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"The vitalism/mechanism debate" as it is exemplified in the writings of Loeb, Bergson and Teilhard "is a central theme in the history and philosophy of biology." This debate focuses on how we are to understand the relationship between the living and non-living. The discussions of the vitalists and mechanists attempt to show how the ostensibly living and non-living things of the world are related. For Loeb, this issue is a purely scientific one which can be resolved by the techniques of a mechanistic experimental science. On the other hand, for Bergson and Teilhard this issue is a metaphysical one which can be resolved by an evolutionary vitalism which is a world hypothesis. Bergson presents a dualistic vitalism which is a contextualistic world hypothesis whereas Teilhard presents a monistic and theological vitalism which is an organicist world hypothesis.

A major part of this thesis presents a description and criticism of Teilhard's vitalism. The description of his views shows that the ultimate foundation of his system of thought is his fundamental category of synthesis (integration) and its embodiment in his adoption of the human personality as the model of the universe. The criticism centers on his arguments for his law of complexity/consciousness and the notion of conscious matter which it presupposes. Indeed, these are the key elements of his vitalism. Teilhard claims that he has established them in a scientific manner. The main conclusion of this paper is that his claim is not justified.

The Relationship of Teilhard de Chardin's Law of Complexity/Consciousness to the Mechanism/Vitalism Debate in Biology

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CHAPTER I

INTRODUCTION

> During the last 2500 years of Western thought
>
> Men have divided the totality of things in various ways. The three most fundamental divisions rest on the distinction between the natural and the supernatural, between the material and the spiritual, and between the lifeless and the living (Adler, 1952, p. 1013).

The general aim of this paper is to examine the third of the above mentioned divisions, namely, the distinction between the living and non-living that is found in the writings of Bergson, Loeb and Teilhard De Chardin. Now, there is here no question as to whether living things exist. Their existence is generally admitted on the basis of empirical observation. On the level of gross observation a plant differs in striking ways from a stone and a living animal differs in important ways from a dead one. In short, given the ostensible differences between the living and the non-living the aim of the discussion in this paper is to examine how the distinction between the living and non-living is to be understood; this is what the vitalism/mechanism controversy is about.

There are two possible ways in which living and non-living

things can be related. In the first instance, the distinction between living and non-living can be understood as a difference in kind. Living beings possess certain essential characteristics, in whatever way we wish to define them, which are totally absent in non-living ones. For example, in Bergson's dualistic vitalism all living beings possess consciousness whereas non-living things, the entire world of inert matter, do not. Thus, if there is a difference of kind between the living and non-living then the natural world is discontinuous.

Secondly, the distinction between the living and non-living may be one of degree. All of the entities of the world contain the same set of properties and the differences between them are due to their possession of different amounts and proportions of these properties. In other words, living bodies differ from non-living ones because they possess different quantities and proportions of some set of properties than do the non-living ones.

It is at this point that two additional alternatives appear. The properties which are possessed by all of the bodies of the world may be those which are characteristic of living things or they may be those which are associated with the non-living. On the one hand, a monistic vitalist such as Teilhard asserts that all of the matter of the world has at least some attenuated form of consciousness even though it cannot be detected. But consciousness is a characteristic of living things and hence Teilhard is in effect saying that all of the material entities

of the world have at least some attenuated form of life. Further, the things of our experience which are detectably alive differ from those which are detectably not alive because they contain a greater concentration of consciousness. On the other hand, mechanists such as Loeb assert that the properties which are possessed by all of the bodies of the world are the physical and chemical ones which are characteristic of non-living things. The phenomena of life are produced by a concentration of highly complicated physical and chemical processes. In short, for positions such as those of Loeb and Teilhard there is a continuity between the living and the non-living.

Recently, there has been a world wide interest in the writings of the theologian-scientist, Teilhard de Chardin (1881-1955), who has developed a vitalism which is monistic and theological. The specific aim of this paper is to relate Teilhard's thought to the vitalism/mechanism controversy in Western thought. The discussion of Teilhard's writings in Chapters IV through VII will focus on his law of complexity/consciousness and its associated notion of conscious matter because these are the key elements of his vitalism. Finally, Teilhard's claim that he has established his vitalism upon a scientific basis will be critically examined.

Now, in order to see in a general way what Teilhard is attempting to do let us briefly examine the relationship of Newton to seventeenth century science. In the seventeenth century a considerable

amount of thought was devoted to developing a general conceptual system, the mechanical philosophy, within which scientific theories could be developed. The mechanical philosophy which was developed at this time attempted to show that the real entities of the world are particles of matter and that all of the observed changes in the world are caused by their motions, rearrangements and collisions. Prior to Newton, the mechanical philosophy did not include gravitation as a form of interaction between the particles of matter. All of the motions of matter were caused by some form of mechanical impact. The reason why the mechanical philosophy restricted the cause of motion to impact was that it presupposed a conception of nature in which all unperceivable causes which act at a distance, the final causes of Medieval Science, were eliminated. Mechanical impact is an observable cause of motion which does not act at a distance whereas final causes are always unobservable. Newton changed the mechanical philosophy. He demonstrated that universal gravitation is another cause of motion for matter. Further, universal gravitation is a cause of motion which both acts at a distance and is unperceivable. With this addition of universal gravitation to the mechanical philosophy Newton was able to construct a mathematical physics which for the first time effectively integrated the laws of astronomy and physics. All of the laws of astronomy and physics were integrated in that they could be derived from a single system of equations. On

the other hand, prior to Newton, the laws of physics and astronomy were not related to any single mathematical system from which they could be derived. Thus, Newton's modification of the existing conceptual framework of science, his addition of universal gravitation to the mechanical philosophy, enabled him to relate two different kinds of phenomena, celestial and terrestrial motion, to a single system of mathematical equations. Teilhard attempted to solve a similar kind of problem. He attempted to integrate two different kinds of phenomena, the expansion of consciousness in the world (cultural evolution) and the development of the physical world (chemical and biological evolution), within a new conception of the world. He attempted to attain this result by changing our present mechanistic framework for science. He changed the existing mechanistic framework primarily by his addition to it of his law of complexity/consciousness and its associated notion of conscious matter. In other words, Teilhard's attempt to modify our present mechanistic conceptual framework for science by the addition of his universal law of complexity/consciousness is analogous to Newton's modification of the mechanical philosophy with his universal law of gravitation. Hence, the major critical problem of this thesis is to determine whether Teilhard's modification of our present mechanistic framework is justified.

In order to critically analyse this problem the discussion is

divided into seven chapters. In Chapter II the issues that are contained in the vitalism/mechanism debate are presented and the mechanism of Loeb is described and related to them.

Chapter III describes Bergson's dualistic vitalism. It also compares the views of Bergson and Loeb on the issues of the vitalism/mechanism debate. Finally, the chapter ends with a brief criticism of the views of these two men.

Chapter IV presents a general description of Teilhard's monistic and theological vitalism which provides the context for the discussion of his arguments in Chapters V through VII.

Chapter V presents an analysis of the arguments in which Teilhard claims that he has established his vitalism upon a scientific basis. Hence, the analyses of this chapter will focus on his arguments which attempt to establish the law of complexity/consciousness and its associated notion of conscious matter. The ultimate aim of these analyses is to reveal his fundamental categories of thought which determine his way of thinking about the world.

Chapter VI presents a summary and comparison of the views of Loeb, Bergson and Teilhard on the various issues which are found in the vitalism/mechanism debate. Hence, this chapter is in effect a summary of the discussion that is present in Chapters II through V.

Now, given the preceding description and analysis of Teilhard's thought within the context of the vitalism/mechanism debate the aim of

Chapter VII is to evaluate his theological and monistic vitalism. The key elements of his vitalism are his law of complexity/consciousness and its associated notion of conscious matter. He claims that these elements are established upon a sound scientific basis. Hence, the criticisms of Chapter VII are concerned with determining whether his arguments do in fact establish the key elements of his vitalism.

CHAPTER II

JACQUES LOEB (1859-1924) AND MECHANISM

Introduction

One of the aims of the present chapter is to describe the vitalism/mechanism debate that will be discussed throughout this paper. Another aim is to relate Loeb's mechanistic biology to this debate. Finally, the discussion will attempt to show how Loeb's mechanistic biology is based upon his general conceptual framework.

Living (Teleological) as Opposed to Non-Living (Non-Teleological) Systems are Those Whose Components Cause Them to Realize Either Fixed or Changing Goals

Vitalism and mechanism are systems of thought which establish relationships between living (teleological) and non-living (non-teleological) systems. A description of teleological and non-teleological systems is therefore an important part of vitalistic and mechanistic thought.

What then is a teleological system? Nagel (1) has presented an accurate description of the logical structure of such systems. Using his description as a guide, teleological systems may be characterized as follows: First, they are goal directed. Secondly, they can be analyzed into structural parts or processes which are the cause of

their goals. The goals of such systems can be either a state, property or mode of behavior that is or can be possessed by the system. For example, if the human body is our teleological system, the maintenance of a constant temperature is one of its goals. The thyroid gland and the circulation of the blood are examples of a part and a process respectively which cause the maintenance of this goal. A serious defect in either the thyroid or the circulation of the blood could prevent the body from maintaining a constant temperature.

The differing descriptions of teleological systems by vitalists and mechanists can then be expected to be centered on the following points: The goals of the system may be either fixed or changing. The maintenance of a relatively constant body temperature and the evolution of new species are examples of fixed and changing goals respectively.

Further, the components of the system which cause its goals to be realized are either physical and hence observable or they are non-physical and hence unobservable. The thyroid gland and the circulation of the blood which cause the maintenance of a constant body temperature are physical and hence observable. On the other hand, Hans Driesch's entelechy is a non-physical vitalistic force, a non-mechanical agency which Loeb's philosophy rejects, which directs and integrates the physical and chemical mechanisms of the living organism. A fertilized egg, for example, develops into an embryo because

its entelechy mobilizes and directs its innumerable biochemical processes to synthesize the structures which are characteristic of the embryo. Further, the direction of biochemical processes in living organisms is determined by the flow of energy from one molecule to another and hence an organism's entelechy is ultimately a vitalistic force which regulates the direction of flow of energy in the organism. Thus, an entelechy is a non-physical and hence unobservable component of a teleological system which causes its goals to be realized.

In Loeb's Biology, the Individual Organism is the Teleological System and Its Principle Goal Which Differentiates It From Any Non-Teleological System is Its Chemical Synthesis of Macromolecules from Lower Molecular Weight Compounds

How then does Loeb distinguish between living and non-living systems? First, consider their common characteristics. The ultimate goal of the physical sciences is to show that the causes of all phenomena are the groupings and displacements of atoms and electrons. But living organisms are also composed of atoms and electrons. Hence, the ultimate aim of biology should be identical with that of the physical sciences (2). In brief, living and non-living systems have the same ultimate components which cause their observable behavior.

Next, consider how living and non-living systems differ. They are differentiated by the behavior of the ultimate components, the atoms and electrons. This is clearly seen in a comparison between

the behavior of a crystal and a bacterium (3). Crystals grow in a supersaturated solution in which the chemical composition of the solute is identical with that of the crystal (4). When a crystal grows, it simply adds a ready-made molecule that is present in the supersaturated solution. The bacterium, on the other hand, grows in a dilute solution of low molecular weight compounds. The latter are then transformed into the high molecular weight carbohydrates, fats and proteins of bacterial protoplasm by the chemical machinery of the cell. It is this synthesis of large complicated molecules from smaller "building stones" that is the principle characteristic of living systems (4). Finally, there are no built-in limits to the size of a growing crystal. Crystals expand indefinitely in all directions so long as there is a sufficient supply of solute and space to grow. The bacterium, on the other hand, divides as soon as its mass reaches a critical size. These then are the fundamental differences between living and non-living things (5).

Biological Behavior and Consciousness are Explainable in Terms of the Laws of Physical Science and Hence These Characteristics Cannot be Used to Differentiate Teleological From Non-Teleological Systems

However, important questions arise here. Are not the extensive phenomena of instinctual behavior and consciousness irreducible in principle to the laws of physical science and hence are they not

important defining characteristics of living systems? Loeb's answer is no.

Consider first the case of instinctual behavior. An example of instinctual behavior, the phototropic response of organisms, can be explained in terms of the Bunsen-Roscoe law of photochemical reactions. This valid law of physics quantitatively relates the speed of chemical reactions to the product of the duration and intensity of the light. Loeb performed experiments on regenerating polyps of Eudendrium (6) which demonstrated that the time for 50% of the polyps to bend toward the light was inversely proportional to the intensity of the light. The numerical relationship between the observed light intensity and duration agreed closely with the numerical predictions of the Bunsen-Roscoe Law. The implication is that a bending toward the light is a function of the accelerating or initiating effect of light upon the chemical reactions occurring within the polyp. Similarly Loeb performed many other experiments which demonstrated the existence of tropisms that were initiated by light, electrical and gravitational stimuli. Hence, Loeb's argument is that since some forms of instinctive behavior have been shown to follow valid laws of physics then all such forms of behavior can in principle be explained in this way.

In addition Loeb was convinced that the components of all behavior are tropisms. Human behavior is no exception. The highest expression of human ethical behavior, the willingness to sacrifice

one's life for another, can be interpreted mechanistically. The idea of self-sacrifice may initiate the release of chemicals in the body which sensitize a person to certain kinds of external stimuli. Hence, when an appropriate stimulus such as the immediate danger to the life of a friend occurs a person who has been sensitized automatically acts in the same slavish manner as does a polyp to a light stimulus (7).

Consider next the case of consciousness. The criterion of consciousness is the possession of the process of associative memory; this is the basic atom of consciousness (8). All higher forms of consciousness are essentially complex collections of atoms of associative memory. An organism which has an associative memory can associate a present stimulus with a past one; it then responds to these associated stimuli. In operational terms, if an organism has an associative memory it can learn or be trained to do something. Using this criterion all matter at the atomic and molecular level of organization and many multicellular organisms such as plants, Infusaria and Coelenterates are devoid of consciousness (9).

The fundamental problem of physiology is to find the physiological mechanism underlying consciousness (10). The atoms of living matter or protoplasm are organized into colloidal solutions. A study of the physical chemistry of such solutions is then the key to the understanding of <u>any</u> living process (11). Hence, it is only through the study of the physical chemistry of the colloids of the brain that we will be able

to explain the mechanism of consciousness (11).

Hence, all behavior and consciousness are in principle explainable by the laws of physical science. The tropisms which are the components of behavior are essentially chemical reactions which are affected in a quantitative manner by the external stimuli of the organism. Consciousness is similarly a product of some highly complex state of colloidal matter. Further, only a restricted group of organisms has consciousness. Thus, we cannot regard biological behavior and consciousness as important defining characteristics of life.

A Clarification of the Vitalism/Mechanism Debate Requires the Identification of a Central Question and the Criteria for an Adequate Answer to It

What is the central issue in the mechanism/vitalism debate? Each vitalist or mechanist affirms that there is at least one central question to which his vitalistic or mechanistic thinking provides the most adequate answer. This question may be the factual issue of determining the nature of life. For example, are living things basically like machines or are they something else? The question may also be the pragmatic one of determining the best strategy of biological research. For example, is biological research most successful only when physical and chemical mechanisms are sought? This central question will be different for each of the three thinkers who will be discussed in this paper.

Further, the answers to the central question all presuppose some theory of knowledge. One of the functions of such a theory is to determine the criteria that an adequate answer to this question must satisfy. For example, one possible criterion affirms that all theoretical terms in our theories such as entelechy or vital force must have at least an indirect connection with some empirical observation (12). Hence, a vitalistic or mechanistic theory which had theoretical terms which were not so related to observation would be inadequate. In brief, the clarification of the vitalism/mechanism debate requires the identification of both a central question and the criteria which determine the adequacy of any answer to that central question.

Loeb's Central Question in the Vitalism/Mechanism Debate is: What is the Integrator of the Vast Mosaic of Individual Physiological and Morphological Processes that Occur in the Developing Embryo?

What then is the central question for Loeb? Vitalists and mechanists generally agree that individual physiological processes such as digestion and metabolism are explainable in physical and chemical terms. Further, genetics shows that these individual physiological processes are controlled by independently transmitted Mendelian characters. Hence, an organism appears to be a mosaic of individual processes that are each controlled by some independently transmitted character. But organisms develop from an egg and all of these

individual processes are harmoniously integrated in both the developing embryo and in the adult. Hence the central question for Loeb is: What is the integrator of this vast mosaic of individual physiological, morphological and behavioral processes?

Driesch's Vitalistic Answer to Loeb's Central Question Is That There Exists a Non-Physical Agent, An Entelechy, Which Integrates the Vast Mosiac of Individual Physiological and Morphological Processes that Occur in the Developing Embryo

"Vitalists affirm that some non-physical agent, a life principle or force, is the ultimate integrator of all of the processes of the organism; the activities of this agent are directed by some pre-existing plan of integration. This postulation of a non-physical integrator is a theoretical decision in the vitalist view to exclude the central question from physics and chemistry. These latter sciences cannot in principle say anything about non-physical forces or agents. Mechanists, on the other hand, search for some physical integrator, an agent or force which can be studied by physics and chemistry (13)."

The vitalism/mechanism debate which centers about this central question is clearly seen in the differing interpretations by Loeb and Hans Driesch of the embryological development of sea urchin eggs. First, consider Driesch's arguments. The chemical substance of unfertilized sea urchin eggs resembles an homogenous fluid and hence

there is no physical structure in it. However, after fertilization the homogeneous substance of the egg becomes gradually differentiated into an embryo. This process requires the harmonious integration of many morphological and physiological processes. What then is the basis of such integration? It clearly cannot be the individual physiological and morphological processes because they are the very processes which require integration. Further, the homogeneity of the substance of the egg and its lack of physical structure eliminates it as a possible source of integration. Now, the homogenous substance of the egg and its morphological and physiological processes are the only two possible physical sources of integration. But, neither of these can be the source. Therefore, it is necessary to postulate some non-physical source of integration. Driesch's entelechy is such a source. The entelechy is a non-physical agent which produces a harmonious integration of the innumerable morphological and physiological processes of the developing embryo.

Loeb's Mechanistic Answer to His Central Question is that the Cytoplasm of the Unfertilized Egg Contains a Preformed Embryo Which is a Physical Integrator of the Vast Mosaic of Individual Physiological and Morphological Processes that Occur in the Developing Embryo

Loeb, on the other hand, states that Driesch's argument is based upon a factual error. The experiments of Boveri with sea urchin eggs have shown which parts of the unfertilized egg will develop into an

intestine, skeleton and ectoderm. If then the substance of the egg is as homogeneous as Driesch claims, why do different parts of the egg consistently produce different morphological structures? Hence, Driesch's conception of an homogeneous unfertilized egg is inconsistent with Boveri's evidence (14).

On the basis of both Boveri's experiments and his own work Loeb formulated a different model of the unfertilized egg (15). The cytoplasm of the unfertilized egg contains a preformed embryo which is analogous to an unfinished but recognizable statue. Only the finer details and the final polishing of the statue would be absent. Further, the nucleus which contains Mendelian characters has no role in the formation of this rough and preformed embryo. The function of the inheritable Mendelian characters is to add the fine details to the preformed embryo in the analogous way that a sculptor adds the fine points and polishes his statue. Hence, the substance of the unfertilized egg is highly structured and hence non-homogeneous.

This conception of a preformed embryo is Loeb's answer to his central question. If the substance of the unfertilized egg is structured in this way then we have a physical source of integration that is required by any logically consistent form of mechanism. Given such a source it is unnecessary to postulate a non-physical agent to assemble Mendelian characters according to some plan (15). Driesch's vitalism is therefore refuted because it is both unnecessary and inconsistent

with experimental evidence.

Loeb Rejected Driesch's Vitalistic Answer to the Central Question of the Vitalism/Mechanism Debate Because it Failed to Fulfill His Three Criteria For An Adequate Answer to This Question

Loeb's defense of his mechanistic and his rejection of Driesch's vitalistic answer to his central question presuppose criteria which determine the adequacy of any scientific explanation. Driesch's vitalistic answer to the central question was rejected because it failed to fulfill Loeb's criteria for an adequate scientific explanation. What then are these criteria?

Loeb's Three Criteria for an Adequate Answer to His Central Question of the Vitalism/Mechanism Debate are Derived From His Mechanistic General Conceptual System

They are based upon his general conceptual system (g. c. s.) (16). A g. c. s. is always some general conceptual framework within which particular scientific theories are developed. Further, a g. c. s. provides a criterion of reality because it answers two fundamental questions: (a) What are the ultimate components of the world? (b) What are the ultimate processes of change in the world? In Loeb's g. c. s. the ultimate components are units of matter, atoms and electrons. The ultimate processes of change are the spatial groupings and displacements of atoms and electrons. All atoms and their

properties and interactions are in principle definable and verifiable by the laws and theories of physics and chemistry. Further, living and non-living things have the same kind of matter and hence biology is in principle simply a branch of physics and chemistry (17). In short, material atoms are the fundamental stuff of the world and all of the fundamental processes of change are the various kinds of physical forces, mechanical, electrical, gravitational, etc., causing the spatial rearrangement of atoms.

Further, Loeb's g. c. s. presupposes that the entire world of nature resembles a machine. The forces which regulate the interactions of atoms are blind. Further, all of the changes which occur in the world must occur as they do because they are compelled to do so by blind physical forces. Living organisms and man in particular are no exception. In brief, the events of the world follow one another in a blind and machine-like manner; hence there is no event in Loeb's world which cannot in principle be accurately predicted from a complete knowledge of the laws of physics and chemistry.

Further, Loeb's conception of change in the world also clearly excludes any reference to the operation of ideal causes or purposes (design) in nature. We generally think that at least man's ideas and plans of action are genuine efficient causes of events. Actions based upon such plans or ideas are thought to be "free" or "spontaneous". Loeb flatly denies this. Man's alleged "free" or "spontaneous"

behavior is reducible to tropisms and the latter in turn are reducible to the laws of physics. Men do not eat, make love and war, etc., because they plan or agree to do so. They do these things because they are compelled to do them in a blind and machine-like manner. Man's machine-like behavior is determined by the inherited instinctual processes of his central nervous system. Human beings are essentially robots which are programed by their central nervous system (18). Hence, given Loeb's total exclusion of all ideal causes, all change in the world must be viewed as the result of the action of blind interatomic forces.

Loeb's criteria for an adequate scientific explanation readily follow from his g. c. s. which equates reality with physical atoms and their forces. Hence, one of Loeb's basic criteria is that all phenomena must ultimately be explained in terms of the spatial rearrangements of atoms that are produced by physical forces. Hence, any vitalistic postulation of a non-physical cause of phenomena will always fail to meet this criterion of explanation; by definition, any non-physical agent or principle is unreal.

In Loeb's g. c. s. the only causes of change are blind interatomic forces. Therefore, another criterion is that a scientific explanation must never appeal to any conception of a final cause, a plan or goal to be realized. Thus, any vitalistic theory which postulates the existence of ends or plans which direct the action of their vital

principle fails to fulfill this criterion; such ends are always some kind of final cause and hence they differ radically from the blind efficient causes of Loeb's g. c. s.

Further, Loeb's g. c. s. states that the properties and behavior of atoms are definable and verifiable by the laws of physics and chemistry. Hence, another criterion is that an explanation must always be verifiable by some experimental means (19). This kind of verification is clearly exemplified in physics and chemistry. Their phenomena can be reproduced at will and/or numerical relationships can be established between the conditions of an experiment and its results. Further, as biology is in principle an extension of physics and chemistry it should also be an experimental science in this sense. Hence, any vitalistic postulation of a non-physical life principle fails to fulfill this criterion in two ways. The life principle is non-physical and therefore, there are no experiments in which it can be used to produce desired phenomena. Also, quantitative relationships cannot be established between a non-physical agent and the phenomena it produces. In brief, vitalistic theories which are similar to those of Driesch fail to satisfy any of Loeb's three criteria of explanation.

Summary of Loeb's Mechanistic Philosophy

Loeb identified teleological or living systems with individual organisms. Organisms are chemical machines which are compelled

to function as they do by blind chemical and physical forces. These forces cause the spatial rearrangements of atoms; this is the fundamental process of change in the world. The most distinctive characteristics of living organisms are their syntheses of macromolecules from smaller components and their reproduction. The highest manifestations of life, man's conscious thought and behavior, are only the products of complex anatomical structures and chemical reactions.

The vitalism/mechanism debate centers around one major question: What integrates the chemical machinery of living systems? An adequate answer to this question is a scientific explanation of the phenomena of life. Such an explanation must satisfy the following criteria: (a) The ultimate terms of explanation are atoms and interatomic forces. (b) A scientific concept must be testable by experimental methods which are modeled on those of physics and chemistry.

Finally, these criteria are derived from a g. c. s. which lists both the components of the real world, atoms and their forces, and the fundamental processes of change, the spatial rearrangement of atoms by physical forces. Hence, it is this g. c. s. which is the conceptual foundation of all of Loeb's mechanistic theories.

FOOTNOTES FOR CHAPTER II

[1] This is a highly simplified presentation of Nagel's discussion but it is adequate here for our purposes. (Nagel, 1961, p. 411-418).

[2] Loeb (1916, p. 1) states: "The physical researches of the last ten years have put the atomistic theory of matter and electricity on a definite and in all probability permanent basis. We know the exact number of molecules in a given mass of any substance whose molecular weight is known to us, and we know the exact charge of a single electron. This permits us to state as the ultimate aim of the physical sciences the visualization of all phenomena in terms of groupings and displacements of ultimate particles, and since there is no discontinuity between the matter constituting the living and non-living world the goal of biology can be expressed in the same way."

[3] Loeb (1916, p. 14-15) states: "Each organism is characterized by a definite form and we shall see in the next chapter that this form is determined by definite chemical substances. The same is true for crystals, where substance and form are definitely connected and there are further analogies between organisms and crystals. Crystals can grow in a proper solution, and can regenerate their form in such a solution when broken or injured; it is even possible to prevent or retard the formation of crystals in a supersaturated solution by preventing "germs" in the air from getting into the solution, an observation which was later utilized by Schroeder and Pasteur in their experiments on spontaneous generation. However, the analogies between a living organism and a crystal are merely superficial and it is by pointing out the fundamental differences between the behaviour of crystals and that of living organisms that we can best understand the specific difference between non-living and living matter. It is true that a crystal can grow, but it will do so only in a supersaturated solution of its own substance. Just the reverse is true for living organisms. In order to make bacteria or the cells of our body grow, solutions of the split products of the substances composing them and not the substances themselves must be available to the cells; second, these solutions must not be supersaturated, on the contrary, they must be dilute; and third, growth leads in living organisms to cell division as soon as the mass of the cell reaches a certain limit. This process of cell division cannot be claimed even metaphorically to exist in a crystal. A correct appreciation of these facts will give us an insight into the specific difference between non-living and living matter. The formation of

living matter consists in the synthesis of the proteins, nucleins, fats, and carbohydrates of the cells, from the split products. To give an historical example, Pasteur showed that yeast cells and other fungi could be raised on the following sterilized solution: water, 100 gm., crystallized sugar, 10 gm., ammonium tartrate, 0.3 gm. to 0.5 gm., and fused ash from yeast, 0.1 gm.[a] He undertook this experiment to disprove the idea that protein or organic matter in a state of decomposition was needed for the origin of new organisms as the defenders of the idea of spontaneous generation had maintained. "

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[a] Pasteur, L., Annal. d. Chim. et d. Physique, 1862, 3 ser., lxiv., I.

[4] Loeb (1916, p. 23) states: "The essential difference between living and non-living matter consists then in this: the living cell synthesizes its own complicated specific material from indifferent or non-specific simple compounds of the surrounding medium, while the crystal simply adds the molecules found in its supersaturated solution. This synthetic power of transforming small "building stones" into the complicated compounds specific for each organism is the "secret of life" or rather one of the secrets of life. "

[5] In another place Loeb (1906, p. 1) states that an organism is a chemical machine which can maintain and reproduce itself.

"In these lectures we shall consider living organisms as chemical machines, consisting essentially of colloidal material, which possess the peculiarities of automatically developing, preserving, and reproducing themselves. The fact that the machines which can be created by man do not possess the power of automatic development, self-preservation, and reproduction constitutes for the present a fundamental difference between living machines and artificial machines. We must, however, admit that nothing contradicts the possibility that the artificial production of living matter may one day be accomplished. It is the purpose of these lectures to state to what extent we are able to control the phenomena of development, self-preservation, and reproduction.

Living organisms may be called chemical machines, inasmuch as the energy for their work and functions is derived from chemical processes, and inasmuch as the material from which the living machines are built must be formed through chemical processes. It is therefore only natural that the dynamics of living matter should begin with an analysis of the specific character of the chemical processes in organisms. It is neither our intention nor is it possible for us to give an exhaustive analysis, and we shall only go far enough to satisfy ourselves that no variables are found in the chemical dynamics

of living matter which cannot be found also in the chemistry of inanimate nature.

The material of which living organisms consist is essentially colloidal in its character. Graham introduced the discrimination between colloidal and crystalloidal substances: the latter diffuse easily, the former only with difficulty, or not at all, through animal membranes. The colloidal substances may be in solution or fine suspension, or they may appear in a jellylike or coagulated or precipitated form. In the former case where they are liquid we speak of sols, in the latter of gels. The structures which we find in living matter originate mostly through a gelation or coagulation of liquid colloids. We shall see in these lectures that liquefactions and gelations or coagulations may possibly play a great role in various physical manifestations of life; but as the physics of colloids is still in its beginning, we must not be surprised that it is as yet impossible to carry its application to life phenomena very far."

[6] Loeb (1916, p. 261) describes this experiment and its results as follows: "The writer suggested in 1897[a] that the light acts chemically in the heliotropic reactions and in 1912 that the heliotropic reactions probably follow the law of Bunsen and Roscoe,[b] and it was possible to confirm this idea by direct experiments.[c] This law states that the photochemical effect of light equals $i\,t$ where i is the intensity of the light and t the duration of illumination. The experiments were carried out on young regenerating polyps of Eudendrium by measuring the time required to cause fifty per cent. of the polyps to bend to the source of light. The intensity of light was varied by altering the distance of the source of light from the polyps. Table VI gives the result."

TABLE VI

Distance between Polyps and Source of Light	Time Required to Cause Fifty Per Cent. of the Polyps to Bend towards the Source of Light	
	Observed	Calculated from Bunsen-Roscoe Law
Metres	Minutes	Minutes
0.25	10	
0.50	between 35 and 40	40
1.00	150	160
1.50	between 360 and 420	360

[a] Loeb, J., Arch. f. d. ges. Physiol., 1897, lxvi., 439.
[b] Loeb, J., The Mechanistic Conception of Life, Chicago, 1912, p. 27.
[c] Loeb, J., and Ewald, W. F., Zentralbl. f. Physiol., 1914, xxvii., 1165.

[7]Loeb's (1964, p. 62-63) use of tropisms to explain behavior is clearly seen in the following passage:

"In closing let me add a few remarks concerning the possible application of the investigations of tropisms.

I believe that the investigation of the conditions which produce tropisms may be of important for psychiatry. If we can call forth in an animal otherwise indifferent to light by means of an acid a heliotropism which drives it irresistibly into a flame; if the same thing can be brought about by means of a secretion of the reproductive glands, we have given, I believe, a group of facts, within which the analogies necessary for psychiatry can be called forth experimentally and can be investigated.

These experiments may also attain a similar value for ethics. The highest manifestation of ethics, namely, the condition that human beings are willing to sacrifice their lives for an idea is comprehensible neither from the utilitarian standpoint nor from that of the categorical imperative. It might be possible that under the influence of certain ideas chemical changes, for instance, internal secretions within the body, are produced which increase the sensitiveness to certain stimuli to such an unusual degree that such people become slaves to certain stimuli just as the copepods become slaves to the light when carbon dioxide is added to the water. Since Pavlov and his pupils have succeeded in causing the secretion of saliva in the dog my means of optic and acoustic signals, it no longer seems strange to us that what the philosopher terms an "idea" is a process which can cause chemical changes in the body. "

[8]Loeb (1964, p. 72-73) presents his criterion of consciousness and some of its implications in the following passage:

"On the other hand, physiologists who have appreciated the untenable character of such metaphysical speculations have held that the only alternative is to drop the search for the mechanisms underlying consciousness and study exclusively the results of operations on the brain. This would be throwing out the wheat with the chaff. The mistake made by metaphysicians is not that they devote themselves to fundamental problems, but that they employ the wrong methods of investigation and substitute a play on words for an explanation by means of facts. If brain physiology gives up its fundamental problem, namely, the discovery of those elementary processes which make consciousness possible, it abandons its best possibilities. But to obtain results, the errors of the metaphysician must be avoided and explanations must rest upon facts, not words. The method should be the same for animal psychology that it is for brain physiology. It should consist in the right understanding of the fundamental process

which recurs in all psychic phenomena as the elemental component. This process, according to my opinion, is the activity of the associative memory, or of association. Consciousness is only a metaphysical term for phenomena which are determined by associative memory. By associative memory I mean that mechanism by which a stimulus brings about not only the effects which its nature and the specific structure of the irritable organ call for, but by which it brings about also the effects of other stimuli which formerly acted upon the organism almost or quite simultaneously with the stimulus in question.[a] If an animal can be trained, if it can learn, it possesses associative memory. By means of this criterion it can be shown that Infusoria, Coelenterates, and worms do not possess a trace of associative memory. Among certain classes of insects (for instance, ants, bees, and wasps), the existence of associative memory can be proved. It is a comparatively easy task to find out which representatives of the various classes of animals possess, and which do not possess, associative memory. Our criterion therefore might be of great assistance in the development of comparative psychology."

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[a] Our criterion puts an end to the metaphysical ideas that all matter, and hence the whole animal world, possess consciousness. We are brought to the theory that only certain species of animals possess associative memory and have consciousness, and that it appears in them only after they have reached a certain stage in their ontogenetic development. This is apparent from the fact that associative memory depends upon mechanical arrangements which are present only in certain animals, and present in these only after a certain development has been reached.

[9] This is an important implication of Loeb's criterion of consciousness; its importance will be seen when the vitalistic views of Bergson and Teilhard are discussed. For Bergson, all life has consciousness and for Teilhard an attenutated form of consciousness is a constituent of all matter.

[10] Loeb (1900, p. 213) states: "The most important problem in the physiology of the central nervous system in the analysis of the mechanisms which give rise to the so-called psychic phenomena. The latter appear, invariably, as a function of an elementary process, namely, the activity of the associative memory."

Again he states (1900, p. 214): "The chief problem of the physiology of the brain is, then evidently this: What is the physical character of the mechanism of associative memory? As we said in the first chapter, the answer to this question will probably be found

in the field of physical chemistry."

[11]In the following Loeb (1900, p. 290) states that physical chemistry is the key to the understanding of life: "If we are anxious to develop a dynamics of the various life-phenomena, we must remember that the colloidal substances are the machines which produce the life-phenomena. But the physics of these substances is still a science of the future. The new methods and conceptions created by physical chemistry give us the hope that a physics of the colloidal substances may be looked for in the near future."

Again he states (1964, p. 74): "It becomes evident that the unraveling of the mechanism of associative memory is the great discovery to be made in the field of brain physiology and psychology. But at the same time it is evident that this mechanism cannot be unraveled by histological methods, or by operations on the brain, or by measuring reaction times. We have to remember that all life phenomena are ultimately due to motions or changes occurring in colloidal substances. The question is, Which peculiarities of the colloidal substances can make the phenomenon of associative memory possible? For the solution of the problem the experience of physical chemistry and of the physiology of the protoplasm must be combined. From the same sources we must expect the solution of the other fundamental problems of brain physiology, namely, the process of conduction of stimuli."

[12]Empirical observation in this paper will always refer to the data we obtain from our five senses. Hence, empirical is to be distinguished from the introspective observation of our own mental states; the latter provide us with the data of consciousness.

The theories of knowledge which are adopted by vitalists and mechanists assign different values to these two kinds of observation. In Loeb's mechanism introspection is irrelevant to a scientific study of life; only the data from empirical observation are to be used. On the other hand, in Bergson's vitalism introspection is an indispensable source of insight.

[13]In the following passage Loeb (1916, p. v-vii) clearly states the central question of the vitalism/mechanism debate and his proposed resolution of it.

"It is generally admitted that the individual physiological processes, such as digestion, metabolism, the production of heat or of electricity, are of a purely physicochemical character; and it is also conceded that the functions of individual organs, such as the eye or the ear, are to be analysed from the viewpoint of the physicist.

When, however, the biologist is confronted with the fact that in the organism the parts are so adapted to each other as to give rise to a harmonious whole; and that the organisms are endowed with structures and instincts calculated to prolong their life and perpetuate their race, doubts as to the adequacy of a purely physiochemical viewpoint in biology may arise. The difficulties besetting the biologist in this problem have been rather increased than diminished by the discovery of Mendelian heredity, according to which each character is transmitted independently of any other character. Since the number of Mendelian characters in each organism is large, the possibility must be faced that the organism is merely a mosaic of independent hereditary characters. If this be the case the question arises: What moulds these independent characters into a harmonious whole?

The vitalist settles this question by assuming the existence of a pre-established design for each organism and of a guiding "force" or "principle" which directs the working out of this design. Such assumptions remove the problem of accounting for the harmonious character of the organism from the field of physics or chemistry. The theory of natural selection invokes neither design nor purpose, but it is incomplete since it disregards the physicochemical constitution of living matter about which little was known until recently.

In this book an attempt is made to show that the unity of the organism is due to the fact that the egg (or rather its cytoplasm) is the future embryo upon which the Mendelian factors in the chromosomes can impress only individual characteristics, probably by giving rise to special hormones and enzymes. We can cause an egg to develop into an organism without a spermatozoon, but apparently we cannot make a spermatozoon develop into an organism without the cytoplasm of an egg, although sperm and egg nucleus transmit equally the Mendelian characters. The conception that the cytoplasm of the egg is already the embryo in the rough may be of importance also for the problem of evolution since it suggests the possibility that the genus- and species-heredity are determined by the cytoplasm of the egg, while the Mendelian hereditary characters cannot contribute at all or only to a limited extent to the formation of new species. Such an idea is supported by the work on immunity, which shows that genus- and probably species-specificity are due to specific proteins, while the Mendelian characters may be determined by hormones which need neither be proteins nor specific or by enzymes which also need not be specific for the species or genus. Such a conception would remove the difficulties which the work on Mendelian heredity has seeminly created not only for the problem of evolution but also for the problem of the harmonious character of the organism as a whole."

[14]Loeb (1916, p. 134) states: "This principle which is under discussion here is the development of a purposeful arrangement of organs out of the egg. If we assume that the egg consists of homogeneous material we are indeed confronted with a riddle. Since the facts contradict such an assumption but show, as Boveri has pointed out, a prearrangement which allows us to indicate in the unfertilized egg already the exact spot where the intestine will grow into the blastula cavity, we are on solid physicochemical ground, although many questions of detail cannot yet be answered. Such a preformation as Boveri has demonstrated is only conceivable if the material of the egg has not too high a degree of fluidity; we may consider it as consisting essentially of a semi-solid gel which is not homogeneous throughout the egg but divided into three strata."

[15]Loeb (1916, p. 151-152) clearly presents his model in the following: "The most important fact which we gather from these data is that the cytoplasm of the unfertilized egg may be considered as the embryo in the rough and that the nucleus has apparently nothing to do with this predetermination. This must raise the question suggested already in the third chapter whether it might not be possible that the cytoplasm of the eggs is the carrier of the genus or even species heredity, while the Mendelian heredity which is determined by the nucleus adds only the finer details to the rough block. Such a possibility exists, and if it should turn out to be true we should come to the conclusion that the unity of the organism is not due to a putting together of a number of independent Mendelian characters according to a "pre-established plan," but to the fact that the organism in the rough existed already in the cytoplasm of the egg before the egg was fertilized. The influence of the hereditary Mendelian factors or genes consisted only in impressing the numerous details upon the rough block and in thus determining its variety and individuality; and this could be accomplished by substances circulating in the liquids of the body as we shall see in later chapters."

[16]The concept of a general conceptual system (G. C. S.) is clearly defined by Harré. (Cf. Harré, 1964, p. 27-35). This meaning will be assumed throughout this paper.

[17]See footnote 2.

[18]Loeb (1964, p. 32-33) clearly presents his conception of human behavior in the following passage: "If our existence is based on the play of blind forces and only a matter of chance, if we

ourselves are only chemical mechanisms--how can there be an ethics for us? The answer is, that our instincts are the root of our ethics and that the instincts are just as hereditary as is the form of our body. We eat, drink, and reproduce not because mankind has reached an agreement that this is desirable, but because, machine-like, we are compelled to do so. We are active, because we are compelled to be so by processes in our central nervous system; and as long as human beings are not economic slaves the instinct of successful work or of workmanship determines the direction of their action. The mother loves and cares for her children, not because metaphysicians had the idea that this was desirable, but because the instinct of taking care of the young is inherited just as distinctly as the morphological characters of the female body. We seek and enjoy the fellowship of human beings because hereditary conditions compel us to do so. We struggle for justice and truth since we are instinctively compelled to see our fellow beings happy. Economic, social, and political conditions or ignorance and superstition may warp and inhibit the inherited instincts and thus create a civilization with a faulty or low development of ethics. Individual mutants may arise in which one or the other desirable instinct is lost, just as individual mutants without pigment may arise in animals; and the offspring of such mutants may, if numerous enough, lower the ethical status of a community. Not only is the mechanistic conception of life compatible with ethics: it seems the only conception of life which can lead to an understanding of the source of ethics.

[19]A science which is experimentally verifiable has a higher truth value than any purely descriptive one.

"It is the object of this paper to discuss the question whether our present knowledge gives us any hope that ultimately life, i.e., the sum of all life phenomena, can be unequivocally explained in physico-chemical terms. If on the basis of a serious survey this question can be answered in the affirmative our social and ethical life will have to be put on a scientific basis and our rules of conduct must be brought into harmony with the results of scientific biology.

It is seemingly often taken for granted by laymen that "truth" in biology, or science in general, is of the same order as "truth" in certain of the mental sciences; that is to say, that everything rests on argument or rhetoric and that what is regarded as true today may be expected with some probability to be considered untrue tomorrow. It happens in science, especially in the descriptive sciences like paleontology or zoology, that hypotheses are forwarded, discussed, and then abandoned. It should, however, be remembered that modern biology is fundamentally an experimental and not a descriptive science; and that its results are not rhetorical, but always assume one of two

forms; it is either possible to control a life phenomenon to such an extent that we can produce it at desire (as, e.g., the contraction of an excised muscle); or we succeed in finding the numerical relation between the conditions of the experiment and the biological result (e.g., Mendel's law of heredity). Biology as far as it is based on these two principles cannot retrogress, but must advance." (Loeb, 1964, p. 5-6).

CHAPTER III

HENRI BERGSON (1859-1941) AND VITALISM

Introduction

One of the aims of the present chapter is to describe Bergson's vitalism. Secondly, a comparison between Bergson's and Loeb's mechanism will be made. This comparison will focus on the following: (1) They have different conceptions of a teleological system. (2) Further, they view the vitalism/mechanism controversy in entirely different ways. (3) They have radically different ways of resolving this controversy. (4) They treat the problem of consciousness in radically different ways. Finally, the limitations of Bergson's vitalism will be pointed out. The terminological problems which arise in the attempt to understand the biological philosophy of Bergson should also be noted. Bergson uses terms in an ambiguous way (see page 66). For example, the vital impetus is described as the source of life and inert matter in some contexts whereas in others it is described as being opposed by inert matter. Also, in this chapter a number of expressions which denote the same reality will be used. They are: life, mind, duration, vital principle, vital impetus, fundamental reality of the world, fundamental process of change in the world, and consciousness.

The Main Characteristic Which Differentiates a Living (Teleological) System From a Non-Living (Non-Teleological) One is the Possession of Real Time or Duration (20)

How does Bergson characterize material bodies, non-living or non-teleological systems? His conception of them is as follows: Their ultimate components are atoms. All changes in them are caused by the spacial rearrangements of atoms. Further, the behavior of a material object at any level of organization is determined by the laws of physics and chemistry. A superhuman intellect with sufficient information could calculate the specific positions and arrangements of any material object at any time (21). In such calculations time is equated with what Bergson calls abstract time, the time which we represent by points on a line. Finally, the whole of any material object is any arbitrarily chosen portion of matter which a scientific investigator wants to study; such a whole is simply an arithmetic sum of all its molecules and their spatial arrangements. In short, Bergson's conception of a non-living (non-teleological) system is approximately the same as our present day notion of inert matter.

On the other hand, living systems are wholes in a different sense. They are composed of unlike parts which have different and complementary functions. For example, a crystal does not have different parts with different functions as does a mouse. Further, even though there are obvious difficulties, especially in the plant kingdom,

of knowing whether a given specimen is an individual organism Bergson thinks that the tendency to form autonomous individuals is another important characteristic of living systems. Finally, it is the possession of real time or duration which is the most essential characteristic of living systems.

Real Time or Duration is the Fundamental Reality of the World and It has the Properties of Simplicity, Indivisibility and Creativity

What then is real time or duration? It is the fundamental reality of the world. An introspective examination of our consciousness will reveal its true nature. Our consciousness consists of a continual stream of qualitatively distinct states. At one moment I am tired, at the next I am hungry and so on. Further, our past is continually being added to our present awareness. My present hunger continues to grow as the day continues. This continual addition of past events to the present, or duration, resembles a snowball which continues to get larger as it rolls down a hill. Further, duration is indivisible and hence simple (22). Even though our intellectual analysis can isolate and label various mental states, duration resembles a flowing river and hence is indivisible (23). Finally, duration is creative. Each event in the history of our consciousness is unique and irreplacable. Hence each new event is incommensurable with its antecedents. On the other hand, the ability to predict future events presupposes the

existence of repetitive events. Thus, the ability to predict the appearance of our unique states of consciousness is in principle impossible. For example, our specific feelings tomorrow at 2:35 P. M. will be dependent upon the flow of duration up to that time. But as we do not know what this flow will be until it has occurred we cannot predict what our feelings will be. Bergson, also identifies the entire evolution of life with the evolution or flow of our consciousness or duration. We can no more predict the emergence of a new species of organisms than we can predict how we will feel at a given time tomorrow (24). In short, real time or duration is simple, indivisible and creative.

Bergson's Central Question in the Vitalism/Mechanism Debate is: What is the Nature of the Evolving Life of the Universe? His Defense of His Vitalistic Answer to This Question is Found in His Description and Criticism of Mechanism and Certain Forms of Vitalism

The Underlying Premise in a Mechanistic Understanding of Life is the Metaphysical Assumption that What is Most Real in the World is Eternal and Unchangeable and Hence Real Time (Duration) Must be Eliminated From Any Mechanistic Explanation of Life

Consider first his description and criticism of mechanism. What then is a mechanical explanation of the nature of life? Its central idea is that a superhuman intellect which possessed a perfect knowledge of the laws of physics and chemistry could accurately

predict the emergence of any phenomenon. For example, a superhuman intellect viewing the primordial dust of our universe would have been able to accurately predict in detail the composition of the flora and fauna in Corvallis at 12:01 P. M. on June 1, 1970. Similarly, such a mind would also be able to accurately predict the feelings we will have tomorrow at 2:35 P. M. (25).

Mechanism presupposes a metaphysical assumption which states that what is most real is eternal and hence unchangeable. Thus, if we had superhuman intellects that could see things as they really are, the total past, present and future would be simultaneously present to our vision. On the other hand, it is the limitation of our finite minds that makes the world appear as if it existed in real time or duration and had a genuine history. Hence this metaphysical assumption is the ultimate reason why mechanistic biologists and philosophers eliminate real time or duration from their conception of the nature of life.

Bergson Rejects Mechanism as a Metaphysical Explanation of the Nature of Life Because of Its Elimination of Real Time (Duration) From Its Explanations

Why then does Bergson reject the mechanistic view of life? Consider first some possible reasons for rejecting mechanism. (a) We might argue that it is not a fruitful research strategy. Some biologists state that the search for physical and chemical mechanisms in natural history is not as fruitful as is the search for behavioral

patterns. (b) Mechanism as a scientific explanation cannot in principle explain all of the phenomena of life. There are biological laws which cannot in principle be deduced from any conceivable physical or chemical laws and theories. This is the thesis of some organismic biologists today. (c) Mechanism as a metaphysical explanation of the true nature of life is inadequate. "True nature of life" refers to some underlying reality such as Locke's substance which is the source of the phenomena of life which are studied by the biologist.

Bergson's primary reason for rejecting mechanism is that it fails to give a correct metaphysical explanation of life. For mechanism, time or duration is an abstraction which can be conveniently represented on one of the axes of a Cartesian Coordinate System. Time or duration is not a cause or process of anything. On the other hand, Bergson thinks that time or duration is the fundamental reality of the world. It is the reality which is the source of all of the phenomena which science studies (26).

Bergson's Rejection of Mechanism as a Metaphysical Explanation is Ultimately Based upon His View That There are Two Distinct, but Complementary Ways of Knowing, Metaphysical and Intellectual, the Two Kinds of Reality in the World, Life (Duration) and Matter

How do we <u>know</u> that duration is this fundamental reality? The only infallible way is to have a metaphysical intuition of it. But what

is a metaphysical intuition and how is it related to other kinds of knowing?

There are two ways of knowing reality. Now, it is useful to divide the whole of reality into inert matter and mind or life. However, these two kinds of reality are derived from duration, the fundamental reality or flux of the world. Duration is a continual flux that resembles the stream of our consciousness. When this flux is attenuated it becomes matter and when it is intensified or accelerated it becomes mind. Or, to use quantitative language we may say that when the basic flux of the world moves at high velocities we have mind and when it moves at lower ones we have inert matter (27).

There are also two different ways of knowing which correspond to the two kinds of reality (28). The object of intellectual knowing is inert matter. The behavior of inert matter is deterministic and hence it makes predictions such as those in physics, chemistry and astronomy possible. For example, a properly designed experiment in chemistry will always produce the same results when it is repeated. Hence, a basic characteristic of intellectual knowing is the use of the rational arguments and precisely defined concepts that are found in the physical sciences.

Intellectual Knowing Must Eliminate Duration (Real Time) Because It Provides Us With the Pragmatic and Rational Knowledge We Need in Order to Manipulate the Physical World

Further, the sole function of intellectual knowing is to direct man's actions upon inert matter. Man's intellect was evolved for this exclusively pragmatic function. In order to manipulate matter it is necessary to have fixed points of reference, a coordinate system. For example, in order to accurately direct a missile to its target its trajectory must be accurately known. Such a trajectory provides us with fixed points of reference which tell us at what time the missile will pass a given point. Hence, the intellect must view duration of real time as a succession of mathematically determinable positions in order to successfully control the physical world. In brief, this elimination of duration or real time is caused by the pragmatic method of intellectual knowing.

Metaphysical Knowing Produces an Intuitive (Non-Rational) and Non-Pragmatic Knowledge of the Fundamental Reality of the World, Duration (Life)

The object of metaphysical knowing, on the other hand, is mind or life. Mind has all of the characteristics of duration or real time that were discussed earlier. Further, even though our minds and the entire world of life are the primary objects of metaphysics, inert

matter with its attenuated duration is a secondary object.

Also, intuitive and non-pragmatic knowing are principle characteristics of metaphysics. Metaphysical knowledge is non-pragmatic because it does not show us how to manipulate the material world. Further, it is intuitive because our mind has a direct vision of itself and hence of its duration in the act of intuitive knowing; this process requires an intense effort of our will. Now, our duration is identical with duration or the fundamental reality of the world. Hence, a metaphysical intuition which reveals what is most real in ourselves also reveals what is most real in the world (29).

No form of rational argument can prove the truth of a metaphysical intuition. Such intuitions are self-justifying. The continual disagreements of philosophers are due to their inability to prolong their intuitions. If such intuitions could be prolonged then all philosophers would agree with one another. Hence, to have the right intuitions of reality is, for Bergson, the most important experience of a philosopher (30).

Further, the contents of an intuition cannot be delimited by the kinds of precise concepts that are used in rational arguments. Hence, Bergon's metaphysical works are filled with images which suggest the contents of an intuition (31).

Metaphysical and Intellectual Knowing Complement Each Other Because the Former Attains an Absolute Knowledge of Life (Duration) Whereas the Latter Can Attain an Absolute Knowledge of Matter. Matter and Life are the Two Kinds of Reality in the World

What then are the functions of these two ways of knowing? Both kinds of knowing can attain knowledge of reality as it is. Our intellectual knowing can gradually attain a true or absolute knowledge of inert matter (32). We would not be able to successfully manipulate the material world if we did not have some knowledge of its true nature (33). Similarly, metaphysical knowing can attain a true or absolute knowledge of mind or life. Hence, both kinds of knowing are required to know the two main divisions of reality, inert matter and mind.

The Basic Error of Mechanism as a Metaphysical Explanation is its Illegitimate Attempt to Understand Life (Duration) Through the Rational Concepts of Intellectual Knowing

Given this distinction between the two ways of knowing the basic fallacy of mechanism becomes evident. The intellect's absolute knowledge of reality is restricted to inert matter; the latter is only one part of the whole of reality. However, mechanism as a metaphysical explanation of the nature of life attempts to explain the whole of reality, matter and mind or life, in terms of intellectual concepts. Hence, the basic fallacy of mechanism is the illegitimate extension of

concepts which are valid for only one part of reality (34, 35).

Bergson Rejects Leibnizian Vitalism Because of Its Logical Inconsistencies

Mechanism and vitalism are the two alternative metaphysical explanations of the nature of life. There is no middle ground. If mechanism is totally rejected then some form of vitalism must be accepted and vice versa (36).

Bergson totally rejected mechanism and therefore adopted some form of vitalism. Now, there are many kinds of vitalism and some are better than others. What kinds did he reject and which one did he accept?

Consider first some general characteristics of vitalism. An important characteristic is the description of some teleological system. This system may be the individual organism as in the case of Loeb or it may refer to a grouping of organisms such as the population, community, ecosystem, etc. Further, the parts of these systems interact with one another to produce certain goals such as the maintenance of a constant body temperature. The unique characteristic of a vitalistic conception of living systems is the positing of a vital principle. The latter is always some non-material agent which is the ultimate cause of the characteristic phenomena of life. Finally, a vital principle either is or is not trying, consciously or

unconsciously, to realize some plan; such a plan is to the organism what a blueprint is to a building.

What kind of vitalism does Bergson reject? He rejects a Leibnizian version. Leibniz asserts that only the individual organism can be a teleological system and hence that there are as many vital principles as individuals. The parts of the individual organism contribute to its maintenance and well being. Leibniz restricted the meaning of teleological system in this way in order to avoid the anthropomorphism of having one individual organism contribute to the well being of another (37).

Bergson rejects this form of vitalism for several reasons. The parts of an individual organism have a degree of autonomy which is comparable to that of the individual organism itself. But, these semi-autonomous parts do cooperate to maintain the functioning of the individual organism. Hence, Leibniz is logically inconsistent when he assumes that a number of individual organisms cannot contribute to the maintenance and functioning of groups such as the population and community.

Further, individual organisms are not as independent of one another as Leibniz thinks. The most individuated organism, man, is originally the product of an egg and a sperm which belongs to its parents. The parents in turn may be traced back through the tree of life. Where then does the individual vital principle begin and end?

Finally, if some degree of goal directed behavior is a basis for identifying teleological systems with individual organisms then organs, tissues and the enumerable cells should also be called teleological systems. Now each teleological system has a single vital principle. Hence we will soon have an indefinite number of vital principles in each individual organism if each organ, tissue, and cell has its own.

In order to avoid the above difficulties, Bergson states that the entire world of life is the only teleological system that exists. There is only one vital principle, the vital impetus.

Bergson Rejects the Vitalism of Ends Because of Its Attempt to Understand the Nature of Life Through the Concepts of Intellectual Knowing

Bergson also rejects the vitalism of ends which asserts that teleological systems are either consciously or unconsciously realizing a plan. A superhuman intellect who knew this plan would be able to accurately predict all past, present and future actions of the system. We are here implying that the total reality of the system is given and hence that duration is non-existent.

In general, mechanism and the preceding form of vitalism are viewpoints which are generated by our intellect's way of thinking about the world. We formulate plans and determine the means to realize them. This is characteristic of our intellectual activity. The basic error of mechanism and the vitalism of ends is to think that the

fundamental reality of the world, duration, operates in the same way as does out intellect (38).

A Premise Which is Common to Both Mechanism and the Vitalism of Ends is that the Real Process of Change Which Occurs in the Evolving Tree of Life Resembles the Process of Manufacturing

A basic premise of both mechanism and the vitalism of ends is that the real process of nature which produces the evolving tree of life resembles manufacturing. Manufacturing includes both the activity of constructing parts and their assembly into the final product. The eye, for example, is a highly complex structure which has gradually become more complex in the course of evolution. Now, if the real process of evolution resembles manufacturing then the eye evolved because an increasing number of highly differentiated cells were formed and then assembled into an increasingly complex structure. For mechanism those chance formations and arrangements of cells which had survival value remained. On the other hand, for the vitalism of ends an existing structural plan, consciously or unconsciously present, determined this formation and arrangement. But for both mechanism and the vitalism of ends, the eye is a structure which is assembled piece by piece as is any manufactured article.

Bergson Rejects the Preceding Common Premise of Mechanism and the Vitalism of Ends Because it is Based Upon Intellectual Conceptions Which do not Represent What is Most Real in the Biological World

The Perceptions and Conceptions of Intellectual Knowing do not Enable Us to Know What is Most Real in the Biological World

A criterion of reality enables us to determine which entities in the world are most real. Those which fulfill the criteria in highest degree are the most real, the really real entities of the world. Now, Bergson's criterion of reality states that what is most real is simple and hence has no parts and is indivisible.

Next, what is the reason for the failure of intellectual knowing to present us with what is most real? Our intellectual perceptions and conceptions of things are complex and divisible. A given box, for example, can be perceived from an infinite number of viewpoints and it will appear slightly different in each one of them. Similarly, our intellectual conception of such an organ as the eye is highly complex. The functioning eye requires the coordination of numerous physiological mechanisms and structures. Hence, given Bergson's criterion of reality our intellectual conceptions and perceptions do not present us with what is most real.

On the other hand, only a metaphysical intuition can present us

with a reality which satisfies this criterion. The duration we intuit is simple and indivisible.

Even Though Intellectual Knowing Fails to Understand What is Most Real in the World of Life It is a Mode of Knowing Which is, Nevertheless, Necessary for the Sciences of Life Which Successfully Manipulate the World of Living Things

Why then do we persist in viewing all reality, inert matter and mind or life, as complex and divisible? Our intellectual faculties of perceiving and conceiving are so constructed that they must present reality as complex and divisible. These faculties arose in evolution and their function was to enable us to act successfully in the material world. Further, successful action in the world requires complex perceptions and conceptions as the development of science clearly shows.

However, is not this disregard of the criterion of reality by the intellect's attempt to know mind or life an illegitimate procedure? Does this not lead to error? In his discussion of the two ways of knowing Bergson states that intellectual and metaphysical knowing can attain an absolute knowledge of inert matter and mind (life) respectively. Further, a basic fallacy of both mechanism and the vitalism of ends is the illegitimate extension of the intellectual way of knowing to the realm of mind (life). However, it must be noted that this procedure is illegitimate only for the attainment of an absolute knowledge

which provides metaphysical explanations of the nature of mind (life). On the other hand, the extension of the intellectual way of knowing is not an illegitimate procedure for sciences such as biology and psychology which provide scientific explanations of life (mind). The intellectual way of knowing mind or life is necessary for the successful manipulation of the living world.

When the Intellectual and Metaphysical Ways of Knowing Life are Compared We Find that the Former Presents Us with a Static and Complex Symbolic Representation of Life Whereas the Latter Enables Us to Feel the Simplicity and Indivisibility of What is Most Real in Life

How then does this intellectual and hence pragmatic knowledge of mind (life) differ from the absolute knowledge of it which is attained by metaphysical intuition? Intellectual knowledge presents a static and partial notion or view of the object which is analogous to a series of snapshots of a moving bird. The bird is in motion but the intellectual representation of it is non-moving or static. Further, the intellectual representation of the bird's motion is only a partial notion or view of it; it is impossible to reconstruct this movement from an infinite number of such partial notions. A fundamental error, one that is common to Empiricism and Rationalism, is to think that a moving reality can be reconstructed from partial notions or views of it. The partial notions or views of reality are not its real parts. The reality

of mind (life) is simple and indivisible and hence has no real parts. In brief, the static and partial notions of the intellect are components of a symbolic expression of reality as are the letters of a poem (39).

Thus, if we want to understand life (mind), as it is, then the intellectual and hence pragmatic way of perceiving and conceiving must be abandoned. On the contrary, a metaphysical intuition must be sought. Such intuitions enable us to <u>feel</u> the simplicity and indivisibility of mind (life) as it is (40).

Bergson presents a number of examples in which he compares the complexity of reality presented by intellectual knowing with its simplicity as revealed by intuition. Let us imagine that we move our hand in a straight line from one side of our desk to the other. The action of moving our hand is <u>felt</u> to be simple and indivisible. This is the viewpoint of a metaphysical intuition. On the other hand, our perception of this movement is complex. Our head can have an infinite number of different positions while our hand is moving across the desk. Hence, we can have an infinite number of different perceptions of the moving hand. Further, our conception of this movement is complex. The moving hand passes through an infinite number of mathematical points. The latter can be plotted on a graph and an empirical equation can be found which will describe their relationships. Therefore, the movement of our hand has two sets of characteristics. When it is intuited metaphysically it is <u>felt</u> to be simple and

indivisible. On the other hand, when it is intellectually known it is a complex set of mathematical points which can be represented by an empirical equation. Now, according to Bergson's criterion of reality the movement which is felt to be simple and indivisible is duration, the reality of mind (life) as it is. On the other hand, our complex conception of the moving hand is only a static and partial view of this same reality (41).

The Real Process of Change Which Occurs in the Evolving Biological World Cannot Resemble the Process of Manufacturing Because the Latter is Highly Complex Whereas the Real Process of Change, Duration, Which Can Only be Known in a Metaphysical Intuition is Simple and Indivisible

Given the relationship of Bergson's criterion of reality to both the metaphysical and intellectual ways of knowing mind (life), it clearly follows that the real process of nature cannot resemble manufacturing. For the latter is a complex process which is divisible in many ways. Many distinct operations and materials are required. But the fundamental reality of life (duration) which is seen in a metaphysical intuition is simple and undivided.

The Real Process of Nature Which is the Underlying Cause of the Evolution of the Biological World Resembles the Thrust of a Moving Hand into a Bucket of Sand. The Vital Impetus is Analogous to the Thrust of the Moving Hand Whereas the Resistance of Inert Matter to the Thrust of the Vital Impetus is Analogous to the Resistance Which Sand Exerts on the Moving Hand

"What then is the nature of the real process in nature which causes the observed evolution of mind and life? From our previous discussion we already know some of its characteristics. This process is identified with duration or the vital impetus and hence it is the fundamental reality of the world. Therefore it is simple, indivisible and creative. It is creative because it is the ultimate source of both life and inert matter." However, its creativity does not resemble the process of manufacturing. How then does the vital impetus produce the evolving world of life? It must be noted that this question can only be answered with images which suggest a metaphysical intuition.

Bergson suggests that the nature of this principle is as follows: Let us assume that we thrust our clenched fist into a small bucket of loosely packed and moist sand. The depth of our thrust is here unimportant. Further, the particles of sand will exercise a force of resistance to the moving fist. The arrangement of the sand particles around the fist and arm will depend upon the depth of the thrust. The deeper the thrust the tighter will be the packing of the sand around the fist and arm. Now, let us assume that the fist, arm and its motion

are invisible. Also, let us assume that the observed configuration of the sand is the result of some real natural process and that the problem is to explain the imprint on the sand. If now the processes of nature are like manufacturing then the observed imprint on the sand is explained by saying that it is caused by the arithmetical sum of the motions of each particle of sand. The specific way the imprint is produced will depend upon whether we are mechanists or vitalists. For the mechanist a complete knowledge of the laws of physics and chemistry would enable one to accurately predict how the activities of the individual particles of sand combined to produce the observed imprint. Similarly, for the vitalism of ends a knowledge of the plan to be realized would generate the same kind of prediction. Hence, in the intellectual understanding of both the mechanist and vitalist the observed imprint is some kind of synthesis of the behavior of individual particles of sand. The observed imprint is therefore highly complex. But the movement of our fist into the sand is <u>felt</u> to be <u>simple</u> and <u>indivisible</u> just as was the movement of our hand across the desk in our prior discussion. Hence, according to Bergson's criterion of reality the <u>real</u> natural process that causes the observed imprint is the simple and indivisible movement of the hand. The observed imprint is caused by the resistance of the particles of sand to the moving hand. By so resisting the forward thrust of the fist, the particles of sand assume the observed imprint. Now, the vital

impetus resembles the thrust of the moving fist and the sand particles resemble the inert matter upon which this principle acts (42, 43).

Bergson extends this image of the vital impetus to suggest how the parallel evolution of the eye could occur. He compares the structure of the eye in a mollusk, the common Pecten, with that of the vertebrate. The eye of this mollusk has a retina, cornea and a lens which are similar in structure to ours. The problem is to account for the appearance of a similar structure on divergent lines of evolution. Let us assume that the act of vision is a simple and indivisible motion of the vital impetus which resembles the thrust of our fist. The vital impetus is here striving to see and hence it is some kind of psychological effort as is the thrust of our fist. Continuing this analogy let us also assume that the complex structure of the eye resembles the compressed mass of many individual particles of sand that is produced by the moving fist. In the case of the moving fist the specific form and complexity of the compressed mass of sand is determined by the depth of the thrust. The deeper the thrust, the greater are the number of particles which are compressed and hence the greater is the complexity of the compressed mass. The vital impetus which is striving to see acts in a similar way upon the inert matter of the living organism. The deeper the thrust of the vital impetus into the inert matter of the organism the more developed is its vision and the more complex is the structure of the eye. In relatively simple organisms

the thrust of the vital impetus is very shallow and hence both vision and the complexity of the eye are very limited. On the other hand, where the thrust of the vital impetus is deep the act of vision is highly developed and the corresponding structure of the eye is very complex. Hence, the appearance of analogous structures in divergent lines of evolution is to be expected. In short, when the depth of thrust of the vital impetus in diverging lines of evolution is approximately the same the appearance of similar structures is to be expected.

However, is not the production by the vital impetus of similar structures such as the eye in divergent lines of evolution a reintroduction of the vitalism of ends? Bergson does not think so. A brief review of the main characteristics of his vitalism will clearly show its inconsistency with any vitalism of ends. The vitalism of ends affirms that the real processes of nature resemble the highly complex and divisible processes of manufacturing. Bergson, on the other hand, states that the real process of nature is simple and indivisible; it resembles the thrust of a fist in the sand.

Finally, the vitalism of ends affirms that the future results or ends of evolution are <u>now</u> present. Such ends resemble magnets because they <u>attract</u> the processes of nature, the chemical and physical phenomena of inert matter, to attain some final result. These ends may be either consciously or unconsciously present. Bergson, on the other hand, states that the effects of the vital impetus or duration

are not at all present in their antecedents. Such effects are unique, irreplacable and hence are in principle unpredictable. The fact that divergent lines of evolution can produce a similar structure such as the eye is due to the origin of all life in a single vital impetus. This single vital principle acts on or pushes inert matter in the direction of increasingly complex arrangements just as does the thrust of our fist in the sand. In brief, Bergson does not reintroduce a vitalism of ends in presenting his version of vitalism.

The Vitalism/Mechanism Controversy is Generated by the Attempt to Understand the Nature of Evolving Life in Terms of Concepts Which are Generated by Intellectual Knowing and this Issue Can Only be Resolved When Intellectual Understanding is Replaced by the Metaphysical Intuition of Life (Duration)

The traditional conceptions of vitalism and mechanism are theories which are generated by the intellectual way of knowing life. Further, all such products of our intellectual knowing are mere static and partial views of the reality of life. For example, a photograph is always a partial and static view of an object. No conceivable number of different photographs will ever present us with the complete reality of any object. Similarly, no multiplication of the mechanistic or vitalistic theories which are produced by the intellect will ever generate an absolute knowledge of life.

Further, life or duration resemble a moving three dimensional geometric solid whereas our intellectual understanding of it resembles a two dimensional and static projection of it. Hence, our intellect automatically presents an impoverished representation of life. In short, life or duration cannot be enclosed by the concepts of our intellectual knowing.

If then we want to have an absolute knowledge of evolving life we must abandon the intellectual and adopt the radically different metaphysical way of knowing. In terms of the analogy between life and the moving three dimensional solid, only a metaphysical intuition is capable of presenting this reality to us without any impoverishment; such an intuition eliminates neither the movement nor the dimensions of the moving solid. In brief, metaphysical intuition grasps the reality of life as it is.

Bergson resolves the traditional vitalism/mechanism debate by proposing a form of vitalism which is based upon a metaphysical and non-intellectual way of knowing. Metaphysical intuition provides us with knowledge of life as it is. Life is the single vital principle, the vital impetus or duration, of the entire tree of life. It is also the fundamental reality of the entire universe. Bergon's vitalism is therefore a metaphysical theory which reveals the underlying reality of our universe. Hence, the vitalism/mechanism debate is resolved as soon as the ultimate reality of the world is revealed to us in a

metaphysical intuition.

Bergson cannot, however, give a rational proof of his vitalism. Rational proofs are based upon the precisely defined concepts of intellectual knowing. But metaphysical intuition cannot be embodied in such concepts. Hence, the results of a metaphysical intuition cannot be a constituent of a rational proof. Metaphysical intuitions can only be suggested by images and analogies. Hence, Bergsonian vitalism is ultimately based upon a self-justifying intuition.

Summary of Bergson's Vitalism

His teleological system is the entire world of life and its main goal is the continual creation of new forms of life. Hence, unceasing novelty is the main characteristic of his teleological system. Further, the vital principle of his system is the vital impetus (duration). Duration is the fundamental reality of the world because it is the ultimate source of the two kinds of reality which are found in it, inert matter and mind (life). Finally, duration can only be known in a metaphysical intuition. In short, Bergson's vitalism is really a metaphysics of the world.

The central question of the vitalism/mechanism debate is: What is the underlying reality of the evolving world of life? An adequate answer to this question is a metaphysical explanation of the nature of evolving life. The criteria which such an explanation must

satisfy are: (a) It must reveal the fundamental reality of the world as it is. This is identical with the need to discover absolute knowledge. (b) This revelation cannot be accomplished through any form of intellectual knowing. (c) Only a metaphysical way of knowing can reveal it. Further, these criteria are in turn derived from a criterion of reality and its associated theory of knowledge. The criterion of reality is: That which is most real has no parts and hence is simple and indivisible. The theory of knowledge may be summarized as follows: Only metaphysical knowing is capable of attaining a knowledge of duration (life) as it is. On the other hand, when the intellect attempts to understand the nature of duration (life) it only obtains a symbolic representation of it which is, nevertheless, highly useful for the successful manipulation of living things. In short, metaphysical knowing can present us with the reality of life as it is whereas intellectual knowing can only provide us with a symbolic representation of it.

Finally, the vitalism/mechanism controversy originates whenever there is an attempt to understand the nature of evolving life by the intellectual way of knowing. On the other hand, this controversy can only be resolved in a metaphysical and hence non-rational intuition which is able to grasp the reality of life (duration) as it is. In short, the vitalism/mechanism controversy is resolved when an intellectual understanding of life is replaced by a metaphysical one.

A Comparison of Bergson and Loeb on the Central Question of the Vitalism/Mechanism Debate

The central questions of these two men are very different. Loeb is above all a physiologist who formulates theories to account for the behavior of individual organisms. Further, the value of such theories is to enable the investigator to reproduce the phenomena at will. This pragmatic function is the ultimate confirmation of a good theory. Now, Loeb's central question about the nature of the integrator of all of the physical and chemical mechanisms in an organism is subject to an experimental test. Hence, a correct answer to his central question has the same kind of pragmatic function as any other physiological theory. In brief, Loeb views the vitalism/mechanism debate as a purely physiological question which can be answered with a testable physiological theory.

Bergson, on the other hand, is above all a philosopher. He does not develop any theories which can be tested experimentally. One of his main concerns is to develop cosmological and hence non-pragmatic theories about the structure and evolution of the universe. His central question about the nature of evolving life is about a cosmic process. Such a question cannot be answered by any scientific theory and hence it cannot be experimentally tested. It can only be answered

by a metaphysics which uses intuitive knowing. Thus, Bergson views the vitalism/mechanism debate as a metaphysical question about the real structure of the world and as a question which can only be answered by intuitive knowing.

In summary, Loeb's central question is about limited processes, the reproducible behavior of individual organisms. On the other hand, Bergson's central question is about an unlimited or cosmic process, the underlying process of evolving life and matter, which is not experimentally reproducible.

A Comparison of the General Conceptual Systems (g. c. s.) of Bergson and Loeb

This radical difference in their central questions implies that they have different general conceptual systems (g. c. s.). Now a g. c. s. as previously mentioned lists the fundamental realities and processes of the world. This listing provides the scientist with a conceptual framework for his theories. Loeb uses the g. c. s. of the physicists and chemists of his time for the conceptual framework of his mechanistic biology. Hence, in all of his theories he explains biological phenomena in terms of the laws of physics and chemistry.

With Bergson, on the other hand, the situation is quite different. He is not a scientist who constructs theories within some g. c. s. On the contrary, a major aim of his thought is to establish a new g. c. s.

His arguments show why there are two kinds of reality, inert matter and mind (life), and how they are ultimately derivable from duration or the vital impetus. He also shows how mind and matter can be known. Science and metaphysics are equipped to reach the absolute truth about matter and mind (life) respectively. Hence, Bergson's arguments which present his vitalism attempt to show what the ultimate components of the world are and how we can know them. This is essentially the task of constructing a new g. c. s.

In summary, Loeb's mechanism is an extension of the existing g. c. s. of the physical sciences into biology. Bergson's vitalism, on the other hand, is an extended argument for the adoption of a new g. c. s. that will produce an integration of science and philosophy. He shows how science and philosophy complement each other and give us an absolute knowledge of the whole of reality.

A Comparison of Bergson and Loeb on the Problem of Consciousness

Finally, any one who adopts a position in the vitalism/mechanism debate will have to consider the problem of consciousness. This problem includes at least three important issues. (a) How extensive is the existence of consciousness in our universe? (b) How do we explain the existence of consciousness? (c) What is the cognitive value of introspection as a source of insight into the nature of consciousness?

Loeb's criterion for the presence of consciousness is the existence of an associative memory which enables the organism to be trained. Hence, according to this criterion only a restricted number of organisms with nervous systems have consciousness. Further, Loeb explains the existence of consciousness as well as all life phenomena by saying that they are "ultimately due to motions or changes occurring in colloidal substances" (Loeb, 1964, p. 74). Hence, the phenomena of consciousness are found in only a limited group of animals and they are essentially epiphenomena of cerebral biochemistry.

Finally, an important consequence of Loeb's mechanistic outlook is that introspection cannot be a source of insight into the nature of consciousness. Loeb's fundamental question about the nature of consciousness is: "Which peculiarities of colloidal substances can make the phenomena of associative memory possible?" (Loeb, 1964, p. 74). This question can only be answered by a thorough investigation of the physical chemistry and physiology of protoplasm. Hence, given Loeb's conception of consciousness as an epiphenomenon of colloidal substances, introspection cannot in principle reveal anything about such processes.

For Bergson, on the other hand, "consciousness is co-extensive with life" (Bergson, 1920, p. 17). Wherever there is living matter, there is consciousness. Further, consciousness is radically different

from the inert matter which lacks it (45). However, both consciousness (life) and inert matter are derived from a common source, duration (the vital impetus), which is a cosmic process. Consciousness and inert matter are essentially two different phases of this process. Hence, Bergson explains consciousness by showing how it evolves from a cosmic process (46).

Finally, for Bergson, introspection is the most important source of insight into the nature of consciousness. This is readily seen when we examine how Bergson establishes his conclusions about consciousness in general. His arguments usually begin with an analysis of what is revealed by introspection (47). Further, metaphysical intuition which knows the cosmic process of duration that is the source of consciousness is the most important form of introspection. Hence, within Bergson's context, introspection is essential to a knowledge of consciousness.

The Limitations of Loeb and Bergson

A Valid Internal Criticism of Loeb and Bergson Should Center on Their Respective General Conceptual Systems

Loeb and Bergson formulates different kinds of questions about the vitalism/mechanism debate and the related problem of consciousness. Their answers are also different. Given these

quesions and their answers it is clear that the vitalism/mechanism debate can exist on at least two levels. For Loeb, this debate is a purely scientific one which can in principle be resolved by experimental methods. Also any alleged metaphysical problem can in principle be solved by such scientific means. For example, what the metaphysician labels as "animal will" can be explained in terms of tropisms.(48). For Bergson, on the other hand, this debate is metaphysical and hence it can only be resolved by the unique intuitions of metaphysics.

Further, the different kinds of questions which emerge in Loeb and Bergson are determined by their radically different general conceptual systems. For the g. c. s. determines both what questions may be legitimately asked and the criteria for any adequate answer to them. Hence, a valid internal criticism of the thought of either Loeb or Bergson should be directed at their respective general conceptual systems.

Bergson's General Conceptual System Contains Ambiguities and Logical Inconsistencies

What are some possible ways of criticizing the general conceptual systems of Loeb and Bergson? A g. c. s. provides us with three lists, a list of the ultimate independent entities of the world, a list of their properties and a list of the relationships between the

entities or their properties. Such a g.c.s. also presupposes some kind of theory of knowledge. This is evident when the various items on the lists are defined. For example, an operational definition of an electron would tell us how it could be known.

Now, one way of criticizing a g.c.s. is to show that the items on the lists are ambiguously defined and logically inconsistent with one another. Bergson's g.c.s. can be criticized in this manner because his independent entities, mind and matter, are ambiguously defined. On the one hand, he posits a psychological monism when he says that mind and matter are really different phases of duration, consciousness (the vital impetus). When duration or the vital impetus is attentuated or congealed inert matter is produced whereas when it is intensified conscious mind (life) is produced. On the other hand, he posits a functional dualism when he states that inert matter opposes the vital impetus in the evolution of life (49). Bergson can also be criticized because he is logically inconsistent. On the one hand, he states that mind (duration) is an object of metaphysical intuition and hence cannot be circumscribed by the sharply defined concepts of intellectual knowing. Yet, on the other hand, his metaphysical works contain numerous descriptions of mind (duration) which utilize such sharply defined concepts.

The Arguments Which Attempt to Demonstrate the Inadequacies of Loeb's General Conceptual System are Inconclusive

Another way of criticizing a g. c. s. is to show that the items on the lists are too limited to be the basis of an adequate theory. Perhaps Loeb's g. c. s. can be criticized in this way on the grounds that the relationships between his independent entities, atoms and electrons, are too deterministic to provide a basis for the development of an adequate theory to explain the existence of consciousness. These relationships in Loeb's g. c. s. are the highly deterministic laws of 19th and early 20th century physics. But highly deterministic laws at the atomic and subatomic levels are no longer accepted by modern physics. However, these results of modern physics may in no way invalidate Loeb's g. c. s. Further, in Chapters IV and V of this paper there will be an extensive discussion of Teilhard's arguments which claim to radically alter the mechanistic g. c. s. Teilhard wants to radically change the mechanistic g. c. s. because he thinks that it is inadequate to explain the existence and nature of consciousness. However, it will be seen that the arguments which he uses to change the mechanistic g. c. s. are inconclusive. In brief, no arguments are presented in this paper which successfully show the inadequacy of the mechanistic g. c. s.

FOOTNOTES FOR CHAPTER III

[20]A more complete discussion of Bergson's conception of a teleological system will appear on page 44 of this chapter.

[21]This deterministic conception of matter was accepted before the emergence of the Uncertainty Principle.

[22]Simplicity and indivisibility are important criteria of reality in Bergson's philosophy. They will be discussed further on page 48 of this chapter.

[23]Bergson's writings contain many images which suggest the nature of duration. Some passages which present his conception of duration or lived time are as follows:

"There is no mood, however, no matter how simple, which does not change at every instant, since there is no consciousness without memory, no continuation of a state without the addition, to the present feeling, of the memory of past moments. That is what duration consists of. Inner duration is the continuous life of a memory which prolongs the past into the present, whether the present distinctly contains the ever-growing image of the past, or whether, by its continual changing of quality, it attests rather the increasingly heavy burden dragged along behind one the older one grows. Without that survival of the past in the present there would be no duration but only instantaneity" (Bergson, 1965a, p. 179).

"To tell the truth, it is impossible to distinguish between the duration, however short it may be, that separates two instants and a memory that connects them, because duration is essentially a continuation of what no longer exists into what does exist. This is real time, perceived and lived. This is also any conceived time, because we cannot conceive a time without imagining it as perceived and lived. Duration therefore implies consciousness; and we place consciousness at the heart of things for the very reason that we credit them with a time that endures" (Bergson, 1965b, p. 49).

"There is no doubt but that for us time is at first identical with the continuity of our inner life. What is this continuity? That of a flow or passage, but a self-sufficient flow or passage, the flow not implying a thing that flows, and the passing not presupposing states through which we pass; the thing and the state are only artifically taken snapshots of the transition; and this transition, all that is

naturally experienced, is duration itself. It is memory, but not personal memory, external to what it retains, distinct from a past whose preservation it assures; it is a memory within change itself, a memory that prolongs the before into the after, keeping them from being mere snapshots appearing and disappearing in a present ceaselessly reborn. A melody to which we listen with our eyes closed, heeding it alone, comes close to coinciding with this time which is the very fluidity of our inner life; but it still has too many qualities, too much definition, and we must first efface the difference among the sounds, then do away with the distinctive features of sound itself, retaining of it only the continuation of what precedes into what follows and the uninterrupted transition, multiplicity without divisibility and succession without separation, in order finally to rediscover basic time. Such is immediately perceived duration, without which we would have no idea of time.

How do we pass from this inner time to the time of things? We perceive the physical world and this perception appears, rightly or wrongly, to be inside and outside us at one and the same time; in one way, it is a state of consciousness; in another, a surface film of matter in which perceiver and perceived coincide. To each moment of our inner life there thus corresponds a moment of our body and of all environing matter that is "simultaneous" with it; this matter then seems to participate in our conscious duration. Gradually, we extend this duration to the whole physical world, because we see no reason to limit it to the immediate vicinity of our body. The universe seems to us to form a single whole; and, if the part that is around us endures in our manner, the same must hold, we think, for that part by which it, in turn, is surrounded, and so on indefinitely. Thus is born the idea of a duration of the universe, that is to say, of an impersonal consciousness that is the link among all individual consciousnesses, as between these consciousnesses and the rest of nature" (Bergson, 1965b, p. 44-45).

[24]Bergson (1944, p. 32-33) states: "Now, the more we fix our attention on this continuity of life, the more we see that organic evolution resembles the evolution of a consciousness, in which the past presses against the present and causes the upspringing of a new form of consciousness, incommensurable with its antecedents. That the appearance of a vegetable or animal species is due to specific causes, nobody will gainsay. But this can only mean that if, after the fact, we could know these causes in detail, we could explain by them the form that has been produced; foreseeing the form is out of the question. It may perhaps be said that the form could be foreseen if we could know, in all their details, the conditions under which it

will be produced. But these conditions are built up into it and are part and parcel of its being; they are peculiar to that phase of its history in which life finds itself at the moment of producing the form: how could we know beforehand a situation that is unique of its kind, that has never yet occurred and will never occur again? Of the future, only that is foreseen which is like the past or can be made up again with elements like those of the past. Such is the case with astronomical, physical and chemical facts, with all facts which form part of a system in which elements supposed to be unchanging are merely put together, in which the only changes are changes of position, in which there is no theoretical absurdity in imagining that things are restored to their place; in which, consequently, the same total phenomenon, or at least the same elementary phenomena, can be repeated. But an original situation, which imparts something of its own originality to its elements, that is to say, to the partial views that are taken of it, how can such a situation be pictured as given before it is actually produced?" (Bergson, 1944, p. 32-33).

[25]Bergson (1944, p. 43) states: "The essence of mechanical explanation, in fact, is to regard the future and the past as calculable functions of the present, and thus to claim that all is given. On this hypothesis, past, present and future would be open at a glance to a superhuman intellect capable of making the calculation."

[26]Bergson (1944, p. 45) states: "We perceive duration as a stream against which we cannot go. It is the foundation of our being, and, as we feel, the very substance of the world in which we live."

[27]In the following passage the condensed drops which fall back resemble matter whereas the upward jet of steam resembles duration or the vital impetus.

"Let us imagine a vessel full of steam at a high pressure, and here and there in its sides a crack through which the steam is escaping in a jet. Thesteam thrown into the air is nearly all condensed into little drops which fall back, and this condensation and this fall represent simply the loss of something, an interruption, a deficit. But a small part of the jet of steam subsists, uncondensed, for some seconds; it is making an effort to raise the drops which are falling; it succeeds at most in retarding their fall. So, from an immense reservoir of life, jets must be gushing out unceasingly, of which each, falling back, is a world. The evolution of living species within this world represents what subsists of the primitive direction of the original jet, and of an impulsion which continues itself in a direction the inverse of materiality" (Bergson, 1944, p. 269-270).

[28]Bergson (1965a, p. 41) states: "Quite different is the metaphysics that we place side by side with science. Granting to science the power of explaining matter by the mere force of intelligence, it reserves mind for itself. In this realm, proper to itself, it seeks to develop new functions of thought."

[29]Bergson (1965a, p. 124) states: "...the matter and life which fill the world are equally within us; the forces which work in all things we feel within ourselves; whatever may be the inner essence of what is and what is done, we are of that essence."

[30]Bergson (1944, p. 260) states: "To get to the principle of all life, as also of all materiality, we must go further still. Is it impossible? No, by no means; the history of philosophy is there to bear witness. There is no durable system that is not, at least in some of its parts, vivified by intuition. Dialectic is necessary to put intuition to the proof, necessary also in order that intuition should break itself up into concept and so be propagated to other men; but all it does, often enough, is to develop the result of that intuition which transcends it. The truth is, the two procedures are of opposite direction: the same effort, by which ideas are connected with ideas, causes the intuition which the ideas were storing up to vanish. The philosopher is obliged to abandon intuition, once he has received from it the impetus, and to rely on himself to carry on the movement by pushing the concepts one after another. But he soon feels he has lost foothold; he must come into touch with intuition again, he must undo most of what he has done. In short, dialectic is what ensures the agreement of our thought with itself. But by dialectic--which is only a relaxation of intuition--many different agreements are possible, while there is only one truth. Intuition, if it could be prolonged beyond a few instants, would not only make the philosopher agree with his own thought, but also all philosophers with each other."

It is important to note that dialectic or reason, intellectual activity, is not irrelevant to metaphysics. However, the absolute truth which the metaphysician can know transcends the activities of reason.

[31]Bergson (1965a, p. 42-43) states: "This direct vision of the mind by the mind is the chief function of intuition, as I understand it.

Intuition will be communicated only by the intelligence. It is more than idea; nevertheless in order to be transmitted, it will have to use ideas as a conveyance. It will prefer, however, to have

recourse to the most concrete ideas, but those which still retain an outer fringe of images. Comparisons and metaphors will here suggest what cannot be expressed. That will not constitute a detour; it will amount to going straight to the goal. If one were constantly to speak an abstract, so-called "scientific" language, one would be giving of mind only its imitation by matter, for abstract ideas have been drawn from the external world and always imply a spatial representation: and yet one would think one had analyzed mind. Abstract ideas alone would, therefore, in such a case, be inviting us to imagine mind on the model of matter and to think it by transposition, that is, in the exact meaning of the word, by metaphor. Let us not be duped by appearances: there are cases in which it is imagery in language which knowingly expresses the literal meaning, and abstract language which unconsciously expresses itself figuratively. The moment we reach the spiritual world, the image, if it merely seeks to suggest, may give us the direct vision, while the abstract term, which is spatial in origin and which claims to express, most frequently leaves us in metaphor."

[32]In the following passage the attainment of the absolute means to know reality as it is; such a knowledge is unrevisable.

"To metaphysics, then, we assign a limited object, principally spirit, and a special method, mainly intuition. In doing this we make a clear distinction between metaphysics and science. But at the same time we attribute an equal value to both. I believe that they can both touch the bottom of reality. I reject the arguments advanced by philosophers, and accepted by scholars, on the relativity of knowledge and the impossibility of attaining the absolute!" (Bergson, 1965a, p. 37).

[33]Bergson states: "The understanding is at home in the domain of unorganized matter. On this matter human action is naturally exercised; and action, as we said above, cannot be set in motion in the unreal. Thus, of physics--so long as we are considering only its general form and not the particular cutting out of matter in which it is manifested--we may say that it touches the absolute" (Bergson, 1944, p. 217).

Again, in the following passage, Bergson (1965a, p. 40) clearly states his belief in the ability of the human mind to see reality as it is and hence without distortion. "I therefore do not see why the science of matter should not reach an absolute. It instinctively assumes this scope, and all natural belief should be held as true, all appearance taken for reality, as long as its illusory character has not been established. Upon those who declare our science to be relative, upon those who claim that our knowledge deforms or constructs its object,

now falls the burden of proof. And they cannot fulfill this obligation, for there is no room for the doctrine of the relativity of science when science and metaphysics are on their true ground, that to which we restore them" (Bergson, 1965a, p. 40).

[34]Mechanism as a scientific theory is not an illegitimate extension of our concepts. Such a mechanism is both natural and indispensable to the intellect. A successful manipulation of the biological world would be impossible if we did not adopt a mechanistic view.

Bergson (1944, p. 214) states: "Positive science is, in fact, a work of pure intellect. Now, whether our conception of the intellect be accepted or rejected, there is one point on which everybody will agree with us, and that is that the intellect is at home in the presence of unorganized matter. This matter it makes use of more and more by mechanical inventions, and mechanical inventions become the easier to it the more it thinks matter as mechanism. The intellect bears within itself, in the form of natural logic, a latent geometrism that is set free in the measure and proportion that the intellect penetrates into the inner nature of inert matter. Intelligence is in tune with this matter, and that is why the physics and metaphysics of inert matter are so near each other. Now, when the intellect undertakes the study of life, it necessarily treats the living like the inert, applying the same forms to this new object, carrying over into this new field the same habits that have succeeded so well in the old; and it is right to do so, for only on such terms does the living offer to our action the same hold as inert matter."

[35]Bergson's criticism of mechanism applies to any form of metaphysics that is based upon an intellectual and hence pragmatic understanding of reality. The fundamental conflicts between the different philosophical systems arise whenever the mind attempts to understand the whole of reality in terms of intellectual concepts. This is emphasized in the following passage:

"Our intelligence is the prolongation of our senses. Before we speculate we must live, and life demands that we make use of matter, either with our organs, which are natural tools, or with tools, properly so-called, which are artificial organs. Long before there was a philosophy and a science, the role of the intelligence was already that of manufacturing instruments and guiding the action of our body on surrounding bodies. Science has pushed this labor of the intelligence much further, but has not changed its direction. It aims above all at making us masters of matter. Even when science is speculating, it is still devoting its attention to acting, the value of scientific theories being gauged constantly by the solidity of the grip

they give us upon reality. But is that not precisely what should inspire us with complete confidence in positive science and also in the intelligence, its instrument? If the intellect has been made in order to utilize matter, its structure has no doubt been modeled upon that of matter. At least that is the simplest and most probable hypothesis. We should keep to it as long as it is not demonstrated to us that the intelligence deforms, transforms, constructs its object, or only brushes the surface, or grasps the mere semblance of it. Now nothing has ever been invoked by way of that demonstration, but the insoluble difficulties into which philosophy falls, the self-contradiction into which the intellect can fall when it speculates upon things as a whole--difficulties and contradictions we naturally come up against if the intellect is especially destined for the study of a part, and if we nevertheless mean to use it in knowing the whole. But it is not enough to say that. It is impossible to consider the mechanism of our intellect and the progress of our science without arriving at the conclusion that between intellect and matter there is, in fact, symmetry, concord and agreement. On one hand, matter resolves itself more and more, in the eyes of the scholar, into mathematical relations, and on the other hand, the essential faculties of our intellect function with an absolute precision only when they are applied to geometry" (Bergson, 1965a, p. 38-39).

[36]In the following passage finalism is another term for vitalism.

"Yet finalism is not, like mechanism, a doctrine with fixed rigid outlines. It admits of as many inflections as we like. The mechanistic philosophy is to be taken or left: it must be left if the least grain of dust, by straying from the path foreseen by mechanics, should show the slightest trace of spontaneity. The doctrine of final causes, on the contrary, will never be definitively refuted. If one form of it be put aside, it will take another. Its principle, which is essentially psychological, is very flexible. It is so extensible, and thereby so comprehensive, that one accepts something of it as soon as one rejects pure mechanism. The theory we shall put forward in this book will therefore necessarily partake of finalism to a certain extent. For that reason it is important to intimate exactly what we are going to take of it, and what we mean to leave" (Bergson, 1944, p. 46).

[37]The following passage presents a detailed criticism of Leibnizian vitalism. Here again finalism is equivalent to vitalism.

"Let us say at once that to thin out the Leibnizian finalism by breaking it into an infinite number of pieces seems to us a step in

in the wrong direction. This is, however, the tendency of the doctrine of finality. It fully realizes that if the universe as a whole is the carrying out of a plan, this cannot be demonstrated empirically, and that even of the organized world alone it is hardly easier to prove all harmonious: facts would equally well testify to the contrary. Nature sets living beings at discord with one another. She everywhere presents disorder alongside of order, retrogression alongside of progress. But, though finality cannot be affirmed either of the whole of matter or of the whole of life, might it not yet be true, says the finalist, of each organism taken separately? Is there not a wonderful division of labor, a marvelous solidarity among the parts of an organism, perfect order in infinite complexity? Does not each living being thus realize a plan immanent in its substance?--This theory consists, at bottom, in breaking up the original notion of finality into bits. It does not accept, indeed it ridicules, the idea of an external finality, according to which living beings are ordered with regard to each other: to suppose the grass made for the cow, the lamb for the wolf--that is all acknowledged to be absurd. But there is, we are told, an internal finality: each being is made for itself, all its parts conspire for the greatest good of the whole and are intelligently organized in view of that end. Such is the notion of finality which has long been classic. Finalism has shrunk to the point of never embracing more than one living being at a time. By making itself smaller, it probably thought it would offer less surface for blows.

The truth is, it lay open to them a great deal more. Radical as our own theory may appear, finality is external or it is nothing at all" (Bergson, 1944, p. 46-47).

[38]In the following passage radical finalism is equivalent to the vitalism of ends.

"We are born artisans as we are born geometricians, and indeed we are geometricians only because we are artisans. Thus the human intellect, inasmuch as it is fashioned for the needs of human action, is an intellect which proceeds at the same time by intention and by calculation, by adapting means to ends and by thinking out mechanisms of more and more geometrical form. Whether nature be conceived as an immense machine regulated by mathematical laws, or as the realization of a plan, these two ways of regarding it are only the consummation of two tendencies of mind which are complementary to each other and which have their origin in the same vital necessities.

For that reason, radical finalism is very near radical mechanism on many points. Both doctrines are reluctant to see in the

course of things generally, or even simply in the development of life, an unforeseeable creation of form!" (Bergson, 1944, p. 51).

[39]In the following passage the point of view of analysis, intellectual knowing, is compared with that of intuition, metaphysical knowing.

"To choose a more striking example, where the notation is more completely symbolical, let us suppose someone puts before me, all jumbled together, the letters which go to make up a poem, without my knowing which poem it is. If the letters were parts of the poem, I could attempt to reconstruct it with them by trying various possible arrangements, as a child does with the pieces of a jigsaw puzzle. But I shall not for an instant think of attempting it, because the letters are not component parts, but partial expressions, which is quite another thing. That is why, if I know the poem, I put each one of the letters in its proper place and link them together without difficulty in one continuous chain, while the reverse operation is impossible. Even when I take into my head to try that reverse operation, even when I place the letters end to end, I begin by imagining a plausible meaning: I thus give myself an intuition, and it is from the intuition that I try to fall back on the elementary symbols which would re-create its expression. The very notion of reconstructing the thing by carrying out operations on symbolical elements alone implies such an absurdity that it would never occur to anyone if it were realized that he was not dealing with fragments of the thing, but in some sort with fragments of symbol.

That, however, is what philosophers undertake to do when they seek to recompose the person with psychological states, whether they confine themselves to these states or whether they add a thread for the purpose of tying the states to one another. Empiricists and rationalists alike are in this case dupes of the same illusion. Both take the partial notions for real parts, thus confusing the point of view of analysis and that of intuition, science and metaphysics" (Bergson, 1965a, p. 171-172).

[40]In the following passage Bergson (1944, p. 100-101) shows how his criterion of reality applies. The simple and indivisible has more reality than the complex and divisible.

"In general, when the same object appears in one aspect as simple and in another as infinitely complex, the two aspects have by no means the same importance, or rather the same degree of reality. In such cases, the simplicity belongs to the object itself, and the infinite complexity to the views we take in turning around it, to the symbols by which our senses or intellect represent it to us, or, more

generally, to elements of a different order, with which we try to imitate it artificially, but with which it remains incommensurable, being of a different nature. An artist of genius has painted a figure on his canvas. We can imitate his picture with many-colored squares of mosaic. And we shall reproduce the curves and shades of the model so much the better as our squares are smaller, more numerous and more varied in tone. But an infinity of elements infinitely small, presenting an infinity of shades, would be necessary to obtain the exact equivalent of the figure that the artist has conceived as a simple thing, which he has wished to transport as a whole to the canvas, and which is the more complete the more it strikes us as the projection of an indivisible intuition. Now, suppose our eyes so made that they cannot help seeing in the work of the master a mosaic effect. Or suppose our intellect so made that it cannot explain the appearance of the figure on the canvas except as a work of mosaic. We should then be able to speak simply of a collection of little squares, and we should be under the mechanistic hypothesis. We might add that, besides the materiality of the collection, there must be a plan on which the artist worked; and then we should be expressing ourselves as finalists. But in neither case should we have got at the real process, for there are no squares brought together. It is the picture, i.e. the simple act, projected on the canvas, which, by the mere fact of entering into our perception, is decomposed before our eyes into thousands and thousands of little squares which present, as recomposed, a wonderful arrangement. So the eye, with its marvelous complexity of structure, may be only the simple act of vision, divided for us into a mosaic of cells, whose order seems marvelous to us because we have conceived the whole as an assemblage.

[41] Bergson (1944, p. 101-102) states: "If I raise my hand from A to B, this movement appears to me under two aspects at once. Felt from within, it is a simple, indivisible act. Perceived from without, it is the course of a certain curve, AB. In this curve I can distinguish as many positions as I please, and the line itself might be defined as a certain mutual co-ordination of these positions. But the positions, infinite in number, and the order in which they are connected, have sprung automatically from the indivisible act by which my hand has gone from A to B. Mechanism, here would consist in seeing only the positions. Finalism would take their order into account. But both mechanism and finalism would leave on one side the movement, which is reality itself. In one sense, the movement is more than the positions and than their order; for it is sufficient to make it in its indivisible simplicity to secure that the infinity of the successive positions as also their order be given at once--with something else which is neither order nor position but which is

essential, the mobility. But, in another sense, the movement is less than the series of positions and their connecting order; for, to arrange points in a certain order, it is necessary first to conceive the order and then to realize it with points; there must be the work of assemblage and there must be intelligence, whereas the simple movement of the hand contains nothing of either. It is not intelligent, in the human sense of the word, and it is not an assemblage, for it is not made up of elements. Just so with the relation of the eye to vision. There is in vision more than the component cells of the eye and their mutual co-ordination: in this sense, neither mechanism nor finalism go far enough. But, in another sense, mechanism and finalism both go too far, for they attribute to Nature the most formidable of the labors of Hercules in holding that she has exalted to the simple act of vision an infinity of infintely complex elements, whereas Nature has had no more trouble in making an eye than I have in lifting my hand. Nature's simple act has divided itself automatically into an infinity of elements which are then found to be co-ordinated to one idea, just as the movement of my hand has dropped an infinity of points which are then found to satisfy one equation.

We find it very hard to see things in that light, because we cannot help conceiving organization as manufacturing. But it is one thing to manufacture, and quite another to organize. Manufacturing is peculiar to man. It consists in assembling parts of matter which we have cut out in such manner that we can fit them together and obtain from them a common action."

[42] In the following passage, the movement of the hand resembles the action of the vital impetus.

"With greater precision, we may compare the process by which nature constructs an eye to the simple act by which we raise the hand. But we supposed at first that the hand met with no resistance. Let us now imagine that, instead of moving in air, the hand has to pass through iron filings which are compressed and offer resistance to it in proportion as it goes forward. At a certain moment the hand will have exhausted its effort, and, at this very moment, the fillings will be massed and coordinated in a certain definite form, to wit, that of the hand that is stopped and of a part of the arm. Now, suppose that the hand and arm are invisible. Lookers-on will seek the reason of the arrangement in the filings themselves and in forces within the mass. Some will account for the position of each filing by the action exerted upon it by the neighboring filings: these are the mechanists. Others will prefer to think that a plan of the whole has presided over the detail of these elementary actions: they are the finalists. But the truth is that there has been merely one indivisible act, that of the hand passing through the filings: the inexhaustible

detail of the movement of the grains, as well as the order of their final arrangement, expresses negatively, in a way, this undivided movement, being the unitary form of a resistance, and not a synthesis of positive elementary actions" (Bergson, 1944, p. 105).

[43]This ambiguity of Bergson's view will be discussed on page 67 of this chapter. The vital impetus is opposed by an inert matter; this is Bergson's functional dualism. On the other hand, the vital impetus or consciousness is the source of matter; this is Bergson's psychological monism.

[44]The differences that will here be discussed are those which will be important in the discussion of Teilhard.

[45]Bergson's ambiguous use of the terms mind and matter will be discussed on page 67 of this chapter.

[46]Bergson (1920, p. 22-23) states: "Let us then place ourselves at the converging point of these different lines of facts. On the one hand, there is matter, subject to necessity, devoid of memory, or at least with no more than suffices to form the bridge between two of its moments, each of which can be deduced from its antecedent, each of which adds nothing to what the world already contains. On the other hand, there is consciousness, memory with freedom, continuity of creation in a duration in which there is real growth;--a duration which is drawn out, wherein the past is preserved indivisible; a duration which grows like a plant, but like the plant of a fairy tale transforms its leaves and flowers from moment to moment. We may surmise that these two realities, matter and consciousness, are derived from a common source. If, as I have tried to show in a previous work (Creative Evolution), matter is the inverse of consciousness, if consciousness is action unceasingly creating and enriching itself, whilst matter is action continually unmaking itself or using itself up, then neither matter nor consciousness can be explained apart from one another.

[47]Bergson (1920, p. 8) states: "But all consciousness is also anticipation of the future. Consider the direction of your mind at any moment you like to choose; you will find that it is occupied with what now is, but always and especially with regard to what is about to be.

Attention is expectation, and there is no consciousness without a certain attention to life. The future is there; it calls up, or rather, it draws us to it; its uninterrupted traction makes us advance along the route of time and requires us also to be continually acting. All action is an encroachment on the future."

[48]Loeb (1964, p. 35) states: "A mechanistic conception of life is not complete unless it includes a physico-chemical explanation of psychic phenomena. Some authors hold that even if a complete physico-chemical analysis of these phenomena were possible today it would leave the "truly psychical" unexplained. We do not need to enter into a discussion of such an objection since we are still too far from the goal. We are at least able to show for a limited group of animal reactions that they can be explained unequivocally on a pure physico-chemical basis, namely, phenomena which the metaphysician would classify under the term of animal "will."

[49]Collins (1954, p. 833-834) states: "Bergon's cosmological theory of matter perpetuates the ambiguity found in his psychological approach to it. Matter is both a factor within the movement of life itself and a counterforce operating against the interests of life. Life creates matter at those points where it interrupts its own vital flow, and yet these interruptions themselves are due to the hindering presence of matter. Otherwise expressed, matter <u>is</u> a congealment of life's process, and yet is the <u>cause</u> of the congealment of this movement. It is both a passive drag upon life and an agency working contrary to life. This ambiguity shows that Bergson gives both a wider and a narrower meaning to life. In the <u>broader</u> or monistic sense, life is synonymous with all degrees of duration and consciousness, including their lower limits, where they assume the form of matter. But life can also refer precisely to that aspect of duration which is a positive movement toward freedom, spiritual consciousness, and the activity of memory. In this <u>restricted</u> or dualistic sense, life stands in opposition to matter, since the latter signifies a frozen state of consciousness, quantitative determinism, and pure perception."

For a criticism of Bergson, see also (Barr, 1913) and (Dolson, 1910 and 1911).

CHAPTER IV

TEILHARD'S DESCRIPTION OF THE FUNDAMENTAL REALITIES OF THE WORLD: HIS GENERAL CONCEPTUAL SYSTEM (50)

Introduction

The object of this chapter is to present a survey of Teilhard's conception of the world whereas the next chapter will present the arguments which attempt to support it. Chapter VI will then state how Teilhard's ideas are related to the vitalism/mechanism debate that was discussed earlier. Finally, Chapter VII will discuss the fundamental weaknesses of Teilhard's vitalism.

Let us first examine Teilhard's answer to the question: "What is the world made of?" (Harré, 1964, p. 27). The answer to this question will provide us with two lists, one which presents the basic individual realities of the world and another which gives their properties. Thus, these lists will tell us what is real in the Teilhardian universe (51).

The Realities of the World are Particles of Energy With Measurable Dimensions

Both Teilhard and modern science agree that the most primitive form of the Weltstoff is energy which exists in a particulate

state (52). Particles of energy are equivalent to particles of matter and they are the basic individual realities of the world for both Teilhard and modern science. On the other hand, some of the properties which Teilhard attributes to matter are foreign to the conceptions of science.

What then is Teilhard's conception of matter? Matter has measurable dimensions which are represented on axis OY in the diagram on the following page. In short, axis OY represents the main objects in the universe which are studied by science.

The Different Kinds of Material Bodies are Formed from the Ultimate Particles of Matter

How are the smallest particles of matter which are the ultimate components of reality combined to produce the various sizes of bodies in the universe? The process which leads to the formation of larger bodies has two main directions. On the one hand, cosmic dust which consists of hydrogen nuclei is condensed into vast galaxies. The latter are further condensed to produced stars and planets. Galaxies, stars and planets constitute the astronomical class of bodies and gravity is the primary force which acts to produce it. On the other hand, the ultimate particles of matter such as electrons, protons and neutrons combine to form the atomic, molecular, and zoological classes of bodies. The latter classes are primarily

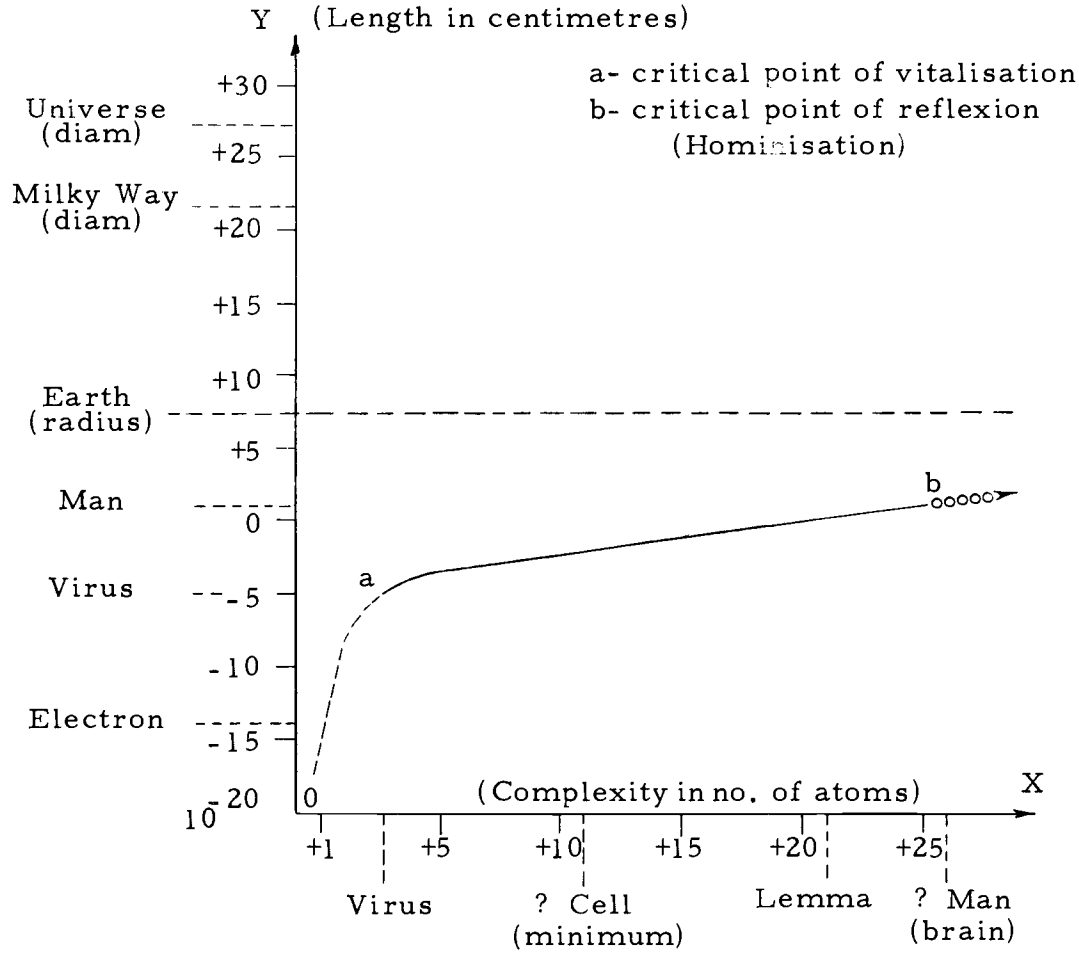


Figure 1. Natural curve of complexities.
Curve suggesting a natural distribution of organised corpuscles (eu-corpuscles), arranged in relation to their linear dimensions and complexity, the latter being approximately expressed in the number of atoms they contain. The curve, departing from its very simple lowest point (nuclear elements) mounts rapidly to the first living corpuscles (viruses). Afterwards, it rises more slowly, the size varying little with the arrangement. The curve is traced asymptotically to the radius of the earth, to show that the largest and highest complexity formed, to our knowledge, in the universe, is that of humanity, planetarily organised in the Noosphere. On the axis OY I have indicated (following J. Huxley) the length (or diameter) of the principal key-objects so far identified by science in nature, from the smallest to the greatest. According to some physicists, the length 10^{-13} may possibly represent an absolute quantum (minimum) of length in the Universe, and in that case should be taken (instead of 10^{-20}) as the base of the axes.
(Teilhard, 1965, p. 213)

produced by the forces of electromagnetism.

The Various Kinds of Material Bodies Have Different Levels of Complexity

The astronomical class of bodies differs in complexity from those of the atomic, molecular and zoological classes. But the members of these classes include all of the different kinds of bodies which are found in the universe. Hence, all of the realities of the universe may be differentiated in terms of their complexity (53).

How then is the complexity of a body described? There are two kinds of complexity, true and false. One kind of false complexity is that of simple aggregation which is found in a pile of sand. Here an unlimited number of particles are held together by gravity. The other kind of false complexity consists of the indefinite repetition of some fixed spatial arrangement of elements that is found in a crystal. It is always possible for a crystal to increase or decrease in size. Thus, a body which has a false complexity has no built-in requirements for a fixed number of parts because it is always possible to either add or remove some of them. On the other hand, a body which has a true complexity has a fixed number of parts, a fixed size and is a closed whole. A closed whole is any system whose parts are causally interdependent as is the case in organisms.

Now, what kinds of complexity do the various kinds of bodies

in the universe have? Astronomical bodies have a false complexity. It is always possible to either add or remove matter from a star, planet or crystal because the latter are not systems which require any fixed number of parts in order to function in a given way. On the other hand, the remaining classes of bodies are true complexities. For example, if electrons, protons or neutrons are removed from an atom its characteristic behavior changes. In short, the classes of bodies in the world are found to possess either a true or false complexity.

Summary

The discussion may be summarized as follows: The entities of the world can be represented in terms of increasing size of the axis OY as shown in the diagram on page 84. They vary in size from the very small to the very large. Further, the bodies which are represented on this axis belong to one or four classes, the astronomical, zoological, molecular and atomic. The members of the astronomical class have a false complexity whereas those of the remaining classes have a true one. In brief, axis OY represents the classes of realities in the world in terms of spatial dimensions and hence in a static way.

The Description of the Complexity of the Realities of the World in Terms of the Number of Atoms They Contain Is Related to Their Emergence in the History of the World

Is it possible to represent the various realities of the world in a manner that is coherent with their emergence in the history of the world? We can do so if we restrict the discussion to material bodies which have true complexity. Now, the complexity of a body can be expressed in a number of ways. For example, on axis OX of the diagram on page 84 the number of atoms a body contains is used to express its complexity. The numbers here presented are only very rough approximations. They are only presented to indicate the astronomical increase in complexity that occurs as we pass from very simple to very complex bodies (54). Hence, curve Oab relates the increasing size of bodies to their complexity expressed in terms of the number of atoms they contain. As we proceed from O to b on this curve, we pass from the less complex inorganic molecules to simple cells and finally to the astronomically complex human molecules. Further, axis OX implicitly represents a time scale because the bodies which are represented by it are placed according to their appearance in the history of the world. Hence, curve Oab represents the bodies which emerge in the process of chemical and biological evolution (55). Thus, curve Oab is a way of representing the

various material bodies of the world in a manner that is coherent with their emergence in the history of the world.

The Infinitely Small and Large Bodies of the World Exhibit Radically Different Kinds of Phenomena

So far we have seen that the bodies of the world can be either very small or very large. Now, detectable phenomena which are generated by the very small particles of matter in very small regions of space differ from those which are generated by the very large ones in the very large regions of space. For example, the photoelectric effect is a phenomenon which is dependent upon the activities of very small particles of matter, quanta of light, whereas the bending of light rays in curved space is caused by the activities of very large bodies such as the sun in the astronomically large regions of space. In short, present day science recognizes that there are phenomena which are characteristic of the infinitely large and small bodies (56).

The Unique Phenomenon of Highly Complex Matter is Life

Are there any phenomena which are characteristic of the activities of highly complex arrangements of matter? When matter reaches a certain level of complexity that is represented by point A on curve OAB,(Cf. diagram on page 84) the phenomena of life become detectable. Prior to this level of complexity matter appears to be dead or

inert. Analogous situations occur in physics. For example, when the temperature of a body reaches 500 degrees Centrigrade its radiation becomes visible to us whereas at lower temperatures it remains invisible. Again, the relativistic mass of a body undergoes a detectable variation only when its velocity approaches that of light. Prior to such velocities variations are undetectable. In brief, detectable life is the characteristic activity of matter which has reached a certain level of complexity (57).

All Particles of Matter Have Consciousness

In chemical evolution the atomic series evolved. Atoms then combined to form molecules and when the latter became sufficiently complex living chemical molecules such as cells or viruses emerged. Finally, biological evolution produced its most complex molecule which is the self-conscious chemical molecule of man. Hence, the evolution of man is an extension of the chemical evolution which produced the atomic series. Now, if the latter is the case then the properties of individual human molecules must be present in at least an attenuated form in all molecules. But the human molecule has the distinguishing properties of consciousness and freedom. Hence, the latter must be present in at least an attenuated form in all matter. In other words, if the simplest particles of matter such as atoms and electrons do not have consciousness and freedom in at least an

attenuated form then these properties would never have been able to emerge in the more complex human molecule (58).

The Level of Consciousness of a Material Body Is Dependent Upon Its Complexity

Finally, the level of consciousness that is present in a material body is dependent upon its complexity (59). Low and high levels of complexity are associated with low and high levels of consciousness respectively. Low levels of complexity such as are present in the individual atom do not have a detectable consciousness. Consciousness is only readily detectable in the highly complex bodies of matter such as the mammals which have a highly developed central nervous system. Here the complexity that is measured by the number of atoms is astronomically large (60).

Summary

A summary of the discussion to this point is as follows: The basic individual realities of the Teilhardian universe are particles of energy which are equivalent to particles of matter. This is what the world is made of. Now such particles have a number of properties. In terms of measurable spacial dimensions, individual material bodies vary in size from those which are infinitely small to those which are infinitely large. Further, the observable properties of

the infinitely large and small bodies are also well known to present day science. Now, in addition, matter varies in complexity from the very simple to the infinitely complex. Life is the special property of highly complex matter. Finally, even though consciousness is only detectable in highly complex matter it is present in an attenuated form in the simplest particles. In short, the discussion has so far examined the properties of the basic individual realities of the world that are dependent upon their particulate nature.

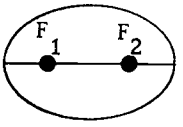
The Energetic Properties of Matter: Tangential and Radial Energy Are Principles of Organization

Earlier, the discussion stated that the individual realities of the world are particulate forms of energy. The particulate nature of these realities was examined in the preceding section of this paper. Let us now examine their energetic characteristics.

The possession of energy denotes the ability to do work. In chemical syntheses energy performs the work of combining a plurality of atoms or molecules into a larger molecule. This process consists of the formation of numerous chemical and/or physical bonds between the atoms. In biological syntheses this process usually requires the presence of molecules which can either donate or receive electrons, phosphate groups, methyl groups, etc. Further, the ability of a molecule A to either donate or receive an electron or group from

another molecule B is dependent upon the difference in the energy levels between A and B. For example, an ATP molecule contains more energy of hydrolysis than does glucose-6-P. With the appropriate enzyme, ATP will donate one of its phosphate groups to glucose-6-P and convert the latter into fructose-1, 6, Di-P. In short, the behavior of molecules in the synthesis of more complex molecules is dependent upon the relative energy levels of the participating molecules.

Now let us represent a particle of matter by an ellipse which is as follows:



Let F_1 and F_2 represent its two foci. Further, let F_1 represent the tangential energy of the particle. Tangential energy is equivalent to the various kinds of physical energy which are accepted by present day science. Hence, tangential energy is the energy which enables particles of matter to organize themselves into larger and more complex units such as the macromolecules of biochemistry. In brief, tangential energy is a principle of organization which is the cause of the increasing complexity of matter.

Now, the increasing complexity of matter is associated with a corresponding increase in its consciousness. Further, the conscious behavior of material bodies requires energy. This behavior and the energy which causes it are also a principle of synthesis or organization.

If the material bodies are higher mammals or birds, then their group behavior to protect their young exemplifies a form of social organization. Here then is a rudimentary synthesis of separate material bodies into a larger whole. On the other hand, if the bodies are individual men, then conscious behavior as a principle of organization is much more evident. Human molecules organize themselves through conscious acts into larger societies. Further, the technology that is generated by these large societies produces vast quantities of manufactured goods and the latter are new organizations of living and nonliving matter. In short, conscious behavior, especially that of man, is a second way in which the matter of the world is synthesized into larger wholes.

Now let us return to the ellipse on page 92 and let point F_2 represent the radial focus. This focus represents radial or psychic energy. Now, all energy is a capacity to do work and radial or psychic energy is that energy which enables one or more conscious beings such as higher mammals and man to form larger groupings or societies through conscious behavior. For example, radial energy unites individual men into groups through such conscious behavior as mutual love, interest in a common goal, coercion, etc. (61). In brief, radial energy is the second kind of energy which is found in matter.

The Interrelationships Between Tangential and Radial Energy: The Expenditure of Radial Energy By Human Technology Directs the Expenditure and Operation of Tangential Energy

How are the tangential and radial energy related? This can best be seen by comparing the complex structures that are formed by them. First, consider a single strand of DNA in the process of replication. This molecule first lines up the appropriate bases before the DNA polymerase catalyzes their synthesis into a complementary strand. This lining up of bases is caused by the formation of hydrogen bonds and Van der Waal forces. Further, the formation of such bonds and forces requires the expenditure of tangential (physical) energy. Here is a case in which the operation of tangential energy transforms a plurality of discreet units, purine and pyrimidine bases, into a larger unit, another DNA macromolecule. Next, consider the formation of a new corporation to produce some manufactured product. A single person who is the inventor of a new product generates ideas about the desirability of producing it. His ideas persuade a number of other persons to combine with him to form a corporation. Here, then, we have a case where the conscious activity of a single person causes the formation of a new group of persons, a human macromolecule (62). Further, the formation of such bonds between persons requires the expenditure of radial (psychic) energy. It is here

that the operation of radial energy transforms a plurality of discrete persons into a collective human macromolecule. However, this is not all. The corporation produces a manufactured product. The conscious activities of the inventor lead to the production of both a human macromolecule, the corporation, and some more complex form of non-living matter, the manufactured product. But, the synthesis of non-living matter requires the operation of tangential energy. Therefore, even though tangential and radial energy have different functions, they do interact in that radial energy can initiate and direct the expenditure of tangential energy.

A Summary of Teilhard's Answer to the Question: "What Is the World Made Of?"

The answer to this question is Teilhard's conception of a Weltstoff which is conscious matter. First, matter is energy in a particulate state. The particles of matter range in size from the infinitely small bodies such as quanta of light whose behavior is detected in the microscopic regions of space to the infinitely large ones such as the stars whose behavior is detected in the macroscopic regions of space.

Secondly, matter varies in degrees of complexity from the relatively simple subatomic particles to the infinitely complex arrangements that we find in living organisms.

Thirdly, the characteristic kinds of phenomena which are exhibited by matter are dependent upon its measurable spatial dimensions and complexity. The kinds of phenomena which are typically exhibited by the smallest particles of matter such as quanta of light differ from those which are produced by the largest aggregations of it such as the stars. Finally, both of the latter kinds of phenomena differ from the characteristic phenomena of life which are produced by the highly complex arrangements of matter.

Fourthly, all matter has the property of consciousness in at least an attentuated form. The amount of consciousness which is possessed by matter is dependent upon its degree of complexity.

Fifthly, the energy of matter has two components, the tangential and radial. Tangential energy is the physical and chemical energy which, for example, enables a plurality of lower molecular weight compounds to form a large macromolecule. On the other hand, radial energy is the psychic energy, which, for example, enables a plurality of individual human molecules to combine into a human macromolecule, a society.

Finally, the tangential and radial energy of matter are interrelated. As tangential energy produces increasingly complex arrangements of matter, increased consciousness is produced. But as the consciousness of matter increases so does its radial energy. Eventually, and especially in human technology, radial energy initiates and

directs the operation and expenditure of tangential energy.

The Fundamental Process of Change in the World is the Cosmic Process of Complexity/Consciousness

Let us now examine Teilhard's answer to the second major question of a g. c. s. which is: "What is the fundamental process by which changes occur?" (Harré, 1964, p. 27). It is the process of complexity/consciousness, the orthogenesis of matter. According to this process the increasingly complex arrangements of matter which have been formed in the history of the world have been associated with increased levels of consciousness.

Further, the law of complexity/consciousness describes a cosmic process. Cosmic processes are those in which all of the matter or energy of the world participate. Consider, for example, the second law of thermodynamics. According to this law there is a continual and irreversible degradation of energy in all of the spontaneous natural processes of the world. This degradation consists of the transformation of high-grade energy such as the mechanical, electrical or chemical forms into the low-grade form of thermal energy. In terms of the kinetic-molecular theory, this degradation of energy is interpreted as an increase in the disorder of the arrangements of the particles of matter. Such disorder is often equated with the random motion of molecules. Further, disordered states are

more probable than orderly ones. Now, entropy is the measure of this degradation of energy. But as the degradation of energy is irreversible, there is a net increase of entropy and hence of the disorderly arrangement of matter in the universe (63). Hence, if there is no new creation of matter from nothing, the continual and irreversible increase of entropy will eventually produce the complete disintegration of our universe (64). Finally, the continual and irreversible increase of entropy in the world is a cosmic process for the disintegration of matter. On the other hand, Teilhard's law of complexity/consciousness describes a cosmic process for the synthesis of matter. Hence, the cosmic process of complexity/consciousness which produces increasingly complex entities produces increasingly improbable arrangements of matter. In short, the cosmic process of entropy produces an increase of disorder, an increasingly probable state of matter, whereas that of complexity/consciousness produces an increase of order, an increasingly improbable state of matter.

The Three Major Stages of the Process of Complexity/Consciousness are Pre-Life, Life and Man

Stage of Pre-Life

What now are the major stages of the process of complexity/consciousness in the history of the world? The first stage is that of pre-life. The chance collisions of atoms are followed by the formation

of the inter-atomic bonds that are needed in the formation of molecules. The latter combine in the same way and eventually produce large biological macromolecules.

Stage of Life

The second stage is that of life, the biosphere. When the arrangement of biological macromolecules reaches a certain threshold of complexity some form of detectable life such as the cell or virus emerges. The emergence of life represents the first mutation of matter in the process of complexity/consciousness. Because living cells perform detectable activities such as self-replication which are not typical of the detectable activities of pre-living molecules.

Next, single-celled organisms combine to form a more complex arrangement of matter, the multicellular organism. With the development of the latter a second kind of orthogenesis develops, the orthogenesis of speciation. This is identical with the extensive proliferation of biological species that occurs in evolution.

What then is the relationship between the two kinds of orthogenesis, that of matter and that of speciation? In the biological world there is a very extensive differentiation of species. Now, if the process of complexity/consciousness is the fundamental process of change then it should be detectable in the emergence of the diversity of species. An increase in the complexity of the organism should be

associated with an increased level of consciousness. But what is our criterion for determining the complexity of an organism? Teilhard's criterion of the complexity is the complexity of the organism's brain. As the complexity of the brain increases so also does the level of consciousness. When we use this criterion the orthogenesis of matter and that of speciation coincide in the evolution of the primates. The brain becomes progressively more complicated in primate evolution which produces the anthropoids.

Stage of Man

The third stage is that of man. The emergence of man from his anthropoid ancestors is the second mutation of matter in the process of complexity/consciousness. There is here a mutation because of the unique character of man's knowing. Anthropoids can have a knowledge or consciousness of the world whereas only man can know that he knows. In short, with the emergence of man matter reaches a qualitatively new level of consciousness.

Special Characteristics of the Human Phase of Complexity/Consciousness

Human Evolution is Now Convergent

In addition to reaching a new level of consciousness the direction of man's evolution has also differed from that of the other

animals. Until man appeared, the divergent evolution of the species was the rule for all species of organisms. However, with the appearance of man a new kind of evolution arose, namely, a convergent one. In the early phases of his evolution, the phase of rapid expansion, man developed as did all other animals, namely, by divergent evolution. Numerous branches of man, the varied races and cultures, developed in various places throughout the world. However, these branches did not remain indefinitely isolated. On the contrary, in man, the various differentiated branches which were produced in divergent evolution began to associate with one another. This is the process of convergent evolution. Now, in the last 50 to 100 years the limited space which is available on our spherical earth together with the population explosion has forced man to enter into the compressive stage of convergent evolution. All of the branches of man are now being forced to associate. In short, convergent evolution is now being superimposed upon man's divergent evolution (65).

Two Important Characteristics of the Present Compressive Phase of Man's Convergent Evolution are the Development of a Noosphere and the Physical Transformation of the Earth by Technology

The present compressive stage of convergent evolution has two important characteristics. The first is the emergence of the noosphere. The term noosphere denotes the cooperative thinking and

acting of a plurality of the individual persons. For example, in scientific research and technology a plurality of individual persons combine their thinking and acting to produce our present technological society. The emergence of our large social, political and economic groupings such as the nation state and corporation are also examples of noospheres. Hence, in our present compressive phase of evolution there is a vast incorporation of a large number of individual persons into large social groupings in order to develop various kinds of thought and action. Thus, a major characteristic of our present compressive stage of evolution is the development of a growing network of thought and hence of consciousness over the surface of the earth.

Another characteristic of our compressive stage is the physical transformation of the world which has been initiated by the intensification of man's conscious thought and action. For example, man has developed computers. Now, this machine is a highly complex arrangement of matter which enables man to solve problems which are too complicated to be solved without it. Therefore, with the development of the computer which is itself a highly complex arrangement of matter, there has been an increase in man's ability to solve problems and hence an increase in the level of his consciousness. Further, computers can be used to design machinery that is used for the manufacturing of goods which are themselves complex arrangements of matter. Hence, the development of computers is an

example of the development of an increasingly complex arrangement of matter which enables man to increase his level of consciousness. The latter can then be used to initiate the building of machine tools which will then further increase the complexity of the matter in the world. In other words, the development of technology is an increase of material complexity which is followed by the development of increased consciousness in man. The inventiveness of man's increased consciousness then initiates a further development of technology, etc.

Prior to the development of the noosphere in man the emergence of an increased complex arrangement of matter in nature was primarily caused by natural selection. However, after the emergence of the noosphere, the inventiveness of man's conscious thought has gradually become the main agent of new and increasingly complex arrangements of matter over the surface of the earth. In fact, the very existence of all life on earth, the biosphere, is now dependent upon the thought and actions of the noosphere which the evolution of man has produced.

The Future of Man in the Compressive Phase of Convergent Evolution Lies in the Emergence of a Transcendent Noosphere Which is a Cosmic Organism

Will the increase of consciousness in the noosphere continue indefinitely in its present form? Teilhard's answer is no. The

consciousness of the noosphere will continue to intensify in its present manner for a time. However, eventually the part of the world's matter which is associated with the development of the noosphere, the totality of human persons, will reach a high level of complexity and its associated consciousness will become so concentrated that a third mutation will occur. At this time the noosphere will begin an unending existence outside of our present world of space and time.

How then is the third mutation in the process of complexity/consciousness related to the previous two? First, examine the realities which emerge in the first two mutations, the emergence of life from prelife and the emergence of the self-conscious animal, man, from his conscious ancestors. Both of these emergent realities are growing complex arrangements or integrations of matter because new, material components are continually being incorporated within them. For example, a growing plant is a growing complexity or integration of matter because new atoms and molecules are always being integrated within it. The biosphere is a growing material complexity because a large number of new organisms are continually being added and incorporated within it. Similarly, our technological organizations, our present noosphere, are continually growing integrations of matter because new persons are continually being born and incorporated within them. Further, these growing complexities of matter and their associated consciousness have emerged and functioned within

the spatio-temporal process of complexity/consciousness. Hence, they are observable phenomena.

Next, examine the reality which emerges in the third mutation. Human persons are the material components, the molecules, which are integrated. Now, after the third mutation of the Weltstoff there will be no increase in the number of human persons and hence there will not be the growing material complexity that we find in our present biosphere and noosphere. On the contrary, the third mutation of the Weltstoff will usher in an era in which the bonds between human persons will undergo a change of state. They will be radically transformed (66). Further, this transformation will occur outside of our present world of space and time, i.e. this transformation will be a transcendent event. Hence, the reality which will be formed after the third mutation of the Welstoff is in principle an unobservable phenomenon.

Next, the cosmic reality which will emerge after the third mutation will terminate the cosmic process of complexity/consciousness. For in our present spatio-temporal world new material components, human persons, are continually being born and integrated by the process of complexity/consciousness. But after the third mutation of the Weltstoff there will no longer be a spatio-temporal world in which persons will be born. Hence, the spatio-temporal process of complexity/consciousness will terminate, because there will be no new

persons to integrate.

Finally, the Weltstoff which undergoes the third mutation which terminates the process of complexity/consciousness permanently escapes the effects of the cosmic process of entropy (67). The following diagram represents this situation:

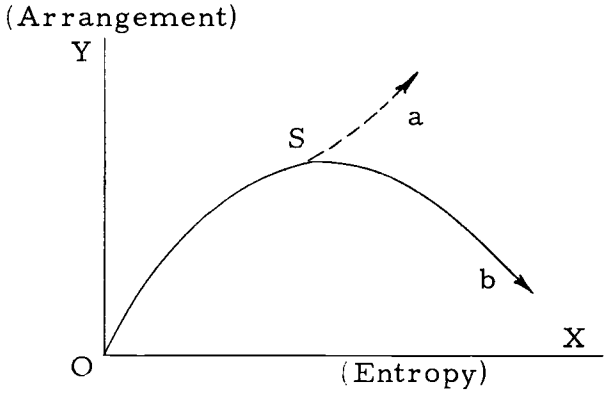


Figure 2. Curve of the evolution of energy in the form of two fundamental cosmic currents of complexity/consciousness and entropy.

Along the Line OX energy dissipates. Along OY, it arranges ('corpusculates') itself and 'interiorises'
Sa, Sb, two different forms of the curve along which, having reached its evolutionary summit (apex), humanity drops back (in complexity/consciousness), or on the contrary escapes by way of a critical point of 'ultra-reflexion' (? by separation of the 'radial' and 'tangential', see below, end of second part)

(Teilhard, 1965, p. 216)

The noosphere will reach a summit of complexity in our present spatio-temporal world that is represented by point S on the graph. There are now two alternatives for such a complexified humanity.

(a) If the cosmic process of entropy is the dominant one in our world,

then the complex human world will gradually disintegrate and the total death of man will be the result. This alternative is represented by the curve Sb. (b) On the other hand, a complexified humanity might undergo a change of state and acquire irreversible (immortal) life. In this alternative humanity would live forever and hence escape the disintegrations of entropy. This alternative is the one which Teilard accepts and it is represented by Sa on the graph (68).

Next, how will the functioning of the noosphere outside of space and time differ from our present one? In the process of complexity/consciousness large numbers of individual cells eventually become arranged into complex multicellular organisms. Later, with the emergence of man, a vast multitude of nerve cells become arranged into a complex organ, man's brain, that enables the individual man to produce thought. The production of thought requires an astronomically large number of neurons. Now the present functioning of the noosphere requires the cooperation of a large number of individual persons to produce thoughts and actions. This is clearly evident in the phenomena of collective research. Further, the bonds which link the individuals who participate in research or in any other part of the noosphere are still very weak. Individual persons are relatively independent of one another and surely are not as interdependent and cooperative as are the individual neurons of the brain. However, Teilhard thinks that as the consciousness of the noosphere becomes

more concentrated in the process of complexity/consciousness individual persons will become more interdependent and cooperative and hence will increasingly resemble the functioning of brain cells. This growth of increasing interdependence and cooperation will reach its limit after the third mutation. After this mutation all of the individual persons of the world will be completely integrated within a single cosmic organism which will be capable of a cosmic act of knowledge. Each individual person will then resemble a neuron of the brain and will fully cooperate in the production of the cosmic acts of knowledge of the cosmic organism (69). In brief, the present functioning of our observable noosphere is caused by a relatively loosely connected body of independent persons. On the other hand, its future functioning will be identical with the behavior of a cosmic organism that will be an integration of all of the individual persons who have ever existed, in our world.

Omega is the Cosmic Vital Principle of the Growing Transcendent Noosphere and the Process of Complexity/Consciousness

The earlier discussion of vitalism in this paper stated that a vitalistic theory always postulates the existence of some non-empirical integrator of the living organism. Hence, we must ask: What is the integrator of Teilhard's cosmic organism, the transcendent noosphere, that is formed by the third mutation? It is the omega point. It exists

outside of the present spatial and temporal world. Therefore, it is in principle unobservable in the same way as the cosmic organism which it integrates. But, the spatio-temporal process of complexity/consciousness has generated our present noosphere and the latter will become a fully integrated organism after the third mutation. Hence, omega must be the ultimate driving force, the vital principle, of the process of complexity/consciousness. Without some kind of activity by omega, the cosmic process of complexity/consciousness would never have been started. In short, the entire process of complexity/consciousness which will be terminated in the production of a trans-temporal and transpatial cosmic organism is ultimately dependent upon the activities of a cosmic vital principle, omega.

The Energetics of the Process of Complexity/Consciousness

In the Process of Complexity/Consciousness There is a Gradual Replacement of Tangential by Radial Energy

What are the activities of omega which initiate the process of complexity/consciousness which will terminate in the production of a cosmic organism? An answer to this question presupposes a discussion of the energetics of complexity/consciousness. Let us first examine the energetics of pre-life. Earlier, a unit of matter, Teilhard's Weltstoff, was represented by an ellipse with two foci, F1

and F2. (Cf. diagram on page 92) The tangential and radial energy of matter were represented by the foci F1 and F2 respectively. In the earliest stage of the process of complexity/consciousness, the stage of pre-life, the chance collisions of primitive particles of matter lead to the formation of atoms or other primary forms of matter. Here, the operations of chance predominate and the organizing power of F1 and F2 is very small. However, after chance collisions have resulted in the production of molecules the organizing power of F1 and to a lesser degree of F2 begins to grow. The larger a molecule becomes, the greater are the number of possible bonding sites it may contain. Further, as the number of possible bonding sites increases the greater is the probability that the molecule will form additional intermolecular bonds. Now, the formation of interatomic and intermolecular bonds requires the expenditure of tangential energy. In short, it is the expenditure of the tangential form of energy and chance which are primarily responsible for the increased complexity of matter in the stage of pre-life.

In the next stage, that of life, the organizing power of F1 continues to grow. There is also a large increase in the organizing power of radial energy which is associated with the increase in material complexity. In brief, in the process of complexity/consciousness which precedes man, both tangential and radial energy are functioning to organize matter into more complex groupings, but it is

the tangential form which is dominant.

Now, with the appearance of man the latter situation becomes reversed. After the appearance of man it is radial energy which begins to become dominant. For example, the radial energy of man's technology now directs the operation of much tangential energy. This domination of tangential energy by the radial energy of our noosphere of technology is now very large. For example, man now literally has the power to destroy all life on earth. Therefore, the entire process of complexity/consciousness occurs as if the radial energy of matter that is represented by F2 were gradually replacing its tangential energy that is represented by F1 (70).

The Teilhardian g. c. s. is Clarified When It Is Compared with the Familiar Mechanistic One

The preceding discussion of the energetics of Teilhard's g. c. s. can be further clarified by contrasting it with our present mechanistic viewpoint. Now, in the mechanistic g. c. s. tangential (physical) energy is the fundamental energy of the world. All of the phenomena of life and consciousness are products of the biochemical activities of matter and the latter are in turn solely determined by the operations of chance and tangential (physical) energy. In brief, for the mechanist the phenomena of life and consciousness are merely accidental by-products, epiphenomena, of the activities of matter which are

described by the familiar laws of tangential energy, the laws of chemistry and physics.

On the other hand, in Teilhard's g. c. s. radial (psychic) energy is the fundamental energy of the world. And hence tangential (physical) energy is derived from it. But how are we to obtain the familiar laws of physics and chemistry from radial energy? Teilhard's answer is as follows: All particles of matter in the realm of pre-life which are studied by physics and chemistry have an attenuated form of consciousness which is not perceptible to us. Further, for all practical purposes the total number of particles, electrons, protons, atoms, molecules, etc., is infinite. Now, the familiar laws of physics and chemistry are based upon the statistically describable interactions of an infinite number of subatomic and atomic particles. Hence, even though these particles are primarily attenuated centres of consciousness, there are so many of them interacting that their behavior can be validly described as if the familiar laws of tangential energy of physics and chemistry were the only one present. Therefore, in the Teilhardian g. c. s. the validity of the familiar laws of chemistry and physics is in no way defined. In other words, the familiar chemical and physical behavior of matter which is the real world in the mechanistic g. c. s. is a statistical by-product of centers of consciousness in the Teilhardian g. c. s.

Summary

So far, the discussion has described two kinds of energy, tangential and radial, that are present in the process of complexity/consciousness and how one kind, the radial, gradually replaces the other. In order to further clarify the energetics of the process of complexity/consciousness a comparison of it with the present day mechanistic conception of life and consciousness was made. The results of this comparison showed that in the mechanistic g. c. s. life and consciousness are simply the result of an accidental arrangement of matter which can be completely described in terms of the laws of physics and chemistry which require the presence of only tangential (physical) energy. Radial (psychic) energy is only an accidental by-product of tangential energy. On the other hand, the Teilhardian g. c. s. states that the fundamental energy of the world is radial and hence that tangential energy is derived from it. Hence, in the Teilhardian g. c. s. life and consciousness are not accidental phenomena in the world. On the contrary, they are the real phenomena of our world, whereas the inorganic phenomena of physics and chemistry are simply statistical by-products of the phenomena of consciousness. Teilhard in effect turns the mechanistic g. c. s. upside down.

The Specific Characteristics of Energy in the Process of Complexity/Consciousness

Now, in order to understand the energetics of the process of complexity/consciousness it is not enough to note the two kinds of energy which are present and the fact that one kind of energy gradually replaces the other. If the function of omega is to be understood, it is also necessary to see clearly how energy functions in the process of complexity/consciousness.

In the Process of Complexity/Consciousness a Succession of Increasingly Higher Syntheses of Matter Emerges

How then does energy function in the process of complexity/consciousness? The central idea which this process embodies is that of synthesis or integration. Hence, the process of complexity/consciousness is essentially a cosmic process of synthesis. Many subatomic particles are synthesized into a single atom. Many atoms are synthesized into a single molecule. Many molecules are synthesized into a single biological macromolecule. Many biological macromolecules are synthesized into a single cell and many of the latter are synthesized into a multicellular organism. Many multicellular organisms are synthesized into single societies such as those of ants and bees. In the case of man the process of complexity/consciousness is now beginning to synthesize a plurality of human persons into a

single cosmic organism. Teilhard often refers to this repetitive process in which many individual components become incorporated within a single grouping as an experimental law of recurrence. The process of complexity/consciousness is therefore a succession of increasingly higher syntheses. In short, higher syntheses or integrations are always being made in the cosmic process of complexity/consciousness.

Prior to the Emergence of Man Higher Syntheses of Matter are Initiated Primarily by the Expenditure of Tangential Energy in the Formation of Physical Bonds

What is the driving force behind the emergence of new arrangements of matter in the history of the world? In all of the stages of the process of complexity/consciousness which are prior to the emergence of man, tangential energy and the chance collisions of matter are the dominant driving forces of synthesis. The formation of increasingly complex arrangements of matter requires the formation of an increasing number of physical and chemical bonds. Bond formation is dependent upon the laws of tangential energy. Thus, prior to the appearance of man the synthesis of matter into increasingly complex forms is primarily determined by the laws of tangential (physical) energy.

After the Emergence of Man, Higher Syntheses of Matter are Initiated Primarily by the Expenditure of Radial Energy in the Formation of Moral or Cultural Bonds

After the appearance of man the mechanism of the process of complexity/consciousness changes. The process of complexity/consciousness is now in the process of synthesizing individual persons into a cosmic organism. The individual person is a highly complex arrangement of matter, a chemical molecule, that is conscious of itself. The cosmic organisms that will be formed from the union of individual persons will be an ultra-human molecule. Man is a person who can freely choose to incorporate himself into larger groups such as the family, tribe, state, corporation, etc. Further, all of these particular groups in which man incorporates himself are simply early stages of his incorporation within a single cosmic organism. The latter will only be completed with the termination of the process of complexity/consciousness by the third mutation of the Weltstoff. Now, the various ways in which man unites to form groups and his reasons for doing so constitute his culture. Also, human beings are persons and hence the relationships or bonds which exist between them in these groups are moral or cultural. Cultural or moral bonds which synthesize the individual physical human molecules into a growing cosmic organism are analogous to the chemical and physical bonds which synthesize molecules which are less complex than the individual

man. Moral or cultural bonds which are produced by individual conscious acts and they are initiated by the expenditure of radial (psychic) energy in the analogous way that chemical and physical bonds are initiated by the expenditure of tangential energy (71). In short, one change of mechanism which the process of complexity/consciousness undergoes after man's appearance consists of the formation of cultural or moral bonds which are initiated by the expenditure of radial energy.

In addition, man's technology is an integral part of his culture and hence the development of it requires the expenditure of radial energy. But manufactured goods produced by technology are syntheses of matter which require the expenditure of tangential energy. Hence, man's expenditure of radial energy in the formation of his technology determines how some part of the tangential energy of the world shall be used. For example, the thought of a single man can initiate the production of millions of automobiles. Thus, another change in the mechanism of the process of complexity/consciousness after the appearance of man is the control of tangential energy by radial energy (72).

As the Process of Complexity/Consciousness Converges Toward Its Final Goal There will be a Gradual Transformation of the Moral or Cultural Bonds of the Noosphere into Those of Universal Love

So far the discussion has described the successive appearance

of the two major kinds of bonds in the process of complexity/consciousness, moral (cultural) and physical. Now, nothing remains static in the process of complexity/consciousness. Hence, the moral or cultural bonds of the noosphere also undergo an evolution. As the noosphere continues to converge toward its end, the third mutation of the Weltstoff, there is a gradual transformation in the nature of its moral bonds.

How then do the moral bonds of the noosphere change? The various bonds between man that now exist are generally those of mutual interest. For example, there are large international scientific organizations which bring together persons who are investigating certain kinds of questions. There are also various kinds of economic bonds which make persons dependent upon one another for material necessities. There are also political and military bonds which are designed to protect the rights of individuals and nations. There are even bonds of mutual interest which exist between the members of organized crime. Now, all of these bonds of mutual interest have one thing in common. They usually do engender some degree of cooperation between individuals of varying backgrounds. In brief, the bonds of mutual interest are based upon some kind of intellectual agreement about the desirability of achieving certain ends.

On the other hand, there are bonds of love which unite the hearts of men. Two men can belong to a scientific organization that

is based on a common mutual interest and cooperate with one another on a research project and yet they may still hate each other. In short, without mutual love, a union of men's hearts, there is no complete union of human individuals.

Now, it is very obvious that the bonds which exist between the individual men of the world are everything except those of love. However, Teilhard is optimistic about the future development of the noosphere. He is convinced that as the noosphere becomes increasingly compressed that love will become the dominant bond between individual men. Men will come to realize that they will have to learn to follow the precept of mutual love that was given to them two thousand years ago by the Founder of Christianity in order to just survive. Also, this growth of universal love in the noosphere will be associated with an increasing attraction or love for the cosmic vital principle, omega. Finally, after the third mutation of the Weltstoff the love of men for one another and for omega will become perfected. At this point there will be a noosphere of universal love functioning in a transcendent (non-empirical) world. In other words, as the noosphere evolves, the bonds between individual men will be dominated by bonds of love.

Omega is the Ultimate Source of the Energy That Is Required by the Process of Complexity/Consciousness

All syntheses cost something in terms of energy. Further,

it is the flow of energy which directs the syntheses that occur in the successive stages of the process of complexity/consciousness. Omega is the cosmic vital principle and the ultimate source of all of the energy that is required by the process of complexity/consciousness. Hence, it is by being this ultimate source of energy that omega initiates and direct the entire process of complexity/consciousness.

The Spatio-temporal Process of Complexity/ Consciousness Terminates in the Production of a Personalistic Universe

Earlier (Cf. p. 108) omega was described as a transcendent cosmic vital principle and integrator of the cosmic organism. In addition to this it is also a transcendent person. The cosmic organism is therefore a community of human persons together with the transcendent person of omega. Further, in the future it will function as a single person because it will be capable of a single collective act of vision. However, the latter will not occur until after the third mutation of the Weltstoff. In the cosmic process of complexity/consciousness there is a gradual transformation of a part of the energy of the world into this cosmic organism which has the property of personality. Therefore, the process of complexity/consciousness which is the fundamental process of change in the world is at the same time a cosmic process for producing personality. In other words, the transformation of the energy of the world by the

fundamental process of change terminates in the production of a personalistic universe (73).

The Cosmic Organism Permanently Escapes the Effects of the Cosmic Process of Entropy

Earlier (Cf. p. 97) the cosmic processes of entropy and complexity/consciousness were compared. The process of entropy results in the disintegration of matter and is a function of tangential (physical) energy (74). On the other hand, the process of complexity/consciousness results in the synthesis of matter into more complex arrangements. This process is ultimately based upon radial (psychic) energy (75). Further, in the Teilhardian world the process of complexity/consciousness is more important than that of entropy because it synthesizes a cosmic organism which is a world community of human persons with omega that permanently escapes ultimate disintegration. The part of the world of matter which is not part of the cosmic organism does presumably disintegrate as predicted by the second law. In short, in the Teilhardian g.c.s. a cosmic process of synthesis creates a physical structure which is alsc a person and which is not susceptible to disintegration by the cosmic process of entropy.

In an earlier discussion the relationship between the two cosmic processes of entropy and complexity/consciousness was represented in the diagram on page 106. According to present day mechanistic

science man is an organization of matter that is represented by point S on the curve and that will eventually disintegrate as will all other material entities. This disintegration is represented by curve Sb. On the other hand, Teilhard is convinced that man is an organization of matter which will not disintegrate. Man is now being incorporated into a growing organism that will exist in its entirety outside of space and time only after the third mutation of the Weltstoff (76). Hence, the cosmic organism of the future is an arrangement of matter which will permanently escape the disintegrating process of entropy. The unending existence of this organism is represented by curve Sa. In brief, in the Teilhardian universe the most conscious form of matter is a cosmic organism which is able to permanently escape the disintegrating process of entropy.

The Cosmic Vital Principle of the Cosmic Organism Which Permanently Escapes the Effects of Entropy Is the Christ of Christian Theology

As we have seen omega is both a transcendent person and the cosmic vital principle or integrator or the developing cosmic organism. In addition, Omega is the Christ of Christian theology (77). Therefore, when Teilhard describes the third mutation of the Welstoff that will bring into existence the completed cosmic organism which will exist outside of space and time he is in effect using the language of science and philosophy to present the Christian theological doctrine

about the second coming of Christ at the end of the world. In effect, because of his identification of Omega with Christ, Teilhard's vitalism is theological (78).

A Summary of Teilhard's Answer to the Question: What Is the Fundamental Process by Which Changes Occur?

First, the process of complexity/consciousness is the fundamental process of the world. It is a cosmic process of synthesis that produces increasingly complex arrangements of matter. Further, increasing material complexity is associated with increased levels of consciousness. Finally, the major historical stages of the process of complexity/consciousness are pre-life (chemical evolution), life (biological evolution) and man (cultural evolution).

Secondly, prior to man's appearance the process of complexity/consciousness is primarily one of divergent evolution. The syntheses of matter which are produced in this period are initiated primarily by the expenditure of tangential (physical) energy. On the other hand, after the appearance of man the process of complexity/consciousness increasingly becomes one of convergent evolution. The syntheses of matter which occur in this stage are initiated primarily by psychic (radial energy).

Thirdly, the convergent evolution of man is now entering a compressive phase because of the population explosion and the

spherical surface of the earth. This means that human beings of different races, cultures and nationalities are being physically forced to associate with one another. This physical compression of vast numbers of human beings will gradually lead to the formation of an ultra-human cosmic organism in the analogous way that the physical compression of the vast number of primitive cells led to the formation of multicellular organisms in the early stages of biological evolution.

Fourthly, the spatio-temporal process of complexity/consciousness will terminate with the production of a completed ultra-human cosmic organism that will be a community of all human persons with Omega (Christ) the cosmic vital principle. This organism will be a collective person that will be capable of a collective act of knowledge. It will also exist outside of our present world of space and time and hence it will be a transcendent organism. Finally, its transcendence will enable it to permanently escape the disintegration of entropy.

Fifthly, Omega is the vital principle and hence the integrator or synthesizer of all persons into this organism. Further, the synthesis of all persons into a cosmic organism by the process of complexity/consciousness requires the expenditure of energy. Omega is the ultimate source of this energy. Hence, it is Omega which ultimately initiates the cosmic process of complexity/consciousness that produces a cosmic organism which is an ultra-human personality.

FOOTNOTES FOR CHAPTER IV

[50]The analysis which is here presented of Teilhard's world will be qualified in Chapter Five. The basic individual realities which are here discussed never exist in isolation. They are elements or parts of a universe which is an organic whole. Now Teilhard's fundamental category of thought is synthesis or integration. Hence, what is most real in the Teilhardian world is always some synthesis or integration of elements. However, it is still fruitful to begin the description of Teilhard's world as here presented because the discussion directly relates his conception to our mechanistic viewpoint.

[51]Cf. Harré, 1964, p. 28.

[52]Teilhard (1959, p. 42-43) states: "Energy. Under this name, which conveys the experience of effort with which we are familiar in ourselves, physics has introduced the precise formulation of a capacity for action or, more exactly, for interaction. Energy is the measure of that which passes from one atom to another in the course of their transformations. A unifying power, then, but also, because the atom appears to become enriched or exhausted in the course of the exchange, the expression of structure.

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

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

[53](Teilhard, 1965, p. 211-212) "The Corpusculisation of Energy. According to the physicists--speaking with the authority

derived from a complete system of successful experiments---cosmic energy, taken in the most primordial, the most extended, the most 'radiant' form we know, appears already granulated (photons): this granulisation 'materialising' rapidly in an extremely numerous swarm of elements, extremely small and often alarmingly brief in their existence: the positive, negative or neutral elements of the atom.

Now this initial corpusculisation is only the beginning or outset of an endless process of 'ultra-corpusculisation' pursued in two directions secretly conjoint though apparently extremely different.

1. Following a first direction, under the dominating force of gravity, matter (having reached a sufficient degree of atomisation) collects in spiral (galaxies), then spherical masses (stars, planets), in the midst of which (despite a certain zonal structure in the whole) the atomic elements find themselves to some extent merged and dis-individualised. In order of magnitude, the whole astronomical series.

2. Following the second direction, and in apparent dependence on the forces of electromagnetism, matter arranges itself in little closed systems, more and more complicated and centred, in which each element functionally superindividualises (accentuates) itself as incorporation takes place.

The whole atomic series, first of all, much longer than we think; and yet (despite its isotopes and its transuranians) relatively limited in its combinations of electrons, protons and neutrons.

The whole molecular series, in which, on the level of organic chemistry, the number of atoms associated in each particle (not to mention the number of their interrelationships) rapidly achieves astronomical figures.

And, lastly, inevitably connected by way of the largest proteins, the whole zoological series formed by living beings: since, to the observant, the cell (and so, stage by stage, man or the whale) is nothing else but an enormous supermolecule."

[54](Teilhard, 1966, p. 21-22) "The second axis, ox, is more unusual. It is an attempt to express and measure not the linear dimension of things but (in the sense defined above) their degree of complexity. I hasten to add that this representation is more conceptual than actual, since once we go beyond molecules it rapidly becomes impossible (at least for the moment) to calculate either the number of elements (simple or compound) that make up a being, or the number of links between the elements or groups of elements. However, as a very rough approximation, we have used as a "parameter of complexity," in the case of the smallest corpuscles, the number of atoms grouped in the corpuscle. This should suffice, I believe, to give some idea of the order of magnitude of the colossal numbers we shall have to accustom ourselves to deal with in this field."

[55](Teilhard, 1966, p. 22) "Next, I have tried, using the two axes so chosen, to trace diagrammatically in its broadest trend, what I shall call the universe's curve of corpusculisation: the curve produced by grouping the natural corpuscles we know according to their two coefficients of length and complexity. This curve starts from the simplest infinitesimal (nuclear elements) and climbs rapidly to living corpuscles. Beyond that it climbs more slowly (for the increase in size varies relatively slightly in comparison with the increase in arrangement). I have drawn it as asymptotic to the radius of the earth, to suggest that the highest and greatest complexity achieved (so far as we know) in the universe, is what I shall later call planetised humanity--the noosphere."

[56]All material bodies exhibit characteristic behavior which enables us to differentiate them. Now, Teilhard states that when bodies which are for all practical purposes either infinitely large or small are observed, then phenomena appear which are very different and appear to have little or nothing in common. This is what he means when he says that every infinite can be "characterized by certain "special" effects proper to that infinite". (Teilhard, 1966, p. 23). His reason for stressing the "special" effects of these infinites will become evident in the discussion on pages 88-89.

[57](Teilhard, 1966, p. 23-24) "Every infinite, physics teaches us, is characterised by certain "special" effects proper to that infinite: not in the sense that it is the only thing to possess them, but in the sense that those effects become perceptible, or even dominant, at the particular scale of that infinite. Such, for example, in the infinitesimal are the quanta, and relativity in the immense. Once we admit this, we have to ask what can be the specific effect proper to the vast complexes we have just recognised as constituting a third infinite in the universe. If we consider that question carefully, surely we must answer that the specific effect is in fact precisely what we call life--life, with its two series of unique properties: one, a series of external properties (assimilation, reproduction etc.) the other internal (interiorisation, psychism).

If my conclusion is correct, we reach here, in fact, the emancipating prospect on which depends for us the meaning and future of the world. The living, as I said above, has long been regarded as an accidental peculiarity of terrestrial matter. As a result, the whole of biology has been left out on its own, with no intelligible connection with the rest of physics. This is corrected if (as suggested by my curve of corpusculisation) life is, in scientific experience, no other than a specific effect (the specific effect) of

complexified matter: a property in itself co-extensive with the whole stuff of the cosmos, but perceptible to us only where (after stepping over a number of thresholds that we shall later specify more exactly) complexity exceeds a certain critical value--below that value we cannot perceive it at all. The speed of a body must approach that of light for the variation in its mass to be apparent to us. Its temperature must reach 500° c. for its radiation to be visible to us. Is it not, then, reasonable to expect that through just the same mechanism matter, until it begins to approach a complexity of a million or half a million, should appear "dead" (though "pre-living" would be the better term), while beyond that figure it begins to show the red glow of life?"

[58](Teilhard, 1953, p. 106-107) 1. "Supportant l'édifice entier des propositions qui vont suivre, se placent une intuition et deux constatations:

a) Intuition: Dans la multiplicité " grouillante " des éléments vivants (monocellulaires et polycellulaires) formant la Biosphère se prolonge authentiquement la structure granulaire (atomique, moléculaire) de l'Univers. Replacé dans la série corpusculaire cosmique, par suite, le corps humain n'est pas autre chose qu'une " supermolécule ", en laquelle, dès lors, nous avons la chance de pouvoir discerner, à l'état " grossi ", les propriétés de toute molécule.

b) --Constations: L'Homme, ultime produit de l'évolution planétaire, est à la fois suprêmement complexe dans son organisation physico-chimique (mesurée au cerveau), en même temps, considéré dans son psychisme, suprêmement libre et conscient.

2. --Mises bout-à-bout, ces trois évidences primordiales font immédiatement apparaître les trois évidences dérivées que voici:

a) A tous les degrés de taille et de complexité, les corpuscules ou grains cosmiques ne sont pas seulement, comme l'a reconnu la physique, des centres de rayonnement énergétique universel; mais tous, en outre, un peu comme l'Homme, ils possèdent et représentent (si diffus, ou même fragmentaire que soit celui-ci, cf. n° 8) un petit " dedans " où se réfléchit, plus ou moins ébauchée, une représentation particulière du Monde: centres psychiques par rapport à eux-mêmes, ---et, en même temps, centres psychiques infinitésimaux de l'Univers --La conscience, en d'autres termes, est une propriété moléculaire universelle; et l'état moléculaire du Monde exprime l'état pluralisé de quelque possibilité de conscience universelle.

b) A travers la série des unités cosmiques, la conscience grandit et s'approfondit proportionnellement à la complexité organisée de ces unités. Absolument insensible pour nos moyens d'observation

au-dessous d'une complexité atomique d'ordre 10^5 (virus)[1] elle se manifeste franchement à partir de la cellule (10^{10}), mais ne prend ses développements majeurs que dans les cerveaux de grands Mammifères (10^{20}), c'est-à-dire pour des groupements atomiques d'ordre astronomique.

c) D'où il résulte le caractère le plus essentiel, le plus significatif de n'importe laquelle des unités dont le groupement forme l'Universe se trouve marqué dans celles-ci par un certain degré d'intériorité, c'est-à-dire de centréité (âme), lui-même fonction d'un certain degré de complexité (corps, et plus spécialement cerveau). Ce coefficient de centro-complexité (ou, ce qui revient au même, de conscience) est la véritable mesure absolue de l'être dans les êtres qui nous entourent. Lui, et lui seul, il peut fonder une classification vraiment naturelle des éléments de l'Univers.

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[1] Par complexité atomique, j'entends ici le nombre d'atomes engagés dans le corpuscule considéré. Que les corpuscules de faible complexité atomique nous paraissent " inanimés ", rien de plus conforme aux analogies de la Science. Nombre de propriétés fondamentales de la Matière (variation de masse, courbure de l'espace etc.) ne nous deviennent perceptibles que dans l'infiniment grand ou l'infiniment petit. De ce point de vue on pourrait dire que la Biologie n'est pas autre chose que la " Physique des très grands complexes ", ---la Physique du troisième infini (celui de la complexité, où apparaît la Vie)."

My translation is:

1. "The entire edifice of propositions which follow is supported by an intuition and two propositions.

a) Intuition: The granular structure (atomic, molecular) of the universe is authentically extended to the swarming multiplicity of living things (monocellular and polycellular) which form the biosphere. When placed within the context of this cosmic corpuscular series, a human being is nothing other than a supermolecule in which, therefore, we have a chance to be able to see, in a macroscopic form, the properties of all molecules.

b) Propositions: Man, the ultimate product of planetary evolution, is at the same time supremely complex in his physico-chemico organization (measured by his brain) and at the same time, considered psychologically, he is supremely free and conscious.

2. Placed end to end these three primordial truths cause the immediate appearance of three derived truths which are as follows:

a) In all degrees of size and complexity, corpuscles and

cosmic particles are not only like those recognized by physics, centers of universal energetic radiation; but in addition, a little like man, all of them[i. e. cosmic particles] possess and exhibit a little within [i. e. consciousness] in which is reflected, in a more or less distinct way, a particular representation of the world: [cosmic particles or molecules are] psychic centers in relation to themselves and at the same time infinitessimal psychic centers of the universe. Consciousness, in other words, is a universal molecular property; and the molecular state of the world is a realization, in a pluralized form, of some possibility of universal consciousness.

b) Across the series of cosmic units, consciousness grows and deepens in proportion to the organized complexity of these units. Absolutely undetectable to our means of observation below an atomic complexity of the order of 10^5 (virus)[1] it is readily manifested beginning with the cell (10^{10}), but it only makes its major development in the brains of large mammals (10^{20}), i. e. for atomic groupings of an astronomical order of magnitude.

c) From which there results that the most essential characteristic, the most significant of any [that are possessed by] the elements whose groupings form the universe, is a certain degree of interiority, that is to say of centriety (soul), [which is] itself the function of a certain degree of complexity (body and especially brain). This coefficient of centro-complexity (or what comes to the same thing, of consciousness) is the true absolute measure of being in the beings which surround us. It and it alone is able to be the foundation of a true natural classification of the elements of the universe.

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[1] By atomic complexity, I here mean the number of atoms linked in the molecule considered. That the molecules of small atomic complexity appear inanimate to us, nothing more conforms to the analogies of science. Many fundamental properties of matter (variation of mass, curvature of space, etc.) only become perceptible to us in the infinitely large or infinitely small. From this point of view one is able to say that biology is nothing other than the "physics of very large complexes", --the physics of the third infinite (that of complexity where life appears)."

[59] The term complexity will be used throughout this paper in the sense of true complexity.

[60] A single cell may have 10^{10} atoms and the brain of higher mammals often has 10^{10} cells. Hence, the brain of such a mammal would have 10^{20} atoms. Also, see footnote 58 which discusses this point.

[61]Another example is the individual person who through his leadership ability catalyzes the formation of a new organization. This is a process which is analogous to the organizational activity of a single reduplicating DNA strand lining up the appropriate bases it requires for the synthesis of its complement.

[62]Teilnard views the individual person as a single molecule and hence a grouping of such persons would be a human macro-molecule or some kind of ultra-human molecule. See footnote 58.

[63](Kemble, 1966, p. 429) "A discussion of the major features of the second law of thermodynamics which are relevant to an understanding of Teilhard's law of complexity/consciousness is presented in the following passages from Kemble:

Obviously, the second law of thermodynamics implies a practical distinction between high-grade energy and low-grade energy. Mechanical and electrical energy are of the highest grade. Either can be used to do mechanical work with an amount of waste that is small and has no theoretical lower limit. Chemical energy can be used in the same way to operate electric motors. On the other hand, thermal energy can be converted into work only to a limited extent. It is low-grade energy whose value depends on its temperature and on the lowest condenser temperature available to the man who wishes to use it. If the temperature of the coldest dumping place for heat is T_2, the fraction of an energy supply at temperature T_1 that can be converted into work is at most $(T_1 - T_2)/T_1$.

The spontaneous natural processes by which the world about us is continually changed are processes that normally involve a partial degradation of energy, that is, the transformation of higher-grade energy into lower-grade energy. This generalization is obviously true, for example, of the flow of heat by conduction from one body to another at a lower temperature and of the production of heat when a moving body is slowed down by frictional forces. Both processes develop in one direction only. They cannot be directly reversed, for heat never flows in the direction of increasing temperature and a moving body never gains kinetic energy at the expense of the thermal energy of the fluid in which it moves. Moreover, it turns out that the degradation of the energy of the universe accompanying these processes cannot be undone by any conceivable process consistent with the second law of thermodynamics. They are in an absolute sense irreversible. The same irreversible degradation of energy accompanies a host of other natural processes, such as the generation of heat by electric currents, the combustion of fuels,

and the oxidation of food in the body. It accompanies the transfer of thermal energy from high-temperature bodies to colder bodies by radiation, the mixing of gasses of different composition, the escape of air from a high-pressure tank into the atmosphere, the processes by which sugar, salt, and other substances dissolve in water.

(Kemble, 1966, p. 432-433) Similar gains in the over-all entropy of the systems involved occur when mechanical, electrical, or chemical energy is converted into heat and whenever pure substances are allowed to mingle with one another, as they do when sugar or salt is dissolved in water. In each case the increase in entropy is a measure of the degradation of energy that accompanies the process. There is no natural process leading to a decrease in the total entropy of the bodies affected. It is easy to decrease the entropy of an individual thermodynamic system by cooling it, but the reduction is always more than offset by an increase in the entropy of other bodies involved. To be sure; the net over-all change in entropy is zero in the slow, reversible changes of state first conceived by Carnot for his ideal heat engines. But these processes, however useful for mental experiments, are not realizable in practice. Every actual change in the state of a thermodynamic system involves some net increase in the entropy of the universe.

(Kemble, 1966, p. 435) In kinetic-molecular theory, entropy has a notable statistical interpretation: It is a measure of disorder. The growth of entropy in the universe is accordingly the growth of disorder. Of course, our ordinary intuitive understanding of the word "disorder" is much too vague to serve as the basis for a statistical definition of entropy. Without entering into details, we may note here that the key to the connection is to be found in the fact that a collection of many elements is considered to be ordered when it is arranged in a definite pattern but disordered when there is no pattern or when the arrangement is "haphazard." If the number of elements is large, the number of disorderly arrangements is always very large in comparison with the number of orderly ones. Hence, disorderly arrangements are inherently more probable than orderly arrangements. That is why accidental, uncontrolled circumstances always tend to create disorder out of the orderly patterns that we as human beings try so hard to impose on our surroundings."

[64](Kemble, 1966, p. 434) "Decades before the astronomers conceived of an expanding universe, the tendency of finite physical systems to move from states of smaller entropy to states of larger entropy was interpreted as an indication that the universe as a whole is running down--moving toward an ultimate dead state in which nothing can happen because all high-grade energy has been used up. The philosophers of ancient Greece thought of the history of the

universe as an ever-recurring cycle of states, like the cycle of the seasons, that would continue without end. This possibility seemed to be ruled out when the entropy law was discovered in the nineteenth century. Today, the steady-state cosmology of Hoyle, Bondi, and Gold (cf. Chap. 5, Sec. 8) provides a scientifically respectable modern version of the Greek view. The alternative conception suggested by the growth of entropy and the recession of the galaxies is that the universe is slowly and majestically evolving from a remote time of birth to a perhaps equally remote time of death. The issue is not yet resolved, but, whatever view is destined to prevail, the growth of entropy is certain to remain a major factor in the evolution of our planet and of the heavens above."

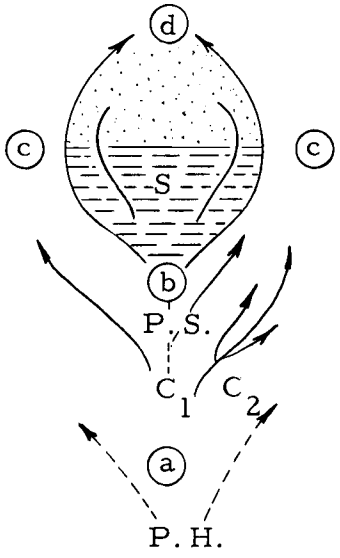
(Kemble, 1966, p. 149) Again, according to the new theory of a relativistic steady-state universe our present universe will not disintegrate as predicted by the second law.

"To escape from such difficulties, a relativistic "steady state" cosmology was propounded in 1948 by Fred Hoyle and independently by Hermann Bondi and Thomas Gold. This bold new theory starts with the radical assumption that the universe as a whole does not share in the evolution of the stars and galaxies. It postulates, on the contrary, that the galactic universe is infinitely old and has always looked very much as it does now. To compensate for the aging of the stars and the continual thinning of the population of galaxies by recession, it supposes that hydrogen gas is constantly in process of creation in interstellar space. The hydrogen forms new galaxies as the old ones radiate their energy and move away. The theory is attractive in its simplicity and explains the mixture of young and old stars and galaxies revealed by our telescopes. The required rate of formation of hydrogen is too small to be directly detected--a tenth of a gram per second in the entire volume of our solar system--so that the assumption that this hydrogen is formed spontaneously out of nothing is not in conflict with any direct observation. On the other hand it violates the most cherished principles of physics: the law of the conservation of energy and the second law of thermodynamics (cf. Chap. 15). Such violations would not destroy these principles but would limit their validity and make them less than absolute. The outcome of the continuing search for a decisive test is not yet clear."

[65](Teilhard, 1965, p. 232) The following diagram presents Teilhard's conception of man's convergent evolution.

Figure 3. Diagram explaining the history of the structure of the human phylum.

P. H., pre- or para-hominians (Australopitheci, etc.)
P. S., Men of the pre- or para-sapiens type (Pithecanthropoids, Neanderthaloids, etc.) S., H. sapiens
a., Initial critical point of reflexion (beginnings of hominsation)
b. Decisive emergence, with H. sapiens, of Co-reflexion
c. c., (present-day)passage for humanity, in the course of co-reflexion, from the dilated to the compressed phase of his evolution
d., Position presumed (by extrapolation of a higher critical point of supra-reflexion (Point 'Omega')
C_1 and C_2, African and Southern Asiatic focuses of hominisation (C_2 miscarrying with the Pithecanthropines) (Teilhard, 1965, p. 232)



[66]In terms of Teilhard's Christian theology, the third mutation of the Weltstoff will usher in the era of unending universal love of all men for one another. This era will only occur after the second coming of Christ, Omega, at the end of the world.

[67]Teilhard (Teilhard, 1965, p. 264) states that the third mutation of the Weltstoff will be an "ultimate break-up of the partnership complexity-consciousness to release in the free state a thinking without brain, the escape of some part of the Weltstoff from entropy..."

[68]Teilhard's reasons for accepting this alternative will be discussed at length in the next chapter.

[69]Teilhard states that this integration of the human person within a larger organism does not in any way dehumanize or mechanize the individual as do present day totalitarian regimes. On the contrary, man's freely chosen incorporation into a cosmic organism will produce the maximum development of his individual personality.

[70](Teilhard, 1966, p. 121) Teilhard concisely summarizes his

views in the following footnote:

"One might say (and it would be a fair summary of the whole content of this book) that every being (every corpuscle) appears figuratively to our experience as an ellipse drawn with two foci of unequal "power": a focus of material arrangement (or complexity), F 1; and a focus of consciousness (or interiority), F2.

During pre-life, F1's activity is practically nil (this is the domain of chance). Then it gradually (cf. p. 108) rises up to the thread of life--until the "threshold of reflection", when the balance is reversed. Starting with man, it is F2 that takes the initiative in the arrangements that bring about the rise of the power of F1 (rebound of evolution through reflective invention); while at the same time it becomes progressively more sensitive (to the point of turning in and back upon itself) to the continually growing, and finally exclusive, attraction of Omega.

This amounts to saying that everything comes about, in the course of cosmic convolution, as though the superstructure (the psychic) were gradually replacing the infra-structure (the physical) as the consistent portion of the vitalised particles."

[71]Prior to the emergence of man the initiation of new and more complex arrangements of matter was caused by the chance collisions of matter and the expenditure of tangential energy. For example, two compounds, A and B, will combine to form a larger molecule, AB, if they have a suitable physical structure, spatial proximity to one another, suitable energy levels, etc. On the other hand, after the appearance of man the emergence of more complex arrangements of matter such as human society and culture is initiated primarily by the expenditure of radial energy. However, man is a biological organism that moves its body through space, digests food, etc., and hence must expend large amounts of tangential energy in all of its activities. Hence, even though the cultural and moral bonds of human society are initiated and directed by the expenditure of radial energy their formation requires the expenditure of much tangential energy. In short, prior to the appearance of man new arrangements of matter are primarily initiated by chance collisions and the tangential energy of matter which can be described by the deterministic laws of chemistry and physics. On the other hand, after man's appearance new arrangements of matter are primarily initiated by the inventiveness of human thought which requires the expenditure of radial energy.

[72](Teilhard, 1966, p. 121) Teilhard describes this process as the "rebound of evolution through reflective invention". See footnote 70, for the entire passage.

[73]Not all of the energy of the world is transformed into personality but some is probably lost by entropy as will be noted in the next section.

[74]Hence, tangential energy has a dual function. It leads to both syntheses and disintegrations of matter. Every decrease in entropy, i.e. every synthesis of a more complex arrangement of matter, in one part of the universe is paid for by a net increase of entropy in some other part.

[75]Tangential energy is, of course, used in the process of complexity/consciousness, but, in the final analysis, tangential energy is ultimately derived from radial energy.

In other words, the fundamental process of change in the world is essentially a psychic (spiritual) one. Teilhard (Teilhard, 1968c, p. 89) states: "As for me.... I've reached the point of being unable to imagine the world, even physically, other than in the form of a huge movement of spirit."

[76]The individual persons who have died now already exist outside of our empirical world of space and time and hence are already incorporated into the cosmic organism of the future. Now, after the third mutation of the Weltstoff, all human life in our empirical world of space and time will end. Hence, after this mutation, all human persons will exist outside of space and time in a cosmic organism.

[77](Teilhard, 1968a, p. 164-165)"Christ coincides (though this assertion will have to be examined more deeply) with what I earlier called Omega Point.

Christ, therefore, possesses all the super-human attributes of Omega Point.

Those two propositions, to my mind, sum up the passionate expectations contained in our Christology and express the progress it is already effecting.

Christ-Omega

We may dig things over as much as we please, but the universe cannot have two heads--it cannot be 'bicephalic'. However supernatural, therefore, the synthesising operation attributed by dogma to the Incarnate Word may ultimately be, it cannot be effected in a divergence from the natural convergence of the world, as defined above. The universal Christic centre, determined by theology, and the universal cosmic centre postulated by anthropogenesis: these two focal points ultimately coincide (or at least overlap) in the

historical setting in which we are contained. Christ would not be the sole Mover, the sole Issue, of the universe if it were possible for the universe in any way to integrate itself, even to a lesser degree, apart from Christ. And even more certainly, Christ, it would seem, would have been physically incapable of supernaturally centering the universe upon himself if it had not provided the Incarnation with a specially favoured point at which, in virtue of their natural structure, all the strands of the cosmos tend to meet together. It is therefore towards Christ, in fact, that we turn our eyes when, however approximate our concept of it may be, we look ahead towards a higher pole of humanisation and personalisation.

In position and function, Christ, here and now, fills for us the place of Omega Point."

[78]Simpson refers to Teilhard as a "mystical evolutionary theologian"(Simpson, 1964, p. 224) and he describes his system of thought as a form of evolutionary theology.

CHAPTER V

AN ANALYSIS OF TEILHARD'S ARGUMENTS FOR HIS NEW CONCEPTION OF MATTER

Introduction

The preceding chapter presented a description of Teilhard's conception of the world. This discussion was necessary to provide a context for the presentation and analysis of Teilhard's arguments in the present chapter. The arguments which will here be discussed are those which are related to his new conception of matter. In the next chapter Teilhard's cosmic vitalism which has been presented in chapters IV and V will be related to the vitalism/mechanism debate that was presented in Chapters II and III. Finally, Chapter VII will present some of the fundamental weaknesses of Teilhard's cosmic vitalism.

First, let us see why it is important to analyze Teilhard's new conception of matter. In Teilhard's view, all matter has the property of consciousness. Further, matter is energy in the corpuscular or particulate state. Radial (psychic) energy is the fundamental energy of the world and all tangential (physical) energy is derivable from it. Hence, matter which is a particulate form of energy is ultimately made of psychic (spiritual) energy. Therefore, in Teilhard's world, Weltstoff is really spiritual Weltstoff.

Next, the cosmic process of complexity/consciousness would

never be able to produce a transcendent cosmic organism unless matter was conscious. Further, a transcendent cosmic organism could never be produced unless there now existed a transcendent cosmic vital principle. Hence, the notion of conscious matter, spiritual Weltstoff, plays a key role in Teilhard's thought.

The remainder of this chapter will examine the arguments for his new conception of matter. Two kinds of arguments will be examined. (A) There are those which attempt to show why the non-conscious or inert matter of modern science is inadequate. (B) There are those which attempt to prove the necessity of postulating the existence of a conscious matter.

Arguments Which Attempt to Show the Inadequacy of the Concept of Inert Matter

Inert Matter and Mechanism: The Notion of Inert Matter is Inconsistent with the Concept of a Transcendent Organism

Let us first try to understand why Teilhard thinks that the process of complexity/consciousness requires a conscious matter. The important characteristic of this process is that it is gradually forming a cosmic organism which will have an unending life in a transcendent world. Hence, in order to understand Teilhard's need for conscious matter let us first see if the non-conscious (inert) matter of present day science can evolve into a transcendent cosmic organism.

Consider first the mechanistic g.c.s. of present day science. For the mechanist, life and consciousness are the accidental by-products of biochemistry. Further, the real processes of nature are the interactions of matter which are determined by the laws of tangential (physical) energy. But one of the main laws of physical energy is the second law of thermodynamics and it states that all matter will eventually disintegrate. Hence, all life and consciousness will eventually disappear from the universe.

Teilhard rejects the mechanistic view of matter for two main reasons: (A) It entails the total death of all life and consciousness. Total death is inconsistent with the formation of a transcendent cosmic organism which has unending life. (B) A Weltstoff which is identical with deterministic matter has no consciousness and hence is incapable of developing into the thought of man. Only a conscious matter can evolve into the conscious thought of man (79). Finally, the first reason, (A), appears to be Teilhard's most fundamental one for rejecting mechanism (80).

Inert Matter and Dualistic Vitalism: In Dualistic Vitalism the Phenomena of Inert Matter are not Physically Connected With Those of Life and Consciousness

Consider next the position of the dualistic vitalists. Matter has the same properties as it does for the mechanist and hence it is unable to be transformed into a transcendent cosmic organism.

However, dualistic vitalists are often spiritualistic philosophers who believe in the existence of a community of immortal souls, a cosmic organism which resembles Teilhard's. Hence, dualistic vitalists argue that the world must contain another category of reality, minds or vital principles, in addition to the realm of inert matter. Minds or vital principles are transcendent entities which mysteriously interact with a world of inert matter. In short, vitalistic dualists affirm the existence of a transcendent realm of life by defending a metaphysical dualism.

Teilhard rejects the position of dualistic vitalism for the following reasons: (A) It posits a mechanistic conception of matter. (B) There is no intelligible connection between the worlds of mind and inert matter. It is not clear how mind or soul directs the activities of inert matter. (C) The transcendent organism is not generated by any physical process of matter and hence it is not subject to scientific verification. In brief, dualisms are unscientific (81).

Arguments which Attempt to Demonstrate the Necessity For Postulating the Existence of a Conscious Matter

Man Has a Psychological Need for Irreversible (Immortal) Life

Man is a chemical molecule which has the unique property of self-consciousness. Further, individual men are now gradually becoming incorporated into a cosmic organism. Now, human beings do

not form bonds, interpersonal relations, with each other in a purely random manner as do some less complex molecules. On the contrary, human action and thought is activated by motivation. The intensity of human action and thought is dependent upon the intensity of its motivation. In the present compressive phase of man's convergent evolution his problems such as overpopulation, environmental pollution, war, etc., are increasing at an alarming rate. Hence, there is an increasing need for man to be motivated to form suitable relationships with others in order to solve these urgent problems. In other words, man's gradual incorporation within a cosmic organism is a process which requires the activation of individuals with suitable motives for thinking and acting.

What then are suitable motives? They are ones which present a conception of the universe which will activate the entire mass of humanity to continue its cultural evolution in spite of the alarming increase of social problems. Teilhard, is convinced that man will freely cooperate with maximum effort to promote his cultural evolution, his incorporation into a cosmic organism, only if he is strongly motivated to do so. Further, man thoroughly wants to realize only those goals which appear to be indestructible. Hence, if man is to freely cooperate with maximum effort to further his incorporation within a cosmic organism then he must be convinced that the latter is in some way indestructible. On the other hand, if man were truly

convinced that he lived in a world in which there is eventually a total death of all life and of all of man's work, then all human motivation to think and act would be destroyed and the entire human race would go on strike and refuse to promote its cultural evolution. Here the plight of the human race would resemble that of trapped miners. If the latter, for example, were thoroughly convinced that it was impossible to escape alive then no would would rationally plan or do anything to escape. Hence, a suitable motive for mankind is one which contains the conception of an open universe in which man can permanently escape death (82).

Next, why does Teilhard assert that man has the psychological need for an irreversible life? He admits that there can be no strict rational proof for this. However, he is convinced that any thorough and honest introspection (83) of the contents of human motivation will reveal the truth of his conclusion (84). Further, even though most present day men are not aware of any need for immortality Teilhard is convinced that the mankind of the near future will become aware of it (85). Thus, Teilhard has attempted to reveal the existence of man's psychological need to live in a universe in which the intensification of man's consciousness terminates in his incorporation into a transcendent organism.

Irreversible Life Does Exist in the Universe

Now, it is one thing to reveal a psychological need for something and it is quite another to show that there exists some reality in the world which can satisfy it. Hence, we must ask: Does irreversible life exist in our world? Teilhard's answer is: Yes. If irreversible life did not exist then the world would be unable to sustain an evolution it had started. Such a world, in Teilhard's opinion, would be logically incoherent and hence absurd (86, 87). In brief, irreversible life must exist because the universe is not absurd. Teilhard thinks, on the contrary, that the universe is a rational coherent whole and hence it could not fail to fulfill the deepest longings of man.

Teilhard's Postulated Existence of Irreversible Life in the Universe is Inconsistent with the Present Scientific Conception of the World

Teilhard's belief in the existence of irreversible life in the world, an after-life for man, is flatly contradicted by our present mechanistic g.c.s. For the mechanist tangential (physical) energy is the fundamental energy of the world and hence radial (psychic) energy is derived from it. The spiritual phenomena of life and consciousness are simply the products of biochemistry. Further, all syntheses of matter will eventually disintegrate in the cosmic process of entropy. Therefore, the universe cannot generate irreversible life.

Teilhard Attempts to Resolve the Contradiction Between the Postulated Existence of Irreversible Life and the Scientific Conception of the World by Radically Changing the Mechanistic g.c.s.

Teilhard attempts to resolve the conflict between the psychological needs of human conduct and our present day scientific conceptions of the world by turning the mechanistic g.c.s. upside down. He modifies the mechanistic g.c.s. as follows: radial (psychic) energy rather than tangential (physical) energy is the fundamental energy of the world and hence tangential (physical) is derived from radial (psychic) energy. Further, if radial (psychic) energy is the fundamental one then the fundamental property of matter must be consciousness. For all matter is essentially energy in a particulate state and hence radial energy in the particulate state must be conscious matter. Also, the function of radial energy is to synthesize higher states of consciousness. Now, if this reversal of the relative importance of these two kinds of energy is made, then Teilhard thinks that two important goals are realized. In the first place the traditional laws of physics remain valid in the realm of pre-life. In the vast realm of pre-life, the realm of inorganic phenomena, the consciousness and hence radial energy of matter exists in a too highly subdivided state to exhibit detectable consciousness. The interactions of such matter are describable by the usual laws of physics. Secondly, a psychic or spiritual Weltstoff can develop into an irreversible life which escapes the

disintegrating process of entropy. In short, Teilhard thinks that he has developed a new conception of matter that is coherent with both the laws of physics and with the existence of irreversible life in the universe (88).

The Ultimate Foundations of Teilhard's Argument

The Major Problem is How to Justify Both the Cosmic Extension and Primacy of the Process of Complexity/Consciousness

A major assumption in the preceding discussion was that the process of complexity/consciousness has a cosmic extension. It is clearly an historical fact that increasingly complex organisms have emerged after a period of chemical evolution. Also, increasingly complex arrangements of matter have been associated with increasing levels of consciousness. Further, this process has only been observed to occur on the surface of the earth and the latter is only a tiny speck of dust in the vast universe. Hence, what kind of justification does Teilhard give for inferring that this process not only has cosmic extension but that it is the fundamental process of the world? An answer to these questions will reveal Teilhard's most fundamental conceptions.

The Goal of Teilhard's Thought is the Search for An Integration of the Whole Phenomenon of Man Within a Scientific Conception of the World

When Teilhard presents his ideas about the process of complexity/consciousness and the structure of matter what does he think he is accomplishing? In the beginning of one of his major works, The Phenomenon of Man, he clearly states some of his major goals (89). His work is intended to be a scientific treatise which provides a scientific description of the universe in which the whole phenomenon of man is integrated. He explicitly denies that he is writing an essay on metaphysics or theology. Further, he also explicitly denies that he is giving any explanation of the ultimate nature of reality. The latter would be a metaphysical undertaking. In other words, he states that he is trying to attain purely scientific results.

Next, what is the whole phenomenon of man which Teilhard wants to integrate within his scientific description of the universe? There are two ways to obtain data about the phenomenon of man. One can observe man from without. In this way data are obtained through the five senses. Or, one can observe man from within. In this way data are obtained through introspection (90). Now, many kinds of insights or knowledge can be grounded on the various kinds of data. Teilhard recognizes the existence of valid scientific, mystical, moral and theological insights. For example, man's need for irreversible life is a moral or theological insight which has an important function

in Teilhard's conception of the world. Hence, the whole phenomenon of man which Teilhard examines includes all of the major kinds of human experience (91). In brief, Teilhard wants to construct a scientific description of the world that is logically coherent with all of man's insights.

Teilhard's Reason for Seeking an Integration of The Whole Phenomenon of Man Within a Scientific Conception of the World in his Mystical Intuition of the Wholeness of the World, His Adoption of Monism

Let us first examine Teilhard's monism. Briefly, philosophers adopt one of two mutually exclusive positions, pluralism or monism. For the pluralist the entire world of reality consists of a vast multitude of distinct and independent things. The latter often have many interconnections because they interact in various ways. However, the independent reality of each member of this plurality is its most fundamental feature. In other words, the pluralist finds no need to postulate the existence of any underlying reality and hence unity behind the plurality of the things of our experience.

On the other hand, the monist thinks that the entire universe is a single cosmic whole (92). The vast plurality of things in our experience are really elements or parts of the cosmic whole, the universe. Hence, there is an underlying reality behind the plurality of things in our experience. For the pluralist, then, our universe is a vast

aggregation of independent realities whereas for the monist, it is a single reality which contains a vast number of distinct elements or parts (93).

Now, Teilhard adopts a form of monism because he claims that he has had primordial intuitions in which he has seen that the world is a whole and that he is a part of it. Further, he states that such intuitions belong to the "polymorphous domains of mysticism (religious, poetical, social and scientific)" (Teilhard, 1969b, p. 25; also Cf. footnote 94). Hence, his primordial intuition of the whole of the world is a mystical one. Descriptions of such intuitions occur in many places throughout his works (95). In short, Teilhard's adoption of monism is ultimately based upon mystical experience.

Secondly, Teilhard is convinced that the evidence for the underlying reality of the world, its wholeness, is direct. This underlying reality can be directly revealed to man. It is grasped by a primordial intuition. But what part of our mind has such intuitions? Teilhard's answer is that every man has a "cosmic sense" which is the faculty by which he can have primordial intuitions of the whole of the universe. Man is by nature sexual and hence can have intuitions of love for the opposite sex. Similarly, man is by nature equipped with a "cosmic sense" and hence can have intuitions of and an attraction for the whole of the universe of which he is an element or part. Thus, all men have a faculty which gives them the ability to

grasp the wholeness of the universe in a primordial intuition.

Further, Teilhard explicitly states that this intuition of the wholeness of the universe is the foundation of his thought. It provides him with an infallible and hence absolute knowledge of the world. He further admits that this intuition generates within him a "passionately felt attraction" (Teilhard, 1969b, p. 26) for the whole of the universe. The whole which is so intuited is a "mighty primordial current" (Teilhard, 1969b, p. 26) which enables him to determine the general structure of the universe in which we are living. Hence, this "mighty primordial current" (Teilhard, 1969b, p. 26), this whole of the universe, is the fundamental objective reality or absolute with which Teilhard begins.

Now, it is evident that most clear-thinking scientists have no such mystical intuitions of the whole of the universe. Most scientists are very practical men who adopt a pluralistic view of the world. They see the world as a vast aggregate of interacting and independent material entities. They spend their lives studying some arbitrarily chosen part of this aggregate. Teilhard is undoubtedly aware of this situation and he accounts for it by saying that such pluralists are persons whose cosmic sense is either atrophied or dormant. For Teilhard pluralists are really monists, but they are not aware of being so. Hence, Teilhard differentiates himself from the majority of his fellow pluralistic scientists in terms of his claim to possess a special

intuition, a mystical experience, of the ultimate nature of reality (96).

The Universe is a Dynamic and Evolving Whole

So far we have seen that the universe is a whole and therefore that is has an underlying unity. The next question then is: What is the underlying reality of the world which is the cause of its unity? Teilhard's answer is that this reality is the cosmic process of duration or "organic time" (Teilhard, 1969b, p. 28). Organic time is measured by the development of global reality, chemical and biological evolution. In other words, the universe is a dynamic and evolving whole because the underlying reality which is the cause of its ultimate unity is a cosmic process of organic development (97).

A Cosmic Process of Spiritual Evolution, the Process of Complexity/Consciousness, is the Unifying Principle of the World

As we have seen a cosmic process of change is the unifying principle of the world. The plurality of the things of our experience are unified by this process. Hence, the next question is: What is the precise nature of this cosmic process of change or development?

It is at this point in the argument that Teilhard attempts to "prove" that the process of complexity/consciousness has a cosmic extension. Now it is a fact that organisms with a more developed consciousness have emerged from those in which it is less developed.

Further, the most highly conscious organism we know is man. Now, does this development of increased consciousness on the surface of the earth have cosmic extension?

Teilhard's answer is yes and his attempted "proof" is as follows: We want to construct a new conception of the world, a general conceptual system. However, the latter task presupposes the choice of a suitable model. For example, in the seventeenth and eighteenth centuries the model of the world was that of a gigantic machine whose behavior could be described in terms of the laws of mechanics. Now, Teilhard's model of the world is the human personality. Of all of the elements in the world the human personality is the key one because everything else can be understood in terms of it. In an analogous way the seventeenth century scientists understood all of the events of the universe in terms of the mechanical laws of machines. In short, Teilhard's choice of a new model for the physical world is the first step in his argument.

The next step is the formulation of an hypothesis. It states that the fundamental cosmic change which is the underlying cause of the world's unity is the development of personality, the "flux of personalization" (Teilhard, 1969a, p. 57). This means that the development of the physical world is a cosmic process which is directed to the production of increased states of personality. Further, the main characteristic of personality is its reflective consciousness.

Hence, the fundamental cosmic process is the development of increased consciousness in the world. This is the essential characteristic of what was previously described as the process of complexity/ consciousness. In the second step of the argument, Teilhard uses his model to construct the hypothesis that the process of complexity/ consciousness is the fundamental one of the world and hence has cosmic extension.

In the next stage of the argument Teilhard asks the question: Can this hypothesis be established? His answer is: Let us assume that this hypothesis does correctly describe the fundamental process in the world. We must next determine if the assumed truth of this hypothesis is coherent, logically consistent, with the totality of our experience. The totality of our experience includes existing scientific laws as well as the various kinds of mystical, moral and theological insights or knowledge that were discussed earlier. Teilhard wants his hypothesis to integrate the whole phenomenon of man within a conception of the universe. Now, if this new hypothesis is logically inconsistent with any component of our experience then it should be abandoned. On the other hand, if it is consistent then we should think that "We have come near to the truth" (Teilhard, 1969a, p. 54; also Cf. footnote 98). Now, Teilhard is convinced that his hypothesis is not inconsistent with any of our experience. Hence, he thinks that it is established (99, 100).

Summary

So far, the analysis of Teilhard's argument has shown how his acceptance of monism, a fundamental premise, leads to the affirmation of the cosmic extension of the process of complexity/consciousness. A crucial part of this argument is the use of the human personality as a model of the universe. Hence, we must now ask why any self-respecting twentieth century scientist would think of choosing the human personality as a model of the universe (101). The answer to this question will reveal two additional premises of Teilhard's thought, his criterion of reality and the logical priority of synthesis over analysis.

Teilhard's Cosmic Process of Complexity/ Consciousness is an Example of a Synthetic World Hypothesis

One of Stephen Pepper's monumental works, World Hypotheses, (Pepper, 1948) clearly shows that in the last twenty-five hundred years of Western thought, four major kinds of world hypotheses have been developed. A world hypothesis is equivalent to the notion of a general conceptual system which has been discussed in numerous places in this paper. According to Pepper, the distinguishing characteristics of a world hypothesis is that no facts are irrelevant to it (102). For example, the mathematician who wants to demonstrate the

truth of a mathematical hypothesis legitimately eliminates data about the history of civilizations because they are irrelevant. On the other hand, the proponent of a world hypothesis cannot consider data from such diverse fields as physics, theology and the history of civilizations as irrelevant. Clearly, then, Teilhard's process of complexity/consciousness with its associated concepts is an example of a world hypothesis. For Teilhard wants to integrate the totality of human experience within a new conception of the world.

The four kinds of world hypotheses, Formism, Mechanism, Contextualism and Organicism, can be divided into two classes, the analytical and the synthetic. Formism and Mechanism are analytical world hypotheses. They assume that the products of intellectual and scientific analysis such as atoms and electrons are the really real entities, the true building blocks, of the world. Such elements or factors are the starting points, the basic facts, of any analytical world hypothesis. Given such independent elements as atoms and their physical laws an analytical world hypothesis such as mechanism will attempt to reconstruct or synthesize a conception of the world from its elements. On the other hand, contextualism and organicism are synthetic world hypotheses. The proponents of the latter say that the really real entities of the world are always gestalts, complexes or wholes. These are the true building blocks of any world hypothesis (103).

In other words, there are two different starting points for the construction of a world hypothesis. The proponents of analytical world hypotheses start with independent entities, the really real, which cannot be further subdivided by analysis and proceed to reconstruct or synthesize a conception of the world from them. Hence, the process of analysis is here logically prior to that of synthesis. On the other hand, the proponents of synthetic world hypotheses start with some ordered grouping of elements, a gestalt or whole, the really real, which can subsequently be analyzed into its components. Hence, the process of synthesis is here logically prior to that of analysis. In brief, the proponents of analytical and synthetic world hypotheses differ in their conception of what is really real and in the logical priorities between analysis and synthesis.

Teilhard's Synthetic World Hypothesis Affirms the Logical Priority of Synthesis Over Analysis

Teilhard is clearly a proponent of a synthetic world hypothesis. In the first place he affirms the logical priority of synthesis over analysis. A fundamental premise or belief about the world such as Teilhard's belief in monism is an intellectual synthesis. In psychological terms it is a gestalt. Such a belief or premise is a whole which cannot be logically derived from any number of prior premises (104). Hence, fundamental beliefs or premises are not products of a

chain of reasoning. They can only be adopted by persons who have had the appropriate intuitions or insights (105). But basic intellectual syntheses such as the belief in monism are the ultimate premises of Teilhard's thought. Thus, Teilhard affirms the logical priority of synthesis over analysis in the adoption of his fundamental premise of monism.

The Analytical World Hypothesis of Mechanism is Incapable of Reconstructing the Whole of the Universe Because the Whole of Any Reality is Always Greater than the Sum of Its Parts and an Analysis of a Whole Only Reveals Its Parts

If we attempt as good mechanists to intellectually reconstruct the world by starting with fundamental particles of matter which are the results of scientific analysis numerous spurious problems will be created (106).

The basic reason here is that the whole of any reality is always greater than the sum of its parts. Hence, no whole can be understood in terms of its fragments or parts. On the other hand, if we start with Teilhard's premise of monism which affirms the fundamental wholeness or unity of the universe, then we can formulate a conception of the world which is free of the previously mentioned problems. Teilhard, then, does not agree with the mechanistic scientists who think that an intellectual reconstruction of the world can be based upon our present scientific analysis of matter.

The preceding argument contains two important premises which must be further examined. They are: (A) The whole is greater than the sum of its parts and (B) scientific analysis reveals only the parts of a whole. An examination of Teilhard's reasons for affirming these two premises will reveal his criterion of reality which states that only synthetic realities such as "providence, the soul and divine life" (Teilhard, 1968a, p. 35) are really real. First, let us examine the nature of any whole. The whole of any reality includes an integrating principle, the synthetic element, and the elements or parts which are integrated. The integrating principle is an "imponderable" (Teilhard, 1968a, p. 29) which cannot be further analyzed whereas the integrated elements or parts are "ponderable" (Teilhard, 1968a, p. 29) and hence can be further analyzed. When the latter is performed a new integrator and its elements are revealed; this process of analysis can continue indefinitely. Further, the integrator is the principle which holds the parts together and hence it is what is really real in any whole. It is the source of a being's "consistence" (Teilhard, 1968a, p. 29). Hence, the statement "every whole is greater than the sum of its parts" means that every whole is something more than its parts. This something more is the integrating principle and hence is that which is really real in the whole. It is the soul, spirit or vital principle of a being which holds its parts or elements together. In short, every whole, whether it is an atom, molecule or a man, has a soul or

spirit, the really real, to integrate its parts (107).

The Really Real of Any Whole, Its Integrator, is Known by Intuition

Next, how do we obtain a knowledge of the whole of any reality? Scientific analysis breaks up wholes into their parts or elements. Now, a knowledge of all of the parts or elements of a given whole will not enable us to intellectually reconstruct it. No whole can be reconstructed without a knowledge of its integrator, the synthetic element. But, scientific analysis cannot reveal the latter. Hence scientific analysis alone will not enable us to reconstruct the whole of anything. It is impossible, according to Teilhard, to intellectually reconstruct the whole of anything by using the results of a scientific analysis of matter as the ultimate building blocks of our reconstruction.

If scientific analysis will not enable us to discover the whole of any reality, then we must begin with an intuition of its integrator or synthetic element, the really real of any whole. This is what Teilhard claims that he has done. For example, he explicitly states that his entire system of thought rests upon an intuition of the whole of the universe as mentioned earlier Thus, in order to grasp the whole of anything, its integrator or synthetic element must be intuited (108).

Teilhard's Conception of an Integrator and His Affirmation of the Priority of Synthesis are Two Different Expressions of His Fundamental Category of Thought, That of Integration

The preceding discussion has presented two additional premises of Teilhard's thought, his criterion of reality and his affirmation of the priority of synthesis over analysis. The criterion of reality states that the really real is the synthetic element, the integrator, of any given natural whole. This whole may, for example, be an atom, a man or the entire universe. Hence, for example, once Teilhard is convinced that the process of complexity/consciousness has a cosmic extension, his criterion of reality requires him to affirm that this process must be more fundamental or real than that of entropy. For the latter leads to the eventual disintegration of the universe whereas the process of complexity/consciousness is a synthetic one because it leads to the universe's integration (109). Secondly, his affirmation of the priority of synthesis over analysis means that the fundamental premises that are used in the construction of a world hypothesis are intellectual syntheses or wholes which are not logically reducible to any prior premises. Fundamental premises can only be grasped in an intuition as, for example, is the case with Teilhard's intuition of the whole of the universe. Finally, Teilhard's criterion of reality and his affirmation of the priority of synthesis over analysis are in

the final analysis really expressions of synthesis or integration at two different levels. In the real world outside of the mind the criterion of reality states that integrators, synthetic elements, are really real. For example, Omega is the most real entity in the world because it is the Integrator of integrators. There is also a corresponding situation in our conceptual world. The affirmation of the logical priority of synthesis over analysis means that our most fundamental beliefs about the world must be intellectual syntheses or gestalts. Teilhard's fundamental belief in the wholeness of the universe is an example of such an intellectual synthesis. Hence, in Teilhard's thought the category of synthesis or integration is the most fundamental (110).

The Human Personality is the Model of the Universe Because It is the Highest Integrator Which has Appeared in the History of the World

The aim of the previous discussion was an attempt to enter Teilhard's mind by examining his basic categories. Hence, it is now possible to answer the original question that was asked on page 151: Why would any scientist in the twentieth century choose the human personality to be the model of the physical world? Now, the really real in the world is always a synthetic element, an integrator or organizing principle. Hence, our model of the world must be centered on some integrator. But what is the highest integrator which has appeared in the history of the world and which is best known to us?

For Teilhard it is clearly the human personality. Man's superiority as an integrating element of the world is ultimately based upon the fact that he is the most conscious being which has emerged in the history of the world (111). Also, man can have a more thorough knowledge of himself than of anything else in the world. This is so because man can see himself from within through introspection whereas the non-human world can only be viewed from without through the senses. The human personality, then, is the highest synthetic reality which cosmogenesis has produced and hence it should be the key synthetic element in our conception of the world.

The Use of the Human Personality as the Model of the Universe is the Key to Teilhard's System of Thought (112)

Now, once the reasons for choosing the human personality to be the model of the universe are understood, then the other principle features of Teilhard's system become evident. If the human personality is the model of the universe then a study of man's requirements for growth and development is identical to a study of the physical requirements of cosmogenesis. For example, it was mentioned earlier that Teilhard thinks that man requires the existence of irreversible life in order to continue his evolution. Now, if the human personality is the model of the universe then this psychological requirement of man automatically becomes a physical requirement of cosmogenesis.

Hence, the Weltstoff of cosmogenesis must have the properties of consciousness in order to enable man to have irreversible (immortal) life. Similarly, some of the principle characteristics of the completed cosmic organism, such as its transcendence and personality, can be predicted from data about the needs of the human personality. In short, an understanding of the human personality is our key for understanding the structure of the universe (113).

A Summary of Teilhard's Argument for a New Conception of Matter

Teilhard's argument can be summarized as follows: Man has a psychological need to live in a universe in which each person has an irreversible (immortal) life. Man must live in such a world if he is to have the necessary motivation to continue his convergent evolution. Thus, the existence of personal immortality is a psychological requirement for human conduct.

On the other hand, our present scientific conception of the world, our mechanistic g.c.s., states that there will eventually be a total death of all life and consciousness in the world. The cosmic process of entropy is supreme. Hence, there is a fundamental conflict between the psychological needs of man and our present scientific conception of the world.

Teilhard attempts to resolve this conflict by radically changing our present mechanistic g.c.s. as follows: The fundamental property

of matter is its consciousness and hence the primary energy of the world is radial (psychic). Tangential (physical) energy is derived from radial (psychic) energy and not vice versa. Given this change in the mechanistic g.c.s. Teilhard thinks that he can accomplish two things. (1) A Weltstoff of conscious matter can be synthesized by the process of complexity/consciousness into an immortal human personality and hence into a transcendent cosmic organism. The inert matter of a mechanistic g.c.s. is not capable of any such development. (2) A Weltstoff of conscious matter is not inconsistent with the present laws of physics and chemistry. When conscious matter exists in a highly divided state its consciousness is not detectable and its behavior is accurately described by the present laws of physics and chemistry, i.e. conscious matter behaves as if it were totally inert or non-conscious. In brief, Teilhard thinks that his new conception of a conscious matter is consistent with both the psychological needs of man for irreversible life and with the existing laws of physics and chemistry.

Summary of Chapter

Teilhard's argument for his new conception of matter may be stated in an abbreviated form as follows: His fundamental starting point is an intuition which reveals that the universe is an organic and evolving whole. The universe is a genuine unity because all of its

parts or elements are connected by some fundamental process of change.

Next, how can this fundamental process of change be characterized? An answer to this question is a world hypothesis. Now, in order to answer this question some fundamental categories are needed. Categories are conceptual tools which enable us to organize our experience in certain ways. For the investigator of world hypotheses, categories organize the totality of human experience. Teilhard adopts what Pepper (Pepper, 1948, p. 280-314) describes as an organicist world hypothesis in which the central category is that of integration or synthesis. Hence, for Teilhard, the fundamental process of change in the world must be a succession of higher integrations.

But, what is the outcome of this succession? In order to answer this question a model of the universe is required. Now, if the fundamental process of change is moving toward higher integrations, then a model of the universe must be some integration or state of integration. For Teilhard, the model of the universe is the human personality because it is the highest integrator which has so far emerged in the history of the world. Hence, Teilhard's world hypothesis is that the fundamental process of change in the world is the development of higher states of personality. It is also described as the process of complexity/consciousness because higher states of

personality and hence of consciousness are associated with higher degrees of material complexity.

Now, how does Teilhard attempt to establish this hypothesis? He assumes that it is true and then sees if it is logically consistent with all known data. For there is no fact which is irrelevant to the truth of a world hypothesis. Teilhard did not find any facts of human experience with which his hypothesis was inconsistent. On the contrary, he thought that it was more consistent with the data than any alternative and hence he concluded that his hypothesis was established.

If the fundamental process of change is essentially a cosmic development of increased states of personality, then the Weltstoff must be concentrated and organized into higher states of consciousness which will eventually produce a transcendent state of consciousness, the cosmic organism. A growth in personality is always an increase in the level of consciousness. What kind of Weltstoff and what kind of energy are capable of developing in this way? The inert matter and physical (tangential) energy of the mechanistic world hypothesis are incapable of undergoing any such development. It is only a Weltstoff of conscious matter whose concentration and complexification is initiated by a psychic (radial) energy which is capable of developing into a transcendent state of personality, the cosmic organism. Thus, Teilhard's new conception of matter is based upon the requirements of the process of complexity/consciousness.

Hence, Teilhard's "proof" of his new conception of matter may be summarized in the following statements: (1) The process of complexity/consciousness is the fundamental process of change in the world. (2) This cosmic process terminates in the production of a transcendent cosmic organism. (3) The mechanistic Weltstoff of inert matter and physical (tangential) energy are incapable of undergoing a process of complexity/consciousness which leads to the formation of a transcendent organism. (4) It is only a Weltstoff of conscious matter and psychic (radial) energy which are capable of undergoing this process. In short, conscious matter is a necessary requirement of the process of complexity/consciousness.

FOOTNOTES FOR CHAPTER V

[79](Teilhard, 1969a, p. 22-23)"Instinctively, in their attempts to make an intellectual scheme of the universe, many men try to use matter as their starting point. Because matter can be touched, and because it appears historically to have existed first, it is accepted without examination as the primordial stuff and most intelligible portion of the cosmos. But this road leads nowhere. Not only does matter, the symbol of multiplicity and transience, escape the direct grasp of thought, but, more disadvantageously still, this same matter shows itself incapable by its very nature of giving rise to the world that surrounds us and gives us substance. It is radically impossible to conceive that 'interiorized' and spontaneous elements could ever have developed from a universe presumed, in its initial state to have consisted entirely of determinisms. Anyone who accepts this starting point blocks all roads that would bring him back to the present state of the universe. On the other hand, from a cosmos initially formed and made up of elementary 'freedoms', it is easy to deduce, by virtue of the effect of large numbers and habitual behaviour, all the appearances of exactitude upon which the mathematical physics of matter is founded. A universe whose primal stuff is matter is irremediably fixed and sterile;whereas a universe of 'spiritual' stuff has all the elasticity it would need to lend itself both to evolution (life) and to involution (entropy). This consideration must be enough to decide our intellectual choice."

[80]The mechanistic view that consciousness is an accidental by-product of biochemistry creates two problems for Teilhard. The first is: How can something which is totally non-conscious produce something which is highly conscious? However, let us assume, for the sake of argument that this question can be answered in biochemical terms. We would still have the second problem, one that is characteristic of Teilhard's vitalism. If consciousness is merely a by-product of biochemistry, then it is a purely transient and accidental event in the world. Hence, our second problem is: How can a transient consciousness which is a purely accidental event in the world become a permanent part of an immortal universe? It is this second problem which is raised by the mechanistic viewpoint that most disturbs Teilhard. For he is above all a Christian theologian who wants to live in a universe in which the individual human personality has an immortal (irreversible) life. In short, Teilhard's primary reason for rejecting mechanism appears to be its conflict with man's need for personal immortality.

[81](Teilhard, 1969a, p. 93-94) In the following passage Teilhard compares mechanism and dualistic vitalism with his own monistic vitalism:

"Around us, bodies present various qualities: they are warm, coloured, electrified, heavy. But also in certain cases they are living, conscious. Besides the phenomena of heat, light and the rest studied by physics, there is, just as real and natural, the phenomenon of spirituality.

The phenomenon of spirit has rightly attracted man's attention more than any other. We are coincidental with it. We feel it from within. It is the very thread of which the other phenomena are woven for us. It is the thing we know best in the world since we are itself, and it is for us everything. And yet we never come to an understanding concerning the nature of this fundamental element.

For some, heirs to almost all the spiritualist philosophies of former times, the spirit is something so special and so high that it could not possibly be confused with the earthly and material forces which it animates. Incomprehensibly associated with them, it impregnates them but does not mix with them. There is a world of souls and a world of bodies. Spirit is a 'metaphenomenon'.

For others, on the contrary, more or less belated representatives of nineteenth-century thought, spirit seems something so small and frail that it becomes accidental and secondary. In face of the vast material energies to which it adds absolutely nothing that can be weighed or measured, the 'fact of consciousness' can be regarded as negligible. It is an 'epi-phenomenon'.

I propose in these pages to develop a third viewpoint towards which a new physical science and a new philosophy seem to be converging at the present day: that is to say that spirit is neither superimposed nor accessory to the cosmos, but that it quite simply represents the higher state assumed in and around us by the primal and indefinable thing that we call, for want of a better name, the 'stuff of the universe'. Nothing more; and also nothing less. Spirit is neither a meta- nor an epi-phenomenon; it is the phenomenon.

To establish the value of this new viewpoint, which is charged with moral consequences, my only form of argument will be that universally employed by modern science, that and that alone: by which I mean the argument of 'coherence'. In a world whose single business seems to be to organize itself in relation to itself that is by definition the more true, which better harmonizes in relation to ourselves a larger body of facts. If therefore I can succeed in showing that, regarded from the point of view I have chosen, the universe harmonizes better with our experience, thoughts and actions than the two contrary viewpoints, I shall have established in so far as is possible the truth of my thesis.

Let us make the attempt."

[82]This is to be contrasted with a closed universe in which there is eventually a total death of all life and consciousness. The conception of such a universe could never be a suitable motive for mankind.

[83]The reason why Teilhard makes extensive use of introspective data and insights will be discussed later in this paper.

The use of introspective data such as man's awareness of a need for irreversible life is obviously an illegitimate procedure in our present mechanistic g. c. s. But one of the main points of this paper is that Teilhard wants to radically change our present g. c. s. to such a degree that the use of such data would no longer be illegitimate. In short, Teilhard is attempting to alter our fundamental conception of science.

[84](Teilhard, 1965, p. 263) "All that I can do, indeed, is to refer everyone to the witness of his consciousness--or at the very least of his more closely analysed sub-consciousness. At present, as I know, plenty of excellent workers on earth imagine that they could go on working with all their hearts and energy, whatever the fate ultimately in store for the fruit of their discoveries. But I cannot really believe them. For all that I have been able to understand (in them as in myself) about the true motives ultimately inspiring the human passion to know and do, has never failed to persuade me that what, despite all sorts of denials, sustained the most agnostic and sceptical scholars in their efforts was the obscure conviction of collaborating, in the words of old Thucydides, in a work that will never end."

In the following passage Teilhard clearly states how he answers his opponents who do not believe in the psychological need for irreversible life.

(Teilhard, 1969b, p. 40-44) "We act, true enough--but what structural properties must the real possess if it is to be possible for this movement of the will to be effected? What conditions must the world satisfy if it is to be possible for a conscious freedom to operate in it? Following Blondel and Le Roy, the answer I give to this problem of action is: "If that thing, apparently so small, which we know as human activity, is to be set in motion, nothing less is required than the attraction of a result that cannot be destroyed. We press on only in the hope of an immortal conquest." And from this I draw the direct conclusion that "ahead of us there must therefore lie something that is immortal."

Let us examine in turn the major premise and the middle term of this argument.

First, the major: this seems to me to represent an elementary psychological fact, even though to perceive it calls for a certain training of the inner eye. For my own part, the thing is clear: in the case of a true act (by which I mean one to which one gives something of one's own life), I cannot undertake it unless I have the underlying intention (as Thucidydes noted many centuries ago) of constructing "a work of abiding value"--not, of course, that I am so vain as to wish to bequeath my name to posterity, but some sort of essential instinct makes me guess at the joy, as the only worthwhile joy of cooperating as one individual atom in the final establishment of a world: and ultimately nothing else can mean anything to me. To release some infinitestimal quantity of the absolute, to free one fragment of being, forever--everything else is but intolerable futility.

I have often made myself question the value of this interior evidence. Numbers of my friends have assured me that they have experienced nothing of the same sort themselves. "It is a matter of temperament," they have told me, "You feel the need to philosophize. But why rationalize one's tendencies? We simply work and go on with research because that is what we like doing, just as we have a drink." And, being certain that I have seen deep inside myself an essentially human, and therefore universal, characteristic, I answer them, "You are not searching to the full depth of your heart and mind. And that, moreover, is why the cosmic sense and faith in the world are dormant in you. You find satisfaction in the fight and the victory, and it is there that the attraction lies. But can you not see, tnen, that what is satisfied in you by effort is the passion for being finally and permanently more--supposing that some day (no matter how distant) notning were to remain of your work, for nobody? In its present form, your zest for life is still emotional and weak. I seem to you peculiar and exceptional because I am trying to analyze my own zest and to relate it to some structural feature of the world. And I tell you, in all truth, that before the human mass sets out tomorrow on the great adventure from which its fulfillment is to emerge, it must gather itself together, as one whole, and once and for all investigate the value of the drive which is urging it ahead. Is it really worth our while to yield--or even, as we must do, to devote ourselves passionately--to the forging ahead of the world? Man, the more he is man, can give himself only to what he loves; and ultimately he loves only what is indestructible. Multiply to your heart's content the extent and duration of progress. Promise the earth a hundred million more years of continued growth. If, at the end of that period, it is evident that the whole of consciousness must revert to zero, without its secret essence being garnered anywhere at all, then, I insist, we shall lay down our arms--and mankind will

be on strike. The prospect of a total death (and that is a word to which we should devote much thought if we are to gauge its destructive effect on our souls) will, I warn you, when it has become part of our consciousness, immediately dry up in us the springs from which our efforts are drawn. Consider all around you the increasing number of those who are privately bored to tears and those who commit suicide in order to escape from life . . . The time is close at hand when mankind will see that, precisely in virtue of its position in a cosmic evolution which it has become capable of discovering and criticizing, it now stands biologically between the alternatives of suicide and worship."

[85] In the following passage the "emergence of co-reflection from time and space" is the emergence of the transcendent cosmic organism.

(Teilhard, 1965, p. 264) "In fact, the more one turns over the fundamental problem of activation, placed before the forces of cosmogensis by the appearance of reflexion, the more convinced one is that from the simple (but inflexible) point of view of energetics, hominisation cannot physically continue for very much longer without explicitly postulating the existence ahead of a critical point of super-reflexion: something like an emergence of co-reflexion from time and space into a definitely irreversibilised life.

(Teilhard, 1968a, p. 42-43) It is in fact quite clear that ninety-nine men out of a hundred never explicitly ask themselves the question, 'Is life worth living?' They fail to see the problem, because life is still carrying them along automatically, just as it did the unreasoning beings who, until man, were alone in conducting the work of evolution. Logically, however, the problem is there, and we may anticipate that it will take on increasing urgency for mankind, as the work achieved by the latter becomes more arduous and valuable. Can we truly hope to create a work that will last, or are we simply building a house upon sand? With intelligence there emerged in the heart of the terrestrial world a formidable power of judging the world critically. Animals, passively and blindly, drag the great lumbering wagon of progress. Before man, in turn, can continue the common task, he can, and must, ask himself whether it is worth the suffering it entails: the toil of living, the horror of dying. And I appeal to every man who is capable of looking into the depths of his mind and heart, to consider frankly and honestly whether the only reward that can satisfy us is not the guarantee that the tangible result of our labours, through some part of itself, is gathered up in a reality where neither worm nor rust can devour it.

The demand I am now expressing may seem excessive; nevertheless I believe that it is absolutely natural to man, because I can

read it so plainly in my own heart that it must logically, be shared by all my fellows. The more I think about it, the more clearly I see that I would be psychologically incapable of making the least effort if I were unable to believe in the absolute value of something in that effort. Prove to me that one day nothing will remain of my work, because there will be not only a death of the individual and a death of the earth, but a death, too, of the universe--prove that, and you break the mainspring of all my activity. Promise my being thousands of years of personal life or of super-human usefulness in some Greater one than itself. If, at the end of that time, annihilation lies in wait for me, it is just as though death were coming upon me tomorrow; I would not lift a finger to be a better man. Free will can be put into motion, in the smallest matter, only by the appeal of a definitive result, of a 'Ktema eis aei'--an everlasting possession--promised to its effort.

And since in actual fact (Principle 2) I cannot admit that the world is badly constructed--is physically contradictory--is incapable of feeding the hunger of the beings it has produced within itself--then I cling desperately to the certainty that life, in its totality, is directed towards the establishment of a new and eternal earth."

86 In the following passage Teilhard clearly states that as life and consciousness develop in evolution the need for irreversible life also grows. When we reach the level of man's noosphere where the totality of reality can be conceived then Teilhard is convinced that truly reflective thought will clearly see the physical impossibility for a universe to contain both the eventual total death of all life and consciousness and the self-conscious thought of man. In short, Teilhard's analysis of consciousness states that life and consciousness have a built-in requirement for irreversible life and that this need becomes explicit in the self-conscious thought of man.

(Teilhard, 1963, p. 48) "La Vie, pour pouvoir fonctionner, a besoin, et toujours plus besoin, de se reconnaître elle-même irréversible.

A un degré implicite et inchoatif, cette exigence interne est déjà lisible dans l'élan tenace qui, depuis des centaines de millions d'années, n'a jamais cessé de pousser " aveuglément " vers des formes plus élevées de conscience les êtres organisés. --A l'état confus, mais déjà explicite, elle jaillit, à la première apparition du fait inévitable de la Mort, dans l'animal devenu capable de voir en avant. Dès la minute critique où, par réflexion sur elle-même, la conscience se met à prévoir, tout être, si primitif soit-il, commence à repousser, comme un scandale, l'idée qu'il puisse jamais disparaître tout entier. --Mais c'est plus haut encore seulement, c'est dans les zones supérieures d'une Humanité en voie de se grouper

collectivement sur elle-même, que l'impossibilité physique apparaît clairement pour un Univers d'abriter simultanément en soi une activité réfléchie et une mort totale."

My translation is:

"Life, in order to function, has a need and always a greater need, to see itself as irreversible. In an implicit way, this internal need [i.e. for irreversibility] is already visible in the persistant impulse of life which for hundreds of millions of years has never ceased to push "blindly" towards higher forms of consciousness in organized [i.e. living] beings. ---In a confused state, but already explicitly, it [i.e. consciousness of the need for irreversible life] bursts out when it first perceives the inevitable fact of death. [This perception of death first occurs] in the animal that has become capable of seeing into the future. Ever since that critical moment [i.e. the appearance of man's self-conscious thought in the world] where, by reflection on itself, consciousness begins to foresee all being, no matter how primitive this foresight may be, it [i.e. the reflective consciousness of man] begins to oppose, as a scandal, the idea that it could ever disappear entirely. ---But it is only higher, in the superior zones of humanity, in the process of collectively grouping on itself, [i.e. the formation of the noosphere] that the physical impossibility clearly appears for a universe to simultaneously shelter in itself the reflective activity [of consciousness] and a total death."

[87]For Teilhard the world is both logically and physically a coherent whole. Hence, an absurd or unintelligible world would be one which lacked this coherence. A universe which would automatically supress or destroy something which it engendered would be absurd. Hence, the hypothesis that there will be a total death of all life and consciousness is absurd. (Teilhard, 1963, p. 361) "A mon avis.... le monde où nous vivons puisse être regardé comme assez cohérent pour ne pas suprimer automatiquement, en fin de compte, la vie qu'il engendre...."

My translation is:

"In my opinion--the world in which we live can be regarded as sufficiently coherent not to automatically supress the life which it has engendered."

[88]The following passage presents Teilhard's basic argument for the adoption of a new conception of matter:

(Teilhard, 1965, p. 264-266) "Like miners surprised by an explosion, who crouch dispiritedly where they are if they think that the gallery is blocked ahead of them, man (the more he is man) could not continue to go on ultra-cerebralising at the behest of evolution without asking whether the universe, above his head, is open or closed; that is to say without putting the definite question to himself (the question of confidence) whether--yes or no--the light towards which humanity is drifting by self-arrangement really denotes a way out into the open air, or if it is only caused by a momentary flash in the night; in which case there would be nothing left for us but to go on strike and, in spite of nature, come to a stop.

In fact, the more one turns over the fundamental problem of activation, placed before the forces of cosmogenesis by the appearance of reflexion, the more convinced one is that from the simple (but inflexible) point of view of energetics, hominisation cannot physically continue for very much longer without explicitly postulating the existence ahead of a critical point of super-reflexion: something like an emergence of co-reflexion from time and space into a definitely irreversibilised life.

I am as well aware as anyone of the fantastic element in these prospects to which our spirit finds itself impelled by this fundamental need. The ultimate break-up of the partnership complexity/consciousness, to release, in the free state, a thinking without brain. The escape of some part of the Weltstoff from entropy(see fig. 2). All this, in the eyes of science today, seems impossible to accept. But, on the other hand, how can we deny the possibility that it is true without at the same time stopping the ascending movement of the entire world (by disactivation, I repeat) in its human leading shoot?

Caught by this contradiction between the present forms of our knowledge and certain growing requirements of our action, the only gesture we can possibly make is to push on in both directions at once, in hope that the conflict will finally be resolved in a science more advanced than ours--as has so often happened already. Now, towards a possible synthesis after the antithesis, may I be allowed to risk the following observation?

In virtue of the 'law of complexity/consciousness', which has guided us so far, one may say that there exist in every corpuscle two levels of operation: one (let us call it tangential) binding physico-chemically, that is to say by way of complexity, the corpuscle in question to all other corpuscles in the universe: the other (let us call it radial or axial) leading directly from consciousness to consciousness, and manifesting itself, on the level of humanity, in the different psychological phenomena, already mentioned, of unanimity and co-reflexion.

Granted this, we have adopted the habit of reserving for the

'tangential' effects (the proper domain for statistics and entropy) both the name of energy and the privilege of constituting the primal matter of things; the 'radial' being then regarded as only a subsidiary effect or a fragile super-structure of the determinism of matter. But turning the perspective upside down, why not decide on the contrary that, of the couple under examination, it is the radial that is primitive and consistent, the tangential being only a minor product statistically engendered by the interactions of the elementary 'centres' of consciousness, imperceptible in the 'preliving', but clearly discernible to our experience once matter has reached a sufficiently advanced degree of arrangement? From this point of view[1], if one accepts it, the edifice of physical laws would remain absolutely intact and valid in the domain of pre-life, where the radial does not yet exist for our eyes. But on the other hand, it would be possible for us to conceive that where the interiorisation of corpuscles is sufficiently developed the axial consciousness, at last capable of directly coiling on itself, centre to centre, escapes the peripheral servitudes of physico-chemical complexity. In this case, very far back (that is to say in the inanimate) all would continue to happen as if entropy were in command. But in front (that is to say at the critical point of super-reflexion), it would be entropy's turn to disappear, thus revealing and releasing the ultra-reflected and irreversible portion of cosmic matter. Which was what we had to prove.

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[1] Briefly, the 'trick' consists in distinguishing two types of energy: the first primary (psychical or radial energy) escaping from entropy; and the other secondary (physical or tangential energy) obeying the laws of thermo-dynamics: these two energies not being directly transformable into one another, but interdependent on one another in their functioning and evolution (the radial increasing with the arrangement of the tangential, and the tangential only arranging itself when prompted by the radial)."

89 The following passages present some of Teilhard's major goals. This statement of goals is applicable to many of his other works.

(Teilhard, 1959, p. 29) "If this book is to be properly understood, it must be read not as a work on metaphysics, still less as a sort of theological essay, but purely and simply as a scientific treatise. The title itself indicates that. This book deals with man solely as a phenomenon; but it also deals with the whole phenomenon of man.

In the first place, it deals with man solely as a phenomenon. The pages which follow do not attempt to give an explanation of the

world, but only an introduction to such an explanation. Put quite simply, what I have tried to do is this; I have chosen man as the centre, and around him I have tried to establish a coherent order between antecedents and consequences. I have not tried to discover a system of ontological and causal relations between the elements of the universe, but only an experimental law of recurrence which would express their successive appearance in time.

(Ibid, p. 30) Take any book about the universe written by one of the great modern scientists, such as Poincaré, Einstein or Jeans, and you will see that it is impossible to attempt a general scientific interpretation of the universe without giving the impression of trying to explain it through and through. But look a little more closely and you will see that this 'hyperphysics' is still not a metaphysic.

In the course of every effort of this kind to give a scientific description of the whole, it is natural that certain basic assumptions, on which the whole superstructure rests, should make their influence felt to the fullest possible extent. In the specific instance of the present Essay, I think it important to point out that two basic assumptions go hand in hand to support and govern every development of the theme. The first is the primacy accorded to the psychic and to thought in the stuff of the universe, and the second is the 'biological' value attributed to the social fact around us.

The pre-eminent significance of man in nature, and the organic nature of mankind; these are two assumptions that one may start by trying to reject, but without accepting them, I do not see how it is possible to give a full and coherent account of the phenomenon of man!

[90] Scientific descriptions of the world often present only those phenomena of man which can be observed through the five senses, the without of man. On the other hand, Teilhard states that the understanding of the whole phenomenon of man requires us to understand his within. The reality of psychical effort, spiritual or psychic energy, in such a within of man which must be understood and incorporated into our scientific conception of the world.

(Teilhard, 1959, p. 62) 'There is no concept more familiar to us than that of spiritual energy, yet there is none that is more opaque scientifically. On the one hand the objective reality of psychical effort and work is so well established that the whole of ethics rests on it and, on the other hand, the nature of this inner power is so intangible that the whole description of the universe in mechanical terms has had no need to take account of it, but has been successfully completed in deliberate disregard of its reality.

The difficulties we still encounter in trying to hold together spirit and matter in a reasonable perspective are nowhere more

harshly revealed. Nowhere either is the need more urgent of building a bridge between the two banks of our existence--the physical and the moral--if we wish the material and spiritual sides of our activities to be mutually enlivened.

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

[91] Teilhard provides many examples of the kinds of phenomena he wants to integrate. In the following passage he says that he wants to relate his zest for life to some structural feature of the world. "I seem to you peculiar and exceptional because I am trying to analyze my own zest and to relate it to some structural feature of the world." (Teilhard, 1969b, p. 42-43). In another very revealing passage he states that his entire conception of an irreversible and convergent universe which was presented in the last chapter of this paper is precisely the kind of world in which the Christ of Christian theology requires. As the italicized statements show, the Christ of Christian revelation could not function in any other kind of universe than the one Teilhard has constructed.

(Teilhard, 1969b, p. 79-80) "If we Christians wish to retain in Christ the very qualities on which his power and our worship are based, we have no better way--no other way, even--of doing so than fully to accept the most modern concepts of evolution. Under the combined pressure of science and philosophy, we are being forced, experientially and intellectually, to accept the world as a coordinated system of activity which is gradually rising up toward freedom and consciousness. The only satisfactory way of interpreting this process (as I added earlier) is to regard it as irreversible and convergent. Thus, ahead of us, a universal cosmic center is taking on definition, in which everything reaches its term, in which everything is explained, is felt, and is ordered. It is, then, in this physical pole of universal evolution that we must, in my view, locate and recognize the plenitude of Christ. For in no other type of cosmos, and in no other place, can any being, no matter how divine he be, carry out the function of universal consolidation and universal animation which Christian dogma attributes to Christ. By disclosing a world-peak, evolution makes Christ possible, just as Christ, by giving meaning and direction to the world, makes evolution possible."

[92]The precise meaning of whole is different for each kind of monism.

[93](Teilhard, 1969b, p. 22-23) "However, it is just at this point, in fact, that we meet an initial split in the thinking mass of mankind. The classification of intelligences or souls seems as though it must be an impossible task. In reality, it obeys an extremely simple law. Beneath an infinite number of secondary differentiations, caused by the diversity of social interests, of scientific investigations or religious faiths, there are basicly two types of mind, and only two: those who do not go beyond (and see no need to go beyond) perception of the multiple--however interlinked in itself the multiple may appear to be- and those for whom perception of this same multiple is necessarily completed in some unity. There are only, in fact, pluralists and monists: those who do not see, and those who do."

[94]We normally associate the term "mysticism" with religion. But Teilhard in this passage clearly refers to the existence of scientific mysticism.

[95]In the following passage Teilhard describes his stirring experience of intuiting the whole of the universe. It is a vision that one can never forget. Further, this vision or intuition brings us into immediate contact with a cosmic Absolute which is the "vital fluid or spirit of things". Finally, this "Absolute" is a "vast current of things" which is carrying us to some ultimate goal.

"If, as I said before, we step down into ourselves, we shall be horrified to find there, beneath the man of surface relationships and reflection, an unknown--a man as yet hardly emerged from unconsciousness, still, for lack of the appropriate stimulus, no more than half-awake: one whose features, seen in the half-shadow, seem to be merging into the countenance of the world.

No brutal shock, no, nor no gentle caress can compare with the vehemence and possessive force of the contact between ourselves as individuals and the universe, when suddenly, beneath the ordinariness of our most familiar experiences, we realize, with religious horror, that what is emerging in us is the great cosmos.

THE CALL

No man who has once experienced this vision can ever forget it. Like the seaman who has known the intoxicating blue of the South Sea--whatever he be whom the ray has touched upon, whether scientist

philosopher, or humble worker--he lives for ever with his nostalgia for what is greatest, most durable, for the Absolute whose presence and activity around him he has felt for one moment. The flash that opened his eyes remains as a light imprinted deep within them; and he never ceases to thrill to the awareness of contact with the universe. Others may smile at his vain worries and his odd concern to extend man's consciousness beyond the accepted limits of practical life. But the man with the vision will follow his own road; he knows that many will understand his language and that they are waiting to hear him speak, sorrowful and somehow stunted because hidden aspirations are clamorous within them and they are unable to express them. This, then, is the word that gives freedom: it is not enough for man to throw off his self-love and live as a social being. He needs to live with his whole heart, in union with the totality of the world that carries him along, cosmically. Deeper than the soul of individuals, vaster than the human group, there is a vital fluid or spirit of things, there is some absolute, that draws us and yet lies hidden. If we are to see its features, to answer its call and understand its meaning, and if we are to learn to live more, we must plunge boldly into the vast current of things and see whither its flow is carrying us."(Teilhard, 1968b, p. 27-28)

[96]The discussion of the last three paragraphs is clearly summed up in the following passage:

(Teilhard, 1969, p. 24-26) "Does not the presence of the whole in the world assert itself for us with the direct evidence of some source of light? I do indeed believe that that is so. And it is precisely the value of this primordial intuition which seems to me to hold up the whole edifice of my belief. Ultimately, and in order to account for facts which I have met in at the deepest level of my consciousness, I am led to the conclusion that man, in virtue of his very condition of "being in the world," possesses a special sense which shows him, in a more or less ill-defined way, the whole of which he forms a part. There is nothing astonishing, after all, in the existence of this "cosmic sense." Because he is endowed with sex, man undoubtedly has intuitions of love. Because he is an element, surely he must in some obscure way feel the attraction of the universe. In fact, nothing in the vast and polymorphous domain of mysticism (religious, poetical, social and scientific) can be explained without the hypothesis of such a faculty, by which we react synthetically to the spatial and temporal ensemble of things in order to apprehend the whole behind the multiple. You may, if you wish, speak of "temperament," since the cosmic sense, like all the other intellectual qualities, has degrees of liveliness and penetrative power that vary with the individual. But it is an essential temperament, in which the

structure of our being is as necessarily expressed as it is in the desire to extend one's being and to attain unity. I said earlier that there are two basic categories of mind, pluralist and monist, but I must now correct that statement. Individually, the "sense of the whole" may be atrophied, or may well lie dormant. Matter, however, could more easily be immune to gravity than a soul could be to the presence of the universe. By the very fact that they are men, even pluralists could have the power of "seeing." They are monists without realizing it.

Later, carried along by the logic of my own development, I shall return to a consideration of the comforting mass of human religious thought which consciously operates in the passionately felt attraction of the whole; and I shall look to this mighty primordial current to give me the ultimate orientation about which my personal thought is undecided. For the moment it is enough for me to have the assurance of the value of a profoundly felt personal intuition, based on an almost universal agreement.

I surrender myself to an ill-defined faith in a world that is one and infallible--wherever it may lead me."

[97](Teilhard, 1969b, p. 28-29) "A first point which emerges for me with a forcefulness that I cannot even dream of questioning, is that the unity of the world is by nature dynamic or evolutive. Here I am simply meeting in myself, in a participated and individual form, the discovery of duration, which for the last century has so profoundly been modifying mankind's former consciousness of the universe. Besides space, so staggering to Pascal, we now have time--not a container-time in which years are stored, but an organic time which is measured by the development of global reality. We used to look upon ourselves and the things around us as "points," closed in on themselves. We now see beings as like threadless fibers, woven into a universal process. Everything falls back into a past abyss, and everything rushes forward into a future abyss. Through its history, every being is co-extensive with the whole of duration; and its ontogenesis is no more than the infinitesimal element of a cosmogenesis in which is ultimately expressed the individuality--the face, we might say--of the universe.

Thus the universal whole, like each element, is defined for me by a particular movement which animates it. When, however, I ask what sort of movement this can be and whither is it taking us, my decision is reached by my feeling suggestions and indications, gathered in the course of my professional researches, working inside my mind and falling into a pattern: and it is as a historian of life, at least as much as a philosopher, that I answer, from the depths of my intelligence and of my heart, "Toward spirit."

[98](Teilhard, 1969a, p. 54) "This entire procedure of assuming the truth of an hypothesis and then examining its logical consequences is analogous to constructing a geometrical system."

[99]Chapter V11 will provide instances in which Teilhard's hypothesis is inconsistent with the development of science.

[100]One passage in which Teilhard's argument is clearly stated is: (Teilhard, 1969a, p. 54) "I confine myself to recording that more conscious matter (that is to say more reflective, better centred) follows historically after less centred, less reflective, less conscious. This seems to be the work of 'a wind of the spirit', to be observed throughout the world. How can we definitely establish this fact which, if proved, would also give us the proof we seek of a definite movement of the universe?

I would answer by accepting it and by enquiring whether, pushed to its final conclusions, it gives a true picture of the universe around us. The physical sciences know no other criterion than this conformity to their actual development.

What I ultimately propose therefore in this essay is to construct a picture of the physical world around the human personality chosen as an element to stand for the whole system. Once we admit that the reflective monad represents the mesh of the cosmos, what structure and what future are we led to attribute to it? This is what I shall try to discover.

On my way, I shall concern myself only to pursue to their logical end the organic links which appear--just to see where they lead--rather as if I were constructing a geometrical system. The overall success will decide. If the construction does not form a complete whole, or if it contradicts some part of experience, it will show that the initial hypothesis was bad and should be abandoned. But if, on the contrary, it seems to encircle and harmonize the world to a greater degree, then we must conclude that in accepting a spiritual direction of evolution we have come near to the truth."

[101]Clearly, from our present mechanistic viewpoint Teilhard's choice of a model is absurd. It is absurd to us because it conflicts with the categories of thought which we use to organize our experience. On the other hand, as we will soon see, Teilhard's choice of the human personality is the most logical one within his context because he uses different categories to organize experience. Hence, the present discussion will hopefully lead to Teilhard's categories of thought. In brief, if we wish to thoroughly enter the mind of another person we must discover the fundamental categories by which he

organizes his experience; this is what the present discussion intends to do.

[102] Pepper here clearly presents his conception of world hypotheses. (Pepper, 1948, p. 1-2) "World hypotheses as objects in the world. --Among the variety of objects which we find in the world are hypotheses about the world itself. For the most part these are contained in books such as Plato's Republic, Aristotle's Metaphysics, Lucretius' On the Nature of Things, Descartes's Meditations, Spinoza's Ethics, Hume's Treatise, Kant's three Critiques, Dewey's Experience and Nature, Whitehead's Process and Reality. These books are clearly different in their aim from such as Euclid's Elements or Darwin's The Origin of Species.

The two books last named deal with restricted fields of knowledge and can reject facts as not belonging to their field if the facts do not fit properly within the definitions and hypotheses framed for the field. But the other books deal with knowledge in an unrestricted way. These unrestricted products of knowledge I am calling world hypotheses, and the peculiarity of world hypotheses is that they cannot reject anything as irrelevant.

When certain inconvenient matters are brought to a mathematician, he can always say, "These are psychological [or physical, or historical] matters. I do not have to deal with them." Similarly with other students of restricted fields. But students of world hypotheses can never have that way out. Every consideration is relevant to a world hypothesis and no facts lie outside it. This peculiarity has extensive consequences.

I wish to study world hypotheses as objects existing in the world, to examine them empirically as a zoologist studies species of animals, a psychologist varieties of perception, a mathematician geometrical systems. These are all in some sense facts. And the analogy between world hypotheses as actual facts or objects now present in the world and the facts or objects studied by zoologists, psychologists, or mathematicians is worth holding in mind. For we all have and use world hypotheses, just as we have animal bodies, have perceptions, and move within geometrical relations. It is just because world hypotheses are so intimate and pervasive that we do not easily look at them from a distance, so to speak, or as if we saw them in a mirror. Even the authors named in my first paragraph do not fully succeed in looking at their results as things to be looked at.

World hypotheses are likely to be studied as creeds to be accepted or rejected, or as expressions of highly individual personalities, or as expressions of epochs, or as objects of historical scholarship to be traced to their cultural sources or given their philological or psychological interpretations. They are rarely treated as objects

in their own right to be studied and described in their own character and compared with one another. Yet it is this last sort of study that I wish to make."

[103](Pepper, 1948, p. 141-142) "Comparisons among the four hypotheses. --There is a certain symmetry about the disposition of the relatively adequate world theories which may itself possess a cognitive significance. Just as in the field of data the table of chemical elements exhibited an order long before the grounds for that order were established by further data and hypothesis, so possibly here in the field of danda.

Four distinct world hypotheses come to view when the various kinds and causes of patent inadequacy have been removed. I am giving these hypotheses slightly unfamiliar names so as to avoid issues over the names themselves. I am calling them formism, mechanism. contextualism, and organicism.

Formism is often called "realism" or "platonic idealism". It is associated with Plato, Aristotle, the scholastics, neoscholastics, neorealists, modern Cambridge realists. Mechanism is often called "naturalism" or "materialism" and, by some, "realism." It is associated with Democritus, Lucretius, Galileo, Descartes, Hobbes, Locke, Berkeley, Hume, Reichenbach. Contextualism is commonly called "pragmatism." It is associated with Peirce, James, Bergson, Dewey, Mead. There may be a trace of it in the Greek, Protagoras. Organicism is commonly called "absolute (or, objective) idealism." It is associated with Schelling, Hegel, Green, Bradley, Bosanquet, Royce. Many of these men are rather eclectic and some of them develop their views only halfway, as notably Hobbes and Berkeley. These references are given simply to offer some immediate filling of meaning to my names for the four theories. Some of the ascriptions are, no doubt, controversial.

These four hypotheses arrange themselves in two groups of two each. The first two are analytical world theories; the second two, synthetic. Not that the analytical theories do not recognize and interpret synthesis, and the synthetic theories analysis; but the basic facts or danda of the analytical theories are mainly in the nature of elements or factors, so that synthesis becomes a derivative and not a basic fact, while the basic facts or danda of the synthetic theories are complexes or contexts, so that analysis becomes derivative. There is thus a polarity between these two pairs of hypotheses."

[104](Teilhard, 1969b, p. 13-14)"On the strictly psychological plane to which I intend to confine myself here, I mean by "faith" any adherence of our intelligence to a general view of the universe. We may try to define this adherence by certain aspects of freedom ("option") or of affectivity ("appeal") which accompany it, but those seem to me derived or secondary characteristics. In my view, the

essential nore of the psychological act of faith is to perceive as possible, and accept as more probable, a conclusion which, in spatial width or temporal extension, cannot be contained in any analytical premises. To believe is to effect an intellectual synthesis."

Again Teilhard states: (Teilhard, 1969b, p. 15) "To believe, is to develop an act of synthesis whose first origin is inapprehensible."

[105] The following passage clearly presents the non-rational characteristics of an intuition which led Teilhard to adopt monism:

(Teilhard, 1968b, p. 272) "The special bent, or attitude, of the cosmic mind (of which the pantheist mind is only one particular form) consists essentially in a modification (change) undergone by the concrete being of the world (to esse rerum), as seen by the intelligence. Whereas, as a general rule, men turn their attention to the individual, plural, forms of things, the 'cosmic' mind (which enjoys a cosmic vision) is primarily aware of their common basis. This basis seems to it to become continually more luminous, real and individual--so much so that the particular determinations of concrete things tend to interest the soul less and less, as though they were dissolving into a higher entity. This transformation (or manifestation) of the universal stuff of the world, we should note, is an experienced psychological fact; in other words it is an intuition, pre-intellectual in order and is not the fruit of a chain of reasoning. It is basically, therefore, beyond the reach of criticism: it exists. However, when we try to explain this--when the man who has that intuition tries to interpret and rationalize his feelings--we find ourselves very much at a loss."

Again, in the following passage Teilhard clearly states that when the issue is an ultimate premise or starting point, we reach irreconcilable positions which cannot be resolved by rational argument. They can only be settled by having the appropriate insights or intuitions. For example, in the following passage Teilhard compares the positions of the physicalists and juridictists about the relationship of Christ to the world. The physicalists, a position adopted by Teilhard, are theological monists who think that the universe is an organically structured whole which is integrated by a physical center. This center is the cosmic vital principle and it is identical to the Incarnate Word, Christ. On the other hand, the juridicists are theological pluralists who think that Christ resembles a large landowner. He is therefore related to a plurality of persons with juridical bonds and hence he is clearly not a physical principle of integration. Hence, physicalism and juridicism are irreconcibable viewpoints just as are monism and pluralism. In Kuhnian terms (Kuhn, 1962) they are irreconcilable "paradigms" (Kuhn, 1962) or gestalts.

Hence, there is no purely rational way of switching from juridicism to physicalism or vice versa. In short, paradigm or gestalt switches can only be made by having the appropriate insights or intuitions.

(Teilhard, 1968a, p. 55-56) "I have, in fact, become convinced that men include two irreconcilable types of minds: The physicalists (who are 'mystics') and the juridicists. For the former, the whole beauty of life consists in being organically structured: and in consequence Christ, being pre-eminently attractive, must radiate physically. For the latter, being is embarrassing as soon as it disguises something vaster and less patient of definition than our human social relationships (considered from the point of view of their artificial content). Christ, accordingly, is no more than a king or a great landowner. These (the juridicists), logically inconsistent with their theology of grace, will always understand 'mystical'(in 'mystical body') by analogy with a somewhat stronger family association or association of friends. The physicalists, however, will see in the word mystical the expression of a hyper-physical (super-substantial) relationship--stronger, and in consequence more respectful of embodies individualities, than that which operates between the cells of one and the same animate organism. The two types of mind will never understand one another, and the choice between the two attitudes must be made not by reasoning but by insight. For my own part, it has been made, irrevocably and as long as I can remember. I am a physicalist by instinct: and that is why it is impossible for me to read St. Paul without seeing the universal and cosmic domination of the Incarnate Word emerging from his words with dazzling clarity."

[106](Teilhard, 1968a, p. 51-52) "Thus those innumerable difficulties vanish which every philosophy comes up against that tries to reconstruct the world from isolated elements (from the monad) instead of affirming in principle the fundamental and substantial unity of the universe. The mutual influence of Spirit and matter, the interaction of beings, the knowledge of the 'external' world, are insoluble questions only because we give ourselves the spurious and impossible problem of trying to understand the whole through fragments of the whole, without introducing, to help us, the properties that are peculiar to the whole (as though a natural whole were not more than its parts)."

[107](Teilhard, 1968a, p. 29-30) "The only consistence beings have comes to them from their synthetic element, in other words from what, at a more perfect or less perfect degree, is their soul, their spirit.

Let us turn back and examine critically the operation of analysis

that gradually led us down from the heights of rational life to the particulate swarming of electrons. We progressed in a series of successive fragmentations. At each operation we separated two elements: an ordering principle, which is imponderable, cannot be analysed, and is synthetic--and ordered (ponderable) elements. On every occasion, as a direct result of analysis, that ordering principle disappeared. We accordingly concentrated our attention on the ordered elements, which seemed to be of a more stable nature. These in turn yielded to analysis, sacrificing a fresh order and being reduced to sub-elements. And so the process continued. Thus we have left the statue to study the grain of marble--the sensation of light to retain the vibration of the ether--cellular life to fasten onto chemical combinations, etc. In doing so, we believed that we were making our way towards what was more solid, to something that would be a non-ordered prime element. It was a hopeless search. We did, it is true, discover a certain law on which reality is built up, an hierarchical law of increasing complexity in unity. But reality itself, the supreme Thing we were trying to reach, eluded us and with each new analysis continued to move even further away, just as the light moves further away from a person who is chasing its reflexion. What we have been doing is to advance in the direction in which everything disintegrates and is attenuated: whereas the absolute, the intelligible, lies at the centre, in the direction in which everything is heightened to the point of being but one. Everything is something more than the elements of which it is composed. And this something more, this soul, is the true bond of its solidity."

[108]The following passage clearly shows that if scientific analysis could reveal all of the components in the whole of reality, then the important synthetic realities in Teilhard's world such as God and the immortal human soul would be reduced to a plurality of impersonal and unconscious particles of matter. Such a reduction would be inconsistent with his theological beliefs and therefore would not be coherent with the totality of his experience. Hence, it is by postulating the existence of integrators, synthetic elements, which are not subject to scientific analysis that Teilhard hopes to combat the scientific materialism that is implicit in a mechanistic g. c. s.

(Teilhard, 1968a, p. 27) "The first thing a man thinks when scientific analysis has led him to the extreme lower limits of matter is that in these ultimate particles of matter he really holds the very essence of the riches of the universe. 'The elements contain in themselves the virtue of the whole: to hold the elements is to possess the whole.' That is the principle implicitly accepted by a number of scientists and even philosophers. Were that principle true, we should have to say that science forces us back into materialism. As

scientific analysis has progressed, in fact, so everything that is 'soul' has gradually appeared to vanish from our outlook; the creative and providential power that directs the world has gradually degenerated, in the eyes of science, into a cluster of evolutionary laws --freedom into determinisms--organic life into physico-chemical phenomena--light into vibrations--molecules into electrons. One after the other, Godhead, morality, life, feeling, continuity.... have been wiped out, to be replaced by a swarm of ever more impersonal elements. If analysis has in truth brought us to the centre of things, that is, to the extreme point of their reality and their consistence, then goodbye to spirit--goodbye to the reign of spirit, to its primacy! Everything is, ultimately, nothing but plurality and unconsciousness."

[109]The following passage states that the fact of evolution reminds us that the principle movement of reality is synthesis. Now, clearly, no mere fact can tell us any such thing. It is only when such a fact is viewed within the context of Teilhard's criterion of reality that it can be interpreted as the principle movement of reality.

(Teilhard, 1969a, p. 56) "At a first analysis the condensation of cosmic reality into human personality seems to reveal a law of universal formation. For perfectly legitimate reasons of utility and method, the physical sciences have principally set out to trace phenomena in the direction of decomposition or atomization. The fact of evolution comes to remind us that the principal movement of reality is a synthesis, in the course of which plurality manifests itself in increasingly complex and organic forms, each further degree of unification being accompanied by a growth of inner consciousness and freedom."

[110]Conceptual wholes or gestalts are collective realities which are found throughout Teilhard's thought. The biosphere and noosphere which were discussed earlier are wholes in Teilhard's universe. The biosphere is not simply the total number of living organisms existing over the surface of the earth at any one time. Similarly, the noosphere is not simply the total number of thinking persons. All individual organisms and all thinking persons are interconnected in such a manner to form their respective wholes. Teilhard admits that the perception of these wholes requires "a special quality and training in the observer" (Teilhard, 1969a, p. 118). However, once an individual is able to perceive these wholes, then our entire earth becomes "draped in splendor" (Teilhard, 1969a, p. 118). In short, the following passage clearly shows how Teilhard is trying to get his readers to see familiar things, individual organisms and human

persons, from a different point of view, namely, as constituents of a larger organic whole.

(Teilhard, 1969a, p. 117-118) "The number, first of all. Human plurality is in some respects a great weakness, in others an extraordinary strength. A variety of complementary points of view, a multiplicity of groping efforts, of searching antennae: this is how our state of multiplicity, which in other connexions causes us such suffering, appears from the point of view of energetics. Have we ever tried to imagine the thousand million human units exerting at every moment intellectual pressure on the universe?

But, viewed on the cosmic scale, these numbers alone are of very little account. Of what importance is the human population of the globe compared with the myriads of particles contined in a drop of water? The truly impressive aspect of total human energy only appears when we decide to observe it from the point of view of its inner connexions. In fact elementary human energies do not operate in disorder, in obedience to merely statistical laws. Nor do they vibrate only in a well defined common direction, of which we shall have to speak later: simply in the direction of greatest consciousness. There is more to it than that. They tend to combine their individual radiations in a single pulsation, that is to say to constitute an organized whole. Until we have perceived this, we shall understand nothing about the problem of human energy.

This fundamental connexion of the living world is not immediately perceptible. Particles swamped amidst other particles, we live habitually unaware of what the mass of consciousness of which we form a part must represent, viewed as a whole. We are like a cell which can see nothing but other cells in the body to which it belongs. And yet the body exists more than the elements of which it is composed. In fact we can expect no decisive advance in our conceptions of the animate world for so long as we remain on the 'cellular' scale and are unable to mount above living beings to see life, above men to discover humanity: not that abstract and suffering humanity of which the philanthropists speak but the living and powerful reality in which all the thoughts of individuals are steeped, and by which they are guided to form from their linked multiplicity a single spirit of the earth.

This perception of a natural psychic unity higher than our 'souls' requires, as I know from experience, a special quality and training in the observer. Like all broad scientific perspectives it is the product of a prolonged reflexion, leading to the discovery of a deep cosmic sense in connexions which habit has accustomed us to regard as superficial, banal, and in fact moral. It is not much easier to see the humanity I am speaking of than to take up a position in the world of relativity. But once we manage to affect this change

of viewpoint, then the earth, our little human earth, is draped in splendour. Floating above the biosphere, whose layers no doubt gradually merge into it, the world of thought, the noosphere, begins to let its crown shine.

The noosphere!

It is to this magnitude, and to this magnitude alone, that the considerations on human energy which follow ultimately apply. It will be useless for those who cannot see it to follow me further."

[111] A detailed discussion which states why the human personality is the highest integrator is beyond the scope of this paper. However, some reasons are as follows: Man is the highest integrator in the animal world because he has self-consciousness and therefore is able to know that he knows. Hence, man is the most conscious of all of the animals. But, what does being most conscious mean? It means that man has the most integrating ideas. Ideas are psychic inventions which integrate or synthesize the facts and actions of our experience. (Teilhard, 1966, p. 34). Further, man is unique in the animal world in that he can have ideas which conceive of the totality of reality. For example, in the conceptual world man's world hypotheses are sets of ideas which are constructed to integrate the totality of reality. In the real world of practical affairs man is capable of integrating all of his activities in the global ecosystem of which he is a part. A final reason is that Teilhard is above all a Christian who firmly believes in the immortality of the human personality as is seen in the following passage:

(Teilhard, 1968b, p. 156) "When the advent of Spirit, properly so called, is close at hand, the mechanism of 'spiritualization' by union becomes easy to distinguish. In the higher animals, with large brains, the instability of the soul is at its greatest, because the very numerous elements that are constitutive of psychism are still loosely combined: the multiples from which being is born are not yet completely knit together, and the least thing can cause them to fall apart: when they are dissociated, their principle of union, which is still itself tenuous, disappears with them. In man, on the other hand, the organic components succeed in centring themselves, and from that time a new spiritual substance appears in the world for the first time --the very centre of unification. In man the body (that is to say the ensemble of united elements) can disappear: the principle of his union, being strictly concentrated on one point, will survive the physical disappearance. As form that can be isolated from its matter--as a bond that can subsist with nothing to hold together--as a unitive force that can exist apart from the united whole--the human soul is incorruptible."

[112]In Pepper's terms (Pepper, 1948, p. 84-115) the human personality is the root metaphor of Teilhard's world hypothesis.

[113]In the following passage, Teilhard states how an individual human personality can combine with others in such a way as to develop its personality. On the basis of this he then proceeds to show how God (Omega), the cosmic vital principle, must be combined with individual persons in the growing cosmic organism. In short, Teilhard's extrapolations into the future are based upon a conception of the world in which the fundamental process of change is the development of higher states of personality.

(Teilhard, 1969a, p. 66-68) "So, starting from the human corpuscle, the extrapolation of the trajectory followed by the world can only lead us to the final stage of a personality of the universe. How can we define this supreme personality in relation to ourselves?

Here we must note the entirely special rules imposed on our reasonings (or rather on our calculations) by the introduction of dimensions of personality. Below man, we have little knowledge of what goes on in incompletely personalized beings. But we have the impression that at this level of evolution 'fusings of immanences' may take place. Two fragments of diffuse consciousness may, perhaps, add themselves together, to lose themselves in a third and higher consciousness; for what they have to transmit by this gift is not so much a soul as the particular state of animation that they have reached. Viable or not, in the deep levels of thought, this process of fusion appears definitely impossible once the stage of hominization has been passed. A person cannot disappear by passing into another person; for by nature he can only give himself as a person so long as he remains a self-conscious unity, that is to say distinct. Moreover, as we have seen, this gift which he makes of himself has the direct result of reinforcing his most incommunicable quality, that is to say the quality of super-personalizing. 'Union differentiates.'

Let us apply these observations to the 'summation' of the universe in God--since God also is the name given by man to the consummated being.

God, as I have often remarked elsewhere, is almost inevitably conceived by a modern positivist as an ocean without shores, in which all things are totalized by loss of themselves. Our generation, essentially pantheist because evolutionist, seems to understand pantheism only in the form of a dissolution of individuals in a diffuse vastness. This is an illusion, caused by the fact that the unity of the world is wrongly sought, by influence of the physical sciences, in the direction of the increasingly simple energies into which it dissolves: God is ether, they would have said some years ago. A completely

different result is obtained if one tries, as I have done here, to extend the universe in the direction of personality, that is to say of synthesis. Then God does not appear in the fanning out but in the concentration of the stuff of the universe; not as a centre of dissolution but a focus of personalization. He is spirit, and from this two things follow.

On the one hand his own I cannot be formed of an aggregation of inferior human or super-human 'I's' gathered together by Him, since, as we have just seen, these 'I's' are not additive. He must therefore possess his particular immanence. On the other hand, correlatively, the inferior 'I's', in the course of their ascent to the peak of divinity do not diminish but accentuate their self-possession. They preserve and therefore deepen their private centres. Not only does something of us survive but we survive as ourselves in unity. Constitutionally, after all, the personalization of the universe can only operate by preserving for ever in one supreme person the separate sum of 'persons' born successively in the course of its evolution. God can only be defined as a centre of centres. In this complexity lies the perfection of His unity--the only final goal logically attributable to the developments of spirit-matter."

CHAPTER VI

TEILHARD AND THE VITALISM/MECHANISM DEBATE IN BIOLOGY

Introduction

Chapter IV presented a summary of Teilhard's g.c.s., his conception of the world, whereas Chapter V discussed his fundamental category of thought and model of the universe which are the basis of his conception of the world. His fundamental category is the concept of integration or synthesis in both the real and conceptual worlds and his model of the universe is the human personality. The aim of this chapter is to relate Teilhard's g.c.s. to the vitalism/mechanism debate that was presented in the discussion of Loeb and Bergson in Chapters II and III.

Teilhard's Teleological System is the Entire Universe and Its Goal is the Production of Higher States of Personality

The discussion in Chapter V showed that Teilhard's starting point is his intuition of the whole of the world. The latter is his teleological system. Further, the world is a dynamic and evolving whole. Its model is the human personality. Further, the cosmic process of complexity/consciousness is the underlying reality which makes our world an organic whole. Finally, this process would not

be able to occur as it does unless all matter had the property of consciousness.

Every teleological system has at least one goal. The goal of Teilhard's system is the production of increasingly higher states of personality. As the process of complexity/consciousness continues, increasingly higher states of personality are produced in the world. The subhuman mammals which preceded man in the history of the world are incomplete persons. It is only with the appearance of man that we have the emergence of a complete personality. However, the individual man does not represent the highest state of personality which the process of complexity/consciousness will produce. Individual human personalities are now being incorporated within a cosmic organism. The latter is an ultra-human personality which will be completed outside of our empirical world of space and time after the third mutation of the Weltstoff. In short, the ultimate goal of Teilhard's teleological system is the production of a transcendent cosmic organism which is an ultrahuman personality.

Further, every form of vitalism posits a vital principle to be the ultimate cause of the goal directed activities of its teleological system. For Teilhard, there is a single cosmic vital principle, Omega. Omega is the physical integrator of the cosmic organism which is now forming (114) in our present spatio-temporal world. On the other hand, Omega is at the same time a transcendent physical

entity. Hence, Omega is a cosmic vital principle which both operates within our spatio-temporal world and yet physically exists outside of it. In short, Omega now exists in the transcendent world into which the completed cosmic organism will enter after the third mutation of the Weltstoff.

Teilhard's Central Question in the Vitalism/Mechanism Debate is: How is the Emergence of the Whole Phenomenon of Man Related to the Fundamental Physical Processes of Cosmogenesis?

The central question for Teilhard is to form a conception of the world which will integrate the whole phenomenon of man within the evolving cosmos. Now, why is this a question for Teilhard? It is one because of his g.c.s. As mentioned earlier, the g.c.s. of a thinker determines both what questions may be legitimately asked and the criteria for an adequate answer to them. Now, in Teilhard's g.c.s. the human personality is the highest synthesis of matter which has emerged in the whole of the evolving physical world. Further, since the universe is intuited to be a single whole then all of its elements must be organically connected. Hence, our criterion of truth about the world must be that of coherence, logical consistency. It is now evident why Teilhard asked the question that he did. For his question is really a demand to know the coherent relationships that exist between the most important element in the world, the human personality,

and all of the other elements or parts of the world. Teilhard is convinced that such relationships must a priori exist because of his intuitively certain belief that the world is a single organic whole. In brief, Teilhard's central question flows logically from his g.c.s. which includes a model of the world and criteria of truth (115).

Teilhard Attempts to Resolve the Vitalism/Mechanism Debate in Terms of His World Hypothesis of Complexity/Consciousness

Teilhard, as also Bergson, attempts to resolve the vitalism/mechanism debate on the metaphysical plane. He does this by presenting his world hypothesis of complexity/consciousness which is an alternative to mechanism and to dualistic vitalism. For the dualistic vitalist the worlds of matter and life (116) are separate, but they do interact in some mysterious manner. Hence, in this view the phenomena of life and consiousness are superimposed upon the chemical and physical phenomena of matter. For the mechanist the phenomena of life and consciousness are simply insignificant accidents or by-products, epiphenomena, of the real chemical and physical phenomena of matter. Teilhard rejects dualistic vitalism because it does not contain a physical connection between the physical phenomena of matter and those of life. He rejects mechanism because of its interpretation of life as a mere accident or epiphenomenon of biochemistry.

On the other hand, Teilhard's hypothesis of complexity/consciousness does provide a genuine alternative. In the first place, it does provide a physical connection between the physical and chemical phenomena of matter and the biological phenomena of life and consciousness which is not found in dualistic theories. Every natural whole consists of a synthetic element, an integrator or soul, and the elements or parts which are the units of conscious matter which are integrated. The soul or integrator of an atom, for example, integrates its electrons, protons and neutrons into a natural whole which has its characteristic chemical and physical properties (117). Similarly, the soul or integrator of a man integrates the various organs of his body into a whole which has the characteristic properties of life and self-consciousness. Further, there is a major difference between the material complexity of atoms and molecules and those of living organisms. When compared to living organisms atoms and molecules have a relatively low level of material complexity because their integrators (souls) integrate a relatively small number of particles of conscious matter. Hence, the consciousness of atoms and molecules is not sufficiently concentrated to be detectable. At this level of complexity only chemical and physical phenomena are detectable. On the other hand, living organisms have a relatively high level of material complexity because their integrators (souls) integrate astronomically large numbers of particles of conscious matter. Hence,

the consciousness of living organisms is sufficiently concentrated by their integrators so that the phenomena of consciousness are readily detectable in at least the higher forms of life. Hence, the physical connection between the chemical and physical phenomena of atoms and molecules and the conscious phenomena of living organisms consists of the particles of conscious matter which are integrated by integrators (souls). Secondly, in Teilhard's world hypothesis, the fundamental process of change is essentially a progressive cosmic concentration of consciousness. Hence, the phenomena of consciousness and life are not mere accidents or epiphenomena but are the phenomena of the world. In brief, Teilhard's world hypothesis does provide a genuine alternative to mechanism and to dualistic vitalism.

Teilhard's World Hypothesis Presupposes Both the Existence of Consciousness in all Matter and the Use of Introspection to Predict the Future Development of Consciousness in the Universe

The discussion in Chapter III stated that the problem of consciousness is crucial in the vitalism/mechanism debate. Three important questions about consciousness were listed and from the arguments presented in Chapter V Teilhard's answer to them should be evident. They are as follows: (A) Consciousness is a universal property of all matter. (B) Conscious matter must exist because only a Weltstoff of this kind is capable of undergoing the process of

complexity/consciousness. (C) Finally, introspection is extremely important in Teilhard's thought. For example, the psychological need of the human personality for irreversible life is an important premise in the argument for the existence of a transcendent cosmic organism which is derived from introspection.

Summary of Teilhard, Bergson and Loeb

A Comparison of Teilhard, Bergson and Loeb on Their Conception of a Teleological System

For Teilhard the entire world is a teleological system, an organic whole. It has a single cosmic vital principle, Omega, which is the ultimate integrator of the system. Further, this system is evolving and as it continues to do so it produces progressively higher states of personality. The ultimate goal which this system is in the process of realizing is the production of a transcendent cosmic organism. Next, for Bergson, the entire world of life is a teleological system and the vital impetus is its vital principle. This system is also an evolving one and it never ceases to produce novel forms of life. However, it is not moving toward the realization of any ultimate goal as is the case in Teilhard's world. Finally, for Loeb, the individual organism is the system. Its goal is the integration of the chemical machinery of the individual organism throughout its life history. Further, integration is achieved by purely physical and chemical

means. A vital principle is not required.

A Comparison of Teilhard, Bergson and Loeb on the Central Question of the Vitalism/Mechanism Debate

The central question of the vitalism/mechanism debate is a metaphysical one for both Teilhard and Bergson. Both men want to discover underlying cosmic processes. Bergson wants to find the underlying process of the evolving world of life and Teilhard wants to discover the underlying process of cosmogenesis.

The answers which they provide to their questions are world hypotheses. Teilhard's hypothesis is the cosmic process of complexity/consciousness and Bergson's is the cosmic process in which the vital impetus and inert matter evolve new forms of life. Now, there are some fundamental differences between these two hypotheses. Bergson's fundamental dualism retains an opposition between inert matter and life. Inert matter completely lacks consciousness and it functions as a cosmic power which blocks the thrust or push of the vital impetus which is the cosmic vital principle. Finally, both inert matter and life are created by the vital impetus and they appear to be cosmic powers of equal value (118). On the other hand, Teilhard's hypothesis eliminates the dualism between an inert matter which totally lacks consciousness and the reality of consciousness. For Teilhard all matter has consciousness and the entire history of the

world is essentially a cosmic process in which the consciousness of matter becomes increasingly concentrated into higher states of personality. Hence Teilhard's hypothesis is monistic. Further, this process is not caused by the push or thrust of its vital principle. On the contrary, Teilhard's vital principle, Omega, is an attractive force which pulls matter into increasingly complex arrangements which are associated with increased consciousness. Hence, the cosmic process in Teilhard's world is convergent and hence leads to a final goal whereas the cosmic process in Bergson's world is divergent and hence no final goal is reached.

Finally, the differences between the world hypotheses of Bergson and Teilhard are rooted in their ultimate categories. These men interpret the fundamental processes of change in the world in different ways. Bergson's contextualistic world hypothesis (119) uses the fundamental category of novelty. The fundamental process in the evolution of life is the production of novel forms of life. Evolution is essentially a process of unending novelty. Hence, evolution is not a change which is moving toward the realization of some pre-determined goal.

On the other hand, Teilhard's organicist world hypothesis (120) uses the basic category of integration. Hence, Teilhard views the fundamental process of change in the world as the progressive realization of some pre-determined goal, the formation of a cosmic

organism. Hence, the most fundamental differences in the world hypotheses of these two men are categories through which they interpret the fundamental processes of change in the world.

Bergson and Teilhard are also similar to each other in that they base their world hypotheses which attempt to resolve the vitalism/mechanism debate upon non-rational intuitions. For Bergson, the vitalism/mechanism debate is generated whenever there is an attempt to understand the nature of life with purely intellectual concepts. The controversy is resolved when the true nature of life, the cosmic reality of duration, is grasped in a metaphysical intuition which differs radically from any kind of intellectual knowing. Similarly, in the case of Teilhard, the vitalism/mechanism controversy is generated whenever there is an attempt to explain the emergence of the human personality in a universe whose Weltstoff is an inert and hence non-conscious matter. This controversy can only be resolved if one postulates the existence of a Weltstoff of conscious matter and the cosmic process of complexity/consciousness. But the latter step presupposes a non-rational intuition of the whole of the universe. Thus, both Bergson and Teilhard presuppose some kind of non-rational or pre-intellectual intuition as the basis of their thinking which attempts to resolve the vitalism/mechanism debate.

Loeb, on the other hand, thinks that the vitalism/mechanism

controversy is a purely scientific question about the nature of some physical integrator of the chemical and physical processes of the individual living organism. Hence, for him this issue can be settled by appropriate experimental means.

A Comparison of the General Conceptual Systems (g.c.s.) of Teilhard, Bergson and Loeb

Further, both Bergson and Teilhard attempt to construct a new g.c.s. Bergson argues for the position that there are two kinds of Weltstoff, inert matter and life, and that duration is the cosmic process of biological evolution. He also argues that there are two different ways of knowing the two different kinds of Weltstoff. Similarly, Teilhard wants to radically alter the mechanistic g.c.s. He argues that the Weltstoff is conscious matter rather than the atomic matter of mechanistic science. He also argues that the fundamental process of change in the world is not entropy, but complexity/consciousness. Hence, both men are, in Kuhnian terms (121), attempting to establish a new paradigm for science. On the other hand, Loeb is primarily a physiologist who extends the existing mechanistic g.c.s. or pardigm of chemistry and physics to biology.

A Comparison of Teilhard, Bergson and Loeb on the Problem of Consciousness

This problem includes three questions. Consider first the

respective answers of these three men to the question: How extensive is the existence of consciousness in the universe? Teilhard states that all of the matter of the world has the property of consciousness. In Bergson's thought consciousness is limited to the biological world. Finally, in Loeb's world consciousness only exists in those higher organisms which can learn new behavior.

Consider next the second question: How is the existence of consciousness explained? For Teilhard a Weltstoff of conscious matter is a necessary requirement for a universe which is undergoing a cosmic process of complexity/consciousness that is producing a transcendent cosmic organism. If the Weltstoff were not conscious matter then the universe would be unable to produce such an organism. For Bergson both consciousness and inert matter are derived from a common source, the cosmic process of duration (122). Finally, for Loeb, consciousness is simply a by-product or epiphenomenon of cerebral biochemistry.

Consider the third question: What is the cognitive value of introspection to reveal the nature of consciousness? In Teilhard's thought introspection is required to understand the nature of consciousness. For example, the need of the human personality for irreversible life is an important premise in his thought which is derived from introspection. Likewise, for Bergson, introspection plays a key role. It is introspection which enables one to have a

metaphysical intuition of duration, the fundamental reality from which life and consciousness are derived. Finally, introspection is totally irrelevant in Loeb's world. His question about the nature of consciousness is formulated in terms of physical chemistry and hence introspection as a source of knowledge is totally irrelevant to answering it.

General Summary of Teilhard, Bergson and Loeb

A comparison of these three men reveals that the vitalism/mechanism debate occurs on at least two planes, the metaphysical and scientific. Bergson and Teilhard present this controversy as a metaphysical one and hence their vitalistic answers are world hypotheses. Loeb, on the other hand, is a mechanistic biologist who thinks that this controversy is a purely scientific one which can be resolved by experimental means.

FOOTNOTES FOR CHAPTER VI

[114]It must be noted that Omega is the cosmic integrator of the world when the latter is viewed as a single whole. However, when the elements or parts of the world are examined then the existence of many physical integrators is seen. For example, the individual human personality is the highest integrator which the process of complexity/consciousness has so far produced. But all individual human personalities will eventually be incorporated within the cosmic organism and hence the cosmic vital principle, Omega, is really the Integrator of integrators.

[115]In the prior discussions about the nature of a g.c.s. only those components of it were introduced which had relevance to the subject of this paper. In addition to the lists of real entities, their properties and interactions, a g.c.s. includes a model of the world which is a conception of nature, a theory of knowledge, criteria of truth, etc. Clearly, all of these components are interrelated and they are the subject of lengthy treatises on metaphysics.

[116]The phenomena of life include the characteristic conscious activities of man.

[117]The elements or subatomic parts of atoms have consciousness because all matter has this property. Now when the soul of an atom integrates its subatomic parts, then a concentration of consciousness is produced. However, the degree to which consciousness is concentrated in the atom is insufficient to enable it to produce the detectable phenomena of consciousness. On the contrary, the astronomically large number of atoms which exist together with the low concentration of consciousness within each atom is the basis of their observable statistical properties which are described by the deterministic laws of chemistry and physics.

[118]In criticism of Bergson, Teilhard states: "...spirit and matter, for him (Bergson) are two powers that are inverse yet of almost equal cosmic value...." (Teilhard, 1969c, p. 87). On the other hand, in Teilhard's world the process of complexity/consciousness is the dominant cosmic process of the world.

[119]See Pepper, 1948, ch. 10.

[120] Ibid, Ch. 11.

[121] See Kuhn (1962)

[122] This is the case when Bergson adopts a psychological monism.

CHAPTER VII

A CRITICISM OF TEILHARD'S COSMIC VITALISM

Introduction

On page 65 of Chapter III the criticism of Bergson exemplified two ways of criticizing a g.c.s. It can be shown that the items on his list of independent realities, mind and matter, are ambiguously defined. Further, it can be shown that his g.c.s. has logical inconsistencies. Now, a similar kind of criticism can be made of Teilhard's g.c.s. For example, his conception of consciousness which appears in the arguments we have examined is ambiguous. Also, the categories which appear in his organicist world hypothesis have logical inconsistencies which are characteristic of this type of hypothesis (123).

There is, however, another way of criticizing a g.c.s. and this is to analyze the arguments which attempt to establish the existence of the individual items which appear in the g.c.s. This is what will be done here. Teilhard's arguments for the existence of conscious matter and those for the cosmic existence of the process of complexity/consciousness will be analyzed. This way of analyzing Teilhard's arguments is more fruitful here because the aim is to reveal the unscientific nature of his arguments and hence also of his entire system of cosmic vitalism.

Teilhard Claims that his Inference of the Existence of Conscious Matter is Consistent with the Development of Science

In the beginning of his work, The Phenomenon of Man (124), Teilhard claims that he is writing a scientific treatise. Hence, he wants to establish his conclusions in a manner that is consistent with the development of science. For example, he claims that his argument for the existence of a Weltstoff of conscious matter is a "sound analogy with all the rest of science" (Teilhard, 1959, p. 56).

Now, why does he think that his argument for the existence of a conscious matter is consistent with the development of science? When the radiations of radium were first discovered they were viewed as an anomaly in the physical world. However, a further examination of these anomalous phenomena initiated a revolution in physics. A new conception of the chemical elements was developed. Prior to the discovery of the existence of radiation the chemical elements were viewed as unchangeable whereas after this discovery they were viewed as changeable entities. Hence, in the discovery of radiation we have an instance in which the discovery of an anomalous phenomenon was a clue to a universal property of matter. In brief, the perception of an exceptional phenomenon can be a revelation of a universal property of matter.

Now, Teilhard thinks that the phenomena of consciousness are today regarded as an anomaly in the world just as were those of

radiation shortly after their discovery. For the mechanistic scientist of today the phenomena of consciousness are simply by-products, epiphenomena, of cerebral biochemistry. On the other hand, Teilhard thinks that the anomalous phenomena of consciousness are the manifestations of a universal property of matter as are those of radiation. Hence, Teilhard thinks that he is justified in inferring the existence of consciousness in all of the matter of the universe upon the basis of the data of consciousness which are only clearly seen by human introspection. In short, Teilhard is convinced that his inference of the cosmic existence of consciousness is consistent with the development of science that is exemplified in development of physics which followed the discovery of radiation.

Teilhard's Inference of the Existence of Conscious Matter Differs Significantly From the Scientific Inferences Which Establish the Existence of Some Universal Property of Matter

Let us now compare Teilhard's inference of the existence of conscious matter with the inference of the changeability of the elements which followed the discovery of radiation. In both cases our inference is in part based upon the perception of exceptional phenomena (125). The latter are the unique phenomena of self-consciousness in man and those of radiation. These observed phenomena are then used to infer the existence of a universal property of matter which is unobserved. In Teilhard's inference the universal property which is not

observed is the consciousness of all matter whereas in the other inference it is the changeability of all of the elements of matter.

On the other hand, the above superficial similarities are overshadowed by fundamental differences. Let us first examine the inference that is based upon the phenomena of radiation. (1) It is based upon observational evidence. (2) The observed phenomena of radiation are measurable. (3) Further, the phenomena of radiation are independent of the observer and hence they are an objective reality, i.e. the existence of radiation phenomena are in no way dependent upon the state of mind or feelings of the scientific investigator.

Next, let us examine Teilhard's inference. (1) It is based upon the non-observational data of self-consciousness, the data of introspection. (2) Introspective data are qualitative and hence are not measurable. (3) Further, the data of self-consciousness are dependent upon the state of mind and feelings of the observer and hence they are subjective. Hence, these fundamental differences show that Teilhard's inference of the existence of conscious matter is <u>not</u> a "sound analogy with all the rest of science" (Teilhard, 1959, p. 56).

A Rule of Inductive Inference Determines Whether a Piece of Evidence Supports the Conclusion of an Inductive Argument and in Teilhard's Case, this Rule is an a Priori Synthetic Statement

The Logical Problem Which Teilhard's Argument Presents is to Determine Whether His Conclusion Which States that Unobservable Conscious Matter Exists is Supported by the Evidence for It

Let us now examine in detail the logical structure of Teilhard's argument for the existence of conscious matter. The version of Teilhard's argument that is here presented differs slightly from those presented in Chapter V, but the criticisms of it that will here be presented will be equally applicable, as will be pointed out, to those arguments which were presented earlier. His argument is as follows:

> The apparent restriction of the phenomenon of consciousness to the higher forms of life has long served science as an excuse for eliminating it from its models of the universe. A queer exception, an aberrant function, an epiphenomenon--thought was classed under one or other of these heads in order to get rid of it. But what would have happened to modern physics if radium had been classified as an 'abnormal substance' without further ado? Clearly, the activity of radium had not been neglected, and could not be neglected, because, being measurable, it forced its way into the external web of matter--whereas consciousness, in order to be integrated into a world-system, necessitates consideration of the existence of a new aspect or dimension in the stuff of the universe. We shrink from the attempt, but which of us does not constantly see identical problems facing research workers, which have to be solved by the same method, namely, to discover the universal hidden beneath the exceptional?
>
> Latterly we have experienced it too often to admit of any further doubt: an irregularity in nature is only the sharp exacerbation, to the point of perceptible disclosure, of a property of things diffused throughout the universe, in a state which eludes

> our recognition of its presence. Properly observed, even if only in one aspect, a phenomenon necessarily has an omnipresent value and roots by reason of the fundamental unity of the world. Whither does this rule lead us if we apply it to the instance of human 'self-knowledge'?
>
> 'Consciousness is only completely recognisable in man,' we are tempted to say, 'therefore it is an isolated instance of no interest to science'.
>
> 'There is evidence for the appearance of consciousness in man', we must continue, correcting ourselves, 'therefore, half-seen in this one flash of light, it has a cosmic extension, and as such is surrounded by an aura of indefinite spatial and temporal extensions.'
>
> The conclusion is pregnant with consequences, and yet I cannot see how, by sound analogy with all the rest of science, we can escape from it.
>
> It is impossible to deny that, deep within ourselves, an 'interior' appears at the heart of beings, as it were seen through a rent. This is enough to ensure that, in one degree or another, this 'interior' should obtrude itself as existing everywhere in nature from all time. Since the stuff of the universe has an inner aspect at one point of itself, there is necessarily a double aspect to its structure, that is to say in every region of space and time--in the same way, for instance, as it is granular: coextensive with their Without, there is a Within to things (Teilhard, 1959, p. 55-56).

The first step in the presentation of the logical structure of the preceding argument is the identification of the logical problem which the argument is intended to solve. This problem is as follows: In this argument there is a transition from the knowledge of man's introspectively observed self-consciousness to the unobserved consciousness of all matter in the universe. The existence of consciousness in all of the matter of the universe is both unobserved and the conclusion of the argument. Now, the logical problem here is whether the

conclusion about unobserved matters of fact is supported by the evidence that is presented in support of it.

Teilhard's Evidence for His Conclusion is the Existence of Consciousness in Man and a Rule of Inductive Inference

Next, what is the evidence for the conclusion? The evidence consists of two parts. (1) Part of the evidence is the existence of consciousness in man which is the "object of a direct intuition" (Teilhard, 1959, p. 55). (2) The next piece of evidence for this conclusion is the rule of inductive inference which states: "Properly observed, even if only in one aspect, a phenomenon necessarily has an omnipresent value and roots..." (Teilhard, 1959, p. 56). Within the context of the entire passage this rule of inference may be reformulated as follows: An exceptional or anomalous phenomenon is a perceptible manifestation of some universal property of matter which is normally not perceptible. For example, the phenomena of radiation which are produced by radium are highly perceptible manifestations of the high instability of this element. On the other hand, the instability of many of the remaining elements is so low that a detectable level of radiation is not produced. If the evidence is now assembled, the argument may be presented in the following syllogism: An exceptional or anomalous phenomenon is a perceptible manifestation of some universal property of matter which is normally not

perceptible. The phenomena of consciousness which are the object of direct intuition are exceptional or anomalous phenomena within the context of the totality of the phenomena of the universe. Therefore, the phenomena of consciousness must be a universal property of matter which is normally not perceptible.

In Order to Determine If the Evidence Supports His Conclusion It is Necessary to Review Some Characteristics of Statements and Inferences

Analytic and Synthetic Statements are Differentiated in Terms of their Content

Next, does the evidence support the conclusion? Let us first briefly review some characteristics of statements that appear in inferences (126). In the first place, statements are differentiated in terms of their content. Analytic statements are those which are about the use of language such as are the rules of logic and grammar. Synthetic statements, on the other hand, are about matters of fact in the world such as are the laws of science.

A Priori and a Posteriori Statements Are Differentiated in Terms of the Way Their Truth is Established

On the other hand, statements can be differentiated in terms of their test of truth. A posteriori statements are those whose truth is

based upon observational evidence which is obtained through the senses. For example, a fundamental requirement of the laws of science is that they must be based upon observational evidence, i.e. they must be true a posteriori. A priori statements, on the other hand, are those whose truth can be established without any appeal to observational evidence. For example, the test of truth for the rules of logic is the absence of self-contradiction.

Rationalists and Empiricists Accept the Existence of a Priori Analytic and a Posteriori Synthetic Statements. However, only Rationalists Accept the Existence of a Priori Synthetic Statements

Next, these characteristics of statements can exist in various combinations. There are at least two different kinds of statements which can be formed. (1) There are a priori analytic statements. These are the familiar rules of logic and grammar. They are all statements which are true by definition. (2) Next, there are the a posteriori synthetic statements which include all of those statements about the world which are based upon observational evidence such as are those of science. (3) A posteriori analytic statements cannot exist because they would be self-contradictory. (4) Finally, the existence of a priori synthetic statements is one of the fundamental issues in philosophy. Empiricist philosophers assert that such statements cannot exist. They always attempt to show that any alleged a priori

synthetic statement is reducible to either an a priori analytic or to an a posteriori synthetic statement. Rationalist philosophers, on the other hand, affirm that a priori synthetic statements do exist.

Non-Ampliative and Demonstrative Inferences are Those in Which the Information Content of the Conclusion Does Not Exceed That of the Premises and in Which the Truth of the Premises Guarantees the Truth of the Conclusion. Ampliative and Non-Demonstrative Inferences are Those in Which the Information Content of the Conclusion Exceeds that of the Premises and in Which the Truth of the Premises Does not Guarantee the Truth of the Conclusion

Next, let us briefly review the characteristics of the two kinds of inference, ampliative and non-ampliative. In a non-ampliative inference, the information content of the conclusion does not exceed that of the premises. This type of inference is the familiar demonstrative argument that is, for example, found in mathematics. Further, in such an inference, it is impossible for true premises which are arranged in correct logical form to imply a false conclusion; if the premises are true then the conclusion must also be true. In short, the conclusion of a valid non-ampliative inference does not exceed, but preserves the information content of the premises. On the other hand, in an ampliative inference, the information content of the conclusion exceeds that of the premises. This type of inference is the one which is characteristic of the scientific method. For example, from a limited number of observed black crows we infer that at least

the majority of the yet unobserved crows are black. Clearly, the conclusion about unobserved black crows exceeds the information content of the premises. Finally, ampliative inferences are non-demonstrative because true premises do not imply the impossiblity of obtaining a false conclusion. For example, upon the basis of a limited number of observations of black crows, it is impossible to conclude that all crows are black. There is always the possibility of finding a non-black crow such as an albino, etc.

Within the Context of the Preceding Discussion About Statements and Inferences We Can Conclude That Teilhard's Rule of Inductive Inference is an a Priori Synthetic Statement

Let us next apply the preceding discussion about statements and inferences to an examination of the major premise of Teilhard's argument which is found on pages 214-215. Why does Teilhard think that this premise is true? He states that is is true "by reason of the fundamental unity of the world" (Teilhard, 1959, p. 56). In the light of the earlier discussion of Teilhard's argument in Chapter V the meaning of this phrase is clear. The "fundamental unity of the world" is not grasped by an empirical observation. For empirical observation reveals that our world consists of a plurality of individual material entities. On the contrary, the "fundamental unity of the world" is grasped in an intuition of the wholeness of the universe which was discussed in

Chapter V. Hence, Teilhard's major premise, his rule of inductive inference, is an example of an a priori synthetic statement. It is clearly about the world and Teilhard thinks that its truth can be established independently of observational evidence by the person who has appropriate intuitions.

The Question as to Whether Teilhard's Evidence Enables Him to Infer in a Scientific Manner the Existence of Unobservable Conscious Matter Includes a Number of Important Issues Which Must be Examined Separately

Teilhard's Aim is to Justify an Ampliative Inference Which Concludes that all Matter has Consciousness

Let us now return to our original question which is: Does the evidence in Teilhard's argument support the conclusion in a scientific manner? This question has a number of components which must be carefully examined. In the first place, it must be clearly noted that Teilhard's aim is to present a scientific inference that is analogous to the scientific inference about the changeable nature of the elements that was based upon a study of the exceptional phenomena of radiation. For Teilhard wants to infer the existence of unobservable consciousness in all matter from the existence of the exceptional and observed phenomena of consciousness in man. "There is evidence for the appearance of consciousness in man... Therefore, half-seen in this one flash of light, it has cosmic extension" (Teilhard, 1959, p. 56).

Hence, Teilhard's aim is to justify a scientific and hence an ampliative inference which concludes that consciousness exists in all matter.

The Evidence Which Justifies the Conclusion of an Ampliative Inference May do at Least One of Two Things. (A) It May Guarantee the Truth of the Conclusion and/or (B) It May Generate Useful Predictions

Secondly, what do we mean when we say that a given piece of evidence justifies the conclusion of an inductive (ampliative) inference? There are at least two important meanings. (1) We may mean that some piece of evidence guarantees the truth of the conclusion. In other words if the observed statement which describes the evidence is true, then the conclusion about the unobserved entities must also be true. (2) On the other hand, we may mean that some piece of evidence enables us to make a useful prediction or to successfully perform some action. Further, it must here be noted that the ability to make useful predictions is not equivalent to making true statements about the world. For example, the radically different conceptions about the world that are found in the Ptolemaic and Copernican systems of astronomy functioned about equally well in making accurate predictions of the planets and stars.

The Key Element in the Scientific Justification of a Conclusion of an Inductive Inference is the Appeal to Observational Evidence

Thirdly, how does a scientific justification of the conclusion of an inductive inference differ from a non-scientific one? In the scientific justification of the conclusion of an inductive inference there is always some ultimate appeal to observational evidence. On the other hand, the intuitive inductions which are found within the rationalistic tradition of philosophy are based upon non-observational evidence (127).

It is the Rule of Inductive Evidence Which Determines Whether a Piece of Observational Evidence Supports the Conclusion

Fourthly, how do we know that a piece of evidence supports the conclusion of an inductive inference? In a demonstrative and non-ampliative inference a rule of deduction is our guide. If the premises are true and are arranged according to the rule, then a true conclusion will follow. Therefore, it is here a rule of deduction which enables us to know that a piece of evidence which is embodied in true premises supports the truth of the conclusion. Similarly, in an inductive (ampliative) inference a rule of inference enables us to know whether the evidence supports the conclusion. In short, it is a rule of inference which enables us to know whether a piece of evidence supports the conclusion of the inference (128).

There are Many Rules of Inductive Inference from Which We May Choose and Hence the Question of Whether a Piece of Evidence Supports the Conclusion is Ultimately Determined by our Reasons for Choosing the Rule

Fifthly, there are many rules of inductive inference from which we may choose in order to perform an inductive inference. How do we know when we have chosen the correct rule? At least two major alternatives appear. (1) We may attempt to justify our choice of a rule A because of some higher rule B. Rule B would in turn be justified because of some higher rule C and so on. In other words we may attempt to justify our choice of a given rule by appealing to some higher or more general principle. Now this attempt to justify rules has two major weaknesses. (A) If we do not exhaust the number of higher rules to which we may appeal then we will have an infinite regress of higher principles or rules which will be unable to justify our choice of a rule. (B) On the other hand, in order to eliminate the possibility of having an infinite regress we may say that there exists some ultimate rule or principle which is a self-evident truth. Now, as the history of philosophy shows, this option is clearly unsatisfactory. A "self-evident truth" is often self-evident to only the individual philosopher who presents it.

(2) On the other hand, there is a second way of justifying our choice of rules which avoids the preceding problem of the infinite regress. According to this way a rule is justified if it realizes the

goal of our inference (129). For example, the goal of deductive inference is to obtain a conclusion which will preserve the truth of the premises. If our premises are true, we want a rule of inference which will guarantee the truth of the conclusion. On the other hand, in the case of induction at least two different goals have been accepted. (A) For some rationalists such as Teilhard the goal of inductive inference is to establish conclusions which are true statements about the unobserved entities of the world. (B) On the other hand, for empiricists such as Salmon the goal of inductive inference is to establish conclusions which are useful predictions about unobserved entities. In short, our knowledge of whether a piece of evidence supports the conclusion of an inference is ultimately based upon our reasons for choosing a specific rule of inference.

An Empiricist (Salmon) Chooses a Rule of Inference Which Will Generate Predictions Which can be Tested With Observational Evidence Whereas a Rationalist (Teilhard) Uses a Rule of Inference Which is an a Priori Synthetic Statement

Sixthly, what then are some reasons for choosing a specific rule of inference? In the preceding discussion two different goals of inductive inference were presented. Hence, there are at least two different reasons for choosing a specific rule of inductive inference. Let us first examine Salmon's empiricist goal of inductive inference (130). Salmon wants a rule of inductive inference that will enable us

to draw conclusions that can be tested by observational evidence. The predictions which are generated by induction can be tested with such evidence. The main reason for this requirement is that inductive inferences constitute the core of science and the latter are based upon observational evidence.

Let us next examine Teilhard's rationalistic goal of inductive inference. He does not choose a rule of inference that will produce a conclusion that can be checked with observational evidence. For he admits that the consciousness of most matter is not detectable. The consciousness of matter becomes detectable only after a certain level of material complexity is reached. Therefore, he chooses a rule of inference which is a statement about the world and one whose truth can presumably be established independently of observational evidence. Hence, his rule is an instance of an a priori synthetic statement. In the final analysis, then, Teilhard's reason for choosing a rule of inductive inference rests upon his acceptance of the existence of a priori synthetic statements, statements which are true independently of observational evidence.

Summary

Let us now briefly review the two kinds of reasons for affirming that a given piece of evidence either does or does not support the conclusion of an inductive inference. (1) First, an inductive inference

explicitly contains evidence such as observed black crows, radiation and the consciousness of man. This evidence appears in the premises of any inductive inference and it constitutes the first kind of reason for affirming the truth of a conclusion. Further, this evidence may be either observational or non-observational. For example, the phenomena of radiation are instances of observational evidence whereas man's psychological need for irreversible (immortal) life is an instance of non-observational evidence. (2) Next, there are reasons for choosing a rule of inductive inference. Here again the evidence that determines our choice may be either observational or non-observational. If we are empiricists such as Salmon we will choose a rule of inference that will connect a piece of observational evidence (e.g. most observed crows in Oregon are black) with a conclusion (e.g. most crows in the United States are black) that will lead to the successful prediction of phenomena. Further, the success of a prediction can be tested with observational evidence. Hence, the main reason for the empiricist's choice of a rule of inductive inference is the observational evidence that it does in fact lead to successful predictions of phenomena. On the other hand, a rationalist such as Teilhard chooses a rule of inductive inference which is an a priori synthetic statement. Further, such a statement is not, by definition, established upon the basis of any observational evidence. Thus, the main reason for the rationalist's choice of a rule of inductive inference

is some non-observational evidence which is presumably revealed in an intuition, rational insight, mystical experience, etc.

Teilhard's Argument for the Existence of Conscious Matter is not a Scientific Induction Because Its Rule of Inference is an A Priori Synthetic Statement

Next, is Teilhard's argument for the existence of conscious matter a scientific inductive inference? If a scientific as opposed to an intuitive induction is one which is based upon observational evidence then Teilhard's argument for the existence of conscious matter is clearly not a scientific one. Even if we assume that Teilhard's premise which affirms the existence of consciousness in man is based upon observational evidence we still do not have a genuine scientific induction. For the rule of inductive inference which is used is an *a priori* synthetic statement and hence it is not based upon observational evidence. Further, Teilhard's argument is not even a genuine induction. The "rule" (Teilhard, 1959, p. 56) which appears in his argument is an *a priori* synthetic statement and hence the entire argument is really a demonstrative and non-ampliative one as it is represented on pages 214-215. The information content of the conclusion is contained in the premises. In short, Teilhard has not presented a scientific induction to support his view about the existence of conscious matter (131).

Even if Teilhard's Rule of Inductive Inference were Known to be True, It would Still be Useless for Scientific Induction

Salmon's criticism (132) of Kant's statement of the law of universal causation which is an a priori synthetic statement is also applicable to Teilhard's rule of inference which is: "Properly observed, even if only in one aspect, a phenomenon necessarily has an omnipresent value and roots by reason of the fundamental unity of the world" (Teilhard, 1959, p. 56). Let us assume that Teilhard's synthetic a priori rule is known to be true. Under these conditions will this rule enable us to infer from the existence consciousness in man to the conclusion that all matter has consciousness? No, it will not because it does not contain any criteria which enable us to determine which phenomena can be generalized. Within the context of the discussion the expression "properly observed phenomena" refers to exceptional phenomena such as the consciousness of man and those of radiation. Hence, "improperly observed phenomena" would presumably be those which could not be generalized. But what are the criteria which enable us to determine which exceptional phenomena can be generalized? For example, a minute fraction of the surface of the earth may exhibit an unusual color and hence be an "exceptional phenomenon". Are we then justified in inferring that this exceptional color is a universal property of matter? Hence, even if Teilhard's

rule of inference were known to be true it would be useless because it would not be able to tell us which phenomena can be generalized.

Teilhard's Arguments for the Existence of Conscious Matter that were Presented in Chapter V are also Unscientific

The unscientific nature of Teilhard's argument is the result of his use of a priori synthetic statements. For such statements are, by definition, true independently of observational evidence.

Further, this criticism of Teilhard's argument for the existence of conscious matter that has been presented in this chapter is also applicable to the arguments which were presented in Chapter V. Let us, for example, examine an important part of the argument for conscious matter which was presented in Chapter V. It may be formulated as follows: The world is a rational whole in the sense that it would not engender fundamental psychological needs in man which it could not fulfill. But man has a fundamental psychological need for irreversible (immortal) life. Therefore, the irreversible life of man must exist in the world. Here again we have a major premise which is an a priori synthetic statement. The minor is also an a priori synthetic statement as it is clearly not, as Teilhard admits, based upon observational evidence. Also, even if the major premise or rule were known to be true what would be our criteria for determining which needs of man are fundamental? In short, the same criticism

of Teilhard's argument that was presented earlier in this chapter also applies to the above argument

Criticism of Teilhard's Postulational Proof for the Cosmic Existence and Primacy of the Process of Complexity/Consciousness

If We Assume that Teilhard's World Hypothesis of Complexity/Consciousness is Logically Consistent with All Possible True Statements About the World We Still are not Able to Infer Its Factual Truth

In Chapter V an important part of Teilhard's argument for the existence of conscious matter was his proof of the cosmic existence and primacy of the process of complexity/consciousness. A cosmic process which produces progressively higher states of consciousness and personality in the universe. For this process cannot occur unless matter has the property of consciousness. Let us now examine Teilhard's argument for the existence of a cosmic process of complexity/consciousness which is producing higher states of personality in the universe. One version of this argument is as follows:

> I confine myself to recording that more conscious matter (that is to say more reflective, better centred) follows historically after less centred, less reflective, less conscious. This seems to be the work of 'a wind of the spirit', to be observed throughout the world. How can we definitely establish this fact which, if proved, would also give us the proof we seek of a definite movement of the universe?
>
> I would answer by accepting it and by enquiring whether, pushed to its final conclusions, it gives a true picture of the universe around us.
>
> On my way, I shall concern myself only to pursue to their logical end the organic links which appear--just to see where they lead--rather as if I were constructing

> a geometrical system. The overall success will decide. If the construction does not form a complete whole, or if it contradicts some part of experience, it will show that the initial hypothesis was bad and should be abandoned. But if, on the contrary, it seems to encircle and harmonize the world to a greater degree, then we must conclude that in accepting a spiritual direction of evolution we have come near to the truth (Teilhard, 1969a, p. 54).

In the above argument Teilhard states that he wants to prove that "a definite movement of the universe" is "a wind of the spirit". In other words he wants to establish the world hypothesis which states that the fundamental process of change in the world is a development of increased states of consciousness and hence of personality. In his attempted proof he assumes that the hypothesis is true and then he examines the logical consequences. If the hypothesis is logically inconsistent with some part of our experience then it should be abandoned. On the other hand, if it is consistent then it should be accepted as "near to the truth" (Teilhard, 1969a, p. 54). Further, he states that this entire process of attempting to establish an hypothesis is analogous to "constructing a geometrical system" (Teilhard, 1969a, p. 54). Therefore, Teilhard is here attempting to establish the truth of his world hypothesis on the grounds that it is a postulate that we must have in order to have a coherent conception of the world.

Now, the fundamental ideas which are found in Salmon's criticism of the view that the principle of the uniformity of nature is a postulate are also applicable to Teilhard's argument which is here

presented (133). When a pure mathematician uses postulates to construct a mathematical system the truth or falsity of the postulates are viewed as irrelevant. His procedure is to examine the logical consequences which would occur if the postulates were true. He is especially concerned with knowing whether the various theorems which are implied by the postulates are logically consistent. In a similar manner Teilhard treats his hypothesis as a postulate and tries to show that it is logically consistent with many other statements about the world. Now, let us assume that Teilhard's hypothesis is in fact logically consistent with all of the statements such as the laws of science which we can make about the world. Does this then establish the truth of his hypothesis? No, it clearly does not because it is always possible to construct another hypothesis that is equally consistent (134). Hence, no amount of demonstrated logical consistency between Teilhard's hypothesis and the totality of statements that can be made about the world can establish the factual truth of his hypothesis.

If We Further Assume that Teilhard's World Hypothesis is the Only Possible One Which is Logically Consistent With all Possible True Statements About the World We Still Cannot Infer Its Factual Truth

Next, let us assume that Teilhard's world hypothesis is in fact the only one which is consistent with all possible true statements

about the world. Would then such a coherence guarantee the truth of his world hypothesis of complexity/consciousness? The clue to our answer can be found in Salmon's criticism of Bertrand Russell (133) who asserts that the principle of the uniformity of nature is a postulate which is necessary in order to make our inductive inferences possible. Now his statement and criticism of Russell's views are as follows: It would be desirable if we could establish the truth of the principle of the uniformity of nature. However, it is impossible to obtain evidence that will render it at least probable. On the other hand, we do have an indispensible need for this principle in order to make our inductive generalizations possible. At this point in the argument Salmon raises the question: What is our justification for postulating a principle such as that of the uniformity of nature when we cannot even find enough evidence to render it at least probable? To say that we have an indispensible need for it in order to make scientific induction possible is simply an instance of wishful thinking. We simply have no evidence that nature must conform to our wishes or needs. Further, the function of inductive reasoning is to obtain some knowledge of things as they are and hence it cannot be based upon some principle which is the product of our wishful thinking. In short, the argument that we must accept the principle of the uniformity of nature as a postulate is an instance of wishful thinking.

Next, let us apply the preceding considerations to Teilhard's

argument. For Teilhard the human mind has a fundamental need to find a world hypothesis which will integrate the totality of facts about the world. Now, we have assumed for the sake of argument that his hypothesis is the only possible one which can fulfill this need of man, i.e. Teilhard's hypothesis is assumed to be indispensible for the realization of man's need to find unity. Can we therefore say that Teilhard's hypothesis is justified? The answer is clearly no. The assumed fact that his hypothesis is indispensible for the satisfaction of a human need does not entail its truth. To say otherwise is to indulge in wishful thinking. Therefore, Teilhard's proof for the truth of his world hypothesis is inconclusive.

An Objection to the Preceding Criticism of Teilhard's Views States that It Contains an Assumption About the Existence of an Objective Reality Which is Explicitly Denied by Him. And Hence the Criticism is not an Internal One. This Objection is not Valid Because Teilhard Does Claim to be Arguing in a Scientific Manner and Hence He Must Accept the Assumption that Science Investigates an Objective World of Reality Which is Independent of Our Thoughts and Desires

Now, the preceding criticism of Teilhard's position is open to the objection that it contains a premise that is not shared by him. This premise is: The truth of our statements about the world, i.e. statements about matters of fact, is determined by observational evidence which is found in an objective reality that is independent of our

feelings, thoughts and desires. Hence, according to this premise our psychological needs and wishes, no matter how "fundamental" they may be, do not in any way determine the characteristics of objective reality. Now, Teilhard explicitly denies this distinction between an objective reality and the truths about man's fundamental psychological needs and desires which were discussed in Chapter V. Teilhard states:

> The truth is nothing but the total coherence of the universe in relation to each part of itself. Why suspect or undervalue this coherence because we are ourselves the observers? Scientists are always contrasting something they call anthropocentric illusions with something they call objective reality. The distinction does not exist. The truth of man is the truth of the universe for man, that is to say the truth, pure and simple (Teilhard, 1969a, p. 54-55).

Again in another passage he states:

> The personality of God (together with the survival of the 'soul') calls out the greatest opposition and antipathy from contemporary scientific thought. The origin of this dislike is to be found in the intellectual contempt which has rejected as 'anthropocentric' all attempts to understand the universe through man. Let us once more put the fact of man in its true place. Let us recognize, not out of vanity or idleness but on scientific evidence, that no phenomenon has had more preparation, or is more axial and characteristic than this (Teilhard, 1969a, p. 45).

Let us first try to understand the meaning of these passages. When Teilhard states that "the truth is nothing but the total coherence of the universe in relation to each part of itself" he means that the truth about the world can be formulated into a set of true statements which are logically consistent with each other. Therefore, a true

world hypothesis would be one in which statements about man's psychological needs would be logically consistent with statements about the structure of the physical world. If, for example, the statement that man has a need for irreversible life were true then in a true world hypothesis statements about the structure of the physical world would be logically consistent with this need. Hence, the cosmic process of entropy would not be the dominant one in the world. Further, we have seen in Chapters IV and V that Teilhard has attempted to formulate a world hypothesis that is consistent in this way. In other words, Teilhard's denial of a separate world of objective reality is equivalent to a demand for the total coherence of all truths about the world.

Further, in view of the discussion of Chapter V the underlying reason for Teilhard's demand for total coherence becomes evident. His central category of thought is integration or synthesis. Hence, the demand for total coherence is a demand for the complete integration or synthesis of our conceptions of the world.

Next, in view of the discussion in Chapter V the meaning of "the truth of man is the truth of the universe for man, that is to say, the truth, pure and simple" becomes apparent. For Teilhard a study of the psychological requirements of man's continuing evolution automatically becomes a study of the physical requirements of cosmogenesis. The fundamental reason for this is that man is the highest

integrator which the process of cosmogenesis has produced.

Finally, in view of the discussion of Chapter V the meaning of Teilhard's anthropocentrism as an attempt "to understand the universe through man" becomes clear. In Chapter V we saw that the human personality is the model of the physical world. Hence, a thorough understanding of the requirements of the developing human personality is the key to an understanding of cosmogenesis.

On the other hand, most scientists accept the existence of an objective reality which is independent of our desires and thoughts and which determines the truth of our statements about the world (135). Hence, for those who accept the existence of an objective reality there is no necessity for statements about the world to be coherent with man's psychological needs and desires. For example, it is this belief in an objective reality which enables present day scientists to accept the fact that we can have a desire and need for immortality which cannot be fulfilled in the present conception of the physical world (136). In short, given a belief in an objective reality there is no necessity to search for the kind of total coherence which Teilhard wants.

We may summarize the preceding discussion about the meaning of the quoted passages in which Teilhard denies the scientific conception of an objective reality as follows: (1) He denies that there is an objective reality as scientists normally conceive of it. For Teilhard

there is no outer reality which is independent of man's thought and desires. On the contrary, Teilhard's real world is a rational whole which is capable of fulfilling man's fundamental needs and desires. (2) Teilhard affirms an anthropocentrism which is rejected by science. For him, the universe can only be understood in terms of the human personality.

What then are the consequences of Teilhard's rejection of the belief in objective reality upon the criticism of his argument in this section? Given the fact that he does not accept the premise of objective reality can we still say that a criticism of his argument which utilizes this premise is a truly internal one? Yes, we can because Teilhard also states that he wants to generate scientific statements about the world. But science requires the premise of objective reality which Teilhard rejects. Modern experimental science does not function without an implicit belief in a world of objective reality which is independent of our thought and desires. Therefore, Teilhard's postulational proof of his world hypothesis is both unscientific and inconclusive.

Teilhard's Criticism of the Mechanistic g.c.s. is not Supported by His Arguments

Teilhard's views which were presented in Chapters IV and V are in effect a sustained attempt to radically alter our mechanistic g.c.s. For in his world hypothesis of complexity/consciousness with its

Weltstoff of conscious matter Teilhard claims to have developed a g.c.s. which is superior to the mechanistic one in the following way: (1) A g.c.s. in which the Weltstoff consists of conscious matter is consistent with the validity of the present laws of physics and chemistry. (2) Further, at least a part of the Weltstoff is capable of developing into an immortal cosmic organism which permanently escapes the disintegrating process of entropy. It is this aspect of his g.c.s. which, in his opinion, makes it superior to the mechanistic one. For in a mechanistic g.c.s. with a Weltstoff of inert matter it is not possible for the latter to develop into a spiritual organism which can permanently escape from the eventual disintegration of the process of entropy. Now, the criticisms of Teilhard in this chapter have shown that his arguments for the existence of a Weltstoff of conscious matter and for the cosmic existence and primacy of the process of complexity/consciousness are not supported by the evidence. But the existence of conscious matter and the cosmic process of complexity/consciousness are the key components of Teilhard's g.c.s. which, in his opinion, make it superior to the mechanistic one. Hence, Teilhard's radical alteration of the mechanistic g.c.s. is not supported by the evidence.

Summary of the Chapter

Teilhard claims that he has presented a scientific argument for

the existence of conscious matter. However, the analyses of the arguments in this chapter have shown that this claim is not established. His alleged inductive argument is based upon a rule of inductive inference which is an a priori synthetic statement. Hence, his entire argument is not an instance of a genuine scientific induction. On the contrary, it is really a demonstrative and non-ampliative inference as is defined on page 217. Further, even if we assume that the a priori synthetic premise or rule of the inference is known to be true it would still be useless as a rule of inference for a genuine scientific induction. Finally, the arguments for the existence of conscious matter that were presented in Chapter V can also be criticized in the same manner.

Next, the existence of conscious matter is also a necessary requirement for the cosmic process of complexity/consciousness. This entire process requires conscious matter in order to function as Teilhard has described it. Hence, any proof of his world hypothesis of complexity/consciousness is indirectly an argument for the existence of conscious matter. However, the analysis of the proof of his world hypothesis in this chapter has shown that this hypothesis has not been established. If we assume that this hypothesis is logically consistent with all possible true statements about the world we still have not established its factual truth. For it is always possible to construct an alternative hypothesis which is equally consistent. Next, if we

further assume that his world hypothesis is the only possible one which can be consistent with all possible true statements about the world we still have not established its factual truth. For the indispensibility of a postulate such as Teilhard's world hypothesis to fulfill some psychological need is not sufficient evidence to establish its factual truth. In brief, the analyses of this chapter have shown that Teilhard's arguments have failed to demonstrate the existence of conscious matter and the cosmic existence and primacy of the process of complexity/consciousness.

Finally, Teilhard wanted to radically alter the mechanistic g.c.s. with his conception of conscious matter and the cosmic process of complexity/consciousness. However, his failure to establish the existence of conscious matter and the cosmic existence of the process of complexity/consciousness implies that he has failed to change the mechanistic g.c.s. as he had intended.

FOOTNOTES FOR CHAPTER V11

[123]See the discussion about organicist world hypotheses in: Pepper, 1948, p. 280-314.

Teilhard's Omega has logically inconsistent properties. It functions within our spatio-temporal world in the process of complexity/consciousness and yet it has a physical existence outside of this empirical world of space and time.

[124]See Teilhard, 1959, p. 29-30.

[125]It will soon be seen that another important part of an inductive inference is its rule.

[126]For extended discussion see Salmon, 1967, p. 5-11; p. 27-40.

[127]See Salmon, 1967, p. 1-5.

[128]The relationship between the rules of inductive inference and the evidence for the conclusion is clearly presented in the following passage from Salmon:

(Salmon, 1965, p. 266) "The fundamental difficulty arises from the fact that the very notion of inductive evidence is determined by the rules of inductive inference. If a conclusion is to be supported by inductive evidence it is necessary that it be the conclusion of a correct inductive inference with true premisses. Whether the inductive inference is correct depends upon whether the rule governing that inference is correct. The relation of inductive evidential support is, therefore, inseparably bound to the correctness of rules of inductive inference. In order to be able to say whether a given statement is supported by inductive evidence we must be able to say which inductive rules are correct.

For example, suppose that a die has been thrown a large number of times and we have observed that the side two came up in one-sixth of the tosses. This is our "evidence" e. Let h be the conclusion that, "in the long run," side two will come up one-sixth of the times. Consider the following three rules:

1. (Induction by enumeration) Given m/n of observed A are B, to infer that the "long run" relative frequency of B among A is m/n.

2. (A priori rule) Regardless of observed frequencies, to infer that the "long run" relative frequency of B among A is 1/k, where k is the number of possible outcomes--six in the case of the die.
3. (Counter-inductive rule) Given m/n of observed A are B, to infer that the "long run" relative frequency of B among A is (n - m)/n.

Under rule 1, e is positive evidence for h; under rule 2, e is irrelevant to h; and under rule 3, e is negative evidence for h. To determine which conclusions are supported by what evidence, it is necessary to arrive at a decision as to what inductive rules are acceptable. If rule 1 is correct, the evidence e supports the conclusion h. If rule 2 is correct, we are justified in drawing the conclusion h, but this is entirely independent of the observational evidence e; the same conclusions would have been sanctioned by rule 2 regardless of observational evidence. If rule 3 is correct, we are not only prohibited from drawing the conclusion h, but also we are permitted to draw a conclusion h, which is logically incompatible with h. Whether a given conclusion is supported by evidence--whether it would be rational to believe it on the basis of given evidence--whether it is made probable by virtue of its relation to give evidence--depends upon selection of the correct rule or rules from among the infinitely many rules we might conceivably adopt.

The problem of induction can now be reformulated as a problem about evidence. What rules ought we to adopt to determine the nature of inductive evidence?"

[129] This point is clearly made in the following: (Salmon, 1965, p. 269) "Strawson also has seen fit to make a legal reference in dealing with the same point: "But it makes no sense to inquire in general whether the law of the land, the legal system as a whole, is or is not legal. For to what legal standards are we appealing?" This analogy is a useful one. It is, indeed, pointless to ask whether the legal system as a whole is legal, but this does not mean that the legal system is exempt from criticism and stands in no need of justification. What does make sense is to ask whether adherence to this legal system will achieve ends we seek to realize, and whether some other legal system would achieve these ends more efficiently. Similarly, although we cannot justify inductive rules by reference to other inductive rules, we can try to show that there are reasons for preferring one inductive rule to others."

[130] In the case of deduction, i. e. non-ampliative and demonstrative inference, rules of inference are adopted which preserve

the truth which is contained in the premises. For the aim of deduction is truth preserving. Salmon (Salmon, 1965, p. 268) states:

"The sole ground, it seems to me, for accepting or rejecting rules is in terms of the aims that will or will not be achieved by conforming to them. The aim of deductive logic, I take it, is to be able to draw true conclusions from true premisses. To achieve this aim we endeavor to adopt as rules of deductive inference only those rules which are truth preserving. We accept modus ponens as a rule of deductive inference because we believe it will never sanction drawing a false conclusion from true premisses."

On the other hand, the rules of inference for inductive or ampliative inference cannot be justified in the same way as are those of demonstrative and non-ampliative inference. We cannot show that an inductive rule of inference leads to true conclusions as is the case with demonstrative inferences. However, we can justify an inductive rule by showing that it is useful for predicting the appearance of phenomena and for the planning of successful action. Salmon clearly summarizes these points in the following passage:

(Salmon, 1953, p. 46-47) "Essentially, the problem of the justification of induction can be solved when we recognize that such a justification cannot function as a guarantee of the truth of our inductive conclusions. If we could furnish a guarantee of the truth of inductive conclusions it would amount to a sufficient condition for the attainment of successful inductions. A rule of induction would then be justified because it would lead to true conclusions. However, we know that such a justification is impossible. But this does not mean that no justification is possible, nor does it mean that no justification is necessary. Feigl has maintained that it is a misunderstanding of the inductive situation to seek a justification, for induction goes according to a rule and rules are not true or false statements, they are directives. Von Wright maintains a similar position when he suggests that philosophers should no longer concern themselves with the problem of justification, but should turn to the more important and fruitful task of formulating the rules of induction.

The answers to Feigl and van Wright contain the key to the problem of the justification of induction. Feigl is perfectly correct when he points out that induction proceeds according to rule, and that rules are directives. And von Wright is correct when he recognizes that the justification of induction cannot be given in the sense of a guarantee. But both are wrong when they conclude that the only problem that remains is to formulate rules of induction. If such a conclusion were correct, there would be no problem of formulating rules of induction, for one rule would be as good as any other rule. However, they lose sight of the fact that while statements require proof, rules require a justification in terms of the purposes they are

purposes they are instituted to serve. One way to justify a rule of inference is to show that it leads to true conclusions. This is the justification of the rules of deductive reference, but unfortunately such a justification is not open in the case of the rule of induction. However, there is another kind of justification which can be given. Rather than showing that our inductions are justified by showing that they lead to true conclusions, we can justify them by showing that they are useful in predicting and acting. This is a legitimate sense of the word "justification" for it consists in showing the bearing of the rule of induction upon the purposes which we have in mind in making inferences.

Such a justification has been given in detail by Reichenbach in Experience and Prediction and in The Theory of Probability. I shall not attempt to state Reichenbach's theory of induction in detail, nor to justify it. A full and detailed discussion is included in the works cited. I shall discuss the theory briefly only to show its bearing upon the subject under discussion here.

Reichenbach's justification consists in showing that if the future can be predicted, then the rule of induction will enable us to predict it. Precisely formulated, the justification of induction says: If successful predictions are possible, then the persistent use of the rule of induction will lead to successful predictions. It consists in showing that if it is possible to make inductive predictions then the rule of induction is an asymptotic method which will eventually lead to successful predictions. This justification gives no proof that the future can be predicted, and indeed, no such proof is available. But it does make it reasonable to act in terms of inductive inferences, because if any path leads to successful action this one will. And to show that action in terms of the rule of induction is reasonable is certainly justification for using the results of induction. There are no better guarantees than this; we must face the situation realistically and realize the status of our inductions. Realizing this status, we avoid an unnecessary skepticism at one extreme and an unwarranted confidence at the other.

In Experience and Prediction Reichenbach emphasized the fact that there is no sufficient condition of success, but the ability to gain success by the use of the rule of induction is a necessary condition of the possibility of success. This is true, but there is another side to this justification which is brought out much more clearly in The Theory of Probability. Although there are no unconditional sufficient conditions of successful prediction, if success is possible in any way, then use of the rule of induction is a sufficient condition of success. While the formulation in Experience and Prediction implies this result, the sufficiency of the rule bears emphasis in order to avoid misunderstanding of the force of the justification. This emphasis

makes it clear that there is one road open to us: if we use the rule of induction we have everything to gain and nothing to lose. If the use of the rule of induction does not yield success, there is no other method which would have yielded it."

[131] Teilhard's argument for the existence of conscious matter might be a valid metaphysical inference, an intuitive induction, within the context of an idealistic philosophy. However, this issue is beyond the scope of this paper. The purpose of the discussion in this paper is to determine whether Teilhard's claim to present a valid scientific argument for the existence of conscious matter is established.

[132] Salmon's criticism of the Kantian principle is as follows: (Salmon, 1953, p. 42-43) "For we can show that even if the principle of the uniformity of nature were true, and could be known to be true, it would be of no use to us as a justification of induction. We can show that the knowledge of the uniformity of nature is neither a necessary nor a sufficient condition for the justification of induction. For example, let us examine Kant's law of universal causation in order to see whether the knowledge of its truth, however that knowledge might come about, would be sufficient to justify induction.

Kant's formulation reads, "Everything that happens (comes into being) presupposes something from which it follows according to a rule." It should be obvious that such a rule or principle is too general to be of any help in justifying induction. For the mere knowledge of the existence of a rule does not help us in the least to know how to find what the particular rule is. And from the knowledge that something is presupposed we can in no way find out what that particular thing is. We are always concerned with the truth of particular inductive conclusion, and with the validity of particular modes of arriving at these conclusions. And such a formulation as Kant's is clearly inadequate for this purpose. It might assure us that true inductions are possible, but it does not tell us how to discover which ones are true. It does not tell us how to distinguish valid inductions from invalid ones, nor does it give us any criteria for distinguishing valid rules of inference from invalid ones. Given any particular inductive inference, we cannot tell, with the aid of the Kantian principle, whether or not it is valid and whether or not the conclusion is true. In short, it does not constitute a justification of induction. Indeed, we cannot even conclude from this principle that inductions would be impossible if it were false. Nor can we conclude that we have ever made a valid induction."

[133]Salmon's criticism of those who view the principle of the uniformity of nature as a postulate is as follows: (Salmon, 1953, p. 41-42) "The third view, that the uniformity of nature is to be assumed as a postulate, is the view which is perhaps most deserving of present-day attention. We must consider what it means to regard the univormity of nature as a postulate. Certainly it is not to be regarded in the same light as that in which a mathematician regards a postulate or postulate set. To the mathematician as a pure mathematician, a postulate is a statement whose truth or falsity is to be regarded as irrelevant within the context of the problem with which he is dealing. Rather, he investigates the logical consequences of the statement in the interest of discovering what would follow if the statement were true. He is not interested in knowing whether the statement and its consequences are true, he is only interested in the relations of entailment which exist. He has not concerned himself with the truth of his postulate and consequently he does not assert the derived statements.

When we make inductions the situation is quite different. We are not particularly interested in the formal consequences of the principle of the uniformity of nature. We are not interested in asserting statements of the form, "if nature is uniform, then such and such consequences follow." Such entailment in and of itself is quite beside the point. On the contrary, our purpose in making inductions is to be able to assert the consequences independently, not as the latter part of a conditional. The purpose of induction is to determine matters of fact about the world, and unless we know that nature is, in fact, uniform, the consequences of the statement that nature is uniform are of no value in determining matters of fact.

On the other hand, if we could in any way establish the fact that nature is uniform, then there would be no need to regard the principle of uniformity as a postulate. Indeed, when philosophers hold the uniformity of nature to be a postulate, they are appealing to the very impossibility of proving its truth. It would seem then that to say the uniformity of nature is a postulate is to say that we will regard it as true even in the face of complete absence of evidence for it. The advocate of the postulate would agree that it would be nice if it were possible to establish the truth of the uniformity of nature principle, but inasmuch as that is impossible, he would maintain the necessity of regarding it as a postulate. He would say that we must assume that nature is uniform in order that inductive inferences should be possible. But, we must ask, what is the justification for assuming any such principle which cannot be known to be true, that is, for which it is impossible to get sufficient evidence to render it at least probable? Certainly the statement that we need it is not sufficient justification; such an attempt at justification would be no more than a species of wishful thinking. We have no reason to believe that

nature so conveniently conforms to our wishes and needs. The purpose of inductive inferences is prediction and knowledge of the unknown, and knowledge concerns things as they are, not things as we wish they were or as we need to have them. If the purpose of inductive inferences were to state our wishes or needs there would be no use for an elaborate system of inferences, evidence, criteria of validity, or justification. It would be much easier simply to state our wants. And certainly there can be no hope that the establishment of such a system of inductive inference will have any effect upon nature or the facts which we hope to discover, such that by virtue of the existence of a logic we shall guarantee that our wishes will come true. The difficulty is that, while it might be possible to prove implications with the principle of uniformity as antecedent, proponents of the postulate wish to assert the consequents unconditionally. The postulate functions as an antecedent which can be used when needed and can then be conveniently forgotten."

[134]See the criticism of the coherence theory of truth in Russell, 1959, chapter 12.

[135]The following passages from Schubert-Soldern presents some of the requirements for a truly scientific analysis of the nature of life:

(Schubert-Soldern, 1962, p.XVl) "If we make phenomena our starting point, they must be accepted as such and be discussed within the sphere of experience in which they have been observed. It is therefore neither necessary nor permissible to attempt to explain these phenomena by means of experience derived from quite a different sphere, however exact and definite such other experience may be. We can only establish the nature of a thing by first making a thorough study of its characteristics. We can be sure we have found the really essential characteristics when we can show that each of them involves the existence of the rest. The characteristics will then be identical with the very nature of life, and will in fact be its expression."

(Schubert-Soldern, 1962, p.XVll-XVlll) "Our conclusion that the two procedures are inseparable points to the fact that every experience which the inquiring intellect has derived from its own inner life must be rigidly excluded from the field of such scientific enquiry. The aspect of nature which can be studied objectively falls within the sphere of what the student may examine and experience. All the knowledge and experience obtained in this sphere is commensurable and so permits us to make comparisons. On the other hand, everything taking its origin in the student's inner life is derived from

quite a different sphere of knowledge and is on a different plane. If this information is regarded as objective fact, comparisons and assimilations will be made which are quite inadmissible. Differences will appear which will owe their origin entirely to the differences between the experience of the two spheres. Antinomies or contradictions which are without logical foundation will turn up in respect of one and the same objective situation. Something claiming to be dialectic is smuggled into the natural world, something which is reality is just the reflection of the genuine dialectic between the subject ego and the object: this is a fact explicitly and rightly emphasized by Erich Heintel. The qualitative and quantitative expressions of the differences between various objects are irretrievably confused once this procedure is admitted--as it so often is.

Objective, observable facts alone can be the basis of any scientific theory of life. Even this limitation must be qualified, for feelings of warmth or cold are objectively ascertainable facts. It is the external world outside the observer and knowable through the senses which must form the basis of any scientific theory of life. In other words, biology treats of life as a phenomenon observable in objects knowable by means of the senses; it does not start from "I am alive". If a synthesis of these two points of view is to be achieved, it must be based upon the total specialized knowledge which biology can provide: the proofs used must be direct linear proofs, and cannot take the form of any genuine dialectic."

The requirements for a scientific theory of the nature of life are as follows: Observational evidence, data obtained through the senses, must be the basis of such a theory. This restriction enables us to construct a theory in which all of the evidence is commensurable. Therefore, any truly scientific theory must rule out any evidence such as the data of consciousness which are obtained from the inner life of the investigator. The data of consciousness of man's inner life belong to a different sphere of knowledge and hence they are not commensurable with the objective data which are derived from sensory observation.

On the other hand, if the data of consciousness which are derived from the inner life of man through introspection are equated with the objective facts that are derived from sensory observation then needless contradictions and problems will be generated. A clear instance of such a problem is Teilhard's description of the contradiction between man's psychological need for irreversible life and the cosmic process of entropy which will eventually result in the total death of all life and thought. In this case man's need for immortality is derived from the introspective data of man's inner life, whereas evidence for the cosmic process of entropy is derived from observational evidence. Hence the contradiction which Teilhard describes

originates in his attempt to harmonize incommensurable spheres of knowledge. The latter procedure may be legitimate for some system of metaphysics, but it is clearly inappropriate for the establishment of a scientific theory of the nature of life.

In summary, a scientific theory about the nature of life "treats of life as a phenomena observable in objects knowable by means of the senses; it does not start from I am alive" (Schubert-Soldern, 1962, p. XVIII). On the other hand, Teilhard's starting point for an understanding of the nature of life is a study of the human personality. Further, not only the nature of life, but the entire process of cosmogenesis is to be understood in terms of the development of the human personality. Hence, Teilhard's starting point for an understanding of the nature of life is what Schubert-Soldern would describe as the premise: "I am alive". In short, Teilhard's conception of the nature of life is not within the scientific realm.

[136]In addition, such scientists would be highly suspicious of any world hypothesis which was totally coherent with all of man's needs and desires. Such a coherent hypothesis would very likely be regarded as a product of wishful thinking and an instance of the anthropocentrism which Teilhard accepts. After all, the objective reality we encounter in everyday life is often quite at variance with our deepest desires and thoughts. Hence, why should we insist on trying to find a total coherence in our intellectual conceptions of the world?

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