

The Etheric Formative Forces In Cosmos, Earth and Man by Dr. Guenther Wachsmuth (Part 2)

(continued from Part 1)

It is necessary here only to emphasize the fact that, when ether is mentioned in the following pages, we by no means refer at any time to a bearer of mechanical motion-processes or of any sort of changes in electrical states, which is void of all non-measurable characteristics, but, on the contrary, one must always so conceive of ether that its nature and action may be indicated, not only in terms of number, measure, and calculations, but also through qualities just as objectively conceivable but which, in the last analysis always elude any kind of consideration and thought which can be reduced to merely mathematical concepts. Without this insight we shall never do justice to the realities of Nature. This we shall be able to indicate concretely in many spheres of natural science.

Lenard's first restriction of natural-scientific research to a conception of the world capable of being held in a merely mechanical-quantitative manner can therefore not be accepted for the views expressed in the following pages, since such a conception contradicts flatly the realities of the world.

But also the second demand made by Tenard, restriction to what is accessible to the physical organs, cannot be admitted. Indeed, the idea

* E.G.N.S., p. 208. † E.G.N.S., p. 209.

% E.G.N.S., p. 250.

of the world held by the scientists themselves contradicts in all its fundamentals this demand. For no physical sense has yet directly perceived electrons, atoms, vibrations, and other hypothetical factors in the natural-scientific conception of the world, since our physical sense-organs are not yet so organized as to be capable of perceiving ether vibrations, etc. When Professor Konig says in his treatise " Die Materie " : " If, together with theoretical science, we look upon the atom or ether as the only reality, and consider bodies perceptible to the senses as mere phenomenal entities, we have already gone half-way over into the realm of metaphysics/'* he therein admits directly that science itself does, as a matter of fact, commit constantly in its basic concepts and hypotheses this supposedly fundamental error, which it would fain avoid, of passing beyond the limits of that which is perceptible to the senses.

We must make clear, then, first of all, what kinds of hypotheses are legitimate and what kinds are not. Steiner saysf : " An hypothesis is an assumption made by us as to which we cannot convince ourselves directly, but only by the way in which the hypothesis works. ... A (legitimate) hypothesis can assume only that which I do not perceive but which I should perceive if I could remove the external obstacles. An hypothesis, then, may certainly assume the not-perceived, but it must assume that which is possible of being perceived. Every (legitimate) hypothesis is, therefore, of such a sort that its content may be directly verified by future experience. Only hypotheses which are capable of ceasing to be mere hypotheses are legitimate." In this sense the atomic hypothesis, the ether hypothesis, of modern natural science are illegitimate, since neither the " ether moved discontinuously in space and penetrable " of Lenard, nor the ether of other investigators, nor the matter void of all characteristics perceptible to the senses, such as is hypothetically assumed in the contemporary conception of the world, can ever be perceived by our sense-organs.

On the contrary, that ether which is to be set forth in the following pages is both a legitimate " hypothesis " and also a reality subject to proof. How is this ? Spiritual science, as given its determinative direction by Anthroposophy, teaches and proves that, in addition to the sense-organs of the physical body, man possesses in other departments of his being other potential organs which, when once awakened by the discipline of spiritual science, are capable of perceiving and also investigating the facts of supersensible spiritual processes in a manner just as clearly conscious and real as that in which the physical organs perceive

•Edmund Konig, Die Materie, Gottingen, 1911, p. 76.

f E.G.N.S., p. 146.

the physical world. Realities, then, which are thus open to the capacities of perception that can be awakened in every man of our age may not only be introduced into an hypothesis legitimate in the sense we have explained, but must be included just as exactly and methodically as results of research among the data of our knowledge of Nature in the future as are the realities of the physical world as given to the sense-organs.

Now, ether especially—that is, the sum total of etheric processes— belongs admittedly to a supersensible reality. The future scientist may take either of two choices with reference to findings enunciated as a result of research in the supersensible :—

1. He may assume these as hypotheses, as he has done with the conception of the atom and the ether, and may then observe whether these hypotheses are substantiated by their effects and their manifestations in the physical world. As an hypothesis, the findings of supersensible investigations are not postulated differently for him from any others. He will then quickly observe that this hypothesis—such it will still

be to him—offers much more far-reaching possibilities than other hypotheses for an entirely consistent explanation of the phenomena of the physical sense-world—indeed, even for the understanding of phenomena whose comprehension on the basis of previous hypotheses was impossible : for example, the life-processes. He will see thus that this hypothesis will withstand every reasonable scientific test.

2. Or he can, in the sense of the requirement stated above, rid himself of the obstacles which prevent his perception of the supersensible world, as explained in the writings of Dr. Rudolf Steiner, and he will by this means attain to the possibility of having the hypothesis of ether become the perception and knowledge of ether.

The proper goal of scientific research in this field can naturally be reached solely in this latter way. Every investigation of ether will forever exhaust itself in still more complicated hypotheses, if it does not advance to the point where the etheric is brought within man's perceptual and cognitional realm. Indeed, being truly scientific consists in this : that one should never decline to test and put in its proper place any attainable experience. Whoever, however, will not himself yet follow this path of supersensible research, to him is given here an hypothesis, as we have said, which—if applied to the actualities of the sensible physical world—is better adapted to the incontestible explanation of these phenomena, and especially the phenomena of life, than the contradictory ether hypotheses of the most recent times, now becoming more and more untenable.

Chapter I

FUNDAMENTALS OF A NEW THEORY OF MOTION

“ Oh most wondrous righteousness of the primal Author of all motion ! ”

Leonardo da Vinci.

IN order to form a clear conception of the essential nature of cosmic ether, it is necessary, first of all, to come to a new conception of the nature of motion, into which all the phenomena of Nature are ultimately reduced by the scientific research of recent centuries. For in regard to the nature of ether and its relation to " motion,1' the views of the most recent investigators are altogether at variance with one another even in the most elementary and basic questions. While Lenard, the distinguished investigator in this field, rejects the theory of an ether continuous through space and moved as a continuum " and would substitute " ether moved not as a continuum in space," yet, on the other hand, immobility is just the one mechanical characteristic which H. A, Lorentz would still attribute to ether; and, finally, according to Einstein, " the whole change in the conception of ether the theory of relativity brought about, consisted in taking away its last mechanical quality, namely, its immobility."* As opposed to these, Lenard now conceives, according to a report, two ethers : one at rest, a primal ether filling the whole cosmos, and another ether borne along by the heavenly bodies like the atmosphere. Thus we see that in regard to the fundamental question, whether the ether, the ultimate something which lies at the basis of all phenomena, moves or does not move, the views of the most noted investigators are widely separated.

Therefore, we must first of all seek to establish clearly and fundamentally the true nature of motion in the natural world. In order to take as our point of departure something actual, which may be a part of the daily experience of every man—always the best standpoint from which to approach such a problem—let us consider a motion-phenomenon of man's own body and originated by himself : for example, the raising of my arm. Here, first of all, three elements yield themselves to observation.

* Sidelights on Ether and Relativity, London, 1922, p. 11.

1. An ego ; that is, something possessed of spiritual being which wills to raise the arm.
2. A medium, which conducts the volition of the will to that which is to move—the arm. That this must be present, and is not identical with the will, or the ego or the possible bearer of the ego, can be shown by stimulating the appropriate nerve centre, through an influence introduced from without, whereupon the result will be, likewise, the motion of the arm.
3. That which is moved—the arm. This alone can I perceive with the physical senses.

One who adheres to the modern quantitative-mechanical world conception will say, however, at this point: The first element belongs to the field of metaphysics, and does not concern me ; the second is—presumptively—an electric (or etheric) force ; the third is a “ material body/’ which undergoes a change of place, a motion, that may be quantitatively-mechanically determined.

Now, what conception or understanding of this indivisible entity, the motion of my arm, is possessed by the observer who restricts himself to what is quantitative-mechanical and perceptible to the senses ? Really only one-third, so to speak, of the totality of facts which, however, only when all combined together comprise unitedly the reality “ the motion of the arm.” And this one-third is the change of place on the part of a previously unmoved body. Although I can, in fact, grasp this third, up to a certain point, in quantitative-mechanical fashion, yet my thinking becomes false and arbitrary the moment that I undertake to grasp in this way the second and the first third of the entity under observation—that is, when I carry over my conception of motion, a change of place on the part of a body, into the remainder of this phenomenon, which is not perceptible to the senses, and would understand this also as solely a change of place, quantitatively-mechanically explicable—that is, as

motion. Because the physically perceptible time-and-space process of change of place on the part of the arm can be quantitatively-mechanically understood, modern science now seeks to explain also in quantitative-mechanical fashion the fundamental underlying electric-etheric process. And this brings us to the important question which Dr. Rudolf Steiner has expressed as follows* : " Whether there does not lie at the basis of the various natural phenomena, light, heat, electricity, etc., one and the same form of motion in the ether ? Hertz had already shown that the same law governs the propagation in space of the action of electricity and that of light. From this we may

conclude that the waves which are the bearers of light lie also at the basis of electricity. It had, indeed, already been assumed that in the spectrum of sunlight only one kind of wave motion is active, which will produce the effects of heat, light, or chemical action according as it strikes reagents sensitive to heat, light, or chemical action. But this is clear a priori : When we seek to discover what happens in that which is extended in space while the entities under consideration are being transmitted therein, we must conclude that it is always a uniform motion. For a medium in

which motion alone is possible must react to everything by way of motion. And all the kinds of transmission which it must perform will be carried out by way of motion. When, therefore, I seek to discover the forms of this motion, then I shall not learn what the thing is which is transmitted, but only in what manner it is conveyed to me. It is sheer nonsense to say that heat and light are motion. Motion is merely the reaction of matter capable of motion to the action of heat and light**

All, therefore, that we learn when we carry over the quantitative-mechanical method of observation into the field of electric-etheric phenomena is always merely the reaction of the substance capable of motion to the action of heat, light, tone, etc. The real nature of these entities, which consists,

not only in motion, but also in other qualities not perceptible to the physical senses, can never be learned by applying to these entities mechanical-mathematical conceptions.

The physicist will, of course, say : " My measurements and observations show me that the measurable and calculable part of the motion-phenomenon in the propagation of sound can be represented by means of certain mathematical equations. The state of motion in the medium conveying the sound—in this case, essentially the air—is determined by certain quite definite numerical values of the constants found in the equations, and in such a manner, indeed, that a quite definite quality of the tone conveyed is co-ordinate and indeed identical in significance with each value of these constants. When the numbers are given, the tone-state is known/' There can be no doubt that contemporary physics, in the sense of its ideal here expressed, considers the essential nature of tone to be calculable because it believes that it has succeeded in the case of a part of the tone-qualities in calculating and measuring the mathematical relationships and numerical values of the constants. But the assumption that the totality of the tone-phenomenon must be calculable is merely an assumption based upon the wish to be able to calculate everything everywhere in the world and then to read mechanically, from the scheme thus attained, what is occurring. The fruit of these acoustics is the gramophone. One gets no nearer to the real nature of tone through calculating the state of motion of the tone-conveying

medium than one gets to the nature of a man when one knows the number of steps he takes in a day or how many kilograms of nutriment he assimilates. These numbers are useful and necessary to know for certain purposes, only it is fallacious to consider everything calculable. Moreover, whoever knows the form of these calculations knows that they are far from being certain and clear. Only the layman is inclined from what he

reads in the newspapers and popular magazines about mathematical calculations to draw the conclusion that all occurrences are calculable. The real investigator was—at least, at an earlier period—far from the illusion that even an essential part of the world-event is calculable. Only because of the justifiable enthusiasm over the undoubted results in those fields where mathematics really apply to the phenomena has the hasty conclusion been drawn that everything must be calculable. When, on the other hand, the physicist or any sort of calculating scientist says that only what he can calculate and what is subject to calculation belongs at all to science ; that everything else may, indeed, be interesting but affords no certitude, and only where certitude is present by reason of calculations is there science,—to such a point of view we may reply that such a scientist thereby declines to grapple with , the greater part of the world-content, and that he simply ignores this part of the world-content through his assertion that it cannot be scientifically approached.

In order to more completely to clear up this question, we must here consider more thoroughly the “ capacity of fixity/” the conception of the “inert” body—the opposite, that is, of motion. Steiner says this is generally defined in physics as follows : “ A body cannot alter its existing state of motion apart ^from a cause operating from without. This definition gives rise to the impression that the concept of a body in itself inert had been drawn out of the phenomenal world ; and Mill, who does not himself go into the question at all but turns everything upside down in the interest of a forced theory, does not hesitate a moment likewise to explain the matter in this way. Yet this is all quite false. The concept of an inert body is a purely conceptual construction. For, if I call that which is extended in space * a body/ I can conceive two sorts of bodies: those in which changes are brought about by outside influences, and those in which changes occur from an impulse of the bodies themselves. If, now, I find in the outer world something which corresponds to

the concept I have formed—* a body which cannot alter apart from an impulse coming from without I—then I call this thing inert, or subject to the law of the property of fixity. My concepts are thus not taken arbitrarily from the sense-world, but freely formed as ideas, and only through their help do I find myself rightly adjusted to the sense-world. The definition above can only read : A body which cannot of itself alter its state of motion is called inert/'*

I must, therefore, distinguish between bodies which can of themselves alter their state of motion, and those which cannot do this of themselves. And this brings us to one of the most essential distinctions in Nature : that between the organic and the inorganic.

While inorganic Nature cannot of itself alter its state of motion,

organic nature, on the other hand, by reason of its inherent possibilities,

is able to do this of itself; however much this capacity varies in the

most widely separated degrees from men to plants, yet it actually resides

always in that which is organic. Now that which causes a carnation, for

example, to grow always and absolutely from the seed of a carnation,

and never any other plant whatsoever, that which induces this movement

of growth, is not something which I introduce from without into the —

seed but something which resides within it by its own nature.

The

objection may be raised that the seed must be buried in the earth in

*

order to become a carnation and does, therefore, require a push from without. Such a thought, however, would be false, for " I cannot say ,this influence from without produces this effect, but only that to this definite influence from without the inner active principle responds in this definite fashion. What happens is the result of an inner conformity to law.tl\ Whatever may be the character of the external stimulus, the inner active principle in the seed of a carnation will, if it works at all, respond always only with a carnation. When Haeckel wrote in reference to a similar process in the lower orders of the animal kingdom : " In the case of more than four thousand species of radiolaria which I have described, every single species is distinguished ,by a special form of skeleton ; the production of this specific skeleton, often of a highly evolved form, by means of a cell of extremely simple form (generally globular) is intelligible only when we ascribe to the formative plasma the capacity of forming a concept," in such a statement Haeckel may be going, perhaps, beyond due bounds because of attachment to his own theory, yet he was forced to assume in the primitive globular cell an inner active principle of its being which first manifests itself in the . completely developed animal, and which, in so far as it expresses itself in the movement of growth, belongs to that extent to the category of motion-phenomena, like any other sort of motion. In the case of all these phenomena, we have to do every time with a thoroughly objective set of facts, which, when we would comprehend them as merely quantitative-mechanical motion-phenomena, we thereby immediately fail to grasp in the innermost essence of their being.

If I assume a formative power in the seed or in the primitive

germcell, then I must also conceive this power as being united with the "idea/" with the "will," to become a carnation—or to become the animal in question—just as with the capacity for motion and change of motion. The former cannot be separated from the latter by any arbitrariness of thought. This is the case in all organic processes—that is, universally wherever there is "life"; and, if modern science continues to place the restriction upon itself of understanding nature only mechanically and quantitatively, then it must restrict itself to the investigation of the lifeless, of the mineral. For this such a world-conception is supposed to suffice—but even for this it does not really suffice, as we shall later show. So that even Lenard, although he holds to the atomic and mechanical conception of the world as being indispensable for modern natural sciences, is forced to confess: "When, however, tens of thousands and hundreds of thousands of atoms form a molecule, so that this is a highly complex little world in itself, as for instance it must be in a molecule of protoplasm, the molecules may then enclose within themselves that which we call spirit. They then become the bearers of the wonderful phenomena of life, which the scientist of our day, with his conceptions which in other ways serve him so marvellously, is entirely unable to explain.**"

But does not, then, the restriction of our world conception to that which is mechanical-quantitative and perceptible to the senses involve also restricting ourselves to agnosticism, to ignorabimus, for ever?

And are there, after all, anywhere in Nature motion-phenomena which, when explained consistently on the basis of the quantitative-mechanical view, can be fully comprehended? "Since, without the

existence of forces, the parts of hypothetical matter would never begin to move, therefore the modern natural-scientists assume force also as one of the elements by means of which they explain the world, and Du Bois Reymond says: 'The

understanding of Nature consists in reducing changes in the corporeal world to motions of atoms, brought about by their central forces independent of time : or, in other words, the resolution of the phenomena of Nature into the mechanics of atoms/ Through the introduction of the concept of force, mathematics goes over into mechanics."*

In every motion, therefore, according to this conception, there is an expression of a force. But, in that case, every motion-phenomenon has also two aspects. In so far as it is perceptible to my senses, I can up to a certain point conceive it quantitatively; but, in so far as it is the operation of force, I can neither perceive it through the physical senses nor determine it fully through quantitative measurement, since

I can never measure force in itself but always only in its physical effects. But, then, do force and motion stand in relationship to each other only as cause and effect ?

They do not. In every motion-phenomenon, we have to do with the following indivisible totality :-That which is moved, which we perceive in the phenomenal world ; through this we become aware, at the same time, of something not perceptible to our senses—a force ?—, which expresses or manifests itself in that which is moved. The entire phenomenon—in the case, for example, of a man who moves his arm— is clearly linked up with phenomena of consciousness. Now, as man is a single indivisible entity, I learn nothing essential in regard to the motion of an arm if I only establish quantitatively the change of place on the part of the “ material ” arm ; what I thus learn has to do only with the nature of the motion of a lifeless arm, which, however, would not of itself have performed this movement ! I can, therefore, understand the nature of this motion-phenomenon as a whole only when I view that which is moved and the action of the force there manifested— linked up with phenomena of consciousness—as a unity, and not arbitrarily separate these. If I divide this unity by considering alone the process which is quantitative

and perceptible to the senses, I not only separate cause and effect, but I part from one another real Being and phenomenon. Since the phenomenon is only an externalization in a form perceptible to the physical senses of the spiritual entity there coming to expression, of the real Being—that is, of an individual reality— and is not to be separated from this Being, therefore when I consider alone the quantitative, measurable process I am dealing with an unreality in the fullest sense of the term.

Is it otherwise in the case of animal, plant, and mineral ?

We can readily take the right attitude toward this question if at this point we divide into the following categories the totality of motion-phenomena occurring in the world.

1. Motions in which there comes to clear manifestation the action of a self-conscious being, the bearer of a will (for example, a man who wills to move his arm and carries out this volition).

2. Motions whose ultimate inducing cause is still unknown to the sciences of our time : motions which are not produced by a man or not subject to his will;

[a) in the organic world,

(b) in the inorganic world.

We can, therefore, divide the totality of motion-phenomena in the cosmos into those in regard to which we can know directly through the perception of our physical senses the being from whose " will " they have taken their origin {for example, man) : and those motion-phenomena in the case of which the primary stimulus to motion escapes our view ; that is, those in the case of which we do not know the being out of whose will the motion took its origin.

If we conceive of life—that is, of the expressions of life in

the organic world--as a totality of self-metamorphosing motion-phenomena (motion of growth, motion of metabolism . . .), then he who is determined

at all costs to understand the world mechanically takes upon himself the task, already shown to be impossible, of understanding as mere mechanics the phenomena of life. He must either resign himself and give up any understanding, or else he must say to himself that in the inner active principle which always causes the seed of a carnation to become a carnation a " will to become a carnation " finds expression,—a will which I simply cannot measure, weigh, or define by other mechanical means. But this " will to become a carnation/' which brings the being of the carnation over into the phenomenal world, is inseparably linked as an attribute to the inner active principle, that force-complex, through which the seed of the carnation grows into a carnation,—that, therefore, which causes and determines the entire motion-phenomenon, both quantitatively and also qualitatively. As we have already said, the forces of the surrounding soil are certainly helpers in this process, but the individual impulse, that of becoming a carnation, is something which resides only within the seed of the carnation, and—unless we are to believe the absurd and naive theory of preformation—is to be understood only when we view the force-complex residing in all seeds of carnations (etheric force-complex, we shall see) together with the " will to become a carnation " as the spiritual attribute inseparably linked to the seed. (We shall take up this process in concrete fashion in connection with our discussion of Mendelism, etc., Chap. XI.)

Yet an essential difference distinguishes this sort of motion, of course, from those considered in connection with man. The individual will of my own ego occasions the motion of my arm, producing the motion by means of the material body, the arm, through the medium of the electric-etheric forces residing in my organism. In the case of plants,, however, a group-will

controls, a will which induces in a multitude, a group, of bodies of a similar kind a like motion-phenomenon : the motion of growing into carnations, and this likewise through the medium of (etheric) forces. As we shall later see (Chaps. III and XI), this act of will is not free, as in the case of man, but the activity of the earth, organism is linked with it in a causal way; yet it is not determined in its individuality, in the character of its being, by the earth organism— otherwise all plants would be alike—but is influenced in its own action

only as to local modifications, and as to point of time, etc. We shall observe this action in detail in connection with a discussion of the phenomena of the force-currents of earth and atmosphere. That riddle of the ascent of water in plants during the spring will then be possible of interpretation on the basis of this reciprocal play of etheric forces in plants and the earth organism.

We have, then, in the case of man, seen the individual volition as cause and as accompanying phenomenon of the action of electric-etheric force, and thus as inducing cause of a motion-phenomenon in substance (the arm) ; but in the case of .the plant, we have seen the group-will as uniform inducing cause of a motion-phenomenon, likewise wrought through etheric forces—that is, of the movement of growth.

In considering motion-phenomena in the inorganic as a whole, which to superficial observation appear most readily understood, we , must, nevertheless, by means of more exact investigation, penetrate as far as possible toward the ultimate cause of such motions. For, whereas movement carried out or induced by the will of a man brings directly before our eyes the inducing cause of this movement in the human individual, and while, in the case of organic Nature, we can observe— though chiefly in individual instances of its effect in the phenomenal world—that inner principle of action which expresses itself in the growth, etc., we come in the case of the movements of the inorganic—those not induced by human

will-upon that " regressus ad infinitum," which finds its expression in the second of the seven world riddles enumerated by the distinguished natural-scientist Du Bois Reymond in his " Grenzen der Naturerkenntnis " : The question of the primal cause of all motion /

For, if we have already distinguished between such bodies as can of themselves alter their state of motion (the organic) and such as cannot do this (the inorganic), then, in the case of the latter, if we would discover the ultimate first cause of a movement, we must simply follow back the " regressus ad infinitum " to the very beginning of the world. For the flowing water of a brook, a stone rolling down hill, tending toward the central point of the earth, the wind which moves the leaves, etc., etc.,— all these are only partial expressions of phenomena of the atmosphere, of atmospheric electricity, of meteorology, of earth magnetism, etc., and these phenomena are in turn only partial movements in the totality of the life-process of the earth organism. But this life-process, too, in all its phenomena of life—that is, in everything which is life and motion, not death and immobility—is induced here by the sun, as the science of our'day shows. If one continues logically and asks then about the inducing cause of the sun motions, he comes at once to the question of the primal origin of motion—and as to this we will briefly explain our view.

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Modern natural science wrongly places at the beginning of all that happens in the cosmos the primal nebula, according to the modified Kant-Laplace theory; and at the end, the heat-death of the entire cosmos, that vast graveyard, into which the scientist, thinking out his law of entropy bravely and logically to the end, allows the world to subside. Between primal nebula and heat-death, according to the view of modern

science, lies all that play which comprises the becoming and the passing away of universe, earth, and man.

The great physicist and discoverer, Professor W. Nemst, says in his work "Das Weltgebäude im Lichte der neueren Forschung,"* p. 13: "Neither Kant nor Laplace could have realized that their theories of the formation of the world necessarily pre-supposed a limited duration of all events ; otherwise they themselves would certainly have denied the universal applicability of their views. It remained for the evolution of the theory of heat, with that sort of assurance which applies to the universe in general a conclusion drawn from the laboratory, to draw the conclusion mentioned above—one certainly unpleasant in the highest degree. It was the famous English physicist Lord Kelvin who first pointed out that, according to the theory of heat set up by Carnot and Clausius, the whole store of force in the world would gradually but surely be metamorphosed into heat, and that just as certainly all existing heat would come to the same temperature. But the world is thereby doomed to eternal rest. The application of the theory of heat—the most universal and reliable of all the theories we possess—to the Kant-Laplace ideas causes the gruesome thought to appear in the background of our minds that the world is striving to bring itself to the state of an eternal graveyard. This is generally expressed by saying that the universe is unescapably doomed to a heat-death." And all who possess religious feeling and who seek for a meaning in human life will sympathize with Professor Nemst as he relates how he reacted as a student to the introduction of this terrible deduction of modern science by a professor of the Vienna Academy in his inaugural lecture. " He remarked, among other things, that all endeavours to save the universe from the heat-death had been futile, and that he also would make no such effort. This passage, which I read as a student, made the deepest impression on me, and my attention has ever since been directed to the matter, to discover whether some way of escape might not appear."

We also ask, therefore : Where is the weak spot in this structure of theory ? Dr. Rudolf Steiner answers this question in the following picture :

When the teacher would make clear to the school children the origin

* Berlin, 1921.

of the world-system and its motions, according to the Kant-Laplace theory of the world, he performs this by means of a drop of oil, floating upon water, which—when set in rotation—throws off tiny particles of oil, which, rotating in turn, circle round the central drop of oil. But in connection with this little world-system he forgets always to mention the ultimate essential of the whole process, and the failure to mention this is the weak spot in the mechanical idea of the world on the grand scale. That is, he forgets to call the attention of the children to the fact 1 that he—the teacher—has all the time by his own will been whirling the central oil drop. If he had not done this, his little world system would either never have come into existence or else would come to a state of rest. Moreover, even though he continues to whirl the central oil drop, the other oil drops do not continue for that duration in motion. And so he generally forgets himself, the most important factor in the whole process. He has set the central oil drop in motion, he keeps it in motion, and, if he wishes to keep his little world system as a whole in continuous motion, he must not only continue the whirling motion of the central drop, but he must so multiply himself that there shall be connected with each of the separated oil drops one " who whirls " : that is, who keeps them in steady motion.

But just such a blunder we make in the mechanical idea of the world belonging to modern natural science. This is often not only a certain forgetfulness, but also concealed indolence. For the mechanical idea of the world becomes endlessly

complicated if I am required to demonstrate not only that something moves and how it moves (this is really never the main problem of science but merely its working tools), but also in dealing with a motion-phenomenon—that is, if I am to understand it, not merely piecemeal and falsely, but rightly and as a whole—■ must also answer this question : Through what operative principle is this motion induced ? What will gave the initial push resulting in this motion, and with what phenomena of consciousness is this act of will united ?

If we are dealing, for example, with the fact of the setting in motion of the primal nebula, out of which our cosmos is supposed to have come into existence, and if we do not play the part of an ostrich, but admit with logically exact thought the fact that at the basis of this first motion there must have been an impulse of will, or a multitude of such impulses, and that these expressions of will were also undoubtedly linked up with phenomena of consciousness, into which we cannot, of course, think ourselves with our present normal objective consciousness, then a twofold question is forced upon us :

1. With what phenomena of consciousness are even yet linked up those operations of force in the cosmos and the motion-phenomena induced by them which do not receive their initial impulse from a human ego ?

2. Are there scientifically exact methods for the investigation of other states of consciousness than that of the normal objective human consciousness of our century ?

The answer to the first question leads to a complete revolution in the mechanical study of Nature characteristic of our time, a method deriving from the theory of " the limitation of the knowledge of Nature " —that is, it brings us to a science of Nature which considers not only the phenomenal world with its phenomena of motion, which as such cannot be

understood at all, but also includes in the scope of its research the real being of things which come to living expression in the phenomenal world,—a science of Nature which strives to know and to understand the spiritual, the real, that which comes to active living expression in the working, weaving world of forces.

For such an inquiry into the world, the best guide and surest means of knowledge is the world ether, the etheric.

For such an inquiry, the " spirit " is not something which can be " imprisoned " within a molecule of protoplasm, or—as modern scientific materialism supposes—something which has first come into existence out of the world of substance. On the contrary, for such an inquiry, the spirit is primary, and the metamorphosing moving substance is secondary—created, maintained, shaped, and evolved by the spirit, as one of its manifestations, its phenomenal form, which it can and will again dissolve, when the spirit, as active principle working in substance, shall have brought this from the imperfect to the perfect.

The spiritual, the real, is also continuously now the ultimate cause of all motion : that is, of all life in the cosmos.

For such an inquiry into the world, there is no abstract creation of a primal nebula set in motion in a manner impossible to conceive, but, on the other hand, the involution and evolution of a spiritual activity in the world of substance ; a spiritual, a real, however, which was present before there was substance, and will persist after the end of substance (see also pp. 105-115).

The second question stated above, in regard to the development of a human capacity to perceive this world, has been answered in the numerous writings of I3r. Rudolf Steiner in which the way is shown whereby, through the most exact methods, human inquiry concerning the physically perceptible, and as such

unintelligible, world of substance can be extended beyond into a direct supersensible view, clearly conscious, of the forces working in this world, the forces of the etheric, and of the spiritual therewith united.

But we should once more emphasize here the fact that even one who is not yet willing himself to take this path may, none the less, test by application to the world of experience what follows in regard to the nature of ether, at least as a legitimate " hypothesis " in the sense explained above—indeed, more legitimate than those of the mechanical world-view; and that he will find the theory not only confirmed but also rendering possible the clarification of many hitherto unintelligible phenomena.

Let us turn back once more to a consideration of the real and the phenomenal in motion-phenomena of the various realms of Nature. That which has a living expression in the human arm set in motion is a " will," something real, spiritual, therefore, which comes to living expression in the world of phenomena ; in this instance, in the motion of the arm. But other natural phenomena also—the flying pollen of flowers, the falling stone—are always manifestations of an invisible world of forces, whose ultimate first impulse we do not at present know, a supersensible, spiritual, ideal impulse operative in these single events in the phenomenal world. Plato spoke in this sense, out of a primal oriental mystery-wisdom, of a world of ideas. The spiritual, then, the idea'— is " not only present and active, where it is consciously known—in man, but also in another form in the realm of Nature. It is not only present in the subject, but is the principle of the objective world."* Eduard von Hartmann conceives of the idea, the spiritual, the real, on the one hand, and the will on the other, as two constitutive world principles standing side by side ; and he looks upon the idea as being at rest, and as requiring, in order to come into activity, the impulse of the will. Steiner shows, in contrast to Hartmann, that these two

cannot be separated : " Will without idea would be nothing. The same cannot be said of the idea, for activity is an element of the idea, while the idea is a self-sustaining being."

The world in endless motion, as perceptible to our senses, is, therefore, a manifestation of the ideal world which is in ceaseless action, of the real world of spirit.

Steiner formulates thus the fundamental perception : " Will is the idea itself conceived as force." Then we must not only desire to know the action of forces in the phenomenal world in their quantitative and mechanical aspect, but we must seek to understand the forces working in Nature as linked up with the qualitative attributes of the spiritual entities acting through these. The distinction here between man and the rest of the realm of Nature is this : That in man the spiritual, the will, when it comes to living expression as the inducing cause of

* E.G.N.S., p. 174.

manifestations of force in the phenomenal world, is linked up with phenomena of consciousness to which we ourselves are alive, since, not only does the spiritual as objective active world-principle manifest itself in man, but man himself is a separated part of this objective active world principle. " Freedom/' therefore, belongs to him alone, in contrast with the rest of the realms of Nature given to our perception, since the rest of Nature is only an object of this spiritual activity.

Nevertheless, a spiritual, supersensible, rules in all the phenomena of Nature,—in the will of the man who moves his arm, in the controlling active principle in the seed as " will to become a carnation," in the falling stone as " will to carry it to the centre of the earth " ; in the content of all these perceptions the real comes to living expression in the

phenomenal.

In opposition to those who have proclaimed with premature satisfaction the purely mechanical idea of the world, a few great investigators have from time to time pointed warningly to the weak spot in this mechanical idea of the world so dogmatically asserted. Thus in reference to the science of the inorganic the famous physicist Nemst, in his endeavour to explain the process of chemical changes in substances on the basis of the physical forces working in these, has been forced to resign himself to this declaration* : " The final aim of the doctrine of affinity must be to ascribe the causes of material changes to well . investigated physical phenomena. The question of the nature of the forces which come into play in the chemical union or decomposition of substances was discussed long before a scientific chemistry existed.

The Greek philosophers themselves spoke of the love and hate ' of atoms as the causes of the changes of matter; and our knowledge of the nature of chemical forces had not advanced very much until quite recently.

We retained anthropomorphic views like the ancients, changing the names only, and seeking the cause of chemical changes in the changing affinity of the atoms."

So far goes the physicist and discoverer Nemst. As to the science of the organic, the investigator of organisms, Oskar Hertwig, in his comprehensive book " Das Werden der Organismen/'f sketches the following picture : " Taplace imagined a mind capable of analyzing the whole world-process into the motions of masses mutually attracting and repelling one another, of expressing this analysis in a stupendous mathematical formula, and of calculating the past and the future of the world-process.

In like manner let us imagine a spirit whose power of vision so far sur- , , passes that of us ordinary men that he could

perceive the tiniest units

* W. Nernst, Theoretical Chemistry, London, 1923, p. 517.

| Jena, 1916, p, 38.

of substance, the atoms of the elements, and could follow their motions. Endowed with such divine power of vision, he would be capable of actually seeing the building up of all sorts of molecules out of the atoms variously grouped—as the chemist seeks to set these forth symbolically in his structural formulae—though seeing the process, perhaps, as somewhat different from that which the chemist supposes. . . .
For a

spirit of such power of vision, chemistry would have become in reality a morphological science ; his eyes, as it were, analyse or dissect molecules into their ultimate elements and obtain a direct view into the atomic morphology of substances. Such a morphologist has actually reached the goal of the mechanistic school. To him the cell is no longer the elementary living organism endowed with structure, but has become a wonderful microcosm of countless molecules. Just as, in cosmic space, the heavenly bodies, held together in solar systems, move in well defined orbits, so would he see the molecules in the microcosm of the cell held together, according to their affinities in smaller or larger groups ; he would perceive, finally, how still more extensive groupings give rise to the forms of substance perceptible to ordinary human vision, which we call protoplasmic threads, granules, centrosomes, trophoplasts, chromosomes, spindle fibres, nucleoli. Although this picture of a future morphology, which would also include contemporary chemistry—thus becoming an all-embracing science of substance—is merely a vain phantasy, in any case the ultimate goal of knowledge would never be reached by this path. For, according to physical theories, even the atom also would have to be conceived in turn as a world of alpha corpuscles. And also chemistry which should

seek to replace, by means of chemical knowledge, that which we have learned of the organization of the world of living bodies, would find itself in the same situation."

Thus, equally for the inorganic and the organic, distinguished experts in modern science have in turn pointed out the narrow boundaries of our present-day research into Nature. When Hertwig says that a morphologist who, by means of vision assumed to be his, sees through the play of forces in the world has "reached the goal of the mechanistic school,"

I might reply to him—and he would agree : But such a morphologist would certainly no longer belong to the mechanistic school, because in the action of the formative forces in the world of substance he would experience the impulses of spiritual entities, and because the world would appear to him, not as a mechanical apparatus of substance, but as a living organism, guided continuously by the spiritual, and striving through all its phenomena of motion toward the goal.

Just as a man—even., the merely physical human body—cannot possibly be understood by studying a corpse, no more can any phenomenon' of motion belonging to the phenomenal world be understood apart from the spiritual entities which impel it. And, just as the world of phenomena—this has been shown by the most recent investigations, not only in the realm of the living, but elsewhere also—can either not be understood at all, by means of the quantitative-mechanical method, or else understood only in one small section, arbitrarily selected and by no means the most essential, so also, when we enter the world of forces, of the etheric, we shall not only be unable to understand anything by means of the quantitative-mechanical method abstracted from the phenomenal world, but shall thereby render the confusion in our conceptions of these entities only the greater.

The ether of the general theory of relativity also, which, as

Einstein says, "4 is a " medium void of all mechanical and kinematical qualities, but which helps to determine mechanical (and electro-magnetic) events," and which " cannot be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time "J to which " the idea of motion may not be applied," and yet which must have the capacity to determine the " configurative possibilities of solid bodies as well as the gravitational field," § etc.— such an ether has, to be sure, the advantage of being stripped of many false attributes of the mechanistic ether, and yet it gives no full picture of reality.

Ether—or, more correctly, the etheric primal forces, formative forces—as they lie at the basis of what herein follows, and as they correspond with reality, do not belong, as such, immediately to the world of phenomena, and they are, therefore, like all forces, imperceptible to the physical senses ; they belong to a supersensible set of facts. But, then, as such, they are to be understood only when we consciously bear in mind in our investigation concerning them that something real, the very beings of things, comes with these forces to living expression in the phenomenal world. The ether—or the etheric primal forces, for there are several as will be shown in the following pages—are, therefore, neither to be understood merely mechanically— as with Lenard and others—nor simply by the negation of all mechanical characteristics, as with Einstein. But, when, as supersensible active principles, they come to living expression in the phenomenal world, they call forth, in this world perceptible to the senses, phenomena of motion, etc., which may, then, only partially and up to a certain point, be considered mechanically. The etheric formative forces, however, are, in

themselves, inseparably linked up with spiritual, and therefore qualitative, characteristics—indeed, in the last analysis with that which is individually spiritual. That is,

we must ascribe to them, not only such characteristics as velocity, mass, length, volume, etc., which are measurable and calculable, but also characteristics whose laws in the last analysis can just as little be exhausted through numerical estimates as the characteristics of a living man can be exhausted by a table of constants and a sum of mathematical formulae. We shall be able, therefore, to form a conception of them only when we observe and investigate them as such entities.

Chapter II

THE ETHERIC FORMATIVE FORCES

WHAT we perceive in Nature by means of our sense-organs—as every person trained in science and philosophy knows—is not in reality substances and forces but states and the changing of these into one another. “ The senses inform us in regard to states. If we speak, then, of something other than states which undergo transmutations, we are no longer restricting ourselves to the bare facts of the case, but are adding concepts to these/1* When we go beyond the states and their metamorphoses given to us by the senses, a twofold question then forces itself upon our thought: 1. What maintains the given states in the form in which they now exist ? 2. What in given instances causes

the metamorphosis from one state to another ?

If we begin, not like Newton from the standpoint of matter, of the bodies, but like Goethe from that of the primary forces, we must reply to both these questions : The etheric primal forces (formative forces). In so far as they are united with bodies in the phenomenal world, these bodies continue in that state induced by them, until such time as free etheric forces of another sort, or stronger ones of the same sort, bring about a metamorphosis of the existing state.

We shall be able to pursue this idea in the most varied

examples in Nature. But at this point we must first give a conception of the nature and the action of the etheric forces. Lenard writes : " Because of the identity of electric waves and light waves, we are sure that the same ether which brings us light, heat, and all energy from the sun also conducts the electric and magnetic forces. ... A single ether for light, heat, and electricity—thus did Lord Kelvin express the great achievement of the electrical researches of Hertz." This error Hr. Steiner combatted as early as 1888, in the words already cited : " When we seek to discover what happens in that which is extended in space when the entities under consideration are being transmitted therein, we must conclude that it is always a motion. For a medium in which

* Rudolf Steiner : E.G.N.S.

motion alone is possible must react to everything by way of motion, and all kinds of transmission which it must perform will be carried out by way of motion. When, therefore, I seek to discover the forms of this motion, I shall not learn what the thing is which is being transmitted, but only in what manner it is conveyed to me. It is sheer nonsense to say that heat and light are motion. Motion is merely the reaction of matter capable of motion to the action of light/'

The conclusions which were arrived at from the researches of Hertz, led not only to the error that from the mere effects which are produced in the ether, a medium capable only of motion, too much was concluded regarding the very nature of the ether itself, but also to the erroneous assumption that—because of the uniformity of the reaction of the perceptible medium (that is, substance) to the actions of the ether—therefore a single ether calls forth all the effects. But this error is fundamental and has blocked the way to reality before all further researches in ether.

As a matter of fact there are altogether seven etheric primal forces, formative forces, active in the cosmos ; of these,

however, only four reveal themselves in the space-and-time processes of our present phenomenal world. In what follows, therefore, we shall deal only with these four etheric formative forces.

Anthroposophical spiritual science designates these four kinds of ether as:—

Warmth ether,

Light ether,

Chemical ether (or sound ether) and Life ether.

In characterizing the differences among the four kinds of ether we cannot restrict ourselves to the ascertained fact that they are distinguished in comparison with one another by the wave-lengths—that is, the degree of motion—which they call forth in the world of substance. Such merely quantitative distinctions of modern science do not at all suffice to explain the phenomena, qualitatively so utterly unlike, which the different kinds of ether produce in the world of substance. The relationship existing among the etheric formative forces is, rather, the following: The four etheric formative forces have proceeded phylogenetically one out of another, and proceed now ontogenetically one out of another; and, in reality, warmth ether has been metamorphosed—that is, has evolved into light ether; light ether into chemical ether; chemical ether into life ether. Further, the mutual relation between the etheric forces is such that the later ether, more highly evolved, always contains in itself the attributes of the earlier, yet always develops, as a new entity, an activity clearly distinguishable from that of the other.

Thus the life ether contains in itself the warmth ether, light ether, and chemical ether; the chemical ether contains the light ether and warmth ether; etc., etc. Nevertheless, each ether acts in the manner characteristic of itself alone; and only when, through having penetrated into the substance-world,

it has been modified, may a higher ether, for instance, be reduced, as it were, to the action of a lower. Warmth ether, from which the other ether forces have evolved, has in turn come into being out of purely spiritual states outside of time and space. Of these we shall speak later.

The four kinds of ether may now be classified in two groups, and this distinction is of fundamental importance for the understanding of all that is to follow :—■

The first two, warmth ether and light ether, have the tendency to expand, the impulse to radiate out from a given central point; they act centrifugally; whereas the other two, chemical ether and life ether, have the tendency to draw in toward a centre, the impulse to concentrate all in a given central point; their action is suctional, centripetal. This polarity of the two ether groups—the centrifugal, radiating, self-expanding will, and the suctional, centripetal will to draw inward, to concentrate ■—is an ultimate elemental principle lying at the bottom of all natural phenomena. This will be indicated hereafter for a great many fields of natural science.

Individually, the four ethers have the following characteristics. The etheric commences with the first state of ether, that of warmth ether. Present-day physics views “heat,” not as an objective state, but only as a subjective quality called forth by a form of motion. Here also, however, the results of the theory of relativity have within a very recent period greatly modified or completely transformed many conceptions long held to be unassailable. Professor T. Graetz in his work “*Her Ather und die Relativitatstheorie*,” which boldly denies many conceptions hitherto in constant use, thus states the problem (p. 62) : “Whereas heat was considered at an earlier period to be a substance, something material, this substance theory has been abandoned since the middle of the last century, and heat and energy in general are considered as something kinetic. The second conception of the law of energy,

according to the theory of relativity, conflicts with this purely kinetic theory; it conceives energy as something material. Mass is, of course, something material; and, since every change in energy is bound up with a change in mass, the theory of relativity views energy as something material, as an energy-substance, not as a motion, or at least not as motion alone. Thus it appears that energy must be conceived in the theory of relativity as energy-stuff." To future observation of

Nature, heat, embraced by such observation in its totality, will, in its essential nature, be just as objective a state as the gaseous, liquid, and solid states of aggregation in substance. "Heat" processes are a transition stage from the purely etheric to the so-called "substantial/" and vice versa (see pp. 115-118). We shall be able to convince ourselves of this fact from many points of view in the further course of these reflections. It will be shown later on that only through the action of warmth ether do heat phenomena arise (Chap. VII), whereas the other phenomena, light, chemical processes, etc., possess quite different qualities for the reason that the etheric forces themselves which call forth these phenomena are marked by quite different qualities.

Warmth ether tends towards the spherical form. If it were merely a conveyer of "motion," then it could in turn call forth only motion in a substance-medium in which it works. Since, however, the tendency to create spherical forms is inseparably linked with its action, therefore it calls forth, wherever it enters into Nature and is not obstructed in its action, spherical forms. We are here dealing—and this must again and again be emphasized—not with abstract dead oscillations of unknown origin, but with concrete formative forces.

The second ether state is that of light ether, or, more simply, of that which is given to the physical perception of man as "light" (for details see Chaps. VII and VIII). As

Lenard says, light gave us the first intimation of the existence of ether, and he thinks " Light is undoubtedly a transverse wave motion: that is, in a beam of light and perpendicular to its direction—never merely backward and forward displacements in the same direction with the beam, as is the case in sound waves—there are present periodically shifting states. Optical researches by no means recent—for instance, those in regard to polarization of light, have already shown the transverse character of light waves. In the course of time we have learned to recognize still other ether waves which are invisible : ultra-violet, ultra-red, and electric waves ; but these as a group have the same characteristics as light waves, differing only in their lengths."* That the " characteristics " are similar, the lengths different,' may satisfy us so long as we are testing in a one-sided .and arbitrary fashion the quantitative-mechanical action in the substance-medium ; but in this way we learn nothing whatever in regard to the natures and the concrete distinctions of the different. kinds of ether. The light ether to which we refer, which calls forth for the human eye in the manner to be explained later the phenomenon of light, does in fact induce among other things a transverse oscillation ; but in addition

* loc, cit., p. ii.

to what has been said above we must add that this occurrence describes the figure of a triangle (see below), so that light ether, as we shall see, when it can exert its effect unhindered in Nature, also produces there triangular forms, whereas warmth ether produces spherical forms.

We agree entirely with benard when he says : " We must take the characteristics of ether just as we find them in order to base these upon experience and seek to harmonize them in a conception free from contradiction ; and we must not permit ourselves to be disturbed in this— a serious error which, I think, has often been made—if we find that these

characteristics are entirely different from those of matter in solid, fluid, or gaseous forms. For ether is simply not matter." When, however, he proceeds further, saying: " and it is legitimate for us only by way of comparison to draw upon matter at all, in order that, proceeding from our knowledge of the motions induced in matter, we may endeavour to reach a conception of the motions in ether," we must remark in regard to this, as we have already said in Chapter I, that we shall never be able to reach a true conception of ether by transferring the forms and laws of motion in matter to the ether itself. If, however, we conceive of ether, or the etheric formative forces, as formative forces void of any quality of substance, as active principles which come to living expression in the phenomenal world only through their active tendencies to definite motions, to shaping definite forms With definite qualities, then this difficulty disappears (see pp. 36-37). We may say, then, that an oscillation, A A A a f°rm wfiicfi is caused by light ether in a substance-r V / \ medium, takes . 'the shape of a triangle. (See also / >"V-V-* Chaps. XI, XII.)

The third ether is chemical ether, or sound ether. Its forces, that is, cause the chemical processes, differentiations, dissolutions, and unions of substances ; but also—though, as it were, through activities in another field—its forces transmit to us the tones perceptible to the senses. The inner kinship of these two spheres of action will be clear to us from the phenomenon of Chladni's sound-forms. For it is tone which causes the uniting together, the orders and forms, of substance and bodies of substance. " That which the physically audible tone produces then in the dust is happening everywhere in space. Space is interpenetrated by waves produced by the forces of chemical ether,"* which, in the manner of the Chladni dust figures, dissolve and unite substances. But chemical ether has in reality " a tone-and-sound nature of which sensible sound, or tone heard by the physical ear, is only an outward expression : that is, an expression which has

passed through air as a medium.”

,* Rudolf Steiner : E.G.N.S.

We shall discuss more thoroughly in Chapter IX the Origin of tones audible to the senses; here we must only establish the fact that tone and chemical processes are to be attributed to the same ether in the manner explained.

Chemical ether, when it can exert itself unhindered in Nature, produces, as we shall be shown concretely, half-moon forms.

In contrast with the expansive kinds of ether—warmth and light ether—chemical ether, as we have said, tends in its action to be centripetal.

It may also be proved that the phenomenon of cold is one of those attributes which are to be ascribed to chemical ether, a fact which is essential for an understanding of the relation between processes of cold and of contraction.

The fourth ether is life ether. It is phylogenetically the most highly evolved ether, and therefore in its qualities most varied and complicated, as we shall later show in connection with the most varied phenomena. It is, as we shall see, that which is rayed out to us, among other things, from the sun and then modified in its action by the atmosphere of the earth in a manner to be described in the following chapters. Life ether, together with chemical ether, belongs to the group of suctional forces, those which tend to draw inwards. We shall also be able to prove its relation to that which is called “ gravitation ” and to the phenomenon of magnetism.

Its form-building tendency, when it can exert $|-i i-j$ $|-i i-$ its effect unhindered in substance, leads to square — — — — shapes, expressed, for instance, as we shall show later, in crystallizing salt.

By way of resume then, we may say:

There comes into existence phylogenetically and ontogenetically out of the non-spatial state :

Spatial

tendency

Form

tendency

State

induced*

Expansive or

Spherical

Heat

Centrifugal

Triangular

Caseous

Suctional

Half-moon

Fluid

Drawing

shaped

inward

Centripetal

Square

Solid

Evolved therefrom, Chemical ether

Evolved therefrom, Life ether \ Centripetal

* See next chapter.

The States of Aggregation of Substance and the Etheric

Formative Forces

We have shown that what we really see in the phenomenal world is " states and their metamorphoses into one another." These may be grouped, first of all, into the four states of aggregation : the solid, the fluid, the gaseous, and the fiery, or heat, state. That the last is in fact an objective state and not only an imaginary " motion " bringing about in the human organism the subjective heat-experience,'—this we have already discussed above (see p. 23). Fearless investigators have already been compelled recently to assume a certain state beyond the gaseous and different from it, but they have not been able yet to reach a concrete conception of its nature (see Chap. III). As a matter of fact, the heat-state is present quite independently of the others, as is evident on the following grounds. If we wish to answer rightly the twofold question naturally arising : 1. What induces and maintains the different states in Nature ? and 2. What preserves these or metamorphoses them one into another ? the answer is that each of the four states of aggregation is brought about and maintained by one of the etheric formative forces, as follows :

The Heat state ... The Gaseous state The Fluid state ... The Solid state ...

... by Warmth ether, ... by Tight ether,

... by Chemical ether, ... by Life ether.

Chapter III

THE EARTH ORGANISM

Its Structure and its Life Processes

WE can never understand the phenomena of cosmos and earth, of atmosphere, atmospheric electricity, and terrestrial magnetism, except as we view the earth as a great living organism which, like all living organisms, is characterized by a process of breathing, circulation, etc., in the manner in which these are now to be explained.

Whoever has read through many books of modern natural science dealing with meteorology, atmospheric electricity, thunderstorms, terrestrial magnetism, etc., will have found that the labour expended in these fields up to the present has resulted in the collection of a great abundance of material in dissociated parts, but that—as is generally confessed by the authors themselves—there is still wanting any system of thought which will clarify and integrate the numerous ill-assorted details of fact—a system in which these single phenomena may be reduced to harmony and order, or out of which they may be seen to have arisen. If we now arrange this scattered mass of single observed facts in the light of the teaching here set forth concerning the earth organism, the facts will be completely and reciprocally confirmed and—what is more important—they will be comprehensively interpreted.

Just as the so-called “atom”■—or let us say, rather, the unit of substance—consists, as we shall see later, of four globular spheres, surrounding one another when in a static condition, which may be viewed as the spheres of activity of the four etheric forces, thus also the great earth organism—that is, the solid earth with its atmosphere—is so formed that it consists of four globular concentric spheres, and in each of these four spheres one of the four etheric formative forces named above is predominantly active.

The following diagram gives a sort of sketch of the earth organism during the static condition of its etheric forces as

distributed according to their ruling principles.

lllllll Warmth ether llllll Light ether Hllll Chemical ether
Life ether

The suctional, inward-drawing, forces of chemical ether and life ether have their principal spheres of activity, corresponding with their tendency, concentrated at the earth, with its component solid and fluid parts (oceans, etc.).

The outward-tending, centrifugal forces of light ether and warmth ether, on the contrary, have their spheres of activity primarily in the gaseous atmosphere surrounding the globe. This gaseous atmosphere is surrounded by a mantle of warmth ether at the outer borders of the atmosphere towards the cosmos (see pp. 61-62).

While the earth in its totality as an organism has the tendency to maintain this basic and normal arrangement of the forces (see diagram), the extra-terrestrial cosmic influences, and especially the sun influence, act upon this as upsetting, chaotic forces. The whole body of phenomena –atmospheric, meteorological, telluric–can, therefore, be understood only in the light of this mutual opposition, this conflict–on one hand, the tendency, the will, of the earth organism to bring about the fourfold stratification as a static condition, and on the other hand the action of the cosmic influences which will not permit this static condition to occur, but cause the layers mutually to whirl through one another and ever and again disturb the normal status ‘of the earth structure.

Yet it is to this same chaotic dissolving, this upsetting of the merely terrestrial conformity to general laws, that we owe the phenomena of life on the planet Earth. Should the earth come to that state of rest toward which it strives–that is, harden, as it were, in the state normal to its general laws–then no life would be possible on it, for life actually requires chaotic dissolution, upsetting of the general laws

tending to fixity. Just as, in the human and animal organism, the phenomena of life present in albumen and other organic substances arise from the breaking up and chaotic upsetting of the fixed normal and characteristic chemical states really basic to them (see Chap. XII), so also the life of the earth organism depends upon the continuous breaking up of its primal normal state of conformity to laws through cosmic influences, and especially those of the sun.

And just as the human organism during sleep, when it is no longer disturbed by the human ego active during the day in consciousness and will, re-orders and builds up during the night its systematic inter-relationship of forces as conformable to organic laws, so also the earth organism re-establishes by night the equipoise of its primal distribution of forces, upset during the day by the action of the sun.

So, then, that which the volitional soul activities of the human ego during the conscious life of the day signifies for the human organism, this also the sun signifies for the earth organism.

Out of the sublime eternal reciprocal play of day and night activities, chaos and order, summer and winter, near and distant sun, proceed all the atmospheric and meteorological phenomena.

The four etheric formative forces have also brought about naturally in their spheres of activity the states of aggregation and conditions of substance normal to these forces. Thus the inward-drawing forces of the chemical and life ethers, tending to concentrate, working in toward the centre of the earth, have produced the solid and fluid substances and assembled these toward the middle spheres of the earth organism ; whereas the outward-striving, centrifugal forces of the light and warmth ether have produced the gaseous state of the earth's atmosphere and— in accordance with their tendency to strive outward from the centre— have in reality

gathered this atmosphere in the outer part of the earth organism.

But the etheric formative forces, in their spheres of activity, not only work in the generation of the corresponding states of chemical inter-relationships and states of aggregation of substance—that is, in the formation and union of substances—but they work also as free forces in many ether phenomena. Meteorology, the science of terrestrial ‘magnetism, etc., have investigated individual instances of these under such designations as vertical current, potential gradient, barometric pressure, induction and emanation, etc., and we shall now see that all these single phenomena may be arranged under the great rhythmic process of the earth organism, for we shall learn that it is an organism not in mere theory, but in that it shows all the typical processes and rhythms of a living organism. It has its process of circulation, its breathing process—that is, it actually breathes, and we shall see how the results of meteorological investigation, hitherto not understood, articulate themselves organically into this harmonious process of life.

The Breathing of the Earth Organism

Goethe sought by observation of the barometer, most important of all instruments for this science, to reach a new conception of the connection between “ barometric pressure ” and atmospheric phenomena ; the rising and falling barometer, due to the changing “ barometric pressure/’ he strove to trace back, not to influences outside the earth or accidental, but to forces acting rhythmically inside the earth organism. Dr. Rudolf Steiner wrote in this connection in his book “ Goethes Weltanschauung : ” Since, however, the height of the mercury depends on the pressure of the air, Goethe imagines that the earth alternate^e presses and again expands the whole atmosphere. If the air is compressed its pressure increases and the mercury rises ; the reverse takes place with expansion. Goethe ascribes this alternating contraction and

expansion of the whole mass of air to a variation to which the attractive power of the earth is subject. He regards the increase and decrease of this force as inherent in a certain individual life of the earth, and compares it with the inbreathing and outbreathing of an organism."

If we follow up this thought in the light of the theory of ether previously stated, we shall find it completely confirmed by thought and observation. For the fluctuation of the barometer—that is, the fluctuating air pressure—does actually result from such a compressing force : namely, that issuing from the chemical ether. This brings us to one of the most fundamental problems of meteorology, which is important also for many other branches of science. In the increase of the so-called barometric pressure—that is, in the rising pressure of the atmospheric column upon the mercury in the barometer—that which induces the rise of the mercury does not come chiefly, as science has till now assumed, from a pressure which the atmosphere, through changes in its temperature, its volume, or otherwise, exerts of itself upon what is beneath, but it comes from the rhythmical tension and release of the suctional centripetal forces of chemical ether proceeding from the solid earth. This fact can now be shown variously in detail. If the suctional, centripetal forces of chemical ether, normally concentrated in the solid earth, extend their activity (as indicated in the diagrams following, pp. 52-53), out from the solid earth into those spheres also not normal to chemical ether but belonging to light ether and warmth ether—that is, the gaseous atmosphere—then this action, now pressing the atmosphere together by way of suction, comes to expression in the increasing barometric pressure and the rising barometer. If the chemical ether sinks back into its own sphere, down to earth, then the influence pressing together the atmosphere ceases, and the barometric pressure is reduced. We might represent what here happens, but only by way of comparison, in the following description. When iron filings lie in a space outside the field of a distant magnet, they will not be drawn

by its attractive force ; but, if we move the magnet toward that space until such space lies within the magnetic field, everything in that space will come under the control of the magnetic action. The alternating barometric pressure is due in like manner to this : whether the earth organism sends its inward-drawing, suctional etheric forces above the solid earth into the atmosphere—that is, exhales; or draws these back into their own spheres of activity—that is, inhales.

We shall see that this great breathing process of the earth organism is always carried out in rhythm, in the alternation of day and night, so that the same thing which man performs in one breath (inhaling and exhaling) many times each day is performed by the earth once in 24 hours, that is, in the manner indicated in the diagram on pages 52-53. We will here first only point out that there is actually a definite cosmic relation between the breathing rhythm of the earth organism and that of each individual man. A man who breathes normally takes 18 breaths in a minute, or (18×60) 1,080 in an hour, or $(1,080 \times 24)$ 25,920 in a day of 24 hours. Now, this number of human breaths in a day corresponds with the number of years that the sun requires in order to be at the time of the spring equinox once successively in every sign in the circle of the zodiac. To such cosmic rhythms, to which the earth organism is adjusted just as is the human organism, we shall later return ; for the moment we must only indicate that the breathing rhythm of the earth organism is induced by the alternating activity of the same etheric forces that control the breathing of man (Chap. XII). As will be illustrated in later diagrams, the breathing rhythm of the earth organism—which expresses itself, and may be proved, by atmospheric pressure, barometric level, vertical current, potential gradient, humidity of the several strata, degree of induction of the air, degree of emanation of the earth, etc., etc.—depends upon the rhythmical alternation by which the earth organism exhales the chemical ether into the light-ether zone (the atmosphere) and then draws it back into the solid earth : that is, it depends

upon the interchange between light ether and chemical ether, or, in other words, an expanding and a compressing force in the atmosphere, chiefly in the lower strata.

Before I proceed to establish the truth of this, it might be well to discuss briefly the views held by science up to this time as to these occurrences and their causes. The increase in barometric pressure and the

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rising barometer have been so conceived as if the column of air over the earth everywhere and also over the mercury in the barometer were a body possessing weight, " now thicker and heavier, now thinner and lighter/" and as if, therefore, " the cause of this daily behaviour of the barometer were to be found in the daily variation of temperature. This last we may conceive, indeed, as a heat wave which moves round the earth with the sun."6 But Professor Trabert himself points out in reference to this that the facts refute such an explanation, and asks :

" How does it happen that, although in the case of the temperature a single wave predominates, yet, in the matter of the barometric pressure, the chief phenomenon is the double wave ? " It is evident, then, that the course of the barometric pressure does not, in its essential rhythms, follow the rhythm of the heat-process.

Heat-processes travel in a single wave and, since they are to be traced back to the action of the sun, have naturally their one maximum at midday, their one minimum at night. Were the phenomenon of barometric pressure dependent upon the heat-processes, the former would have to travel in the same rhythm and have its maximum and minimum at corresponding times. This, however, is not at all the case in either respect. The maxima and minima show exactly the opposite course from what they would have to show according to the above hypothesis, which scientists have endeavoured to uphold with the help of other hypotheses. We have at midday in reality an unquestionable minimum, and in the morning and evening, about the times of sunrise and sunset, the maxima of barometric pressure. This is the well-known double wave, of which Professor Trabert, in his very lucid book already cited, *Meteorologie* " (p. 65), says

that it is "the characteristic of the course of barometric pressure, a regular double daily wave ! Whence does it come ? The most distinguished physicists and meteorologists have laboured in vain to explain this. . . /"

But, if we apply the description of the distribution of the four etheric formative forces as given above to this fundamental phenomenon, we obtain a complete and indisputable explanation. Indeed the twofold wave of air pressure, its maximum and minimum, could not occur otherwise than they actually do in the light of the following description of the breathing process of the earth organism.

In order to be able to introduce the (lata of specific scientific research as proof of the activity of the etheric formative forces, here stated to be fundamental, special value is attributed to two factors which reveal themselves both to observation and to experiment:

1. Maxima and minima.
2. Increase and decrease in the several components—atmospheric electricity, terrestrial magnetism, etc.—with the increasing altitude, or distance from the surface of the earth.

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Special importance was attached to the observation of the barometric pressure for the reason that a great many of the causative factors in this phenomenon stand in direct relation to the other meteorological elements.

We must have clearly in mind with what a tremendously important phenomenon we are here dealing, what profound significance there must be for all the phenomena of life on the planet Earth in the fact that the earth-enveloping air, in which we live and breathe, is compressed together and again expanded in a mighty rhythm in the course of each day.

We have said that the rhythmic change in barometric pressure is due to the fact that the suctional, inward-pressing forces of the chemical ether, normally centralized in the solid earth, are exhaled, as it were, into the atmosphere (in the morning), and thus extend to these strata into which they penetrate their suctional inward-pressing action ; and likewise are (in the evening) inhaled again into the earth organism. As this breathing rhythm occurs once in a day of 24 hours, therefore these suctional inward-pressing forces of the chemical ether pass an observer standing on the surface of the earth twice in a day, once in the exhalation into the atmosphere, the second time in the inhalation back into the solid earth (diagram pp. 52-53). The human observer,⁷ therefore, in the lowest atmospheric stratum of the earth will be able to recognize twice each day the action of the chemical ether in producing this air pressure : that is, when the chemical ether rushes past him in the morning, exhaled from the solid earth into the atmosphere, and in the evening when it rushes past him again, being inhaled back into the solid earth. This is, in reality, the " double wave " for which physicists and meteorologists seek an explanation.