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Motion, Dualism, and Modern Physics

MATTER DISCLOSES A PLURALITY OF SUBSTANCES

The question of whether nature is one or many is a favorite theme of philosophers. In a variety of form, it plays through the whole symphony of man's philosophical endeavors, leading him at times into the discordant notes of pluralism or monism and often to that delicate harmony of a realistic mean.

The extreme views in this controversy are alive today. William James, George Santayana, Bertrand Russell, Rudolf Carnap, Charles Morris, and in general the whole empiriological spirit slopes toward the view of pluralism. This doctrine involves the Humean reduction of substance to phenomena and the tendency to hold the infinite dividedness or the radical indetermination of all things in themselves.

Monism, typified in the ancient world by Parmenides and on the modern stage by Spinoza, Hegel, Marx, and F. H. Bradley, comes to light in the present-day systems of dialectical materialists, of Samuel Alexander, of Alfred North Whitehead (in a modified way), and of the theory of relativity when it elevates its space-time continuum into a philosophical altitude. For monism, everything is substantially one and at most only apparently different. If this reality is called God, the monism is called pantheism.

In this chapter, evidence will be adduced first in a familiar way and then a little more technically to show that atoms and mole-

cules are all distinct substances and that the changes which they undergo are therefore substantial changes. But a preliminary issue is the problem of whether there are no substances whatever in the universe, resulting in a pluralistic cosmos; whether there is only one substance in nature, justifying monism; or whether there are, as a realism would hold, many substances in nature each charged with a unity of its own, making for a plural (as opposed to pluralistic) universe.

As the philosophical science of nature presses onward in its reflex purification of common-sense notions, it observes that the realities in the mobile world are, so to say, drawn in upon themselves; they are invested with a stamp, however frail it may sometimes appear, of isolation, exclusiveness, nucleation; things have a certain centricity (a datum which the atomic physicist also admits when he seeks and sees the centralizing tendencies of the nucleus in an atom and now, in the era of the meson, of the "nucleolus.") As Bergson put it, "matter has a tendency to constitute isolable systems . . ." ¹ All these facts are crystal clear in that part of the mobile world which is living. Plants have an intussusceptive character; animal action is more immanent than the vegetative; at the summit of nature stands man, so centralized within himself that he can achieve a total reflection on his own being and determine his own actions through his own will. In the organic world, the hierarchy of being stands forcefully there for man to see. The original substantial character of each living thing is shown by its interiority to itself which we may call immanence.

The substantial nature evidenced in a man, an animal, a plant, is also realized, however feebly, on the level of inorganic or mineral matter.

This could be shown, according to one approach that looks promising, by comparing the thinker's experience of himself with the similar but lesser types of being whose operations are apparent

¹ *L'évolution créatrice* (Paris, 1918), p. 108.

in the outer world. According to this view, man understands the sensation of the animal and the vegetation of a plant much more intimately when, as justified by their operations which are seen as analogous to man's, he projects beneath these operations what sensation and vegetation mean in his own self-experience.

This understanding of the lower world in terms of ourselves rather than the reverse procedure, which evolutionary psychology has popularized, is suggested by the psychophysicist, Kurt Goldstein. It could be extended easily to the inorganic world where there is found a feeble analogy to that substantial unity which man himself understands in his own being, and finds tapered off as he goes down the scale of reality. Certain existentialist approaches might be taking this heading.

But on the other hand, valid knowledge, it was established in Chapter I, must begin with the general and move toward the more determinate, and a take-off from our subjectivity, an individual being, would involve the reversal of this direction. Hence, the approach suggested here seems inadequate and wears at most the character of a confirmatory argument.

But there is another avenue also open to show the plurality of substance in matter. What is meant by saying that in the objective world beings seem drawn in upon themselves, centers of action, nucleating identities? A first approximation to this answer might be given in Spinoza's maxim, *unumquodque in suo esse preserverari conatur*. Things in interaction resist one another. There is no mere Heraclitean flow. There is dynamism in nature, but at the same time, there is something somewhere that is definite in everything. There is a plurality of differences, or else things would be indistinguishable. No motion, and above all, no distinctions in motion could be and be discerned in a pure flow.

To deal rigorously with this problem, philosophical physics may well resort to the idea of inertia which is at the core of empirical physics and should be clashed against the notion of nature. What is inert has its principle of motion outside of it, as the very converse of natural movement; what is inert is sluggish

because it is indifferent, passive, actualized completely by outside agents. If inertia rules the real and nothing owns anything from within itself, there is an infinite regression in matter.

Aquinas censured the Pythagorean spirit for using principles "extraneous to the natural." Moreover, he argued, if a thing has a finite velocity, it cannot be moved completely from the outside. For if bodies did not put up resistances to these outer agents and did not bear a reality from within, by the same force that moves a thing it should be moved faster and faster until an infinite velocity has been attained.²

Now if there were no natures with their inner principles and if all things had their principles of motion outside them, anything that moved would move infinitely fast. The plain fact is that there are no infinite velocities in our universe and that, if (*per impossibile*) they did occur, they would be indeterminate and hence closed off from knowledge. If bodies differ in motion, as they do, then none is infinite. Far from being indeterminate, they are comparable and hence definite in themselves. In other words, granted that there is such a thing as inertia at all, it cannot be unlimited in this moving world of ours, and if it is limited, there are brakes. And these brakes are natures or substances.

It is said that there must be natures or substances, a plurality of them. For differences cannot be explained if there is only one so-called bottleneck to inertia. Opposites have diverse principles. To ground the fact of differences, there must be a manifold of these counteragents to inertia, a plurality of things moved from within. Aquinas depicts every nature in the strong language of a "prime mover" and declares as the study of being more clearly shows, that these prime movers on the finite scale are not moved inertially but by participation in the Prime Movership of God.

The empiriological physicist may counter that the resisting principles to inertial movement are inertial themselves and that

² *In de coelo et mundo*, Bk. III, chs. 3, 4, 7.

the world is a cosmic cascade of mere inertia where the fluid is simply seeking and finding its own level as time goes by. But this view is not satisfactory. For what is inert cannot be differentiated; one purely inert thing could never differ from another, and if there is only inertia in the world, there are no differences. If there are differences in inertia, there is no pure inertia; there are principles of difference within the inertia, an equivalence to saying form and matter. Since the inert as such is indeterminate and has no distinctions and since nature unfolds a plurality of differences, there must be a plurality of non-inertias, a plurality of substances, a plurality of natures. For substance is a nature existing.

A purely inert world would be actually nothing. Where there is one divergence from inertia, there would be only one being formed by the two opposites. Where there are two such divergences, there would be two differing citizens in the cosmos. If there is a plurality of being, there is a plurality of non-inertias.

This logic is enough to show plurality, but it may not convince the monist, holding that the mineral world is one substance, at least at its roots, while branching into a plurality of appearances or attributes. In Spinoza's language, the world is *natura naturata*, and for Alexander, it is a continuum in which individuals are nothing but "pieces" of space-time.

There are some pointed answers that can be given against the monism of the material world. This world, if it is radically one, would not be a mobile reality since it would have to move itself; there is nothing outside it in matter that could move it, and ontologism of course would lead to pantheism too. Hence, there could be no motion in a monism of matter.

Nothing could account for such a world in its temporal history. If it were one, it should be absolutely ordered, and yet there are disorders like earthquakes and tropical storms which clearly argue to a cosmos that is more than a single substance.

A monistic world should not produce the novelty which motion

discloses. As a mover, it would have the actualization in the first place and would not, could not, confer it on itself what it already owned.

But there is another way of disproving monism. An acute accent should be laid upon the difference between the living and the lifeless which the philosophical science of nature, the study of mobile being taken simply, has a duty to discuss. Plants and animals, acting immanently, are more perfect than lower matter; they are more finalized with respect to themselves. The lifeless, lacking the immanence-conferring form of the living, has less of a unifying principle to muster its various differentiations into unity and marshal them to final good of their subject. From the amoeba to man, a living thing shows its own individuality by its motions, and is capable of achieving a remarkable unity amid functional and structural difference.

The living is greater than the lifeless, more directed to itself, more whole-making, more unifying of variety. A single tree is greater than the entire mineral universe, just as all the trees in the world could not act as immanently as a single moth.

Now of the unity amid variety in the inorganic world, there can be no doubt. The coursings of the stars, the cycles of the weather, the neutralization of storms and lightning and even meson showers, the pull of gravity that presumably keeps the crust of the earth from peeling off into space, in fact all the phenomena pondered by empiriological physics show the order, coordination, harmony, and general balance of the material world.

But if this material world were all one being, the perfection of it would have to be greater than that of a living thing. The non-living world, single reality that it would be in a monism of matter, would be ordering itself, acting on itself, and integrating such variety into unity that the single mineral substance would be a being more perfect than the individual plant and even the animal. The single material nature would be more versatile than the life above it, if it could unite the whole manifold of the mineral world into a radical oneness. To state a corollary, this min-

eral unity would have to act, like every cosmic being, for its own intrinsic good, and its unifying achievement would be greater than that of life. So if the inorganic is less perfect than the living, as the previous logic revealed, then the material world cannot be one substance, and monism must be rejected.

The argument against pluralism showed that there are natural differences in the universe. The present assault against monism shows that these differences cannot simply be modes of a single substance and that there must be many substances in the material world. If then, nature is neither many nor one, it must at the same time be one and many, or since the oneness and the manifold affect the same things, it must be one-in-many. This is one of the meanings of matter-form.

It was said above that inorganic things are bent in upon themselves, self-centered, and nucleated. There is a real resistance by a thing to every movement which tugs at it. There is always a reaction to action, a stubborn opposition of things differentiated from each other, and this balking character in the mineral world shows itself whenever differences are to be changed. When hydrogen reacts with oxygen to become water, it does not do so without putting up a resistance. It does not flee off, falling away like an infinitely long line of tenpins when the first one tumbles over. It stands fast. It tries to hold its own. If it did not resist becoming water, it could never become water at all. If there were no friction, a machine could never produce anything—automobiles could never run, a pen could never write; if there were no analogue to friction in the atom, the atom bomb could never have exploded. The thing that resists in an atom must be the very same thing that yields. Otherwise, there could never be any action at all.

One may well use empiriological physics as Aquinas applied it, by way of illustrating philosophical physics rather than by way of proof. In such a light, an example of the centrality of the atom can be seen in the present attempts to account for it. The orbital electrons are viewed as moving around the nucleus. The nucleus

is composed of protons and neutrons, and their cohesion is presently believed associated with the meson, the supreme centralizing agency so far detected in mineral matter. But how can this centralization of the atom and its withdrawal toward itself be explained?

Such use of empiriological physics does not of course subscribe to an ultrarealism regarding the submicroscopic and insist that so-called "scientific objects" in Whitehead's language—such as atoms and their substructures—really exist in matter as they do in empiriological theory. But they have at least a basis in the real world. There is some analogy in matter, some real counterpart to the empiriological report on them. Otherwise, the triumphs of empiriological theory would be impossible. "Scientific objects" might be called constructs, partly real and partly logical, but Russell has given the construct an unfortunate meaning. It is safer to say that electrons, protons, atoms, and the like in some way analogate real things, and this applies not only to the foregoing mention of "scientific objects" but to the discussion that will soon get under way.

Material substance cannot be its own passivity, for then all would be prime matter moving, when moved by the lightest stroke, with an infinite velocity, and making the universe indeterminate. It is something more than potency, plurality, and quantity. It is acted upon through its potency, but it is not passivity and inertia alone. The world is not pluralistic.

Nor can material substance be its own activity. For then it would have its own perfection to begin with and motion toward the new would be impossible. It would be pure act. Hence the world is not monistic.

The same subject must ultimately be active and passive. If this were not so, then either the passivity and activity, running in parallel, would never be rooted in the same principle, and no action could occur; or the substance would be both passive and active simultaneously and under the same aspect—a contradic-

tion. That is why Aristotle argued to the existence of nature as the subject of contraries and why, in his view, the active character of things seen by the monists and the passivity which the pluralists exalt are accounted for by avoiding the errors of both extremes.

THE ATOM IS A SUBSTANCE

It may be now be proposed that this fact of substance is realized at least on the level of the atom and the molecule. No one can deny that atoms of the various elements parade a dazzling heterogeneity. One can begin with hydrogen, the first element, and run the scale to the recently fabricated element, berkelium, the ninety-seventh, finding in the long stretch that no two elements have the same pattern of properties. Some are colorless, some are colored, and their colors, varying in wave length and wave amplitude, cover the whole visible spectrum and range beyond it at both ends. Some of the elements are gaseous, some liquid, some solid. They taste differently and smell differently. Each has a different weight, a different electrical and magnetic structure, different spectroscopic lines when suitably excited. Some are soft, some are hard, some cannot be felt, others would be injurious if we touched them. The same rainbow of difference shines at the level of the molecules, as every freshman chemist learns.

Now the point to be debated is this: Can a single type of subatomic substance account for these differences of atoms, or if there be a plurality of types of subatomic substances, can they in turn by a merely mechanical rearrangement explain this heterogeneity which the atoms of the various elements exhibit? This is the critical issue in the struggle between the dualism of matter-form and the contemporary empiriological spirit. (The case of mechanism in chemical compounds will be discussed after settling the question of the atom.)

The first alternative can easily be dismissed. A single type of subatomic structure, rearranging and recombining in myriad

ways to form the manifold of the mobile world would have to be as versatile, as adaptable, as pregnant to relations, and as immanent as life itself. There must therefore be a plurality of different *types* of substances. At this point, the issue becomes: Can these different subatomic types by their various recombinations give rise to the manifold of motions in the sense world? Though the answer is somewhat more difficult than in the preceding case, the philosophical physicist is compelled to decide in the negative.

The reason for such a decision would lie along this line: As we scale up the ladder of being from mineral, to plant, to animal, to the human level, there is noted a growing interiority and a dying away of that inertia which limits the spontaneity of a nature. Neutrons, protons, and electrons, together with the lesser known entity, the meson, are the building blocks of minerals and would lie at the base of the ladder. Looking again at mineral heterogeneity which experience discloses, if so few units could account for such a vast and varying number of immediate relations—for every relation must ultimately be rooted in the immediate—the periodic chart would be a story of subatomic particles more versatile and adaptable than life itself. These (four or so) particles would have to be capable of immanent operation, of the spontaneity, interiority, and originality displayed by plants, animals, and even man.

The material world which affects our senses (much less, as will later be shown, the subatomic particles which are even lower on the scale of mobile being than elements) is not capable of achieving the immanence of a living, many-talented thing. Immersed in inertia, activity and spontaneity are limited to a corresponding degree. Whether matter-form terminology be employed or not, the point cannot be denied that such entities as neutrons, protons, and electrons, few in number and poor in property, do not have sufficient reality, an adequate amplitude of substance, *being* which is intrinsic enough, to individuate so many attributes and relations as the elements reveal. Charles Hartshorne

has rightly pointed out, for instance, that the superiority of a dog over a pillar is that the dog can relate itself in various ways to the pillar but that the pillar cannot do likewise to the dog.³ As Aquinas remarks, the degree of actuality, of perfection, of interiority in a subject is measured by its ability to receive accidents.⁴ The subatomic particles do not have such perfection, actuality, and interiority to account, of their own inner natures, for the heterogeneity of our experienced world.

A comparison of the mineral and living worlds spells out the verdict that the living is higher than the lifeless and cannot enjoy an immanence and versatility greater than that which turns up in the living domain. In full-dress terminology, the subatomic particles are much more "determined to one" capacity than living things, much more limited and localized, much fuller of inertia and passivity, much more specific and particular, ampler in potency and poorer in act. "Determination to one" is the opposite to originality, spontaneity, versatility, and immanence: "the less a thing is immersed in matter, the less it is finited," says Aquinas.⁵

Form in the inorganic world is so faint that a mineral is almost completely under the tyranny of inertia; hence, the success of the empiriological method in the region of the mineral, its lesser success in biology where form is greater and more exertive, and its shortcomings when it attempts to philosophize about man, the reflective self-determining creature, where form triumphs over matter or over inertia. Mineral matter is much more "determined to one" accident (or several) than it is capable of subsuming many. If all facts of difference could be reduced to a few rather simple subatomic substances—electron, proton, neutron—determined differently in forming atoms by the corresponding interiority and versatility of their own intrinsic powers, there would be a contradiction in nature. Effects would be beyond the com-

³ *The Divine Relativity* (New Haven, 1948), p. 7.

⁴ *De natura accidentis*, ch. 1.

⁵ *De natura materiae*, ch. 1.

mand of their causes. The operations of subatomic particles, achieving such heterogeneity, would be richer than their impoverished principles.

On the ladder of being, it is found that the plant embodies the perfection of the mineral world; animals have the perfections of plants; and man has the perfection of all the world below him. Man has all the perfection of, say, a rose, but this perfection is not specifically and distinctively present, like a panel on the door. It is indeterminately present in the unity of man's being. In Aquinas' view of men by reference to lower creatures, "they are less finited." Rose-ness is indeterminate in man because man's formal determination is of a higher nature. At the very peak of reality stands God, the exemplar of all things, and yet He is a simple substance. Now if all the facts of difference which experience reveals in the mobile world are to be reckoned from a few subatomic realities, recombining under their own mechanical power and in a purely mechanical way, they would be, as it were, the exemplars of all their possible determinations. They would have a fullness of being that would be as the fullness of man, containing all the perfections of the world below him. But such a richness cannot be conceded to the subatomic entities.

The stature of a being may be measured, to borrow a Kierkegaardian expression, by its ability to relate itself to itself. In this respect, man is the greatest of changing beings and a mineral is the lowest. A living thing is more operative of itself, and though still requiring potencies for all of its activity, is more capable of coming into direct contact with what is external to it without changing in its substance. The ability of a thing to relate itself to itself is the measure of its ability to assume relations to the outside without changing. The lower beings in nature depend on their accidents and have a feebler power, from the natural resources of their own substances, to assume relations to the outside without that loss of identity which matter-form dualism would claim to be the fate of subatomic particles within the atom.

The "determination to one" is but a paraphrased and realistic

version of Spinoza's maxim, "every determination is a negation."

There is a determinate proportion between an agent and what this agent can produce. If the principle to be acted upon by the agent exceeds the proportion of the agent, no effect will follow; but when the passivity in the being to be acted upon is scaled downward by increasing and thus brought within the sphere of influence which the agent commands, then motion can eventuate. This is but a rephrasing of the principle of causality or sufficient reason.

The variety in the mineral world demands a variety of principle, while the subatomic principles actually grow not more varied but fewer in number than the mineral heterogeneities they are supposed to explain. And as the units become fewer in number, their depth of being would have to be greater to assume, without changing, so many relations as the macroscopic manifold would require. Is their being so deep, their reality so rich?

MODERN RESEARCH ARGUES TO HIERARCHY

To answer, it is enlightening to consider the Thomistic principle of continuation or hierarchy, compared with the latest developments of empiriological physics. The hierarchy in nature is arranged according to the degree of actuality owned by the various grades of being or in other words, starting from the higher entities and tapering downward, according to increase of passivity or inertia. As Aquinas so pointedly puts it, plants are more inert than animals and the atoms and molecules are more inert than plants:

And therefore in the elements the matter is least perfect, because only one form of one element is actuated at a time: and if sometimes the form of another element is virtually present, there is no abiding of the first thing but a change, as for example when the heat of fire acts on air inducing the quality of fire. In compounds, indeed, matter is more perfect: for here, with the one form conferring actuality to the compound there are present all the forms of the elements, virtually however and not essen-

tially because each of these requires its own determinate quantity . . . ; hence since there is one substratum for the compound and one existence, its form is one. Some compounded substrata, however, are animated, and especially man whose form is not produced from matter predisposed by the quantity of the compound; hence it is fitting that in the animate world the essences of some forms should be without their full perfections; for this is the profoundest way in which animate things transcend simple compounds, namely by perfecting their matter through the acquisition of more than one form at a time, just as we see that in one way what is simple is resolved from compounds and in another way from prime matter in which, prior to the becoming as such, there is nothing actual of the form to be produced . . .⁶

The reality of hierarchy in the world of changing being is of so striking importance that another analysis may be cited:

And hence it is that the forms of elements which are the most material of all are characterized by active and passive qualities, say hot, cold, humid, dry, and so on as befits the disposition of the matter. But the forms of compounds, namely of inanimate bodies such as stones, metals, minerals, besides the powers and activities which they participate from the elements of which they are composed, have some other more noble powers and activities characterizing the forms specific to them . . . and thus in a constant ascension, the nobler the specific form, the more excellent the powers and operations proceeding from it; so far forth that the noblest form which is the rational soul has the intellectual power and operation, that not only transcend the power and action of elements but all corporeal power and action.⁷

Empiriological physics has disclosed data on particles below those of the element which provided the first step in the Thomistic hierarchy, a hierarchy that may be described in terms of matter-form, as Aquinas himself preferred in the foregoing passages, or described in the broader perspective of various degrees

⁶ *De natura materiae*, ch. 4.

⁷ *De occultis operibus naturae*.

of changing being. Descending beneath the surface of the atom, the empiriological physicist has sounded a further increase in the degree of inertia, a greater determination to one, or in the more picturesque way of putting it, a greater immersion in matter.

According to relativity mechanics, even energy is inert. A photon (light particle) at rest would be of zero mass; it must be kept in motion to preserve its being. A single atom or molecule is thermodynamically meaningless since heat depends on the agitation in an aggregate; a single particle is neither hot nor cold, according to empiriological physics. An electron by itself is also without significance; it is inertly defined by what is outside of it, say a proton. Such entities are poor in their being.

The free electrons which account for electric conductivity are "free" in different ways depending on the substance in which they float and in whose tyranny they are. That is why the conductivities of different substances differ. An electron, if empiriological physics be correct, has only two properties, mass and charge. In the same category is the proton. The neutron has only one property, weight, and like its fellow subatomic particles, it manages to enjoy a magnetic moment by its spin. A neutron in nature is limited and quite determined to one, like all the other fundamental particles. Its slot in nature is the nucleus whither it tends, never having enough interiority and independence to make a permanent abode elsewhere, for example amid the orbital electrons. The negative meson, first detected in cosmic ray showers, survives in independent status for only millionths of a second, and the neutral meson, believed now as the fundamental cohesive particle of the atom, has a lifetime that is almost incomparably shorter. Such entities are in matter's poorhouse.

Atoms, empiriological physics reports, can appear colored through a kind of resonance radiation: the wave length of the incident light which strikes the natural vibrating frequency of the outer electrons in the atom will be reflected, while the other wave lengths are absorbed. An electron is the cause of color, but color itself it cannot claim. It is impoverished. The neutron, proton,

electron, and meson can be combined in so many different ways only because they are so dependent, impoverished, and inert, so determinable not of their own intrinsic powers but by forces acting from without.

An atom is much more respectable in its status. Oxygen cannot combine in as many ways as an electron combines into other systems, simply because oxygen is less inert and has more of its own, more independence, more nature. An atom is richer, less immersed in matter, greater in nature and in being; in the Thomistic terminology of hierarchy, the subatomic particles even more so than the elements are characterized by their enslaving localization to only one form at a time; they are more determined to one, more impoverished, "more finited"; they have less power and activity than even the elements; they are more inert.

What empiriological physics has done and what the following sections will attempt to deepen is to revise downward the hierarchy of being detected in experience, a hierarchy that begins with the material and mounts from the element to the compound to the plant to the animal, and finally to man. Empiriological physics has dug out a world below the elements. Such a world is weak in being and can no more account by its own power for the level above it than inertia added to inertia gives less inertia or the sum of passivities yields act.

EMPIRIOLOGICAL PHYSICS TENDS TO THE LOGICAL ORDER

In Chapter 5, it was seen that the difference between empiriological physics and philosophy may be projected against the difference between art and nature, the logical and ontological orders. A further pursuit of what this means will forge a powerful tool for the denial of mechanism in the atom.

In the ontological order, the so-called order of first intention, beings become richer and fuller as the scale is mounted, beginning with the quiddity of sensible things and stretching to the perfect simplicity of God. In the logical order, the richness of a thing, as the analytic of logic moves along, becomes less and less,

intension decreases as comprehension increases. In the end, being has become so vague that it has virtually lost all content. Hegel, mistaking this impoverished being of logic for real being, denied the principle of non-contradiction and identified being with the naught. From the content angle, the procession in the ontological order is from the complex to the simple; in the logical order, it is from the simple to the complex. In Alexander's words, "Things are grouped extensionally into classes; intensionally they are connected by a common nature."⁸

Kant held, in his attempt to ground Newtonian physics, that ontology must give place to analysis, and Lachelier was keen enough to detect that empiriological method is essentially analytic and regressive. Empiriological physics as such seems to make this option for the analytical and logical sequence. Each part isolated, not being capable of immanence or nature, tends to have a distinctly compartmented function; united the parts form the whole as in the logical sequence. Theories, for instance, are judged not by their intension but by extension in their domain of application. Intension cannot be treated in empiriological physics as such; it is available only to abstraction.

To reinforce this view of the empiriological disciplines as categorical and summative, a typical modern textbook on biology may be consulted. The simplest forms of life are studied first, the one-celled amoeba or paramecium, then comes the study of the hydra, then perhaps the earthworm, then fishes, frogs, guinea pigs, and so on—until man is studied last, as though he were simply a more complicated form of the preceding structures. This order is dictated largely by the theory of evolution, and it moves from the simple to the complex. A similar direction is revealed in empiriological physics where, for instance, the world experienced by man is pictured as a more complicated form of particles and processes of submicroscopic dimensions. Even in Russell's latest language, for instance, and "event" is "a bundle of compresent qualities."⁹

⁸ *Space, Time, Deity*, I, 176–177.

⁹ *Human Knowledge* (New York, 1948), p. 83.