available on the surface of the earth in its early stages, go to? Was it merely to be lost around the globe in obscure emanations?

Another much more probable hypothesis occurs to us when we look at the world today. When it became too weak to escape in incandescence, the free energy of the new-born earth became capable of reacting on itself in a work of synthesis. Thus, as today, it passed with the absorption of heat into building up certain carbonates, hydrates or hydrites, and nitrates like those which astonish us by their power to increase indefinitely the complexity and instability of their elements. This is the realm of *polymerisation*,<sup>1</sup> in which the particles 'concatenate', group themselves and exchange positions, as in crystals, in a theoretically endless network. *Only, this time it is molecules with molecules in such a way as to form on each occasion (by closed or at all events limited combination) an ever larger and more complex molecule.*

This world of 'organic compounds' is ours. We live among them and are made of them. So intimately do we see it as connected with the phenomena of life that we have got into the habit of considering it only in direct association with life *already constituted*. Moreover, despite its incredible wealth of forms, which far surpasses the variety of mineral compounds, it concerns such a tiny part of the substance of the earth that we are instinctively

<sup>1</sup> I trust I shall be forgiven (as later in the case of 'orthogenesis') for using this term in so generalised a sense, i.e. to include (as well as the strict polymerisation of the chemists) the entire process of 'additive complexification' producing large molecules.

inclined to relegate it to a minor position of geo-chemistry—like the ammonia and oxides that surround the lightning's flash.

If we wish later to fix the place of man in nature, it seems to me essential to restore to this phenomenon its true physiognomy and its 'seniority'.

Whatever the quantitative disproportion of the masses they respectively involve, inorganic and organic chemistry are only and can only be two inseparable facets of one and the same telluric operation. And the second, no less than the first, must be regarded as already under way in the infancy of the earth. We are back at the refrain that runs all the way through this book. *In the world, nothing could ever burst forth as final across the different thresholds successively traversed by evolution (however critical they be) which has not already existed in an obscure and primordial way.* If the organic had not existed on earth from the first moment at which it was possible, it would never have begun later.

There is good reason to think that around our nascent planet, in addition to the inchoation of a metallic barysphere, a siliceous lithosphere, a hydrosphere and an atmosphere, there was the outline of a special envelope, the antithesis, we might say, of the first four: the temperate zone of polymerisation, in which water, ammonia and carbon dioxide were already floating in the rays of the sun. To ignore that tenuous film would be to deprive the infant earth of its most essential adornment. For, as we shall see, it is in this that the 'within of the earth' was soon to be gradually concentrated (if we hold to what I have already said).

## 2. THE WITHIN

When I speak of the 'within' of the earth, I do not of course mean those material depths in which—a few miles beneath our feet—lurks one of the most vexatious mysteries of science: the chemical nature and the exact physical condition of the internal regions of the globe. The 'within' is used here, as in the preceding



chapter, to denote the 'psychic' face of that portion of the stuff of the cosmos enclosed from the beginning of time within the narrow scope of the early earth. In that fragment of sidereal matter which has just been isolated, as in every other part of the universe, the exterior world must inevitably be lined at every point with an interior one. This we have shown already. Only here the conditions have changed. Matter no longer spreads out beneath our eyes in diffuse and undefinable layers. It coils up round itself in a *closed volume*. How will its 'inner' layer react to such involution?

First let it be noted that, by the very fact of the individualisation of our planet, a certain mass of elementary consciousness was originally imprisoned in the matter of earth. Some scientists have felt obliged to invest some interstellar germs with the power of fecundating cooling stars. This hypothesis disfigures, without explaining, the wonderful phenomenon of life, with its noble corollary, the phenomenon of man. It is in fact quite useless. Why should we turn to space to look for a fecundating principle for the earth—which is incomprehensible in any case? By its initial chemical composition, the early earth is itself, and in its totality, the incredibly complex germ we are seeking. Con-  
genitally, if I may use the word, it already carried pre-life within it, and this, moreover, in *definite quantity*. The whole question is to define how, from this primitive and essentially elastic quantum, all the rest has emerged.

To form an idea of the first phases of this evolution it will be enough to compare, stage by stage, on the one hand the general laws we have felt able to lay down for the development of spiritual energy, and on the other the physico-chemical conditions we have just acknowledged in the nascent earth. We have said that spiritual energy, by its very nature, increases in 'radial' value, positively, absolutely, and without determinable limits, in step with the increasing chemical complexity of the elements of which it represents the inner lining. But the chemical complexity of the earth increases in conformity with the laws of thermo-dynamics in the particular, superficial zone in which its elements polymerise.

If we put these two propositions side by side we see that they interweave and shed light upon each other without ambiguity. With one accord they tell us that pre-life is no sooner enclosed in the nascent earth than it emerges from the torpor to which it appeared to have been condemned by its diffusion in space. Its activities, hitherto dormant, are now set in motion *pari passu* with the awakening of the forces of synthesis enclosed in matter. And at one and the same stroke, over the whole surface of the new-formed globe, the tension of internal freedoms begins to rise.

Let us look more attentively at this mysterious surface.

A character to be noted at the outset is the extremely small size and the extremely great number of the particles of which it consists. For a thickness of some miles, in water, in air, in muddy deposits, ultra-microscopic grains of protein are thickly strewn over the surface of the earth. Our imaginations boggle at the mere thought of counting the flakes of this snow. Yet if we take it that pre-life has already emerged in the atom, are not these myriads of large molecules just what we ought to expect?

But there is another point to consider.

In a sense more remarkable than their multitude (and as important to keep in mind for future developments) is the solidarity due to their very genesis which unites the specks of this primordial dust of consciousness. That which permits the growth of elementary freedoms is, essentially, I repeat, the growing synthesis of the molecules they subtend. And let me also repeat that this synthesis itself would never take place if the globe as a whole did not enfold within a closed surface the layers of its substance.

Thus, wherever we look on earth, the growth of the 'within' only takes place thanks to a *double related involution*, the coiling up of the molecule upon itself and the coiling up of the planet upon itself.<sup>1</sup> The initial quantum of consciousness contained in our terrestrial world is not formed merely of an aggregate of particles

<sup>1</sup> Precisely the conditions we find later on, at the other end of evolution, presiding over the genesis of the 'noosphere'.

caught fortuitously in the same net. It represents a correlated mass of infinitesimal centres structurally bound together by the conditions of their origin and development.

Here again, but in a better defined field and on a higher level, we find the fundamental condition characteristic of primordial matter—the unity of plurality. The earth was probably born by accident ; but, in accordance with one of the most general laws of evolution, scarcely had this accident happened than it was immediately made use of and recast into something naturally directed. By the very mechanism of its birth, the film in which the ' *within* ' of the earth was concentrated and deepened emerges under our eyes in the form of an organic whole in which no element can any longer be separated from those surrounding it. Another ' *indivisible* ' has appeared at the heart of the great ' *indivisible* ' which is the universe. In truth, a *pre-biosphere*.

And this is the envelope which, taken in its entirety, is to be our sole preoccupation from now on.

As we continue peering into the abysses of the past, we can see its colour changing.

From age to age it increases in intensity. Something is going to burst out upon the early earth, and this thing is Life.

## BOOK TWO

## LIFE