THE THEORY OF ORTHOGENESIS IN THE SYNTHESIS OF TEILHARD DE CHARDIN

by

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PREFACE

Today the name of Père Pierre Teilhard de Chardin is known to millions. The rate at which his works are being consumed by an audience with widely divergent interests testifies to his phenomenal popularity and universal appeal. It seems, however, that only a small portion of his vast following has approached a true understanding of his synthesis. His theory is at the same time comprehensive and profound, and even scholars who take profundity in stride have difficulty in grasping the extensive unity of Teilhard's thought. There is a natural tendency to categorize his work into traditional compartments, to judge it as if it were natural science, or philosophy, or theology. Teilhard himself says that his work is <u>hyperphysics</u>, that is, a new science based on modern natural science but extending through social science, philosophy and natural theology. If the possibility of such a science is rejected, then the Teilhardian synthesis is rejected from the outset. If the Teilhardian synthesis is to be understood it would seem that it must be understood, not as natural

science, philosophy or theology, but as hyperphysics.

Many authors who compliment Teilhard on his synthesis criticize or even reject his theory of orthogenesis on the grounds that it is incompatible with modern science. If, however, his synthesis is a coherent logically connected whole, the rejection of an essential part of it such as orthogenesis constitutes a rejection of the whole of his hyperphysical theory. A defense of Teilhard's hyperphysics requires a defense of his theory of orthogenesis, and a defense of orthogenesis requires some demonstration of its compatibility with established scientific theories and facts. The latter is the purpose of this thesis.

From this statement of the problem the limitations of this work may be deduced. First, only those writings directly connected with hyperphysics will be considered. Teilhard's paleontological and geological works will not be discussed, nor will his spiritual works even though they are based to some extent on his hyperphysical synthesis. Secondly, no direct attempt will be made to justify the validity of hyperphysics, or the whole Teilhardian synthesis. The justification of orthogenesis as compatible

with modern science and as scientific in itself certainly is a necessary step towards such a validation, but is only one of many such steps.

The plan of the thesis is as follows: First an exposition of Teilhard's orthogenetic theory will be presented. Here the nature and basis of hyperphysics will be discussed, and then the meaning of the concept of orthogenesis will be analysed, both in general and within the Teilhardian synthesis. This general exposition is not intended to be exhaustive. It will contain only the essential elements of his theory which should be emphasized and further elaborated for the subsequent discussion.

The second part of the thesis will be a consideration of the main problems confronting acceptance of Teilhard's concept of orthogenesis. The first is its relationship with the physical laws of thermodynamics, and in particular the law of entropy. The second is its compatibility with the modern biological explanation of the evolutionary process in terms of Darwinian theory. Finally the problem of the scientific nature of Teilhard's

theory of orthogenesis will be discussed.

As can be seen from the above outline the problem of orthogenesis cuts through hyperphysics so as to involve both the physical and biological sciences. It also involves concepts such as consciousness, love, chance and design, which are truly philosophical. This again is the problem of the comprehension of hyperphysics. The dangers involved in grappling with such difficult topics as entropy and natural selection without an expert knowledge of them is evident. Nevertheless, there is a need to encounter a hyperphysical problem as Teilhard meant it to be encountered in all its extension as an integral whole.

I wish to thank all those who have helped me with this work. Particular thanks must go to Father F. E. Banim, O.M.I. of St. Patrick's College, who introduced me to Teilhard in 1958 and who has contributed much to my understanding of him since then. I am also grateful to Father Marcel Patry, O.M.I. of the Faculty of Philosophy of the University of Ottawa, and Father L. T. McDonald, O.M.I. of the Philosophy Department at St. Patrick's

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PART I

An Exposition of Teilhard's Theory of Orthogenesis

The "raison d'être" of this thesis is the existence of certain problems which have arisen from Teilhard de Chardin's theory of orthogenetic evolution. There is reason to believe that the major source of these problems is a lack of understanding of the Teilhardian synthesis. Accordingly, the first part of this work will be an exposition of Teilhard's theory of orthogenesis, presented within the general context of his total synthesis.

CHAPTER I

SOME IMPORTANT ASPECTS OF TEILHARD'S THOUGHT

The concept of orthogenesis in Teilhard can be understood only within the context of the total Teilhardian synthesis. The Teilhardian synthesis can be understood only within the broader context of Teilhard's general attitude toward the world and toward science. Accordingly, before orthogenesis within the Teilhardian synthesis is discussed, some important aspects of Teilhard's thought will be presented. These are: Teilhard's vision of the physical universe, discussed under the heading The World Vision of Teilhard de Chardin; Teilhard's attitude toward science and philosophy, under Teilhard as a Philosopher; and finally, the basis of his epistemology, under Teilhard's concept of Truth. The interpretation of Teilhard's thought found in these sections will provide the basic context for subsequent analysis in this work.

A. The World Vision of Teilhard de Chardin:

Teilhard is a phenomenologist; not in the sense that Husserl and Merleau-Ponty are phenomenologists, but

in the etymological sense of the word.[1] He is interested primarily in man, and attempts to draw conclusions about man, not from analysis of the isolated individual nor a metaphysical consideration of human nature, but by seeing him within the total context of time and space. In order to understand Teilhard, one must see what he sees; one must share, to some extent, his view of the world as a physical scientist.

Today the world vision of the physical scientist is quite different from the world vision of the layman, or what we might call "the common sense world vision". For example, it seems that the desk in front of me has a smooth, solid, flat, hard surface; it appears to be composed of densely packed matter, so densely packed that from my vantage point I can see no possibility of anything sifting through it. This common sense view is not, however, the view of the physical scientist as a physical scientist. He may view the surface of this desk as a

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1. cf., Claude CUENOT, Pierre Teilhard de Chardin, Paris, Plon, 1958, p. 311.

swarm of sub-atomic particles, or packets of energy, with relatively immense distances between them, moving relative to one another with fantastic velocity. He may picture a book resting on the desk not as one material body in contact with another but as an interaction of two force fields with no actual contact in the traditional common sense of the word. In order to understand an explanation or a theory of a particular phenomenon one must first of all understand the particular point of view that the originator of the theory has. In other words one must have, to some extent, the same vision that he has. If someone says to me, "If you remain seated exactly as you are now the chances that you will suffocate are one in one hundred billion", this will make no sense at all unless I am told that he is looking at the situation from the point of view of quantum mechanics, and, from their random motion, has calculated the chance of the air molecules surrounding my head moving away from that particular point.

Teilhard de Chardin was a physical scientist, a geologist and paleontologist, and his synthesis flows from his scientific world view. Accordingly, unless one under-

stands something of this world view and is able to distinguish it from what we have called the common sense world view, one will not be able to understand the theory of Teilhard. It is for this reason that we begin by a presentation of some of the new theories of science which have contributed greatly to this world view.

The essence of Teilhard's synthesis is contained in Le Phénomène Humain and La Place de l'Homme dans la Nature. The manuscript for the former was completed in 1938 and permission to publish the latter work was sought in 1950. Three of the theories which radically changed the world view of the physical scientist were presented before these dates. Charles Darwin's Origin of Species was published in 1859. In 1927, Canon George E. Lemaitre proposed his so-called "big bang theory", a theory presented to explain the origin of the universe, derived from an application of Einstein's theory of relativity. In 1936 the Russian scientist Oparin published his theory of the origin of life. Darwin, Lemaitre, Oparin, and all their successors who have developed and are still developing, clarifying, and adding precision to these theories

have presented to science the basis of its new world vision: - a vision of the world as a continuously developing, dynamic, homogeneous unit, a world, as Darwin expressed it, in which from so simple a beginning endless forms most beautiful and most wonderful have been and are being evolved. Because of the importance of these theories to Teilhard's world vision, the origin of the universe, the origin of life and Darwin's theory of evolution will be discussed briefly.

i) The Origin of the Universe

There are two theories of the origin of the universe in vogue today: the evolutionary universe theory and the steady state theory.[2] The former is a direct development of the theory of George Lemaitre, the latter is being developed especially by Hoyle, Bondi and Gold. According to the evolutionary universe, or "big bang" theory, the universe was born in a tremendous explosion of energy which produced vast amounts of hydrogen, which is the simplest

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2 Evidence of Teilhard's awareness of these theories is found in La Place de l'Homme dans la Nature, p. 38ff.

element and constitutes more than 95% of our physical universe. From this hydrogen gradually developed helium and the other elements As this material rushed out from the centre of the explosion, the gravitational forces eventually caused the formation of galaxies and then, within the galaxies the star systems with their planets were formed.

According to the steady state theory the universe is expanding, as is evidenced by the red shift found in the spectrum of distant galaxies. The density, however, of any large area in the universe remains constant, and from this notion the name steady state was adopted. If the galaxies are rushing away from one another and at the same time the density of the universe is remaining constant, matter must be continuously produced in order to fill the space vacated by the retreating galaxies. According to the steady state theory, the density is maintained constant by the continuous creation of hydrogen

at a steady state throughout infinite time.[3]

The essential difference between the two theories is in the explanation of the manner in which the fundamental building block of the physical universe, that is, the hydrogen atom, is produced. Apart from the origin of hydrogen itself there is a fundamental agreement on the explanation of the development of more complex matter from hydrogen. Accordingly, either theory gives the view that the physical universe has developed continuously from the electron and the proton or, perhaps, from a still more fundamental energy.[4]

ii) The Origin of Life

That a development in complexity on the inanimate level can occur, that is, that a development from the sim-

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3. The word creation here must be used by the physical scientist in a metaphorical sense, for if the origin of the hydrogen itself is within his realm of investigation then it is not creation, but rather a development from some other form; a development which he does not yet understand. On the other hand, if it is a true creation, then the problem is not that of the physical scientist but rather the theologian's or the philosopher's.

4. Teilhard seems to favour the "big bang" theory; cf., Le Phénomène Humain, pp. 42 & 44.

plest elements, hydrogen and helium, to the most complex molecules such as protein and nucleic acid can come about in nature is generally accepted by scientists today. Such development is relatively well understood by the physical chemist and the organic chemist and can be duplicated by them in the laboratory. Next to the origin of the elements which make up the universe the second critical point in the scientist's explanation of the history of the universe is the origin of life. In the last twenty years, however, much of the mystery which surrounded this problem has been dissipated and it is generally accepted today that living forms did naturally evolve from the non-living.

There is evidence that the transition from the heavy molecules, in particular protein and nucleic acid, to living organisms is both continuous and natural, just as is the transition from atoms to molecules. The discovery of the virus has especially strengthened the theory of the origin of life. First, the virus has a peculiar combination of living and non-living characteristics. Like a living thing it can reproduce with inheritable changes, and it metabolizes; in fact, it is the product of its

metabolism which causes disease. Unlike an organism, however, it does not respire and, more strikingly, it can be crystalized, stored for an indefinite period, and does not lose its infective powers. Finally, it can be broken down into non-living protein and nucleic acid, and then resynthesized to an active virus. Viruses, then, are on the borderline between the living and the non-living.[5] Although modern viruses are parasites it is felt that free living viruses may now exist and indeed could have been the intermediate between non-living and living beings millions of years ago.

It is believed that the primeval earth was covered with a hot (near boiling) ocean, rich in methane and ammonia, and subjected to electrical discharges from continual thunderstorms. These conditions were duplicated in the laboratory in the now famous experiment of S.L. Miller, in which he produced amino acid, the basic component of the protein molecule which itself is a constituent of the virus. It is quite possible then, that in this environment,

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5. cf., E.O. DODSON, Evolution: Process and Product, New York, Reinhold, 1960, Ch. 8.

which does not exist on earth today except in the laboratory, the heavy molecules and finally primitive life itself developed.

iii) Darwin's Theory of Evolution:

Once the gap between the living and the non-living has been explained by the physical scientist,[6] the history of natural development is taken over by the century-old Darwinian theory of evolution. The basic Darwinian principles of the prodigality of nature, variation, and natural selection, are still generally accepted by the scientific community. The modern theory of the chromosome adds to the Darwinian explanation of variation. Before continuing with a brief explanation of this theory, we must make a distinction between evolution itself and the method whereby things evolve. That the creatures in existence on earth today have evolved from lower forms is most probable. The method, however, whereby they have evolved is another question. The principles cited above refer to the

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6. We do not suggest of course that these explanations have reached the level of fact; however, they seem to have approached the level of probability.

"how" of evolution. A theory must be based on facts, must be a probable explanation of the facts, must lead to new facts, and lead toward a more unified knowledge. According to all these criteria the theory of evolution is a good theory. Regarding the method of evolution, the prodigality of nature and variation are directly observable. Both natural selection and the genetic means whereby variation is brought about have been experimentally demonstrated in certain cases. Accordingly, theories of the Darwinian school on the process of evolution, though still containing many problems, must also be considered to be good theories.

The Darwinian explanation of the method of evolution merits special attention. Darwin's basic theory is quite simple. He observed that many more creatures are born than can possibly survive to maturity. For example, if all the offspring and their descendants of two starfish lived long enough to reproduce normally, in fifteen generations there would be 10^{79} starfish. Ten to the seventy-ninth power is the estimated number of electrons in the visible universe. Under the same conditions, the

elephant, possibly the slowest breeder on earth, would produce nineteen million descendants from one pair in about seven hundred and fifty years. This fact of the prodigality of nature coupled with the fact that no two living beings, even if they are offspring of the same parents, are exactly alike, led Darwin to his theory of natural selection. Variation within a species causes various degrees of adaptability to the environment. The organisms with "good" characteristics, that is, with characteristics that are compatible with their surroundings will survive long enough to reproduce. As we move along the scale in the descending order of "good" characteristics, the organisms will have less and less chance to survive long enough to reproduce. Certain characteristics, then, will be more or less favoured and therefore more or less likely to be passed on to the next generation. Given enough time, and the geologist and physicist tell us that there was enough time, the changes will be great enough to give rise to what is called a new species. In Darwin's time the problem was: What caused variation and how are changes transmitted? The Mendelian laws of heredity and the discovery

of mutations have solved much of this problem.

There is, then, the possibility, indeed, for most scientists today, the probability, of a continuous evolution of inanimate beings from the simplest to the most complex, a natural transition from the inanimate to the animate, and then a continuous development of animate beings from the simplest forms, such as our modern virus, to the most complex forms, the modern primates. It is within the history of the order, Primates, that we find the third critical point in our vision of a developing universe. The Primate order includes tree shrews, lemurs, tarsiers, monkeys, the anthropoid apes, and man. The critical point is, of course, the origin of man.

The fossil record of man is far from complete. There is, however, much evidence of a gradual evolution from a more primitive ape-like body up to and including modern homo sapiens sapiens. From Dryopithecus of the pliocene period, through Australopithecus, the Pithecanthropus group, the Neandrethal man, Cromagnon (an early form of modern man) to modern man himself, we see a gradual transition of physical features which can best be

explained if we accept the gradual evolution of the modern human body from a more primitive ape-like form.

In the light of all these theories, namely the theory of evolution, the origin of life and the origin of the universe, the scientist views the world as a continuously developing dynamic process.[7] It is no longer viewed as a static, compartmentalized world composed of beings which were substantially finished by the act of creation, composed of unchangeable essences and unbridgeable specific differences, but rather as a mutually interacting homogeneous becoming. This is the world vision of Teilhard the scientist; it is from this world vision that his synthesis flows. It is only within the context of this world vision that his theory can be understood. In his introduction to The Phenomenon of Man, Sir Julian Huxley attached special importance to this point:

> In The Phenomenon of Man, he has effected a threefold synthesis of the material and physical world with the world of mind and spirit; of the past with the future; and of variety with unity, the many with the one. He achieves

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7. cf., Hermann WEYL, Philosophy of Mathematics and Natural Science, Princeton University Press, 1944, p. 214.

> this by examining every fact and every subject of his investigation sub specie evolutionis, with reference to its development in time and to its evolutionary position. His perhaps most fundamental point is the absolute necessity of adopting an evolutionary point of view.[8]

Teilhard was primarily interested in man, and he used his scientific background to attempt to shed more light upon the nature of man and the future of man. In the introduction of Letters from a Traveller, Huxley says that the important thing for Teilhard "is to study the problem of mankind as a phenomenon and to look at it sub specie evolutionis".[9]

It is, however, not only within the context of evolution that Teilhard studies man. The limits of his world vision are not defined by the physical sciences. Teilhard was not only a physical scientist, but also a Christian in the fullest sense of the word, and specifically, a Jesuit priest. As a result he saw man not only in the context of evolution, but also in the context of

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8. HUXLEY, in: TEILHARD, The Phenomenon of Man, (English translation) pp. 11 & 12.

9. TEILHARD, Letters from a Traveller, p. 14.

the Divine Milieu, and his aim was to show that these contexts were, in reality, one. According to Cuénot:

> Tout l'effort de Teilhard consistera à montrer que l'univers "tombe en équilibre" sur l'esprit, et à bâtir une dialectique allant de la matière au Dieu-Esprit, en passant par l'organique réhabilité, car, pour qu'un foyer spirituel apparaisse, il faut que la matière se complexifie, s'organifie.[10]

Teilhard clearly states in his Forward to Le Phénomène Humain that this new total world vision is absolutely necessary for a proper and complete understanding of mankind. He says that for man to discover man and take his measure, whole series of senses are necessary: a sense of spatial immensity, a sense of depth, a sense of number, a sense of proportion, a sense of novelty, a sense of movement, and a sense of the organic. He then adds that without these senses to illuminate our vision man will remain indefinitely for us what he still represents to so many minds: an erratic object in a disjointed world. Conversely, he says, we have only to rid our vision of the threefold illusion of smallness, plurality and immobility for

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10. Claude CUENOT, Teilhard de Chardin, Paris, Editions de Seuil, 1963, p. 26.

man effortlessly to take the central position we prophesied - the momentary summit of an anthropogenesis which is itself the crown of a cosmogenesis.[11] It is toward this end that Teilhard considers man as a phenomenon, - a phenomenon which can be studied by the physical sciences, but which is not limited to the traditional methods of the physical sciences. For, as he says, the true physics is that which will one day achieve the inclusion of man in his wholeness in a coherent picture of the world.[12] It is within this broader context, this total vision, that we find Teilhard's aim, which he himself repeatedly insists is to develop a homogeneous and coherent perspective of our general extended experience of man; a whole which unfolds.[13]

B. Teilhard as a Philosopher:

The exact nature of Teilhard's non-technical works has been the subject of much discussion and controversy.

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11. TEILHARD, Le Phénomène Humain, pp. 27 & 28.

12. Ibid., p. 30.

13. Ibid., p. 29.

The statement made above to the effect that Teilhard is a phenomenologist, and his own statement that Le Phénomène Humain is not a work in metaphysics, nor theology, but simply a scientific treatise, is not sufficient. A more precise evaluation of the nature of Teilhard's phenomenology is necessary, at least to put the following work into its proper context. If Teilhard's work was purely scientific in the traditionally accepted sense of experimental science, a discussion of philosophical concepts within it would be meaningless. Teilhard's work is not natural science as defined today, but is in some way philosophical, and is presented by him as a replacement for metaphysics. Let us now try to justify this position.[14]

In his article, The World Vision of Teilhard de Chardin, F.G. Elliott states:

> Teilhard's work is incontestably a philosophical one, and it is philosophical in the true and full sense of the word for the simple rea-

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14. As will become immediately evident, the word "philosophical" here is taken in very broad sense. A more precise evaluation of the nature of Teilhard's work demands further analysis of that work. An approach to such an evaluation will be found in Chapter V, below.

> son that it seeks to answer the fundamental question: "What is man?" and above all, "What is his future?"[15]

Added to Elliott's reason is the fact that Teilhard insists that he is dealing with the whole phenomenon of man within his whole context. He is looking for causes which are more ultimate than those considered by the physical sciences. For these reasons, his work cannot be approached simply as analysis of a physical or biological nature; it must be considered to be in some way philosophical.

Teilhard's statement that his work is not metaphysical could be interpreted to mean that, recognizing the nature and value of metaphysics, he realizes that his phenomenological approach is inherently limited and cannot encroach upon the domain of the metaphysician. In Le Phénomène Humain itself, there is evidence for this position.[16] A look at some of the author's correspondence, however, indicates that he meant something quite different. Con-

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15. F.G. ELLIOTT, "The World Vision of Teilhard de Chardin", in International Philosophical Quarterly, I, 4, p. 621.

16. cf., TEILHARD, Le Phénomène Humain, footnotes on pages 186, 206 & 332.

sider, for example, the following excerpts from Teilhard's letters:

> Je me méfie de la Métaphysique (au sens habituel du mot) parce que j'y flaire une géométrie. Mais je suis prêt à reconnaître une autre espèce de Métaphysique qui serait réellement une hyperphysique, - ou une hyperbiologie.
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> ... je serais heureux de vous voir (comme je m'y essaie moi-même) pénétrer à partir de là dans les questions spirituelles et humaines avec les méthodes de la Science, de manière à substituer aux Métaphysiques dont nous mourons une Ultraphysique (la vraie phusike des Grecs, j'imagine) où Matière et Esprit seraient englobés dans une même explication cohérente et homogène du Monde.[17]
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> /The essay La Centrologie is/ un essai d'explication universelle: non point synthèse à priori, géométrique, à partir de quelque définition de l'"être", - mais loi de récurrence expérimentale, vérifiable dans le champ phénoménal, et convenablement extrapolable à la totalité de l'Espace et du Temps. Non pas une Métaphysique abstraite, - mais une ultraphysique réaliste de l'Union.[18]

Teilhard's attitude towards metaphysics is evident from the above quotation. It would seem, however, that he

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17. TEILHARD, cited in: CUENOT, Pierre Teilhard de Chardin, Paris, Plon, 1958, p. 264. (Letters of April 29, 1934 and October 11, 1936).

18. Ibid., p. 287.

is referring to a rationalistic metaphysics such as that of Leibniz or Spinoza, rather than a more realistic Aristotelian-Thomistic metaphysics; but other statements indicate that he did not distinguish between the rationalist and the scholastic. For example:

> ... forcés comme nous le sommes hors du cosmos statique aristotélicien, et introduit (par le système entier de la Physico-chimico-biologie moderne) dans un Univers en état de Cosmogénèse...[19]

> Vous êtes préoccupé, avec raison, par la question des "essences". Mais comprenez bien que, puisqu'il s'agit désormais pour nous de passer d'une "métaphysique de Cosmos" à "une métaphysique de Cosmogénèse", - comprenez bien, dis-je que la question n'est pas exactement de savoir comment il faut conserver, mais comment il faut transposer (à une dimension de plus), la notion de fixité des essences.[20]

Teilhard's reaction against metaphysics and his desire to replace it with a hyper-physics is, then, not limited to the rationalist, but is extended to Aristotle's metaphysics, which Teilhard would seem to consider also rationalistic. Cuénot emphasizes this point by stating

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19. Ibid., p. 441. (Letter of April 28, 1954)

20. Ibid., p. 448. (Letter of April 25, 1954).

that:

> Tous l'effort de la science et de la philosophie teilhardiennes consiste au contraire à réagir contre la conception aristotélicienne d'un temps cyclique, en subordonnant étroitement les vagues à la marée, les oscillations à la dérive (DRIFT) /sic/ orthogénétique.[21]

A hint that the immobilist position is, for Teilhard, the general position of Scholastics to the present day is found in a statement in a letter discussing a symposium held in 1954 at Columbia University:

> J'ai naturellement pris vigoureusement position (avec Huxley et la grande majorité des scientistes) contre la position immobiliste, hélas, des éléments les plus christianisés de la section, à savoir Gilson,...[22]

It would appear, then, that Teilhard considers all metaphysics to be rationalistic, abstract systems dealing with fixed essences, and therefore viewing the universe as static. This concept of metaphysics is almost identical with that of the Marxist, or the modern positivist. On the other hand, whereas the positivist or materialist merely

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21. Ibid., p. 421.

22. TEILHARD, Nouvelles Lettres de Voyage, p. 180.

rejects metaphysics, Teilhard replaces it with his hyper-physics, which does attempt to present a picture of the whole phenomenon. To this extent his synthesis is not positivistic.

> Le moment est venu de se rendre compte qu'une interprétation, même positiviste, de l'Univers doit, pour être satisfaisante, couvrir le dedans, aussi bien que le dehors des choses, - l'Esprit autant que la Matière. La vraie Physique est celle qui parviendra, à intégrer l'Homme total dans une représentation cohérente du monde.[23]

His "science" is not, therefore, modern science with its present limits, but an all-encompassing hyper-physics. Teilhard's vision of a continuously evolving universe led him to the rejection of compartmentalization, both on the level of extra-mental reality and knowledge. There is, for him, one true natural science which develops continuously from what is now called physics.[24]

> L'Homme ne peut être compris que en remontant de la Physique, de la Chimie, de la Biologie et de

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23. TEILHARD, Le Phénomène Humain, p. 30.

24. As well as this unique natural science there is also a supernatural science based on revelation, that is, theology. The two must converge for a true picture of the whole. This will be considered further in Ch. V, The Role of Faith.

la Géologie.[25]

A view of the whole phenomenon, going beyond the exterior to a deeper understanding of what lies beneath is, then, also the task of the physicist. In other words, the physicist, as physicist or hyperphysicist, must eventually consider the more ultimate causes of beings, including the great mysteries of faith, as suggested by Teilhard's reference to the Incarnation as a prodigious biological operation.[26] The synthesis of knowledge is further indicated by his reference to his scientifico-philosophico-religious manuscripts.[27]

In the light of what is seen above, it is at first difficult to understand the vagueness of the preface to Le Phénomène Humain, and the footnotes therein, referred to above. The following facts may help to explain this. Le Phénomène Humain was completed around 1940, and yet, in 1947 permission to publish had not been given, and in that

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25. TEILHARD, cited in: CUENOT, op. cit., p. 428.

26. TEILHARD, Le Phénomène Humain, p. 327.

27. CUENOT, op. cit., p. 287.

year Teilhard was ordered by his superior to write no more philosophy. Regarding this censorship, which was never to be lifted, Teilhard wrote in a letter:

> A la réflexion, le moyen m'est apparu de satisfaire les exigences du censeur, sans rien altérer, évidemment, de ma pensée, mais en parsemant mon texte d'un certain nombre de "points sur les i" (par notes infra-marginales, - et aussi dans les douze pages, maintenant prêtes, du sommaire-postface qui me paraît bien).[28]

Notwithstanding the absence of a complete appraisal of the nature of hyperphysics it seems evident that Teilhard's synthesis is not intended to be natural or physical science but rather an extension thereof presented as a substitute for metaphysics. Moreover, insofar as Teilhard treats of the whole man, that is, of both matter and spirit, his hyperphysics must be approached as a philosophical work and be judged accordingly.

C. Teilhard's Concept of Truth:

Truth, that is, the conformity between the idea and the known object, may be arrived at in different ways. Direct observation, whether or not it exhausts the intelli-

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28. TEILHARD, Nouvelles Lettres de Voyage, p. 97, (footnote).

gibility of the object, can give us certain knowledge about some aspects of the object, and therefore, some absolute truth. Truth may also be arrived at through the methods of inductive and deductive reason. The truth of the results of induction will depend upon the accuracy and universality of the individual facts. The truth of the conclusion of deductive reasoning depends upon the truth of the premises and the logic of the deduction.

Teilhard's conclusions obviously are not arrived at through direct observation for they are too extensive both in time and space, as is the case for any general theory of evolution. Nor are they arrived at by a simple process of induction from a set of observed facts. And, as Teilhard himself states: "chacune des propositions ci-dessus formulées n'est pas absolument déductive, ni par suite cogente."[29]

In what light, then, can the truth of Teilhard's conclusions be judged? Teilhard himself follows the prin-

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29. TEILHARD, "Agitation ou Genèse?" in, L'Avenir de l'Homme, p. 287.

ciple "qu'une plus grande cohérence est le signe infaillible de plus de vérité."[30]

> En science (et ailleurs...) la grande preuve de vérité est la cohérence, et la fécondité. Pour notre intelligence, une théorie est d'autant plus certaine qu'elle met plus d'ordre dans notre vision du Monde, - et en même temps, qu'elle se montre plus capable de diriger et de soutenir en avant notre pouvoir de recherche et de construction. (Théorie vraie = la plus avantageuse).[31]

For Teilhard, therefore, truth is coherence. Accordingly, insofar as the theory of evolution gives a coherent picture of the universe, that theory can be accepted without question, and any true picture of the universe must rest upon it.

> Une théorie, un système, une hypothèse, l'Evolution? ...Non point: mais, bien plus que cela, une condition générale à laquelle doivent se plier et satisfaire désormais, pour être pensables et vrais, toutes les théories, toutes les hypothèses, tous les systèmes. Une lumière éclairant tous les faits, une courbure que doivent épouser tous les traits: voilà ce qu'est l'Evolution.[32]

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30. TEILHARD, ibid., p. 275.

31. TEILHARD, "La Place de l'Homme dans l'Univers" in, La Vision du Passé, p. 318. Cf., also: Le Phénomène Humain; Avertissement and Prologue.

32. TEILHARD, Le Phénomène Humain, p. 242.

To the premise of an evolving universe, Teilhard adds two other assumptions upon which the validity of his conclusions depend.

> La première est le primat accordé au psychique, et à la Pensée dans l'Etoffe de l'Univers. Et la seconde est la valeur "biologique" attribuée au Fait Social autour de nous.[33]

From these assumptions follows Teilhard's theory of the evolution of complexity-consciousness: a continuous process which moves along two parameters, from the simplest material things, for example free energy, electrons, protons to the highest form of being known on earth today, namely human society, and beyond, to human society in union with the Omega Point. Teilhard emphasizes the coherence of this process by stating that: "De haut en bas, une triple unité se poursuit et se développe: unité de structure, unité de mécanisme, unité de mouvement."[34]

Distinctions between realities previously considered to be fundamentally different have vanished. According to Teilhard, the structure and mechanism of development of

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33. TEILHARD, Le Phénomène Humain, p. 22.

34. Ibid., p. 245.

all levels of reality, from atom to society, has a basic unity. This allows for a unity of movement, which is the rise and expansion of consciousness.[35] This unity of mechanism and structure is so great that Teilhard speaks of consciousness and love at the molecular level and below,[36] and of the Incarnation as a "prodigious biological operation."[37]

Accordingly, the following is presented as a simple outline of Teilhard's reasoning process in syllogistic form:

M. That which is most coherent is true.

m. The view of a continuous evolution of complexity-consciousness is the most coherent view.

Therefore there must be a continuous evolution of complexity-consciousness.

The major is Teilhard's criterion for truth. The minor is based on the physical theory of the evolution of material complexity, in addition to some further observa-

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35. cf., Ibid., pp. 245-251.

36. cf., for example: Ibid, L'Amour-Energie, p. 293ff.

37. Ibid., p. 327.

tions and, as Teilhard himself says, many intuitions.[38] By analysis and extrapolation Teilhard draws further conclusions about "the ultimate earth" from the above conclusion.

Although Teilhard himself appears to have been convinced of the truth of his synthesis, the conclusions cannot be, and in this work are not considered to be facts, but rather theories, more or less probable. In recognition of the rather pragmatic nature of Teilhard's concept of truth it might be better to categorize these theories as "good" or "bad", as theories should be categorized, rather than as "true" or "false". A theory is good if it presents a probable, or at least possible explanation of the facts, if it does not contradict the facts, if it presents a simpler or more coherent picture of reality, and if it is useful. A theory might meet all these conditions without its conformity to reality, that is, its truth being actually known.

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38. cf., TEILHARD, "Agitation ou Genèse?" in, L'Avenir de l'Homme, pp. 287-288.

D. Conclusion:

The synthesis of Teilhard de Chardin develops from his scientific background, or, as we have called it above, his world vision as a natural scientist. Hence it has been stated that one must share in this world vision if one is to understand and appreciate his synthesis. One must see the universe as Teilhard the scientist saw it: as an homogeneous, continuously developing dynamic complexity.

At the same time, however, it must be borne in mind that Teilhard does not share the positivist's view that the empirical sciences as presently defined can lead man to a complete understanding of reality. For Teilhard an extension of physics and biology is required, that is, a hyperphysics or hyperbiology which, using an expanded principle of coherence, will consider not only complexity but also consciousness. Hyperphysics, a replacement for metaphysics, will study the whole man in his total natural context. By its very nature, then, hyperphysics is difficult to define. But in the light of its object: to be a replacement for metaphysics which will study the whole man, and its method which must go beyond the method of physics

in order to encompass consciousness, hyperphysics must be approached as philosophy in a broad sense of the term.

CHAPTER II

THE MEANING OF ORTHOGENESIS

The English word orthogenesis and the French word orthogénèse are derived from the Greek orthos meaning straight, and genesis meaning origin, or birth, from gignesthai: to become or to be born. Etymologically orthogenesis is, therefore, a becoming or development in a straight line. The word, however, has taken on a number of different connotations, which, although related to the root definition, may signify widely divergent views of evolution. Because of this general difficulty with the concept of orthogenesis, the meaning, or meanings of the word will be first considered outside of the Teilhardian context. Then Teilhard's definition will be presented, followed by a discussion of his criterion for the notion of direction in the orthogenetic process.

A. The Meaning of Orthogenesis in General:

According to Chambers's Technical Dictionary, orthogenesis is:

> ...a theory of the mechanism of evolution which postulates that variation is determined by the action of the environment on the fixed constitution of the organism, so that the possibilities of variation are limited to certain definite lines.[1]

Here orthogenesis is presented as the result of a combination of exterior influences and internal conditions, in other words, a combination of ectogenesis and autogenesis. The limiting factor itself is the fixed constitution of the organism. The degree of limitation of the line of development depends upon the degree of fixity of the constitution. Rather than speaking of fixed constitution it may be better to refer to the potentialities of the individual which determine, within more or less broad lines, the development in certain environmental conditions. According to Van Nostrand's Scientific Encyclopedia this notion is generally accepted.

> It is accepted today that every heritage must have certain potentialities, and therefore evolution of any group must proceed along the lines made possible by these potentialities. To this extent, orthogenesis is considered to be an established

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1. TWENEY and HUGHES, Chambers's Technical Dictionary, New York, The MacMillan Company, 1961, p. 600.

principle.[2]

Analysis of this definition shows it to be almost self-evident, so that the term orthogenesis defined in this manner would be generally accepted by modern science. Those who reject it do so because of other meanings which they attach to it. For example, the words of three authors often quoted by Teilhard may be considered. First, according to Sir Julian Huxley:

> The discovery of the principle of natural selection made evolution comprehensible; together with the discoveries of modern genetics, it has rendered all other explanations of evolution untenable. So far as we know, not only is natural selection inevitable, not only is it an effective agency of evolution, but it is the only effective agency of evolution. With the knowledge that has been amassed since Darwin's time it is no longer possible to believe that evolution is brought about through the so-called inheritance of acquired characters - the direct effects of use or disuse of organs, or of changes in the environment, or by the conscious or unconscious will of organisms; or through the operation of some mysterious vital force; or by any other inherent tendency. What this means, in the technical terms of biology, is that all the theories lumped together under the heads of orthogenesis and Lamarckism are

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2. Van Nostrand's Scientific Encyclopedia, 3'd edition, Princeton, N.H., D. Van Nostrand Co. Inc., 1958, p. 1168.

invalidated.[3]

For Huxley, then, orthogenesis is Lamarckian autogenesis, and, as such, cannot be considered to be a scientific theory. It is either speculation with no basis in reality, or a modern version of old superstitions.

The problem surrounding the term orthogenesis appears, from the above, to be one of meaning. If it is defined in a modern Darwinian context, including reference to autogenesis and ectogenesis, as in Van Nostrand, it is acceptable. If it is identified with a purely autogenetic or Lamarckian process it is generally rejected. The problem is further pointed out by Blum and Simpson. According to Blum:

> The idea of direction in evolution is sometimes associated with the term orthogenesis, a word whose usage seems to be somewhat uncertain. If employed to describe the persistence of evolution in certain pathways, the term may be useful. On the other hand, if an extraphysical directing factor is implied - as seems often to be the case when mention is made of a "theory of orthogenesis"

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3. Julian S. HUXLEY, Evolution in Action, New York, Mentor Books, 1957, p. 35.

- only confusion results.[4]

The "extraphysical directing factor" to which Blum refers, - the counterpart of Huxley's "mysterious vital force", indicates that Blum also rejects orthogenesis if it is synonymous with autogenesis or some forms of vitalism. Although he accepts it if it means simply that evolution follows certain paths, he warns that to say that evolution follows a "straight line" is meaningless, and it might be better to avoid the term orthogenesis altogether.

Simpson states that, although evolution does not follow a steady, undeviating path, neither can it be considered random. There is some direction and orientation. Regarding the term orthogenesis, however, he states:

> Evolution in a straight line is commonly called "orthogenesis" and will be found discussed under that title in most books on evolution. The term has, however, been kicked around so much that hardly any two students mean exactly the same thing when they use it. To some it means little more than that evolution is not completely random. To others, use of the term implies granting the whole finalist thesis of undeviating progress toward a goal. Arguments over orthogenesis are

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4. Harold F. BLUM, Time's Arrow and Evolution, New York, Harper & Bros., 1962, p. 180.

> unduly obscured and complicated by entirely unimportant semantic difficulties. It usually is understood, however, to mean a postulated inner urge or inherent tendency for evolution to continue in a given direction.[5]

Three main meanings emerge from the above discussion: First, orthogenesis may have a purely descriptive sense, meaning that evolution has some direction, or follows some path, more or less straight, more or less limited; it is not completely random. Secondly, orthogenesis may refer to a determined evolution, following a well-defined line within rigid limits. This definition is also descriptive, but leads directly to the notion of a set goal and a tendency toward that goal. It is related, therefore, to a third use of the term orthogenesis which connotes a kind of causality insofar as it refers to an inner urge, a mysterious vital force or a non-physical directing factor, which causes evolution to follow a straight-line path.

The first definition, inasmuch as it leaves room for some random motion and meandering, some accidents, dead-ends and even regressions, should be acceptable to most

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5. George Gaylord SIMPSON, The Meaning of Evolution, New York, Mentor Books, 1956, p. 32. (cf. also p. 30 & 31).

Darwinians. In it, however, the meanings of "direction", "path" and "straight" still leave problems, which will be discussed later in this chapter.[6]

The second descriptive meaning of orthogenesis may have suited an earlier, simplified picture of evolutionary development, but cannot be applied today. Evolution is no longer pictured as a tree with a main trunk and a few well-defined branches steadily growing upward, but rather as a tangled bush which, although in general growing up, has shoots in all directions, as well as dead-ends.

The third definition would be rejected in general as being too autogenetic or Lamarckian. This is the meaning that Huxley attaches to the word, and, as Simpson points out, it is the most common connotation. Dobzhansky, for example, uses the term to refer to theories in which purposefulness is a property of life itself, a kind of autogenesis in which the potentiality existing in things was gradually unfolded in a manner which suited the existing

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6. p. 52ff.

environment. He says further that it is unfortunate that Teilhard speaks of evolutionary development as orthogenetic and that this indicates a lack of knowledge of biology on Teilhard's part.[7] Dobzhansky apparently feels that Teilhard uses the term in the third sense as defined above. The following discussion of the meaning of orthogenesis in Teilhard will show that this is by no means entirely true.

B. The Meaning of Orthogenesis in Teilhard:

Teilhard is well aware of the problems involved in the use of the term orthogenesis. He states that:

> Sous prétexte que ce terme, "orthogénèse", a été employé en divers sens discutables ou restreints, - ou bien qu'il a une saveur métaphysique, certains biologistes voudraient qu'on le supprimât tout simplement.[8]

He feels, however, that the word is indispensible to convey the notion of direction that he has in mind. He brings this notion to the fore in a work written in 1955 entitled "Une Défense de l'Orthogénèse à propos des Figures

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7. cf. Theodosius DOBZHANSKY, Mankind Evolving, New Haven, Yale University Press, 1962, pp. 347-8.

8. TEILHARD, Le Phénomène Humain, p. 114 (footnote).

de Spéciation". Here he states:

> Ce mot /orthogénèse/ (si discuté) étant évidemment pris ici dans son sens étymologique, le plus général, de transformation dirigée (à quelque degré, et sous quelque influence que ce soit que se manifeste "la direction").[9]

In the same work Teilhard points out that because of certain unacceptable meanings of the term orthogenesis, such as, "linéarité quasi magique des phyla, impliquant certaines conceptions vitalistes ou finalistes décidément périmées"[10] a respectable paleontologist cannot use the word without embarrassment. It must not be rejected, however, but corrected and reintroduced in a manner that will convey the important ingredient of a general direction in evolution.

> ...pour rendre compte scientifiquement de l'énorme édifice des formes vivantes, tel qu'il se dégage peu à peu à nos yeux à travers les temps, géologiques, sur près d'un billion d'années, est-il vraiment possible de se contenter de "nombres"? ou plutôt, d'une manière ou de l'autre, ne faut-il

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9. TEILHARD, "Une Défense de l'Orthogénèse A Propos Des Figures de Spéciation" (1955), in La Vision du Passé, p.384 (footnote). (cf. also: TEILHARD, "La Structure Phylétique du Groupe Humain", (1951), in L'Apparition de l'Homme, esp. pp. 197-8).

10. Ibid., p. 386.

> pas inévitablement recourir à des vecteurs - c'est-à-dire réintroduire ipso facto "de l'orthogénèse"?[11]

On the one hand Teilhard recognizes the problems involved in using the term orthogenesis, and distinguishes between the unacceptable and acceptable meanings. On the other hand, however, because of the importance he attaches to the direction of evolution, he refuses to reject the term.

The very general and cautious definition given by Teilhard would seem to be acceptable among Darwinians. Evolution is directed, he says, to some degree, and under some influence, whatever it is, and the notion of vectors must be applied in some way or other. It is a descriptive definition which is basically the same as the first definition above. He insists, further, that orthogenesis is a general characteristic, a large-scale effect of evolution, and in no way implies absolute determinism at any level

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11. Ibid.

of development.[12]

> Observée sur un nombre de cas et sur un intervalle de durée suffisants, la spéciation, longtemps répétée, donne naissance à des alignements d'ensemble: effet, disons-nous, de phylétisation, - ou, ce qui revient au même, d'orthogénèse: ce dernier mot ne désignant pas autre chose, ici, que l'apparition dans le temps, chez espèces apparentées, d'une distribution statistiquement orientée.
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> Prise à ce degré de généralité, l'orthogénèse (si âprement discutée par les biologistes!) est, on le voit, une notion parfaitement simple et évidente, - puisqu'elle ne fait qu'exprimer ce qu'il y a d'indiscutablement "fibreux" et "radié" de l'avis de tout le monde, dans la texture de la Biosphère.[13]

The relationship between the above authors' notions of orthogenesis and Teilhard's will be discussed, but first his concept of "direction" will be considered from the point of view of its criterion and its cause.

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12. This is a point made by Teilhard as early as 1923 in a note on the difference between irreversibility and orthogenesis, cf. "Sur la Loi d'Irreversibilité en Evolution", in La Vision du Passé, p. 71ff.

13. TEILHARD, "Note Sur la Réalité Actuelle et la Signification Evolutive d'une Orthogénèse Humaine", in La Vision du Passé, p. 355. (The Concept of a "statistically oriented distribution" will be discussed later).

C. Teilhard's Criterion for "direction":

According to Teilhard, that there is some kind of "direction" to evolution is indisputable. The axes of development of species and phyla can be, and have been traced. The problem is: what is meant by direction? Is this notion simply a heuristic structure used by the scientist to simplify his categorization of species? Or, is there in reality some fact which can be considered as a proper criterion for direction? For Teilhard, the latter is the case.

Teilhard notes that man, at one time, was considered to be the centre of a static universe. The fall of the geocentric theory, however, and further scientific development, left man wondering about his place in the universe. In fact, it left him wondering about the place of life itself. Within the newly discovered dimensions of space and time life is considered as an accidental occurrence of little importance in the overall picture, an epiphenomenon which is born by chance and will disappear in the same way. The history of life on earth, including the history of man, can be represented as a small parabola,

rising and falling, alongside the general parabola of the universe plotted by the law of entropy. But such a representation would have little real significance, except to underline our insignificance.

For Teilhard, the truth lies between these two extreme views. From the viewpoint of spatial dimension man certainly is not the centre of the universe, but according to Teilhard, there is another valid point of view. Besides "l'infiniment grand et l'infiniment petit" there is "l'infiniment complexe".[14] If one abstracts from the spatial dimensions of the universe and considers it from the point of view of growing complexity, life takes on a new significance. The stars and galaxies, because of their relatively simple make-up, drop to a lower place on the scale than the tiny virus. Within this context man takes his place:

> ...non plus centre d'un monde statique (ceci est bien fini), - mais l'Homme, cependant, élément extrasignificatif, ou même principal, d'un

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14. cf., TEILHARD, "La Place de l'Homme dans l'Univers" (1942) in: La Vision du Passé, p. 245ff. TEILHARD, La Place de l'Homme dans la Nature, Paris, Editions du Seuil, 1956, p. 25ff. TEILHARD, "Vie et Planètes" (1945) in: L'Avenir de l'Homme.

Monde en mouvement.[15]

In this light, the galaxies, the stars, our planet, all take on importance inasmuch as they produced the necessary conditions for the emergencè of more complex beings. The dimensions of the sun, in themselves, are of little significance from this point of view. What is important is the fact that the sun emits life-sustaining radiation.

By complexity, Teilhard refers not simply to the number and variety of elements forming the ensemble, but also to their arrangement.[16] In La Place de l'Homme dans la Nature, he defines complexity as follows:

> ...sous cette expression, j'entendrai, fort précisément, la combinaison, - c'est-à-dire cette forme particulière et supérieure de groupement dont le propre est de relier sur soi un certain nombre fixe d'éléments (peu ou beaucoup, peu importe), - avec ou sans l'appoint auxiliaire d'agrégation et de répétition, - en un ensemble clos, de rayon déterminé: tels l'atome, la molécule, la cellule, le métazoaire, etc.[17]

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15. TEILHARD, "La Place de l'Homme dans l'Univers", in La Vision du Passé, p. 306. (cf. also ibid: p. 317 (graph), and La Place de l'Homme dans la Nature, p. 31).

16. cf., Ibid, pp. 312-313.

17. TEILHARD, La Place de l'Homme dans la Nature, p. 29.

According to this definition a star, though containing more elements than a virus or a man, is less complex. It is a large, but simple aggregation. A crystal, being no more than a simple geometric repetition of particles, no matter how many, would also be less complex than a virus. The important characteristics of complexity are: "Nombre fixe d'éléments, ensemble clos."[18]

The concept of increasing complexity is in accord with the generally accepted theories of the origin and development of the universe, as presented earlier. At the lower levels of development the degrees of complexity are quite evident: the water molecule is more complex than the hydrogen atom; the protein molecule is more complex than the water molecule. At the more advanced levels of evolution, however, the relative complexities become more obscure. First, there is no single line of ascent but rather, as Teilhard states, a thick column of pluricellular types developing in the general direction of complexity. Secondly, the complexity of the elements on the rays of

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18. Ibid.

this column is so great that it would be virtually impossible to compare them in terms of numbers of elements or arrangement. Furthermore, parts of certain beings actually become less complex as the whole develops; for example, the hoof of the horse. It would appear, then, that complexity as a criterion for direction must be abandoned, at least at the higher levels of evolutionary development. There is, however, according to Teilhard, an empirical criterion of complexity at these levels, a parameter which leads one through the labyrinth of living forms. This criterion is the development of the nervous system including the brain, that is, "cérébration".

> Dans la perfection et la céphalisation croissantes des systèmes nerveux, nous tenons véritablement, semble-t-il, un paramètre concret et précis permettant de suivre, à travers la jungle des formes vivantes, la variation absolue et utile de la corpuscularité cosmique.[19]
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> Non seulement une répartition des formes animales suivant leur degré de cérébralisation épouse exactement les contours imposés par la Systématique; mais elle confère encore à l'Arbre de la Vie un relief, une physionomie, un élan, où il est

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19. TEILHARD,"La Structure Phylétique de Groupe Humain", in L'Apparition de l'Homme, p. 196.

> impossible de ne pas reconnaître le signe de la vérité. Tant de cohérence, - et ajoutons-le, tant d'aisance, de fidélité inépuisable et de puissance évocatrice dans la cohérence - ne sauraient être un effet du hasard.[20]
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> Mais la seule chose finalement qui compte, dans la classification absolue /c'est-à-dire par ordre de "complexité"/ des vivants supérieurs, c'est (en plus du nombre) la perfection, en structure et en agencement, de leurs neurones cérébraux.[21]

Cephalisation is considered to be a parameter of complexity which is concrete, precise, clear and absolute, and therefore it provides a means of determining the direction of evolution.[22]

Teilhard points out that this parameter is indecipherable or, at least, uncomputable,[23] insofar as the nervous system itself is too complex for easy comparisons of relative complexity. These comparisons, however, can be made by the measurement of certain morphological characteristics such as the folding, and concentration of the

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20. TEILHARD, Le Phénomène Humain, p. 158.

21. TEILHARD, La Place de l'Homme dans la Nature, pp. 69-70.

22. TEILHARD, Le Phénomène Humain, p. 158.

23. cf. TEILHARD, La Place de l'Homme dans la Nature, p. 70.

brain in the head and the selective development of certain parts of the brain. This does not lead directly to a single line of development but rather to a "quivering spray of foliage."[24] From the multitude of lines of development, however, through the application of this parameter there springs a principal axis of development. Amidst a bundle of developing living forms, each with its own direction, there emerges a main line of development which defines the main direction of evolution.

At this point the question arises: how can a quantitative analysis of complexities lead to such a conclusion? Who can say that one line of development has a privileged position amongst the rest? From the point of view of biology there is no reason to place the development of any one phylum on a pedestal. A cephalic index or cranial capacity is not enough, in itself, to enable one to state that one being or species or phylum is apart from the rest. Something other than mere complexity is required for such a qualitative judgement. What is this "other"?

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24. cf. TEILHARD, Le Phénomène Humain, p. 158.

For Teilhard, it is the principle of consciousness.

Cerebration has been discussed from the point of view of complexity alone, and indeed, Teilhard himself considers it in this light. According to him, however, complexity and consciousness cannot be separated. Consciousness is not an accidental occurrence at the level of the higher animals, but a necessary element along with complexity in every being, and accordingly, a necessary element in all development.

Consciousness is universally recognized at the animal and human level. Moreover, the generally accepted view that man is essentially different from the lower animal is based, not on the increased complexity of his nervous system, but on his more perfect kind of consciousness. The physical scientist, however, is not particularly interested in consciousness; it is considered to be, as Teilhard says, an epiphenomenon. The physicist and chemist have no interest at all in psychic activity. The biologist, although he recognizes its existence in the objects he studies, is still chiefly concerned with complexity. Teilhard feels, on the other hand, that psychic activity,

or consciousness, or a within must be recognized at all levels of development alongside the material complexity or without of things. Not only must it be recognized but it must be considered as an integral and essential part of the object of the science, whether it be biology or physics. A science which is concerned with the within and without, the whole phenomenon, is Teilhard's hyperphysics or hyperbiology.

Accordingly, it is not through the eyes of the physical scientist alone that Teilhard sees direction in evolution. He makes no attempt to argue against the commonly accepted view of the scientific community that the development of material complexity, as presented by the general theory of evolution, does not lead to the conclusion that there is a true direction to evolution or that evolution has a goal. Nor does he abandon the physical sciences and present metaphysical proofs for orthogenetic development. His concept of an evolution with true direction, and the criteria he presents for the establishment of this direction must be understood within the context of his hyperphysics. It is based upon his belief that on the

exterior, that is, on the level of material complexity, evolution is essentially the development of the nervous system, and that this corresponds to the development of consciousness on the interior, with the result that evolution is ultimately psychic in nature. This introduction of Teilhard's panpsychism with its concepts of the within and without leads directly to his explanation of the mechanism of orthogenetic development.

D. The Mechanism of Orthogenetic Development:

Teilhard's definition of orthogenesis has been presented as an acceptable one, and yet biologists who would accept his definition may still reject his theory of orthogenetic evolution. According to Fr. Forsthoefel, "Modern biologists as a group reject Teilhard's orthogenesis as an explanation of evolution..."[25] The objections may begin with Teilhard's consideration of two parameters of evolution, that is, complexity and consciousness as introduced in the last section. The root of the problem,

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25. Paulinus F. FORSTHOEFEL, "Beneath the Microscope", in: R. T. FRANCOEUR (ed.) The World of Teilhard, Baltimore, Helicon Press, 1961, p. 108.

however, lies deeper within the Teilhardian synthesis in the explanation of the fundamental mechanism of evolution.

For many, the theory of evolution itself gives an explanation of man's nature and provides the key to his future. Friedrich Engels, for example, stated that evolutionary development is the Ariadne's thread that leads the way out of the labyrinth.[26] Many, like Engels, see Darwinian chance or natural selection as ultimate causes without looking further for the explanations of these concepts.

For Teilhard, however, evolution is not an ultimate explanation, but is itself a labyrinth; the Ariadne's thread is the axis of development of complexity-consciousness. Moreover, the development of complexity-consciousness must itself be explained and its orthogenetic character demonstrated. Contrary to Father Forsthoefel's suggestion therefore, Teilhard's orthogenesis should not be considered to be an explanation of evolution. It is an aspect of evolution which, once seen, gives the process a true sense, but it is also an aspect of evolution which must be explained

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26. Friederich ENGELS, Dialectics of Nature, New York, International Publishers, 1960, p. 13.

and demonstrated by a study of the mechanism of evolutionary development.[27] Accordingly it is necessary to go beyond the definition and criterion of orthogenesis to its explanation. This explanation involves discussion of the *within* and *without*, *centreity* and *psychic temperature*, and *radial and tangential energy*.

i) *The Without and Within*

Teilhard's theory of orthogenetic development is based upon a description of the development of material complexity, or, the *without* of things. This is, basically, a description resulting from Teilhard's own knowledge of the physical sciences; it conforms with the modern scientific theory of evolution and, inasmuch as it may be presented in purely spatio-temporal terms, it is a mechanistic description.

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27. The use of the term *mechanism* here and throughout this work is not meant to suggest that Teilhard's synthesis is mechanistic. The meaning intended is: physical or mental processes whether conscious or unconscious, by which some result is produced. (*Webster's New Twentieth Century Dictionary*).

Teilhard then presents an explanation of this physical development. Psychic energy is introduced as the dynamic and vital principle of the evolutionary process. It is necessary for an explanation of the whole phenomenon, and, because of this, the physical scientist himself will eventually have to become involved with it. At present, however, only those physical scientists who consider the higher forms of natural development are at all concerned with psychic activity. To the extent that they are concerned with psychic activity the life-sciences tend away from purely mechanistic explanations, since a vital principle manifests itself in the activities of higher forms of life.

Those sciences which deal with the lower end of the spectrum of development, such as relativity physics and quantum mechanics, are still basically mechanistic. The discovery of the tremendous energy which exists at the level of the atom and sub-atomic particle, and the subsequent development of wave and field theory, however, indicate a tendency away from the classical mechanistic approach. But so far, these theories are little more than

mathematical models which represent in abstract terms what is known of reality without presenting any true explanation of the source of the new-found dynamism or the activity it produces.

Within the physical sciences themselves there is, at present, no justification, and possibly no necessity for the Teilhardian extrapolation of psychic activity from the highest level of material being to the lowest. The zoologist is justified in explaining certain types of animal behaviour in terms of psychic activity which is found primarily on the human level, since man, as an animal, is a member of the class of things which the zoologist studies. The nuclear physicist, on the other hand, it not in the fortunate position of being himself a member of the class which he studies. He is not in a position to assume that the activities of the objects within his view as a physicist can be explained in the same way as the activities of more developed objects, such as animals or man. At this stage in the development of the physical sciences, the physicist must be content with the application of mathematical models as a substitute for explanation.

This is not to say, however, that such an extrapolation cannot be justified from any point of view. Teilhard's premise that all energy is psychic comes not from an analysis within one branch of the physical sciences, but rather from a synthesis of all branches. The physical sciences, when viewed from a height, are seen to have the same continuity and homogeneity as the world which they study. Physics blends into physical chemistry, physical chemistry into biochemistry, biochemistry into biology. The actual dividing lines between the sciences are so arbitrary that a scientist himself may not be sure whether he should be called a physicist or a physical chemist, a biochemist or a biologist. Accordingly, the justification for Teilhard's starting point cannot be found in any particular segment of nature, nor in any particular physical science, but rather in the universe at large, and the physical sciences in general.

Although Teilhard's theory is based on a world vision acquired through modern physical science, it does not follow that all those who accept the scientific basis will accept the theory. The realization that the universe

today is the result of a continuous development from fundamental particles leads some to the conclusion that the most complex beings, such as man, may be totally understood by analysing them into their component parts. These simple parts will fit neatly into mathematical models, and thereby give rise to purely mechanistic explanations. The Cartesian dream comes true, but through empirical methods. If one accepts Bertrand Russell's suggestion that man is nothing but an accidental collocation of atoms, one could maintain that a complete knowledge of man would be gained by a complete study of atoms. This positivistic, mechanistic tendency is one of analysis and reduction. The more complex, analysed into its component parts, may be reduced to a lower level and studied by a more mechanistic, mathematicized science. Man, considered as a collocation of atoms, would become the object of study of the atomic and nuclear physicists.

The vision of a continuously developing universe leads Teilhard to a vitalistic explanation rather than the mechanistic one discussed above. The continuity and homogeneity of the universe lead him to the conclusion that

there is a unity of structure and mechanism throughout. Accordingly, since complexity and consciousness exist at the upper levels, it is reasonable to assume their existence at all levels of material being, even though consciousness is not apparent at the lower levels.

> Puisque, en un point d'elle-même, l'Etoffe de l'Univers a une face interne, c'est forcément qu'elle est biface par structure, c'est-à-dire en toute région de l'espace et du temps, aussi bien par exemple que granulaire: Coextensif à leur Dehors, il y a un Dedans des Choses.
>
> Dedans, Conscience, et donc Spontanéité, à ces trois expressions d'une même chose il ne nous est pas plus loisible de fixer expérimentalement un début absolu qu'à aucune des autres lignes de l'Univers.
>
> Dans une perspective cohérente du Monde, la Vie suppose inévitablement, et à perte de vue avant elle, de la Prévie.[28]

Our first encounter with consciousness or the within is on the level of man, and then on the level of the higher animals. Teilhard, therefore, is making an attempt to explain the lower in terms of the higher, rather than the other way around as in the mechanistic approach. Rather than use his knowledge of the atom to give him

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28. TEILHARD, Le Phénomène Humain, pp. 52-3.

further knowledge of man, he uses his knowledge of man to lead him to further knowledge of the atom.

To justify this approach the following considerations should be borne in mind: First, on the level of material complexity, continuous development and unity of structure are generally accepted. Secondly, the existence of a consciousness or within in man, which is more than his material complexity, is also generally accepted.[29] Thirdly, the existence of this within explains the activities of man. Fourthly, the activities of the simpler material beings, especially those below the living, have been described to some extent, but in no way have they been explained. Finally, many of these activities, if not all, are in some ways similar to those activities of higher beings which may be explained in terms of a within; for example, the attraction of an electron to a proton, a

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29. Some hold that consciousness has developed from material complexity. Here, however, we are not directing our attention to the source of consciousness, but to its existence here and now. (It might be noted that even the Marxist philosophers are putting greater emphasis on the distinction between matter and consciousness. cf. International Philosophical Quarterly; Vol. 4, No. 1, pp. 146ff).

rabbit to a carrot, a man to a woman.

Finally, from the above five points it is at least not unreasonable to assume, or postulate, the existence of continuity and homogeneity on the level of consciousness as well as on the level of complexity. Such an assumption leads to a more coherent picture of the universe and gives a unified explanation of all activity. Though at present it is not empirically verifiable, it could nevertheless be classed as a good scientific theory, and "true" according to Teilhard's criterion of truth.

The scientist who knows the modern theories of general evolution should have no difficulty in accepting this theory. Those, however, who reject the notion of a "mysterious" vital principle may in the beginning reject Teilhard's panpsychism. The analytical, positivistic mind, interested in reducing the more complex to the less complex, sees no reason to assume the existence of a separate line of development for consciousness. For the analytic positivist, the appearance of consciousness at the higher levels of evolution might be explained in terms of material complexity. To introduce a line of development

of consciousness alongside that of complexity would seem gratuitous at least, if not a remnant of bygone superstitions.

For Teilhard, however, the within of things is not the product of superstition or rationalism, both of which he would reject. It is mysterious in the sense that it is not yet completely understood, but not in the sense that it is beyond the understanding of science. According to Teilhard, if one attempts to synthesize, to obtain a coherent picture of the whole, one cannot sidestep the problem of the within, or the spiritual face of material beings. The assumption of a within is not gratuitous, but necessary.[30]

> Le moment est venu de se rendre compte qu'une interprétation, même positiviste, de l'Univers doit, pour être satisfaisante, couvrir le dedans, aussi bien que le dehors des choses, - l'Esprit autant que la Matière. La vraie Physique est celle qui parviendra, quelque jour, à intégrer l'Homme total dans une représentation cohérente du monde.[31]

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30. cf., TEILHARD; "L'Energie Spirituelle" in: Le Phénomène Humain, p. 59ff.

31. Ibid., p. 30.

It is within this "true physics" or hyperphysics, which considers both the within and the without that one can see a direction in evolution. Complexity is encountered first, and accordingly the development of the nervous system is the first criterion or the first indication of direction. But the development of consciousness, which cannot be separated from complexity, is what gives direction its true meaning; it is this that makes evolution truly orthogenetic. What must be considered, then, for an understanding of orthogenesis in Teilhard, is the development of complexity-consciousness.

> A partir du "mycélium" initial Protéines-Monocellulaires qu'il faut bien supposer, dans tous les cas, à la base de l'opération générale de vitalisation planétaire, une gerbe touffue de types pluricellulaires jaillit ... en direction générale de quelques accroissement en complexité et conscience.[32]

ii) Centreity and Psychic Temperature:

As has already been stated, according to Teilhard the absolute classification of living things, from the

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32. TEILHARD, "La Structure Phylétique du Groupe Humain", in: L'Apparition de l'Homme, p. 196.

point of view of complexity, is given by the perfection of the structure and arrangement of the nervous system.[33] This is seen to be the criterion of direction because of its intimate association with the development of consciousness, the tendency towards "centreity" and "interiorisation", or the rise in "psychic temperature".

> Ce qui derechef, faut-il ajouter, définit et mesure la vitalisation d'un corpuscule donné, c'est son degré d'intériorisation, ou "température psychique" (conscience, culminant chez l'Homme en liberté). Puisque, avons-nous reconnu, les deux variables sont étroitement liées. - Qu'est-ce à dire, sinon que, s'il y avait par chance dans le vivant certaine portion (certain organe) plus spécialement connectée avec le développement psychique de l'être, c'est la complexité de cette partie, et de cette partie seule (le reste ne faisant que troubler les mesures!) qui pourrait, et qui devrait, être employée pour apprécier le degré de corpusculisation atteint par le vivant examiné.[34]

An examination of the scale of beings indicates that their development in the order of complexity does correspond to an increase in the concentration of psychic activity. Because of our limited knowledge of the nature

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33. cf., TEILHARD, La Place de l'Homme dans la Nature, pp. 69-70.

34. Ibid., p. 68.

of the beings at the bottom of the scale, an examination at this level is difficult. For example, the electron and proton have measurable fields of gravitational, electrostatic and nuclear attraction, each of which produces certain activities. There is no evidence that the source of these activities is concentrated in specialized parts of the particle, nor, on the other hand, is there any evidence that it is not. One might assume that the simplest elements would be very homogeneous, but at present this would be just an assumption. Some specialization or concentration of the source of activity which goes hand in hand with increased complexity is found in the atom. The positive charge appears to be concentrated in the nucleus, whereas the negative charge exists in the electron shells. Any statement, however, regarding psychic energy, or the concentration of psychic energy at this level certainly does not follow from direct empirical evidence, but from our knowledge of psychic energy on a higher level and the assumption that there is in nature a fundamental unity of structure and mechanism.

Specialization becomes more evident at the lowest

levels of the scale of living beings. Some cells, for example, may perform the activity of bringing in material from the environment, while other cells will perform the activity of assimilating it as food. This specialization is very evident in the plants with which we are most familiar. Different activities are concentrated in different parts of a plant; for example, in a tree the roots perform the activity of absorbing moisture from the ground, while the leaves absorb sunlight. Still, there is no central agent at this level directing the various activities. This extreme concentration is not found until one comes to the development of the brain in the animal kingdom, where there is increased specialization of the parts and a higher and higher degree of concentration or centralization of psychic activity within the head. From this point on the rise in psychic temperature corresponds with the growing complexity of the nervous system. This development does not follow a straight line, as has already been stressed; but a privileged axis does emerge, leading to man with the greatest complexity and highest concentration

of psychic energy.[35]

It should be noted once again that Teilhard does not attempt to explain the higher in terms of the lower. This becomes more evident from the above discussion. If Teilhard sees psychic energy at the inanimate or lower animate levels, it is not from direct observation, but from his knowledge of psychic activity in man and his belief in the unity of structure and mechanism of nature. An analysis of atoms alone would not necessarily lead to the conclusion that their activity is caused by fundamentally the same kind of energy which causes activity in man. Such a conclusion comes only from a synthesis that views the world of consciousness and matter as a unified whole. It follows, then, that Teilhard's concept of direction does not come directly from analysis of the elements involved in evolution, but from his synthetic world view.

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35. Concentration of psychic energy does not necessarily involve increased specialization of parts, or vice versa. In fact, over-specialization may lead to a dead-end in total development and possibly extinction, whereas beings which have continued to develop the most have shown great diversification within a specialized part (e.g. man's hand).

iii) Radial and Tangential Energy:

For an understanding of the mechanism of the development of complexity-consciousness, as well as an explanation of the relationship between orthogenesis and certain physical laws, especially the second law of the thermodynamics, Teilhard's theory of radial and tangential energy is essential.

As has already been seen, Teilhard maintains that all energy is essentially psychic in nature, and that the within is the source of this energy. In an analysis of this energy he states that there must be a single energy operating in the world,[36] but it has two distinct components.

> ... cette énergie fondamentale se divise en deux composantes distinctes: une énergie tangentielle qui rend l'élément solidaire de tous les éléments de même ordre (c'est-à-dire de même complexité et de même "centréité") que lui-même dans l'Univers; et une énergie radiale, qui l'attire dans la direction d'un état toujours plus complexe et centré, vers l'avant.[37]

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36. TEILHARD, Le Phénomène Humain, p. 60.

37. Ibid., p. 62.

Tangential energy is the energy of matter, the energy of the body, or the energy of the without. It is the energy with which the physical scientist is immediately concerned. Radial energy is the energy of the spirit, the energy of the soul, or the energy of the within. Teilhard presents this distinction to safeguard the natural complexity of the stuff of the universe.[38] On the other hand, his insistance that these two energies are merely components of one fundamental energy is presented to avoid a fundamental dualism, at once impossible and anti-scientific.[39]

The physicist defines energy as the capacity to do work. In keeping with this definition, Teilhard writes:

> Sous ce mot, qui traduit le sens psychologique de l'effort, la Physique a introduit l'expression précise d'une capacité d'action, ou plus exactement d'inter-action. L'énergie est la mesure de ce qui passe d'un atome à l'autre au cours de leurs transformations. Pouvoir de liaison, donc; mais aussi, parce que l'atome paraît s'enrichir ou s'épuiser au cours de l'échange, valeur de constitution.[40]

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38. Ibid.

39. Ibid.

40. Ibid., p. 36.

But because Teilhard sees two levels of operation, he posits two kinds of energy.

> En vertu de la "loi de complexité-conscience" qui nous a toujours guidés jusqu'ici, on peut dire qu'il existe, dans tout corpuscule, deux niveaux d'opération: l'un (appelons-le tangentiel) reliant physico-chimiquement, c'est-à-dire par voie de complexité, le corpuscule considéré à tous les autres corpuscules de l'Univers; l'autre (nommons-le radial, ou axial) courant directement de conscience à conscience, et se manifestant, à la hauteur de l'Humain, par les divers phénomènes psychologiques ci-dessus mentionnés, d'[illegible]ité et de co-réflexion.[41]

In a footnote following the above quotation Teilhard identifies radial energy with psychic energy, and tangential energy with physical energy, which seems to conflict with his statement that all energy is psychic. The explanation for this may be found in the fact that in this work Teilhard distinguishes the two energies according to the two levels of operation, which are generally known as the physical and psychic. The fundamental capacity for any activity, according to Teilhard, is psychic. Activities which flow from this psychic energy are traditionally

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41. TEILHARD, "Les Singularités de l'Espèce Humaine" in: L'Apparition de l'Homme, p. 362.

divided into psychic and physical, and that aspect of energy which produces the former is called radial, that which produces the latter is called tangential.[42]

In the language of the physicist, radial acceleration is an acceleration toward the centre, radial force is a force toward the centre; in other words the term "radial" in this context means "towards the centre". The term "tangential", when referring to velocity or acceleration in physics, means "along the tangent and away from the centre". This appears to be Teilhard's reason for the use of these terms, for he points out that strongly centred particles have a high degree of radial energy, whereas particles with less centreity have less radial, but more tangential, energy.[43] Increased centreity, or increased concentration of the source of psychic activity

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42. Because of the close association between the physical and psychic - the material and spiritual - in Teilhard's thought, there is a general problem in vocabulary, of which the above is one example. Since, for Teilhard, all matter has a within and a without, one could say, for instance, that in the traditional vocabulary, all matter has a material aspect and an immaterial aspect.

43. cf., TEILHARD, Le Phénomène Humain, p. 62 (footnote).

is found in beings higher up on the scale of natural development, and so, as beings become more and more centred, or more and more highly developed, the tangential energy becomes less evident, and the radial energy becomes more evident.

In Le Phénomène Humain, Teilhard identifies radial energy with love. Love, he states, does not exist only on the human level. In fact, in order for it to exist in man it must exist, in some way, at all levels of development. Teilhard defines love as the affinity of being with being. He equates it with radial energy when he states that driven by the forces of love the fragments of the world seek each other so that the world may come to being,[44] which statement, he insists is neither metaphor nor poetry. This identification is made quite definite in a more explicit way in another quotation:

> Seule, une union réalisée par amour et dans l'amour (ce mot "amour" étant pris à son sens le plus général et le plus réaliste de "affinité mutuelle interne") seule une telle forme d'union - parce qu'elle rapproche les êtres non pas superficiel-

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44. Ibid., p. 293.

> lement, tangentiellement, mais centre à centre - a physiquement la propriété non seulement de différencier, mais de personnaliser, les éléments qu'elle organise.[45]

This identification is a consequence of, and further evidence of Teilhard's belief in the unity of structure and mechanism in reality. He recognizes that the analogy between human love and the affinities between lower beings is quite obscure. But whether the relationship can be seen or not, he insists that all affinities are fundamentally the same. Furthermore, it is love energy, or radial energy at all levels that produces development.

The concept that love exists at all levels of material being and that all affinities are fundamentally the same is certainly not a part of modern science. Even the term "attraction" would be used by the scientist without reference to the attractions associated with human love. This concept, however, is an essential part of Teilhard's hyperphysics. It is the ray of light which will help us

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45. TEILHARD, "Les Directions et les Conditions de l'Avenir", in: L'Avenir de l'Homme, p. 302.

to see more clearly around us.[46]

Here Teilhard's method of explaining the lower in terms of the higher is quite evident. Since he sees the attraction between man and man essentially as love, and since he believes in a fundamental unity of nature, he believes also that the attraction between electron and proton, or between hydrogen and oxygen for example, is also produced by love. This further unification of the cause of development at different levels is very important to his theory of orthogenesis insofar as the direction of evolution may be traced in terms of a development of love energy. The affinity of the subatomic particle is indeed very rudimentary. It is attracted to other masses, as is all matter, and possibly to another specific particle. The same affinities are found farther up the scale of being, with other affinities added, making a more and more complex system of attractions and repulsions. With the advent of the nervous system, and the development of its chief ganglion, the brain, the complexity of the affinities

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46. TEILHARD, Le Phénomène Humain, p. 294.

becomes enormous, increasing alongside the increasing centreity until it reaches its peak in man.

It would seem that to deny that this development has direction necessitates either the denial of the fundamental unity of mechanism and structure, that is, of Teilhard's definition of love as the affinity of being for being, or the denial of an increase in consciousness and affinities. The scientist who favours a theory of continuous evolution to one of special creation should, from the point of view of coherence at least, be able to accept Teilhard's analogous concept of consciousness and love-energy. The alternative would involve the supposition that psychic activity is an effect of advanced complexity. Such a supposition would violate the principle of causality inasmuch as it would postulate the development of the immaterial from the material, would lead to a less coherent view of the evolutionary process, and would lead to the conclusion that the fundamental structure and activity of the universe can be explained completely in mechanistic terms.

With regard to the denial of an increase in

affinities and consciousness, it would be impossible to deny that, at least from a quantitative point of view, beings higher up the scale of development are conscious of more objects in their environment and have more affinities than those below them. Furthermore it seems that this increase in psychic temperature and fundamental unity is not simply a quantitative change, but a qualitative change and consequently a true increase in perfection and a true indication of direction.

E. Conclusion:

The term orthogenesis may be used in a purely descriptive way, referring to a more or less directed development, or it may also connote the actual directing causes, which are usually conceived of as being mystical and mysterious vital forces. The latter connotation is generally rejected by the modern evolutionist. Teilhard's definition of orthogenesis is the acceptable descriptive one in which evolution is seen to follow some pattern and have some direction without being absolutely determined. His explanation of orthogenetic development does, never-

theless, introduce concepts such as psychic energy and the within of things which have been looked upon by some as being mystical and mysterious vital principles with no scientific foundation.

From what has been discussed above it may be seen that the criterion and explanation for orthogenetic evolution are set in a scientific context. Major questions arise, however, when physics is extended to hyperphysics in Teilhard's complete synthesis: Is Teilhard's theory of orthogenesis based on accepted scientific theory? Is it compatible with scientific theory? Is hyperphysics science? These problems will now be considered.

PART II

Some Problems in Teilhard's Theory of Orthogenesis

In our earlier treatment of the term orthogenesis,[1] we saw that it is often associated with Lamarckian evolution and with some mysterious vital principle. Teilhard's theory in particular has been labeled Lamarckian and vitalistic. This presents a problem since, on the one hand, Teilhard bases his synthesis on scientific theory, and on the other, scientists as a group reject Lamarckianism and vitalism.

Furthermore, the physical scientist claims that, according to the accepted laws of thermodynamics, the universe is running "down hill", toward complete disorder. This also presents a major problem in Teilhard's work. Insofar as his theory of orthogenesis is based on scientific theory, how can it be reconciled with the scientific theory of entropy?

Finally, there has been much discussion and debate

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1. Chapter II, part A.

about the nature of Teilhard's thought. As seen above,[2] he himself states that his work is not metaphysics, nor is it science in the traditional sense. Instead, he prefers to refer to it as hyperphysics. Notwithstanding this categorization, the hyperphysical theory of orthogenesis is presented as an extension of modern science, and as the science of the future. Therefore it is certainly appropriate to ask: Is Teilhard's theory of orthogenesis scientific?

These are the major problems which will be discussed in Part II. Since the problem of the irreversibility of evolution follows directly from the concepts of radial and tangential energy, treated in the last chapter, it will be analysed first. This analysis will be followed by a chapter on Teilhard's Lamarckianism. Finally a chapter on the scientific nature of his orthogenetic theory will be presented.

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2. Chapter I, part B.

CHAPTER III

The Irreversibility of the Evolutionary Process

According to Teilhard and according to modern science, evolution implies increased order or complexity, and order or complexity requires energy. According to Teilhard, this process of development will continue to a final perfect and permanent state. According to modern science, however, the energy required for development is gradually being used up so that eventually, when no more energy is available, not only will development stop but there will be a regression to complete disorder.

Two questions result from this apparent dichotomy between Teilhard's theory and the law of entropy. First, does Teilhard's theory of orthogenetic development to a perfect state contradict the law of entropy? Secondly, is his theory of continued development based on scientific foundations, or is it a conclusion reached in some other manner, possibly through his religious faith? We shall attempt an answer to the first question by analysing tangential and radial energy in relation to the laws of

thermodynamics; and an answer to the second, by analysing his theory of the necessity of a continuing evolution and the transformation which will permit it.

A. The Two Energies and Entropy:

Whether through a study of the modern theory of evolution, or casual observation of the things around us, we are aware of development toward greater order or complexity. On the level of phylogenesis, the primate is more complex and has a more ordered structure than the ameba; on the ontogenetic level, the mighty oak is more complex and ordered than the acorn. Also evident is the fact that greater order and complexity requires a constant supply of energy, not only for its development but also for its maintenance. A tree isolated from its food supply soon decomposes into a disorderly array of simple molecules; in other words, it dies.

A fate similar to death also awaits non-living things. Well formed rocks break down into sand; gasses mix and spread through their container in a random and disorderly way; salt disolves in water with a resulting

increase in molecular disorder. Thus, there is a tendency in nature to proceed to a state of greater molecular disorder, which is the state of greatest stability.

In the language of the physicist, an increase in internal disorder is an increase in entropy.[1] Development towards greater order or complexity, or less stability, is always at the expense of free energy.[2] In developing to a higher level of order, a body uses up free energy from its environment, or, as the physicist would say, from its near surround. As a result of this loss of available energy, the near surround tends towards greater entropy.

According to the first law of thermodynamics, the total amount of energy in the universe remains constant, but, according to the second law, the total free energy, or energy available for increased complexity, is decreasing.

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1. Entropy is defined as a thermodynamic property of a substance related to its absolute temperature, pressure and volume, all of which define the state of the substance. It may be an expression of the available energy of a system or of the degree of internal disorder.

2. Free energy refers to thermodynamic potential, which is the energy required to bring a unit mass of a substance from an arbitrarily defined initial state to any other state.

In other words, the entropy of the universe is increasing. This is an overall effect and does not mean that the entropy of any given material body at any given time is necessarily increasing. It does mean, however, that the development of complexity seen in the evolutionary process is a "backwash", or a current running against the main stream which is towards increased entropy.

Tangential energy obeys the law of entropy, whereas radial energy does not.[3] It appears, in fact, that this is the main distinction between radial and tangential energy. Radial energy is first recognized in man, where it exists to the greatest degree, to the extent that it can completely overshadow the tangential energy at this level. It manifests itself in those affinities which enable man to develop: the apparently inexhaustible appetites for physical sustenance, which he shares with the lower animal; the true love of other persons required for total human development of man as a social animal; the love of God which brings about man's ultimate development. None of

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3. cf., TEILHARD, "Les Singularitées de l'Espèce Humaine", in: L'Apparition de l'Homme, p. 363 (footnote).

these energies appear to have any regard for the laws of thermodynamics. On the other hand, each is associated with a necessary activity which does obey these laws. The search for, and acquisition of, physical sustenance certainly requires the expenditure of physical energy. To a lesser degree, true human love, a higher manifestation of radial energy, necessitates some use of physical energy, or, in Teilhardian terms tangential energy of arrangement. Even the human act of loving God involves energy which may be measured by the physicist.

In conformity with Teilhard's belief in a unity of structure and mechanism throughout the physical universe, the combination of tangential and radial energy is found in different ratios at all levels of development. For example, two molecules of sulpher-dioxide will unite with one molecule of oxygen to form two molecules of sulpher trioxide. In Teilhardian terms, sulpher-dioxide and oxygen molecules have a certain complexity and also a certain radial energy. Their radial energy is their capacity to unite, to form a more complex unit and thereby develop further, and this remains constant, and therefore does not obey the law of

entropy.[4] The actual union of these molecules, however, takes place in a chemical reaction, and since this is an exothermic reaction, a definite amount of energy is lost, in accordance with the law of entropy. The actual reaction, therefore, involves tangential energy. When the reaction is completed, a higher complexity exists and consequently a higher degree of psychic or radial energy, which gives the new molecules a capacity for further development.

In the light of the above examples, the following explanation of Teilhard may be considered:

> A partir de cet état initial, et à supposer qu' elle dispose d'une certaine énergie tangentielle libre, il est clair que la particule ainsi constituée, se trouve en mesure d'augmenter d'une certaine valeur sa complexité interne en s'associant avec des particules voisines, et par suite (puisque sa centréité s'en trouve automatiquement accrue) de faire monter d'autant son énergie radiale, - laquelle, à son tour, pourra réagir sous forme d'un nouvel arrangement dans le domaine tangentiel. Et ainsi de suite.[5]

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4. Gravitational, electrostatic and nuclear repulsions and attractions vary as a function of distance but not time. e.g. The electrostatic force $F \propto \frac{qq'}{d^2}$. F, as a measure of a fundamental affinity is a measure of radial energy.

5. TEILHARD, Le Phénomène Humain, p. 62.

In a footnote found on the same page as the above quotation, Teilhard makes a further distinction:

> Il faudrait sans doute distinguer deux espèces d'énergie tangentielle: l'une de rayonnement (maxima pour les très petites valeurs radiales, - cas de l'atome); l'autre d'arrangement (uniquement sensible pour les grandes valeurs radiales,- cas des vivants, de l'Homme).[6]

According to Teilhard, a particle having a certain amount of free tangential energy is in a position to increase its internal complexity, or form a new arrangement.[7] It seems, therefore, that tangential energy of arrangement is thermodynamic potential or free energy, as defined by the Gibbs function or the Helmholtz function.[8]

The distinction between energy of arrangement and energy of radiation is based on the two currents produced

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6. Ibid.

7. cf., TEILHARD, Le Phénomène Humain, p. 62.

8. The Gibbs function may be written: G=U-TS+pV. Where G is the Gibbs free energy, U the internal energy, T the absolute temperature, S the entropy, p the pressure and V the volume.
The Helmholtz function is: A=U-TS, and is commonly called the work function.
In either function, free energy is greatest for small values of S (entropy), which corresponds to Teilhard's concept of tangential energy of arrangement.

by physical energy in the universe: one towards disintegration, or to an elementary physical energy of radiation with maximum entropy, and the other, a backwash towards higher arrangement or lower entropy. The energy of arrangement is decreasing, according to the second law of thermodynamics, and therefore the backwash cannot continue indefinitely. Energy of radiation is found at the level of maximum stability and is constant.[9] The physicist is concerned with the change to maximum entropy, or from maximum arrangement, and it would be for this reason that Teilhard states that it is tangential energy of arrangement that is troublesome for the physicist.[10]

With regard to the progressive current towards lower entropy, both radial energy and tangential energy of arrangement are necessary for this "backwash". Radial energy drives the being forward, but since this development requires a new arrangement, tangential energy of arrangement is necessary.

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9. cf., TEILHARD, "Sur les Degrés de Certitude Scientifique de l'Idée d'Evolution", in: Science et Christ, p. 246.

10. cf., TEILHARD, Le Phénomène Humain, p. 63.

The consequence of Teilhard's premise that there are two parameters of evolutionary development, that is, the law of complexity-consciousness, and his associated distinction between tangential and radial energy is a denial of the statement that all real processes are irreversible in the direction of greater entropy. This denial has nothing to do with the generally accepted fact that within systems in which there is an interchange of energy there may be a decrease in entropy. Nor is it a rejection of the second law of thermodynamics as a physical law. Teilhard sees two main currents of evolution: the development of complexity which obeys the law of entropy, and the development of consciousness which does not. Both main currents are real, and both are irreversible, but whereas the former is irreversible in the direction of greater entropy, the latter is not.[11]

> Peu à peu échappant aux limitations et à la stabilité du Cosmos antique, notre esprit commence à se

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11. Here we will discuss only the idea that the development of consciousness does not follow the second law of thermodynamics. The irreversibility of this development will be considered in part B.

> familiariser avec l'idée de courants majeurs affectant l'univers dans sa totalité. Courants régressifs, d'abord: Entropie, Désagrégation de l'Energie, - les premiers reconnus. Mais courants progressifs, ou constructifs, aussi...
>
> Si bien que, en plus de l'Entropie (par quoi se dégrade l'Energie), - en plus de l'Expansion (par quoi se déploient et se granulent les nappes de l'Univers), - en plus des attractions électriques et gravifiques (par quoi s'agglomère la poussière sidérale), force nous est désormais (si vraiment nous voulons couvrir l'expérience et sauver tout le phénomène) de considérer et d'admettre, animant la masse totale des choses, un courant constant, pérenne, de "complexification intériorisante".[12]

The scientist himself recognizes two currents. Reactions which tend towards greater entropy, as all spontaneous reactions do,[13] form the main current towards greater randomness, greater disorder, or less arrangement. Running against this current are the endergonic reactions, most important to living beings, which take on energy and therefore tend towards less entropy and greater arrangement. Endergonic reactions, however, cannot be considered as isolated events. They require an exergonic reaction to

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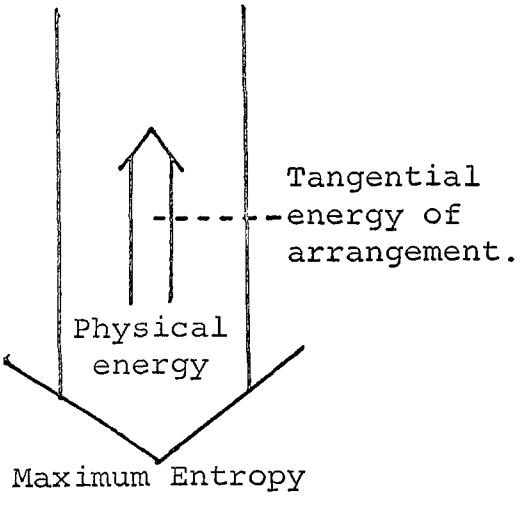
12. TEILHARD, La Place de l'Homme dans la Nature, pp. 45, 46.

13. That is, exergonic reactions.

supply their energy, and the loss of energy in the exergonic reaction is always greater than the gain in the endergonic. Therefore the whole process is exergonic, or, tending towards less arrangement.

Teilhard's view of the two currents is not identical to that of the physicist. Both currents for the physicist have to do with physical energy, that is, with the parameter of complexity. The radial energy, necessary to explain the "backwash", belongs to the parameter of consciousness, and as such, has not yet been recognized by the physicist. The following diagrams may help to illustrate this point:

a) Axis of Complexity



b) Axis of Consciousness

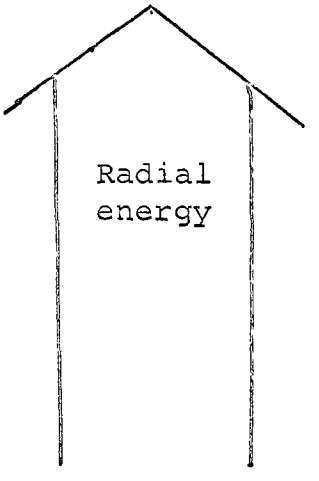


Figure a) represents the physicists' view of the two currents: the general tendency towards maximum entropy and the counter-current using up the available energy. Figure b) represents the continuous development towards greater consciousness: the axis of evolution for which the physicist shows little concern. Teilhard's position that evolution is a development of complexity-consciousness brings the two axes together, uniting them as essential parts of the one process. Radial energy then becomes the driving force behind the back current towards greater complexity, which is, in turn, the necessary requirement for higher degrees of radial energy. In the light of physical energy alone, the universe is running downhill. The development of greater complexity is truly no more than a back-current or eddy.[14] Within the context of Teilhard's two parameters, however, the universe is running uphill, towards even greater development of consciousness, through the development of radial energy.

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14. cf., TEILHARD, "La Réflexion de l'Energie", in: L'Activation de l'Energie, pp. 343ff. (especially p. 345, fig. 1); and TEILHARD, "Le Phénomène Humain" (1930) in: La Vision du Passé, pp. 235ff.

It can be seen from the above that Teilhard does not reject, nor ignore the law of entropy. The very fact that the distinction between radial energy and tangential energy is based on the second law of thermodynamics indicates this. The law of entropy is accepted for the parameter of complexity, which satisfies the requirements of the present-day physicist. It does not apply, however, to the parameter of consciousness, which is not yet the concern of the physicist.

This in itself does not solve the problem of entropy. The universe will still end in ruins if there is a necessary connection between tangential and radial energy. This Teilhard himself accepts when he states that spiritual perfection, or conscious centreity, and material synthesis, or complexity are but the two aspects or connected parts of one and the same phenomenon.[15]

If the development of consciousness is connected to the development of complexity, and the development of complexity, after reaching a maximum, diminishes to a mini-

15. TEILHARD, Le Phénomène Humain, p. 57.

mum in obedience to the second law of thermodynamics, then it would follow that consciousness itself must eventually diminish and ultimately disappear. Even if radial energy is seen to be in itself independent of the law of entropy, this would still be the case. Even if it were true that the act of knowing in itself, or the affinity of molecule for molecule in itself, does not obey the second law of thermodynamics, nevertheless, as long as these activities depend upon the complexity of the structure, they can exist only as long as the structure itself exists.[16]

Here Teilhard's theory of orthogenesis arrives at a most critical point. In La Réflexion de l'Energie (1952), the problem was expressed by him in the form of two questions.[17] First, is the development towards greatest complexity simply a sub-effect of the general evolutionary development? Secondly, when the maximum point of complexity is reached, will all development redescend to minimum

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16. cf., TEILHARD, "La Place de l'Homme dans l'Univers", in: La Vision du Passé, p. 318 ("Matière et Conscience se relient l'une à l'autre:"...).

17. cf., TEILHARD, "La Réflexion de l'Energie", in: L'Activation de l'Energie, p. 346.

complexity, or will the line of development undergo some transformation?

In Le Phénomène Humain, Teilhard presents the same problem in the form of three questions:

> a) En vertu de quelle énergie spéciale, d'abord, l'Univers se propage-t-il, suivant son axe principal, dans la direction, moins probable, des plus hautes formes de complexité et de centréité?
>
> b) Y a-t-il, ensuite, une limite et un terme définis à la valeur élémentaire, et à la somme totale des énergies radiales développées au cours de la transformation?
>
> c) Cette forme ultime et résultante des énergies radiales, enfin, si elle existe, est-elle assujettie et destinée à se désagréger réversiblement un jour, conformément aux exigences de l'Entropie, jusqu'à retombée indéfinie dans les centres prévivants et au-dessous, par épuisement et nivellement graduel de l'énergie libre tangentielle contenue dans les enveloppes successives de l'Univers, et dont elle a émergé?[18]

Teilhard answers these questions about the irreversibility of radial energy and the required transforma-

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18. TEILHARD, Le Phénomène Humain, p. 64. The special energy, to which he is referring in a) is neither tangential nor radial, but some energy which is the ultimate cause of tangential and radial. "Less probable direction", refers to the back-current against entropy or most probable arrangement.

tion by further developing his theory of complexity-consciousness and the two energies into an explanation of the noosphere, that is, the realm of human consciousness.

B. The Development of the Noosphere

The existence of the "two energies", radial and tangential, does not in itself enable physical being to escape from the law of entropy. Since the two energies are, according to Teilhard, intimitely bound together, in fact, are really aspects of one fundamental energy, the eventual dissipation of tangential energy would bring about the dissipation of radial as well. Even at the level of man Teilhard states that tangential energy, while overshadowed by radial energy, is still essential. A vitalism which would postulate an essential difference between life and non-life would be a solution to the problem, for then living beings could be freed from the physical laws of thermodynamics. This idea, however, runs contrary to Teilhard's insistence on a unity of mechanism and structure. Life, being a part of a total, continuous development, must follow the laws of that development. In 1952

Teilhard wrote:

> Pour résoudre cette antimonie de fond entre Entropie physique et "Orthogénèse" biologique, les vitalistes du 19e siècle avaient cherché à développer la notion de certaines forces (pondérables) spéciales aux substances organisées: position qui devait vite s'avérer intenable, aussi bien expérimentalement que théoriquement, dans la mesure où elle impliquait la coexistence de deux énergetiques indépendantes dans le même Univers: l'une pour la Matière dite inerte, l'autre pour la Matière vitalisée.[19]

As a consequence of Teilhard's position that there is only one basic energy within the evolutionary process, as well as his acceptance of the law of entropy and the consequences of this law, there are only two alternatives: extinction or transformation.[20] In its present form, the tangential aspect of psychic energy, succumbing to the law of entropy, will bring about the destruction of all psychic energy. If psychic energy is to survive it must take on a new form, must suffer a transformation whereby it will be free of the law of entropy. Such a transformation, Teilhard

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19. TEILHARD, "La Réflexion de l'Energie", in: L'Activation de l'Energie, p. 343-4.

20. cf., TEILHARD, "La Structure Phylétique du Groupe Humain", in: L'Apparition de l'Homme, p. 227ff.

believes, will come about; a transformation within the evolutionary process which will make that process irreversible.[21]

The conclusion that the evolutionary process is irreversible is, according to Teilhard, based on a scientific analysis. Once again, however, it is not science in the traditional sense of the word, but, rather, it is hyperphysics. Teilhard does not analyse the complexity of the universe alone, for such an analysis leads to the conclusion that the universe will, one day, reach maximum entropy.[22] He analyses evolution as a development of consciousness which he considers to be a universal property of all material things:

> ... posons en principe que la conscience (tout comme la faculté de changer de masse avec la vitesse, ou de rayonner en fonction de la température) est une propriété universelle, commune à tous les corpuscules constitutifs de l'univers, - sous cette réserve que

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21. This refers to the irreversibility of the evolutionary current, or "backwash" itself. It is irreversibility, then, in the direction of lower entropy, not higher.

22. cf., TEILHARD, "La Réflexion de l'Energie", in: L'Activation de l'Energie, p. 343ff.

> la propriété en question varie alors proportionellement à la complexité de chaque espèce de corpuscule considéré.[23]

In the light of this postulate Teilhard sees two stages in the development of consciousness which lead to the conclusion of irreversibility: the advent of self-consciousness and the future unification of all self-conscious elements.

> Une fois déjà, il y a des centaines de milliers d'années, la conscience est parvenue à se centrer, et donc à penser, dans un cerveau arrivé à limite de complication nerveuse: et ce fut la première hominisation de la Vie sur Terre.
>
> Une fois encore, après d'autres milliers ou millions d'années la même conscience peut, elle doit se surcentrer au foyer d'une Humanité totalement réfléchie sur elle-même.[24]

With the advent of reflection the conscious centre became the object of its own consciousness:

> Du point de vue expérimental qui est le nôtre, la Réflexion, ainsi que le mot l'indique, est le pouvoir acquis par une conscience de se replier sur soi, et de prendre possession d'elle-même comme

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23. TEILHARD, "Un Grand Evénement qui se Dessine: La Planétisation Humaine", (1945) in: L'Avenir de l'Homme, p. 165.

24. Ibid., p. 169.

> d'un objet doué de sa consistance et de sa valeur particulières: non plus seulement connaître, - mais se connaître; non plus seulement savoir, mais savoir que l'on sait.[25]

Morphologically the transformation associated with the birth of self-consciousness was slight [26] states Teilhard, however the consequences of such a transformation are immense.[27] The effects of this transformation were not limited to man, insofar as self-consciousness became an integral part of the mechanism of evolution.

> Car en l'Homme, en même temps qu'elle devient à la fois self-consciente et (au moins axialement) self-opérante, l'Evolution devient automatiquement prévoyante de son avenir.[28]

The non-reflecting animal has little individuality; its whole self is submerged in the group. Able only to look outward and hence unaware of its own energies and purpose, it develops blindly for the good of the species,

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25. TEILHARD, Le Phénomène Humain, p. 181.

26. Ibid., p. 163.

27. Ibid., p. 181.

28. TEILHARD, "La Réflexion de l'Energie", in: L'Activation de l'Energie, p. 348. cf., also Le Phénomène Humain, 244: "L'Homme...n'est pas autre chose que l'Evolution devenue consciente d'elle-même..."

the phylum, the whole evolutionary process. Man, through reflection, looks inward at his own powers and inclinations, and in doing so takes on a new identity. The evolutionary process is no longer blind, nor is it simply a development of the masses. There is within the species man, the leading edge of the whole process, a kind of internal granulation.[29]

> Au premier contact de la Réflexion, chaque élément conscient s'isole, et il tend toujours plus, dirait-on, à ne plus vivre que pour soi-même: comme si, par hominisation, le phylum se pulvérisait en individus, - et comme si, dans l'individu hominisé, le sens phylétique s'oblitérait puis s'évanouissait.[30]

This granulation does not, however, lead to a divergence of isolated individuals which would bring evolution to a halt. The self-conscious individual not only knows, but also knows that he knows. He can consequently know himself as "self", thus increasing his own identity and "centreity", and can know another as other,

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29. cf., TEILHARD, "Un Grand Evénement qui se Dessine: La Planétisation Humaine", (1945); in: L'Avenir de l'Homme, 168-9.

30. Ibid., p. 169.

bringing about a new intentional union. Furthermore, through this truly human knowledge, truly human love becomes a reality, and with it the highest degree of affinity in the evolutionary process.

Man, because of his new kind of radial energy, is the most centred being on earth. But self-consciousness enables him not only to centre himself upon himself, but also to centre all other centres upon himself. Consciousness has a threefold property:

> 1) de tout centrer partiellement autour de soi;
> 2) de pouvoir sur soi se centrer toujours davantage; et
> 3) d'être amenée, par cette sur-centration même, à rejoindre tous les autres centres qui l'entourent.[31]

Man becomes, therefore, a centre of centres which, rather than leading to a divergence of isolated individuals, leads to the second major stage of the process: the threshold of the Phylum, the hominisation of the Species,[32]

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31. TEILHARD, Le Phénomène Humain, p. 287.

32. cf., TEILHARD, Le Phénomène Humain, pp. 192ff.

Reflexion,[33] or the convergence of the self-conscious granules.

Teilhard indicates a number of causes of this unification or convergence [34] The increase in population on our planet will necessarily cause convergence. This Teilhard calls "geological curvature". Further unification will necessarily come about because of the universality of ideas, referred to as "mental curvature". Teilhard insists, however, that neither the physical proximity imposed by increased population in a limited space, nor the unity of ideas imposed by a community of scientists and advanced communications is sufficient to produce complete convergence. True unity will come about freely,

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33. The use in English of the two spellings of the word "reflection" (i.e. reflection and reflexion) is taken from Norman Denny's Translator's Note, in the English edition of L'Avenir de l'Homme. cf., TEILHARD, The Future of Man, London, Collins, 1964, p. 9. Reflection is the power of man to know that he knows; reflexion is the process whereby the species man centres upon itself, or coils inward on itself. Teilhard uses the word "Réflexion" for both meanings, (cf. L'Avenir de l'Homme, pp. 169-70) and sometimes "co-réflexion" for the second meaning.

34. cf., TEILHARD, "La Formation de la Noosphère" (1947) in: L'Avenir de l'Homme.

through love; - through an attraction to a common destiny freely accepted by all.

> Il serait évidemment prématuré d'affirmer qu'une telle disposition /the attraction/ agisse encore bien explicitement sur la marche des événements politiques et sociaux, autour de nous. Et cependant, sous la montée en cascade des démocraties et des totalitarismes qui se succèdent depuis cent cinquante ans dans l'histoire du monde, n'est-ce pas le Sens de l'Espèce qui, après avoir semblé un instant s'évanouir au fond de nos coeurs, volatilisé en quelque sorte par l'émergence de la Réflexion, - n'est-ce pas le Sens de l'Espèce, dis-je, qui par-dessus tout individualisme rétréci reprend peu à peu sa place et ses droits?[35]

For Teilhard the second stage in the development of the self-conscious layer, or noosphere, has already begun. There is definite evidence of convergence because of "geological curvature" and "mental curvature"; and what is more important, in spite of the obvious divergences that exist on our planet, there is evidence for a developing human love of global proportions.

Convergence has begun, but it may take millions of years to complete. According to Teilhard the ultimate

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35. TEILHARD, "Comment Concevoir et Espérer que se Réalise sur Terre l'Unanimisation Humaine?" in: L'Avenir de l'Homme, p. 372.

result will be a perfect and permanent union between the individual human elements. If it is to be permanent, a transformation would be required to escape the law of entropy; but for Teilhard there is reason to believe that this escape will take place. In fact he insists that an analysis of the mechanism of the process itself shows the development of the noosphere to be necessarily irreversible, but not in the direction of maximum entropy. The cause of this irreversibility will now be discussed.

C. The Cause of Irreversibility:

It might appear at first sight that Teilhard's reason for stating that evolution is irreversible is in no way scientific. He says, for example:

> A partir du moment où elle se pense, l'Evolution ne saurait plus s'accepter, ni s'autoprolonger, que si elle se reconnaît irréversible, c'est-à-dire immortelle. Et en effet, vivre constamment et laborieusement penché sur l'avenir, - fût-il celui d'une Noosphère - si finalement cet avenir se chiffre par un zéro, à quoi bon? Mieux ne vaut-il pas s'arrêter et mourir de suite?[36]

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36. TEILHARD, "Le Rebondissement Humain de l'Evolution et ses Conséquences", in: L'Avenir de l'Homme, pp. 264-5.

He seems to be saying that man looks towards the future, and therefore there will be a future, and this is, indeed, what he is saying. But within the context of his thought, it is not wishful thinking, but an argument based on scientific foundations.[37] This argument proceeds as follows: First, the most coherent picture of the universe is the most true. The view of a continuous development of complexity-consciousness is more coherent than the view of a continuous development of complexity alone. Therefore this view most closely approximates the truth.[38]

From this it follows that the production of life, of self-conscious man, and of socialization, and the infolding of the noosphere are not epiphenomena, but essential and integral parts of the one, whole continuous process of evolution.[39] The fundamental unity of structure

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37. This in itself does not imply, of course, that the conclusion of this argument is true. The scientific nature of this theory will be considered in Chapter V.

38. cf., TEILHARD, "Note Sur le Progrès" (1920) in: L'Avenir de l'Homme, p. 35.

39. cf., TEILHARD, "Agitation ou Genèse?" in: L'Avenir de l'Homme.

and mechanism exists throughout this process from the bottom to the top. Nevertheless, at each new level of evolution something radically new is produced and accordingly, the development of the new being is nor merely a repetition of a development on a lower level.

> Tissée d'une seule pièce, suivant un seul et même procédé (la loi de conscience et de complexité), mais qui de point en point ne se répète jamais, l'Etoffe de l'Univers correspond à une seule figure: elle forme structurellement un Tout.[40]

Radically or essentially different elements are produced within the one process of development. The development of the noosphere, from this point of view, is as much a biological development as is the development of the lower forms of life. The development of the noosphere must, therefore, follow the same laws of development as do lower levels of evolution if the whole evolutionary process is to retain its coherence.

Reflecting upon the lower levels of development, we see that electrons without protons to attract, and be attracted to, would be incoherent or contradictory in

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40. TEILHARD, Le Phénomène Humain, p. 40.

nature. The production of a herbivore without grass to eat or birds without an atmosphere in which to fly would also indicate an incoherence in nature. It is a general rule that the conditions for the fulfillment of a particular nature have existed and do exist.

Man knows the future, and desires a future. He is a creative creature who wants not only well-being, that is, that which will maintain him in his present state, but also desires to transcend his present state of being. He desires more-being.[41] As consciousness develops this will be increasingly the case. Man, therefore, with no future, with no prospect of "more-being", would be as incoherent as the herbivore without grass, or the bird without air.

Within the context of Teilhard's principle of the unity of mechanism and structure, this same argument may be restated in terms of love-energy. Consistently, throughout nature, the actual existence of an attractive being is necessary before attraction can take place. The electron is attracted to the proton because of the love-energy of

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41. cf., TEILHARD, "Du Pré-Humain à l'Ultra-Humain" and "La Fin de l'Espèce" in: L'Avenir de l'Homme (esp. p. 395).

the electron and the existence of the proton. The rabbit is attracted to the carrot because of the love- of the rabbit and the existence of the carrot. If there is an attraction, there must not only exist the being attracted, with all its love-energy, but the being to which it is attracted, with its capacity for fulfillment as a terminus. Love is the affinity of being for being.

If, then, the mechanism of evolution on the human level, or on the level of the noosphere is basically the same as at all other levels, it should follow that the existence of a love for a future of "more-being" leads to the conclusion that this future of "more-being" actually exists. Without this existence, human evolution would come to a halt since its mechanism would lack an essential element.

Coincident with the halt of human evolution all true directed development on earth would stop, because man is the spearhead of the whole directed process. Without the continuation of human evolution the main axis of evolution would disappear and any further changes in non-human elements would be completely random and lacking in

orientation. Without the possibility of an ultimate development of consciousness, evolution would no longer be orthogenetic.

It is, consequently, from an analysis of evolution as a development of complexity-consciousness that Teilhard concludes to the existence of a terminal point which he calls Omega, towards which the whole process, led by the self-conscious centres, is attracted. This conclusion is, therefore, arrived at within his science of hyperphysics. The following passage presents this important part of hyperphysics in Teilhard's own words:

> Par nature de l'oeuvre, et corrélativement par exigence de l'ouvrier, une Mort totale, un mur infranchissable, où se heurterait et disparaîtrait définitivement la Conscience, sont donc "incompassibles" avec le mécanisme (il en briserait le ressort) de l'activité réfléchie:
>
> Plus l'Homme deviendra Homme, moins il acceptera de se mouvoir sinon vers de l'interminablement et de l'indestructiblement nouveau. Quelque "absolu" se trouve impliqué dans le jeu même de son opération...
>
> Si le Progrès est un mythe, c'est-à-dire si devant le travail nous pouvons dire: "A quoi bon?", notre effort retombe, entraînant dans sa chute, <u>puisque nous la sommes</u>, toute l'Evolution.

> Il n'y a pas, quoi qu'on dise, "d'énergie du désespoir". Ce que ces mots signifient, au vrai c'est un paroxysme d'espérance aux abois. Toute énergie consciente est, comme l'amour (et parce qu'amour), à base d'espoir.[42]

The concept of an "absolute", discovered by an analysis of the mechanism of human evolution, is further developed in the light of Teilhard's concept of a converging noosphere. Through reflection and love the self-conscious elements are converging upon themselves. This infolding of mankind upon itself is, for Teilhard, a fact beyond dispute.[43] If, however, the elements of the noosphere are converging upon themselves, they must also be converging upon a common centre, a centre of centres, or a focal point.

> ... le psychisme réfléchi ne saurait absolument plus être regardé, au sein du cosmos, comme une simple superstructure passagère. Non seulement la Vie, devenue self-consciente, se manifeste à l'expérience comme self-évolutrice: mais encore elle exige d'être self-consistante, cette essentielle self-consistance pouvant à son tour s'expliquer de deux façons:

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42. TEILHARD, Le Phénomène Humain, pp. 256-7.

43. cf., TEILHARD, "L'Humanité se Meut-elle Biologiquement sur elle-même?" in: L'Avenir de l'Homme, p. 321.

> a) soit qu'elle naisse de la seule confluence des particules réfléchies se refléchissant les unes sur les autres;
> b) soit (plus probablement) qu'elle exige et décèle l'existence d'un Foyer suprême (non pas seulement virtuel mais réel) de convergence cosmique.[44]

Through an extrapolation of the axis of complexity-consciousness, the concept of a converging noosphere leads Teilhard to the concept of a unique focal point of evolution. This focal point is the "absolute" arrived at through an analysis of the mechanism of human evolution. The actual existence of Omega is demonstrated more in the analysis of the mechanism of human evolution than in the extrapolation of the axis of complexity-consciousness. Just as the demonstrations for the existence of God presented by St. Thomas are not based on any projection of the human soul's desire for the infinite, but on an analysis of being here and now, so too Teilhard's demonstration is not based on any projected development in the future, but on the nature of the present state of human evolution. The whole process of reasoning may be presented in this manner:

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44. TEILHARD, "La Réflexion de l'Energie", in: L'Activation de l'Energie, p. 351.

An analysis of the mechanism of self-conscious development as it presently exists, in the light of the principle of the unity of mechanism and structure concludes immediately to the existence here and now of Omega. This same analysis also leads to a prediction of the convergence of the Noosphere ultimately on Omega, its unique focal point.

The analysis of the mechanism of reflection and reflexion presents Teilhard with some further conclusions about the nature of Omega. As has been discussed above the degree of centreity is proportional to the development of radial energy. Man, the most centred being in himself, through knowledge can centre all of the centres of the universe upon himself; through reflection he can centre himself upon himself; and through "reflexion" the human centres themselves converge, or centre upon themselves. Each man is, then, a centre of centres, a focal point of the universe, and all of these focal points are themselves focusing themselves on a super-focal point: The Centre of centres.

The process of "centering" is, however, also a process of personalising. The raising of the "psychic

temperature", that is, the concentration of radial energy, increases the identity of being until, when consciousness turns back upon itself, the person is born, the cell becomes someone.[45] The person cannot develop in isolation, however, but by centering other centres upon itself through knowledge and love. "Le 'Je' qui ne tient qu'en devenant toujours plus lui-même, dans la mesure où il fait tout le reste soi."[46]

The Centre of centres, therefore, must be a Person. This is a deduction based upon the meaning of centre of centres as seen on the level of human consciousness where man becomes a person inasmuch as he is a centre of centres, that is, inasmuch as he can know and love another in a truly human manner. The Omega point is The Person inasmuch as it is The Centre of centres, that is, the focal point of all consciousness and love.

As well as being a Person, Omega must also be irreversible, autonomous and transcendental. These prop-

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45. cf., TEILHARD, Le Phénomène Humain, p. 191.

46. Ibid., p. 190.

erties, however, are directly related to Teilhard's explanation of how entropy is overcome, and so will be considered in the next section on the escape from entropy.

D. The Escape from Entropy:

The properties of actuality, irreversibility, autonomy and transcendence which Teilhard attributes to Omega are all essential to his explanation of the escape from entropy. We have already seen that, as the real pole of attraction of an irreversible process, Omega must be actual and irreversible. Also, it must be autonomous and transcendental; that is, it must be not only the term of the series, but also outside the series, [47] and function independently of the other parts of the series.[48] "Pour satisfaire aux exigences suprêmes de notre action, Omega doit être indépendant de la chute des puissances dont se tisse l'Evolution."[49] Omega is the "Great Stability"

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47. cf., Ibid, p. 301.

48. The biological definition of autonomy is: functioning independently of other parts.

49. Ibid., p. 300.

towards which a seemingly unstable evolution is tending:

> Tout d'abord, le principe qu'il nous fallait trouver pour expliquer soit la marche persistante des choses vers le plus conscient soit la solidité paradoxale du plus fragile, nous le tenons: c'est Omega. Contrairement aux apparences encore admises par la Physique, le Grand Stable n'est pas au-dessous, - dans l'infra-élémentaire - mais au-dessus, - dans l'ultra-synthétique. C'est donc uniquement par son enveloppe tangentielle que le Monde va se dissipant au hasard en Matière. Par son noyau de radial, il trouve sa figure et sa consistance naturelle en gravitant au rebours du probable, vers un foyer divin d'esprit qui l'attire en avant.
> A L'Entropie quelque chose échappe donc dans le Cosmos, - et y échappe de plus en plus.[50]

According to the law of entropy, the universe is tending towards its most probable state, a state of dissipated energy, the state from which it evolved, the state at the infra-elementary level. For the physicist, then, this is the state of Great Stability. The hyperphysicist, however, through his analysis of the parameter of consciousness, and the self-conscious element, sees the Great Stability in the actual irreversible Omega. Similarly, a study of self-consciousness provides an understanding of the

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50. Ibid., p. 301-2.

autonomy and transcendence necessary for the Great Stability. Here Teilhard's distinction between radial and tangential energy plays a most significant role. The high degree of centreity associated with self-consciousness permitted a new phase in the evolutionary process. The reflecting centre became a person and as a person was able to form a new union with Omega as Person:

> Pendant d'immenses périodes, au cours de l'Evolution, le radial, obscurément agité par l'action du Premier Moteur en avant, n'a pu arriver à s'exprimer qu'en groupements diffus, la conscience animale. Et, à ce stade, faute de pouvoir s'accrocher au-dessus d'eux à un support dont l'ordre de simplicité dépassait la leur, les noyaux se dénouaient à peine formés. Sitôt, par contre, que, par Réflexion, un type d'Unité est apparu non plus fermée ou même centrée, mais ponctiforme, alors s'est mise à jouer la sublime Physique des centres. Devenus centres, et donc personnes, les éléments ont enfin pu commencer à réagir, directement comme tels, à l'action personnalisante du Centre des centres. Franchir la surface critique d'hominisation, c'est en fait, pour la conscience, passer du divergent au convergent, - c'est-à-dire, en quelque façon, changer d'hémisphère et de pôle. En deçà de cette ligne critique, "équatoriale", la retombée dans le multiple. Au delà, la chute dans l'unification croissante, irréversible.[51]

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51. Ibid., p. 302.

Self-consciousness requires irreversibility, and irreversibility requires an Omega which is free from the reversible effects of evolution, and which can free the self-conscious element from these effects. Omega, then, is not just the Final Cause, but also the Efficient Cause of evolution: the Prime Mover ahead.[52]

The self-conscious elements develop by centering the universe upon themselves and by becoming one with Omega, and this idea is quite similar to the Hegelian explanation of development in which perfection is reached by the conceptualization of Nature by man. Teilhard's

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52. It might be argued that Teilhard uses "Prime Mover" in an Aristotelian sense of final cause rather than efficient cause. From statements like the above in which the Prime Mover stirs up radial energy, or that Omega is now in operation, animating and directing evolution at all levels (Le Phénomène Humain, p. 324ff), or that there is an extra-human energy (ibid) or a divine force of evolution ("Action et Activation" in Science et Christ, p. 227-8), it would appear, however, that the concept of efficient causality is applicable. At the same time it must be borne in mind that the metaphysician might object to the use of the concept of efficient cause in hyperphysics. Nevertheless, the important point is that Omega is not only the attracting focal point of an orthogenetic process, but also the energising and directing force according to Teilhard.

explanation of development is, however, essentially different from Hegelian pantheism. The essential difference lies in the fact that Hegel sees man as a part of the self-development of Absolute Spirit, a single, total development which disregards the individual person. Teilhard on the other hand, emphasizes the progress of the person, seeing communion with other persons as necessary for increased identity, rather than destroying it. It is not a case of Omega, like Absolute Spirit, developing through man, but man as person developing with other persons toward Omega, itself outside of the process. As an autonomous, transcendent being, the "Prime Mover ahead" must be an extrinsic cause, not simply an intrinsic cause.[53]

An extrinsic cause free from the laws of thermodynamics is not enough. The developing beings themselves must, under the influence of Omega be transformed from

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53. In stressing Omega's autonomy and transcendence to defend Teilhard from the accusation of being a pantheist we must not lose sight of the fact that Omega is also an immanent part of the process. Omega energises and directs the process from within.

beings susceptible to entropy into beings free from its effects. Otherwise they would fall short of their goal.

Such a transformation will take place, according to Teilhard, through the reflexion of the noosphere. Convergence towards a structural cohesion seems to run counter to the dissipative effects of entropy, and Teilhard states: "par effet croissant de cérébration et de réflexion, la convergence l'emporte sur la divergence dans le mécanisme de la phylogénèse."[54] It is, he says: "comme si les puissances de ramification avaient perdu la force de pousser au delà de la 'race' ou de la 'sous-espèce' le clivage des unités zoologiques."[55] The force which produces divergence is replaced by a new force which synthesizes.

It is not sufficient, however, that man has this energy at his disposal: "Il faut encore qu'il le veuille. Et, pour ce, il faut qu'il ait le goût d'aller plus loin, - c'est-à-dire que, sous l'influence d'une sorte de 'gravi-

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54. TEILHARD, "La Structure Phylétique du Groupe Humain", in: L'Apparition de l'Homme, p. 212.

55. Ibid.

tation' interne il soit attiré vers le haut, par le dedans."[56] Just as the tiger, with the soul of a carnivore, must have a taste for meat, so too man, with the soul of a self-conscious person, must have a taste for the future.

Here, Teilhard's insistance on unity of mechanism and structure is evident. The energy involved is the fundamental radial energy found in all beings. In man, however, it takes on new importance inasmuch as it becomes less dependent on tangential energy. Below man the radial energy is greatly subjected to the laws of natural selection and chance; in man the freedom of the psychic centre is much more evident. Indeed, it is sufficiently evident to make credible the required transformation which will completely free the radial from the tangential, and thereby free man from entropy. Just as there have been radical transformations in the past, like the transformation from pre-life to life and from infra-human to human, so too there will be a radical transformation in the future,

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56. TEILHARD, "La Place de l'Homme dans l'Univers", in: La Vision du Passé, p. 322.

affecting the whole noosphere, and ipso facto the whole universe; - a transformation whereby Man will overcome entropy.

> Or, prenons-y garde, une différence essentielle, une différence d'ordre, séparera de tout ce que nous connaissons encore cet état unitaire vers lequel nous nous acheminons...
>
> En se planétisant l'Humanité acquiert de nouveaux pouvoirs physiques lui permettant de super-organiser la Matière. Mais, effet plus important encore ne devient-elle pas susceptible, par rapprochement direct de ses membres, de dégager (comme par résonance) certains pouvoirs psychiques jusqu'ici insoupçonnés?[57]

Teilhard makes quite clear in a work written in 1952 that this essentially new stage in development will escape the law of entropy:

> Tout se passe donc finalement, du point de vue énergétique, comme si l'Univers se propageait, non seulement suivant un seul, mais suivant deux axes conjugués: l'un (Entropie) de plus grande probabilité, - l'autre (Vie) de plus grande complexité; - la conscience se développant tout du long (conformément aux exigences de la Thermodynamique) en fonction de l'Entropie, mais finalement échappant à la "désorganisation" par effet spécifique de Réflexion, soit comme une Energie

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57. TEILHARD, "La Formation de la Noosphère", in: L'Avenir de l'Homme, pp. 223-4.

> à part, "de deuxième espèce"; soit comme une fraction intériorisée de l'Energie commune.[58]

For Teilhard, evolution is basically a continuous process of development of complexity-consciousness, with a fundamental unity of structure and mechanism throughout. But it is a process which does produce qualitative novelty, that is, in which there are transformations giving rise to essentially different beings governed by new laws. The living is essentially different from the non-living, and consequently cannot be understood completely by the physicist through the laws of physics. The self-conscious is essentially different from the conscious, and as a result man cannot be understood completely by the biologist through the laws of biology. In the light of a coherent picture of the whole evolutionary process it is possible, therefore, that in the future this process will cross a new threshold of being, beyond which some new laws will come into effect:

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58. TEILHARD, "La Réflexion de L'Energie, in: L'Activation de l'Energie, p. 352.

> Ce qui revient à dire que, pour couvrir entièrement l'économie de l'Univers (Vie incluse), un troisième Principe, celui de la Réflexion de l'Energie, doit être ajouté et associé à ceux, déjà admis, de la Conservation et de la Dégradation de l'Energie.[59]

The law of "Reflexion of Energy" and the new being which gives rise to this law would be a natural outcome of the whole process, and not something superadded. In non-Teilhardian terms we might say that this new and final stage of development would come about by secondary causality, just as, according to Teilhard, life and self-consciousness did. Omega, however, would be the "Prime Mover", or the ultimate principal cause of the process, itself transcending the process.

The development of this higher level of being in the future is consistent with Teilhard's position that radial energy, which does not obey the law of entropy, does exist at all levels of material being. Since the development of complexity-consciousness involves an increase in centreity, or concentration of radial energy a

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59. Ibid., p. 353.

qualitative change,or essential change can occur within the process. This transformation may be compared to others which appear to be analogous and which can be explained by the physical scientist. For example, as the temperature of liquid water rises, so does the kinetic energy of the water molecules until, at a transformation point, that is, the boiling point, the temperature, and therefore the kinetic energy is sufficient to overcome the molecular forces which bound the substance together as a liquid. Another example of a transformation which introduces a new law may be found in the "Evolutionary Universe Theory". It is thought that at a certain stage in the early expansion of matter, the gravitational forces took over from the forces of radiant energy, bringing about the formation of the galaxies.

These phenomena in which a transformation causes a change in the predominant law are commonplace in science. This might lead one to suspect that if development continues into the future as it has in the past, some transformations unheard of today may be expected and, associated with them, some new laws, such as Teilhard's "Reflexion of Energy".

This is not intended to suggest, however, that Teilhard's theory is based on an extrapolation which is itself based on an overall view of past evolution. Extrapolation is a devise used in mathematics, often in statistics, to approximate a value beyond the known range. Generally, however, (and this would hold true especially in statistical applications), the "known" range is not known completely. For example, if through statistical methods one can plot a straight line rising to the right, one might feel justified in locating a further point on the line by extending it continuously with the same slope. Such a graphical extrapolation may give good results. If, however, a more complete analysis of the given line shows that it is part of the arm of a parabola, and if its equation were discovered, then, without a graphical extrapolation, the correct position of a further point could be determined. In this case, the correct position would be far removed from the point arrived at by the graphical extrapolation.

Teilhard attempts this latter type of extrapolation. It is based not only on the vision of the past

billions of years of evolution, but also and primarily on an analysis of the laws governing the structure and mechanism of that evolutionary process. These laws are discovered through analysis of the present state of complexity-consciousness as seen in man himself.[60]

E. Conclusion:

We have made no attempt to prove the validity of Teilhard's position on irreversibility. Teilhard himself states that such a proof is not possible within natural science. The material presented is intended to show that this theory of irreversibility is an integral part of Teilhard's hyperphysics. In other words, it is a logical development of his principles of coherence and unity of mechanism and structure and his concept of the two energies. The theory of irreversibility, and Omega which is required for its fulfillment is arrived at by analysing the mechanism of evolution, especially at the level of the self-

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60. Teilhard himself presents a graphical representation of the process of "Hominization", portraying the development of the hominids, and the convergence of Homo Sapiens. TEILHARD, Le Phénomène Humain, p. 212.

conscious. It is, therefore, neither mysticism nor wishful thinking; nor is it an application of theology or faith to scientific data.

As an integral part of hyperphysics, Teilhard's theory of irreversibility is based on modern science. He accepts the physical laws of thermodynamics and the consequences of the second law. Teilhard defines the two energies, so essential to his explanation of the irreversible process, in terms of the law of entropy, and he neither contradicts nor overlooks this law throughout the development of his theory. In fact it is his strict adherence to this physical law that causes Teilhard to forecast a radical transformation which will free material beings from its effects.

The fact that this theory of irreversibility is hyperphysical and is compatible with the laws of thermodynamics does not in itself lead to the conclusion that it is scientific. Such a conclusion demands further analysis of Teilhard's concept of irreversibility in the light of the criteria for good scientific theory. This will be done in Chapter V.

CHAPTER IV

Teilhard's Lamarckianism

We have seen that both vitalism and determinism are generally unacceptable to the evolutionist who subscribes to the modern Darwinian theory.[1] Inasmuch as the within of things is a vital principle, Teilhard's theory may be called vitalism. Is it, however, the kind of vitalism that must be rejected by modern science? Is it a Lamarckian vitalism which may lead to an autogenetic and deterministic theory of development? Such a theory would assuredly conflict with the Darwinian explanation which leans heavily to the side of chance and ectogenesis. In the light of the Teilhardian mechanism of orthogenesis, it has been said by some that Teilhard is too Lamarckian. Teilhard himself anticipated this criticism and refuted it, without denying that he did use a Lamarckian principle. What, then, is the nature of Teilhard's Lamarckianism? To answer this question we must first consider the problem of

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1. Chapter II, above.

chance and design in the process of evolution.

A. Chance and Design:

According to Marxism, evolution is explained either as a process toward an ultimate final cause, or, "...it has its basis in objective causes. The mechanism by which these causes operate was revealed by Darwin's theory."[2] Since these are considered to be mutually exclusive explanations, the acceptance of Darwin eliminates final causality. This notion, echoing Marx's statement that Darwin destroyed teleology, is not peculiar to Marxists. There are a great many scientists and philosophers today who feel that a teleological explanation of development is incompatible with modern Darwinian theory. According to Simpson, for example, finalists, who are almost always vitalists, abandon the mechanistic or materialistic solution to some degree.[3]

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2. Fundamentals of Marxism-Leninism, (translated by C. Dutt), Moscow, Foreign Languages Publishing House, 1961.

3. G. G. SIMPSON, The Meaning of Evolution, p.131; cf. also: ibid, p. 26.

Finalistic theories such as that of Hegel put the burden of explanation on the final cause and leave no room for chance thereby presenting a deterministic picture of development. This would certainly be difficult to reconcile with the theory of evolution as presented by modern science. It seems that when many modern thinkers refer to teleology or finalism they have this extreme rationalistic type in mind. For some, the law of causality has become identified with determinism. Bertrand Russell, for example, presents the law of causality in this way: "Given any event E_1, there is an event E_2 and a time interval t such that whenever E_1 occurs, E_2 follows after an interval t."[4] Similarly, Bohm defines causality deterministically as follows: "The necessary relationships between objects, events, conditions, or other things at a given time and

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4. Bertrand RUSSELL; "On the Notion of Cause, with Applications to the Free-Will Problem", in: FEIGL and BRODECK, Readings in the Philosophy of Science, New York, Appleton-Century-Crafts, Inc., 1953, p. 389. Russell, of course, rejects determinism, and therefore the law of causality as well.

those at later times, are termed causal laws."[5]

This identification of causality and determinism developed out of mechanistic physics and philosophy, which likewise left little or no room for chance occurrences. The determinism found in classical mechanics, and to some extent in Einsteinian mechanics, is not teleological, but rather a stronger form of mechanical causation than may be found within quantum mechanics. The tendency in science has been away from these deterministic or rigidly mechanistic explanations and toward explanations involving chance. Throughout the scientific world, however, the emphasis has been on mechanistic or efficient causality, while teleology, in any sense of the term, appears to have no place.[6]

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5. David BOHM; Causality and Change in Modern Physics, New York, Harper Torchbook, 1961, p. 2.

6. The most general meaning of the term "teleology", as the Greek root would suggest, is any study of final causes. The term can also refer to the fact of being directed toward particular ends, or the fact of having an ultimate purpose. It has also been used to refer to doctrines such as vitalism which, rejecting a purely mechanistic explanation, state that natural phenomena are in some way determined, not only by mechanical causes, but by an overall design or purpose in nature.

Chance, used in its most radical sense, refers to that which happens totally without cause, that is, to the absolutely spontaneous or fortuitous. Another view of chance sees the chance event as causally identical to the non-chance or determined event, the difference being not in the causes themselves, but in our knowledge of them. In a third meaning, chance presupposes the mutual interference of independent lines of causation. It is this latter meaning of chance that will be accepted here, not only because it has traditionally been considered to be the most realistic, but also because it is the most useful definition for understanding Darwinian chance.

Let us consider, for example, the concept of chance mutation in the light of this definition. One line of causality may bring about the existence of a certain amount of radiation at a particular place and at a particular time. Another line of causality may place a particular animal at that same place at the same time. The coming together of the effects of these two lines of causality may produce a chromosomal transformation in the animal, which in turn will cause a change in its offspring. This is a chance

event or accident in the sense that the cause of the radiation was not necessarily determined to bring about this mutation, nor were the causes of the movement of the animal determined to bring it about.

The tendency away from strictly mechanistic explanations and toward the introduction of chance was greatly influenced by Darwin. According to Waddington:

> Darwin's theory was one of the first important scientific achievements in modern times to place its main reliance, not on simple causation, but on processes of the kind we usually refer to as chance. The success of his theory has had a profound effect in making probability theories, or stochastic thinking, respectable. Much of modern physics is now phrased in such terms, and so at the other end of the spectrum of sciences is most of sociology.[7]

In some cases the swing of the pendulum has been complete, from the strict determinism of classical mechanics, to the acceptance of chance as the complete and final explanation. This is exemplified in Russell's suggestion that man is nothing but an accidental collocation of atoms.

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7. C.H. WADDINGTON, The Nature of Life, New York, Atheneum, 1962, p. 73. cf., also: BOHM, Causality and Chance in Modern Physics, p. 140ff.

On the other hand there is the call for a more balanced view. Waddington goes on to say:

> But I shall want to argue that in the sphere of evolution we are now finding ourselves confronted with the need for organismic thinking. Darwin's emphasis on the importance of chance was a crucial step in breaking the hold over men's minds of the notion of strict causal determinism of the Newtonian kind; but once this idea has been abandoned, the idea or organization, or cybernetic schemes of causation should be recognized as just as important as that of random chance or stochastic causation.[8]

The Teilhardian explanation of development combines the concepts of order and chance. Chance is a part of the general design of the evolutionary process, in somewhat the same way that chance is a part of the design of a card game, or the game of dice. This idea is summed up in Teilhard's statement to the effect that God plays with chance and uses the chances that occur to assure the insertion of life in the world.[9] The following quotations from Teilhard's work present an introduction to his point of view:

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8. WADDINGTON, op. cit., p. 73. By "cybernetic" Waddington refers to interacting systems. cf., ibid., p.65.

9. cf. CUENOT, Teilhard de Chardin, p. 257.

La terre est probablement née d'une chance. Mais, conformément à une des lois les plus générales de l'Evolution, cette chance, à peine apparue, s'est trouvée immédiatement utilisée, refondue en quelque chose de naturellement dirigé.[10]

Laissée assez longtemps à elle-même, sous le jeu prolongé et universel des chances, la Matière manifeste la propriété de s'arranger en groupements de plus en plus complexes, et en même temps de plus en plus sous-tendus de conscience; ce double mouvement conjugué d'enroulement physique et d'intériorisation (ou centration) psychique se poursuivant, s'accélérant et se poussant aussi loin que possible, - une fois amorcé.[11]

Plus profond qu'une série de combats singuliers, c'est un conflit de chances qui se développe dans la lutte pour être. En se reproduisant sans compter, la Vie se cuirasse contre les mauvais coups.

Elle accroît ses chances de survivre. Et en même temps elle multiplie ses chances d'avancer.

Et voilà où se poursuit et ré-apparaît au niveau des particules animées la technique fondamentale du tâtonnement, cette arme spécifique et invincible de toute multitude en expansion. Le Tâtonnement, où se combinent si curieusement la fantaisie aveugle des grands nombres et l'orientation précise d'un but poursuivi. Le tâtonnement, qui n'est pas

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10. TEILHARD, Le Phénomène Humain, p. 73. cf. also: TEILHARD, "Vie et Planètes", in: L'Avenir de l'Homme, p. 130ff.

11. TEILHARD, "La Structure Phylétique du Groupe Humain", in: L'Apparition de l'Homme, p. 195. cf. also: TEILHARD, "Agitation ou Genèse?", in: L'Avenir de l'Homme, p. 278, (footnote).

> seulement le Hasard, avec quoi on a voulu le confondre, mais un Hasard dirigé.[12]

This concept of "directed chance", so essential for Teilhard's concept of orthogenesis, is a result of a view of evolution which is Darwinian and Lamarckian, ectogenetic and autogenetic. Teilhard would appear to subscribe to the Darwinian theory for the explanation of the mechanics of evolution. Changes come about, not primarily because of some kind of conscious or unconscious desire within the being, but because of outside effects which may well be considered accidental, such as the influence of radiation on the chromosomes. A chance event of this kind may be the actual cause of a change in the progeny of the being which has suffered the chromosomal alteration.[13] According to the Darwinians themselves,

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12. TEILHARD, Le Phénomène Humain, p. 116.

13. According to Dobzhansky: "Mutations occur by "chance" only in the sense that they appear regardless of their usefulness at the time and place of their origin. It should be kept in mind that the structure of a gene, like that of the whole organism, is the outcome of a long evolutionary development; the ways in which the genes can mutate are, consequently, by no means indeterminate."
T. DOBZHANSKY, "The Genetic Basis of Evolution", in: Scientific American, Jan. 1950.

however, the change will be maintained or rejected within the species depending upon the interaction of the progeny and its environment. For example, a chance chromosomal change in a tiger may produce elongated fangs in its offspring. The elongated fangs, given a tiger's environment, will be beneficial, enabling the tiger to survive longer and produce more progeny.[14] Here, the emphasis is on ectogenesis, on external influences which are accidental and beyond the control of the tiger itself. A further question may be asked, however, which leads to Teilhard's Lamarckianism, namely: Why is it <u>better</u> for a tiger to have elongated fangs, or why is this change maintained within the species?

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14. This oversimplified account is not intended, of course, as an explanation of natural selection, but simply as an illustration of the point being made. Mutation is not the only source of evolutionary change. cf., SOL TAX (ed.), Issues in Evolution, Chicago, University of Chicago Press, 1960, p. 114.

B. Teilhard's Lamarckian Principle:[15]

In answer to the above question one might state that it is better for a tiger to have elongated fangs because a tiger wants to eat meat, or needs to eat meat to survive. This inner desire or urge is necessary. If the tiger were indifferent toward meat, or preferred a vegetable diet, or had no appetite for food at all, the longer fangs would be superfluous and their development within the species could not be explained. Looking at the individual tiger one may correctly say that he eats meat because he has fangs, and has fangs because of an accidental mutation. Looking at the species, however, one may say that tigers have fangs because they eat meat.

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15. Lamarck's principles are:
1. Living organisms and their component parts tend continually to increase in size.
2. Production of a new organ results from a new need and from a new movement which this need starts and maintains.
3. If an organ is used constantly, it will tend to become highly developed, whereas disuse results in degeneration.
4. Modifications produced by the above principles during the lifetime of an individual will be inherited by its offspring, with the result that changes are cumulative over a period of time.

cf. DODSON, Evolution: Process and Product, p. 76.

The long-term development, according to Teilhard, is not an effect of external forces, but of psychology; it is not ectogenesis, but autogenesis:

> Suivant notre manière actuelle de parler, un animal développerait ses instincts carnivores parce que ses molaires se font tranchantes et ses pattes griffues. Or ne faut-il pas retourner la proposition? Autrement dit, si le Tigre a allongé ses crocs et aiguisé ses ongles, ne serait-ce pas justement que, suivant sa lignée, il a reçu, développé et transmis une "âme de carnaişsier"?[16]

When Teilhard speaks of the soul of a carnivore, he is referring to the within. Along with the physical activity, explained to a great extent by chance, there is the psychic activity of the within, - an activity which is determined inasmuch as it flows from the nature of the within. Teilhard himself regards this aspect of his doctrine as Lamarckian:

> De divers côtés, on ne manquera pas de relever, dans les explications qui suivent, une pensée trop lamarckienne (influence exagérée du "dedans" sur l'arrangement organique des corps.)[17]

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16. TEILHARD, Le Phénomène Humain, p. 164.

17. Ibid., p. 163 (footnote).

The Lamarckian principle accepted by Teilhard is obviously not the principle that modifications produced during the lifetime of an individual will be inherited by their offspring resulting in cumulative changes over a long period. It appears that the Lamarckian principle used is that the production of a new organ results from a new need and from the new movement which this need initiates and maintains. But while the original principle was applied to ontogenesis, Teilhard applies it to phylogenesis. That is to say, in an individual being, a new characteristic is explained by the Darwinian theory of chance and external forces, rather than by a new need in the individual. In the species, however, the selecting and maintaining of a new characteristic is explained by the needs of the species, which are fulfilled by the activity of the within of each member.

> ... dans l'action "morphogénétique" de l'instinct telle que je l'entends ici, une part essentielle est laissée au jeu (darwinien) des forces externes et du hasard. Ce n'est vraiment qu'à coups de chances que la Vie procède; mais à coups de chances reconnues et saisies, - c'est-à-dire psychiquement sélectionnées.[18]

18. Ibid.

Teilhard refers to this psychic selectivity as Lamarckian anti-chance. This selectivity becomes more predominant at the higher levels of evolution where psychic activity is most developed and where phylogenesis is more important; it cannot be seen directly at lower levels where evolution is basically ontogenetic.[19] Indeed, he states at one point that the neo-Darwinians probably are right in claiming that in the pre-human zones of life nothing but the play of chance selection is detected, but at the level of man the forces of internal arrangement are clearly seen in the process of evolution. For Teilhard, this amounts to saying that biological purposiveness is not everywhere apparent in the living world, but that it only shows itself above a certain level; its appearance coincides with the attainment of a certain value in the axis of complexities.[20]

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19. Re. the lower levels of evolution and their ontogenetic character, cf. TEILHARD, La Place de l'Homme dans la Nature, p. 38ff.

20. TEILHARD, "Le Rebondissement Humain de l'Evolution et ses Conséquences", in: L'Avenir de l'Homme, p. 258.

Even at the level of man, however, Lamarckian anti-chance or autogenesis still plays a relatively minor role as a mechanism of evolution when compared to Darwinian chance. Nevertheless, autogenesis is an essential ingredient of the whole evolutionary process:

> Dans l'Hominisation en cours, telle que nous pouvons l'observer aujourd'hui, l'influence statistique des chances et le rôle de la sélection naturelle continuent, bien sûr, à tenir une place énorme. Comparé à ce domaine immense (darwinien) de nos passivités, il pourrait même sembler que l'espace (lamarckien) gagné et occupé par notre effort inventif compte pour bien peu de chose. Or ne nous y trompons pas. Si minuscule soit ce bourgeon, si petit ce germe, c'est précisément là que se trouve ramassée la puissance de renouvellement et de rebondissement du Monde. Née sous les apparences et le signe du Hasard, c'est seulement par la finalité réfléchie lentement conquise, que la Vie peut espérer s'élever désormais plus outre, par effet d'auto-évolution, dans la direction conjugée de la plus haute complexité et de la plus grande conscience.[21]

Although it is the reflective human zone, with its purposive autogenetic activity, which Teilhard regards as explicitly Lamarckian, this zone is a natural development of the pre-reflective layers of evolution. Accordingly, traces of Lamarckian anti-chance are found at lower levels,

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21. Ibid.

as suggested by his reference to the tiger's "soul of a carnivore". Wherever beings have a within, autogenesis is possible, and all being is composed of a without and a within. The within, as the source of radial or love energy, produces in all beings a propensity or a "desire" to develop according to their own nature.

These autogenetic tendencies, however, are to a great extent at the mercy of the external world and chance. No conscious effort on the part of the tiger can bring about the mutation which elongates its fangs, or the fangs of its offspring. This is produced by an occurrence over which it has no control, such as radiation or a biochemical reaction. Nor does it have any control over its surroundings, over the fact that it lives among animals which it can prey upon for instance. All these factors come from outside the tiger, and make up the ectogenetic side of its development.

Nevertheless, the tiger's propensity for meat does come from within, and, acting within the conditions laid down from outside, is an essential cause of development. The non-reflective being has, of course, no control over

the appetite or affinity itself. The existence of the "soul of a carnivore" itself developed through an auto-ectogenetic process; it did not develop by a conscious desire on the part of the individual tiger to become a meat eater. In other words, at each and every stage of evolution there is an inner cause of development or an energy within the being which controls and directs the development. This inner energy makes evolution autogenetic at every level, and orthogenetic overall.

Man, as a reflective being, is more or less aware of his affinities. He has, within certain limits, control over them, and accordingly a greater control over his evolutionary development. The activities of the non-reflective being are controlled by a pre-ordained within, over which the being itself has no direct control. The self-conscious within has a certain control over itself, permitting a true spontaneity which other material beings lack. The carnivore has no control over his desire for meat, but man, for any number of reasons, may decide to become a vegetarian in spite of his appetite for meat.

Although according to Teilhard, Lamarckian anti-chance might not apply to the lower ontogenetic levels, and certainly is not apparent at these levels, the combination of chance and design may be seen to exist there. What is most evident at the atomic level is, as Russell puts it, the accidental collocation. It is by chance, for instance, that a particular electron unites with a particular proton to form a hydrogen atom. In other words, it would seem that particular electrons are not determined to unite with particular protons. There is, however, design in the fact that electrons in general unite with protons in a certain way. For example the electrons have a specific orbital velocity and unite with protons at a specific distance. It could be said that this union depends upon "the soul of an electron", or, the within, which demonstrates a certain purposiveness.

From the above, it can be seen that the traditional principles of causality are not violated by Teilhard's statements that the earth was born by accident or

that the planets were created by chance.[22] In his system, the actual cause which brings about any development is found in the centre of psychic energy, or in the within. The terminology used by Teilhard, such as 'born by accident' and 'created by chance' is misleading, for what he really means is that evolutionary development is not absolutely determined. It was not absolutely necessary that our planet be born and develop as it did, and in this sense it was 'born by chance'. Chance is not presented as the cause of its birth.

The emphasis on chance does not eliminate the notion of necessity from Teilhard's thought. In place of the absolute necessity of the determinist Teilhard subscribes to the modern mathematico-physical concept of statistical necessity. For example he states that the improbable development of proteins leading to the origin of life was brought about by the play of large numbers:

> Mais ce que nous savons /re. the development of protein/ c'est d'abord qu'un tel événement s'est certainement produit, ensuite qu'il ne pouvait,

22. cf. TEILHARD, Le Phénomène Humain, p. 73; L'Avenir de l'Homme, pp. 135-6.

> de nécessité statistique, manquer de se produire, étant donné les conditions physico-chimiques de l'astre qui nous porte. Si improbables en effet, d'un point de vue mécaniste, que puissent paraître les extraordinaires édifices organiques réalisés par la Vie, il semble de plus en plus évident que vers ces états d'arrangement extrêmes la substance cosmique soit portée par une sorte d'attraction particulière qui lui fait à chaque instant saisir de préférence, dans le jeu des grands nombres où elle se trouve engagée, toutes les occasions de devenir plus complexe, et ainsi de se libérer davantage.[23]

The mathematical theories of statistics and probabilities have been closely associated with game theory, and an example from a game of chance such as dice may help to clarify the meaning of "statistical necessity". If one die is thrown it is said to be "by chance" that one particular number turns up. Knowing the design of the die and the physical laws brought into play, one can calculate the chance as one in six. Similarly, the chances of different combinations of numbers, say "snake-eyes", may be calculated if a pair of dice is thrown. Since there is just one chance in thirty-six of getting "snake-eyes" in one toss of two dice, the appearance of this

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23. TEILHARD, "Du Pré-Humain à l'Ultra-Humain" in: L'Avenir de l'Homme, p. 378.

combination could not be considered a necessary event. If, however, one had a large number of dice, say one hundred, or one thousand, and furthermore, if they could be thrown a large number of times, then the chances of not getting this combination would be so small that one could say that its occurrence was inevitable, or necessary. In fact, there would necessarily be many such combinations. This is not absolute mathematical necessity, but practical necessity, that is to say, an event so probable that it may be considered necessary for all practical purposes.

The combinations required in the development of the protein molecule, to which Teilhard refers in the last quotation, are infinitely more complex than the dice combinations in the example. This is why Teilhard refers to them as improbable in the mechanistic sense.[24] Given, however, the number of elements available for these combinations, the length of time available for these combinations to take place, and the fact that the complex combinations are formed not in one step, but in a series of less

24. Also improbable from the point of view of the second law of thermodynamics.

complex, and therefore more probable steps, it is generally accepted today that the occurrence of these combinations was statistically necessary.[25]

Within the context of Teilhard's thought, the statement that God plays with chance may be interpreted as a rejection of a deterministic universe like that of either Hegel or Laplace. Instead, it advances the belief in a world in which things, with certain natures leading to certain activities, act as secondary causes, producing effects which are not absolutely necessary.[26] For example, an electron is determined to act in a certain way, but is

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25. For an account of this process, that is, the development of life, cf., DODSON, Evolution: Process and Product, p. 93ff. In his book Human Destiny, LECOMTE DU NOÜY points out the improbability of forming a protein molecule by accident. By considering the number of elements and the time available, but not the series of steps in the process, he draws the conclusion that such an event could not have occurred by chance. cf., LECOMTE DU NOÜY, Human Destiny, New York, Longmans, Green & Co., 1947, Chapter 3. A similar argument, with the same defect, is found in:GARRIGOU-LAGRANCE, God: His Existence and His Nature, New York, Herder, 1955, Vol. I, p. 351.

26. It may be noted that Charles Darwin expressed belief in the existence of a universe in which the Creator used secondary causes for the development of His creation. cf., Charles DARWIN, The Origin of Species, Chapter XV (especially the last two paragraphs).

not determined to unite with any particular proton, or any proton for that matter, although given the large number of electrons in the universe,[27] and the time available, it is statistically necessary that many will unite with protons in different combinations. Accordingly, Teilhard defines orthogenesis as: "l'apparition dans le temps, chez espèces apparentées, d'une distribution statistiquement orientée."[28]

In the light of this interpretation of Teilhard's explanation of the mechanism of evolution some of the major criticisms of his theory of orthogenesis may be considered. The first that we shall consider revolves around Teilhard's use of Lamarckian principles and is found in an article by P. F. Forsthoefel, a Jesuit biologist. After stating Lamarck's second and fourth laws he says:

> Teilhard's psychic evolution is certainly similar to these ideas of Lamarck, and in particular one seems justified in saying that Teilhard assumes

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27. It has been estimated that there are 10^{79} electrons in the visible universe.

28. TEILHARD, "Note sur la Réalité Actuelle et la Signification Evolutive d'une Orthogénèse Humaine", (1951) in: La Vision du Passé, p. 355.

> the reality of Lamarck's second law, the inheritance of acquired characteristics.[29]

He states also that Teilhard did not favor modern genetical theory of evolution, but rather explained evolution as a drive of life to expand into all available environments. Forsthoefel goes on to say that Teilhard did not repudiate his assumption of its validity in his later work, and he refers explicitely to Evolution Zoologique et Invention, written in 1947. Contrary to Fr. Forsthoefel's position, however, this work substantiates the position taken above namely, that Teilhard does accept the modern theory of gene mutations, but uses Lamarck's second law in a phylogenetic sense. This is seen for example, in the following quotation:

> Reste cependant que le problème est posé - et inévitablement - par le cas de l'Homme, de savoir s'il

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29. P.F. FORSTHOEFEL, S.J., Beneath the Microscope, in: R.T.FRANCOEUR (ed.), The World of Teilhard, Baltimore, H Helicon Press, 1961, p. 106.
(Although in this quotation the author refers to Lamarck's second law as the law of inheritance of acquired characteristics, he had immediately above stated the second law as: "The production of a new organ in an animal body results from a new need which continues to make itself felt...," and the fourth law as the law of the inheritance of acquired characteristics.)

> ne faut pas laisser une place ouverte aux effets de conscience dans le mécanisme de l'évolution zoologique. Il conviendrait de nous en souvenir chaque fois que dans l'analyse de cette évolution un résidu se manifeste, irréductible aux facteurs ordinaires de hasard, d'hérédité et de sélection. En vérité, n'est-ce pas une gageure (pour ne pas dire une contradiction) que de vouloir expliquer par un simple jeu de probabilités la dérive constante de la matière organisée vers des formes d'arrangement toujours plus improbables? La Vie, incontestablement monte des automatismes qu'il nous faut scientifiquement comprendre. Mais les monte-t-elle absolument automatiquement? Toute la question est là.[30]

There appears to be no reason to assume that these words, or any part of the article from which they are taken, refer to Lamarck's principle of the inheritance of acquired characteristics. It does refer to the role of consciousness, or the within, in the selection and maintenance of a new characteristic which is good for the species, and which was produced by a random mutation. Teilhard had no aversion to natural selection, as Forsthoefel suggests he had,[31] but

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30. TEILHARD, "Evolution Zoologique et Invention", in: La Vision du Passé, p. 331.

31. cf., FORSTHOEFEL, op. cit., p. 110.

saw psychic activity as a necessary element of natural selection.

The last paragraph in Teilhard's above cited article makes direct reference to this "Lamarckian-like" principle:

> Aujourd'hui, sous nos yeux, l'"invention", agit comme facteur d'une incontestable orthogénèse humaine. Quand et sous quelles formes ce régime a-t-il commencé? et à quelles profondeurs dans les nappes de la Vie?[32]

Out of context, it may appear that Teilhard is accepting Lamarck's principle that a new need produces a new organ. Within the Teilhardian context, however, the term "invention" would better be taken in its etymological meaning of discovery. In other words, he is saying that man, and quite possibly lower forms of life, discover through consciousness the new perfections produced by mutations, and make use of them.

> Ce n'est vraiment qu'à coups de chances que la Vie procède; mais à coups de chances reconnues et saisies, - c'est-à-dire psychiquement sélectionnées.[33]

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32. TEILHARD, op. cit., p. 331.

33. TEILHARD, Le Phénomène Humain, p. 163 (footnote).

We can compare this notion of invention, and Teilhard's insistance on the existence of psychic activity as a vital principle of natural selection, with the position of Theodosius Dobzhansky:

> The modern evolutionists believe that...evolution is a creative response of the living matter to the challenges of the environment. The role of the environment is to provide opportunities for biological inventions. Evolution is due neither to chance nor to design; it is due to a natural creative process.[34]

This is exactly Teilhard's view of the evolutionary process, and his theory of the psychic energy of the within is an attempt to explain this view. The within is the source of the "creative response" which brings about "biological inventions". It is the active agent necessary in natural selection.

With this in mind we may recall that Sir Julian Huxley, in the quotation cited earlier,[35] stated that the only effective agency of evolution is natural selection,

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34. DOBZHANSKY, "The Genetic Basis of Evolution" in: Scientific American, Jan. 1950.

35. P. 43 above.

and that all theories of orthogenesis, Lamarckianism and "mysterious vital forces" are invalid. Huxley apparently believes that either evolution is brought about by natural selection or by an orthogenetic, Lamarckian process caused by vital principles. Since science, therefore, has shown that the former is the effective agent, he dismisses the latter.[36] Huxley may very well be accused, at least partly, of the "nothing but" fallacy which he himself deplores in the same work.[37] That is to say, if natural selection is a cause of evolution, therefore nothing but natural selection is the cause of evolution.

In fairness to Sir Julian Huxley, however, it should be pointed out that the modern theory of natural selection is incompatible with the principles of Lamarck, and also with orthogenesis, if the term 'orthogenesis' is taken to mean a determined process of development in a straight line. This much is beyond dispute. What must be

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36. A similar view is expressed by SIMPSON, cf. The Meaning of Evolution, p. 51 and p. 93.

37. cf., HUXLEY, Evolution in Action, p. 115.

considered is the compatibility of Darwinian natural selection with Teilhard's "Lamarckianism", Teilhard's "orthogenesis" and Teilhard's "vital principle" or within.

The first point to note is that whereas Teilhard accepts the theory of natural selection, he does not consider it to be a complete explanation. Natural selection involves activities within the being itself and mutual reactions between it and its environment. Darwin explained this as follows:

> All of these results /the development of new species/ follow from the struggle for life. Owing to this struggle, variations, however slight and from whatever cause proceeding, if they be in any degree profitable to the individuals of a species, in their infinitely complex relations to other organic beings and to their physical conditions of life, will tend to the preservation of such individuals, and will generally be inherited by the offspring. The offspring, also, will thus have a better chance of surviving, for, of the many individuals of any species which are periodically born, but a small number can survive. I have called this principle, by which each slight variation, if useful, is preserved, by the term

natural selection.[38]

Darwin's concept of natural selection has been developed to a great extent, with more emphasis placed on slight selection pressures and slight variations producing cumulative effects over a long period of time. Nevertheless, the basic idea of natural selection remains the same, and is considered to be the mechanism or agent which brings about an oriented evolution. "The orientation element (of evolution) was found to be adaptation... The mechanism of adaptation is natural selection."[39] "Mutation and recombination provide the raw materials for evolutionary change. Natural selection is the guiding or directive agency in that change."[40] "I do not think any prominent geneticist now would question the essential validity of Darwin's

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38. Charles DARWIN, The Origin of Species, ch. III. Darwin notes that the term struggle is to be taken in a broad and metaphorical sense. Not only may two dogs be said to struggle for food in a famine, but also a lily in the field may be said to struggle for moisture, meaning that it requires moisture to survive. cf. Ibid, "The Term, Struggle for Existence used in a large sense".

39. SIMPSON, The Meaning of Evolution, p. 93.

40. Julian HUXLEY, quoted in: Tax (ed) Issues in Evolution, p. 116.

conception of natural selection as the guiding principle of evolution."[41]

But from the proposition that natural selection is the orienting element, guiding agency or guiding principle does it follow that: "No conscious action is involved in natural selection"[42] or that there can be no "innate life tendency or progression toward a destined goal according to plan."?[43] As we have seen,[44] Teilhard maintains that an innate life tendency is essential for the mechanism of natural selection. Natural selection would not have developed a tiger's fangs unless the tiger had the soul of a carnivore. In any example of natural selection, an innate life tendency is seen as necessary. In order for individual beings to act and react with other beings in

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41. Sewall WRIGHT, quoted in: Ibid.

42. HUXLEY, quoted in: Ibid. For the modern view of natural selection, the account of the panel discussion from which the above quotations are taken is valuable. cf. ibid, p. 107ff.

43. SIMPSON, op. cit, p. 93.

44. P. 147ff,above.

their environment, thereby bringing about an oriented development, there must be some source within these beings which produces these activities, like the "soul of a carnivore". This source of activity can be recognized at the human level, and Teilhard "sees" it at all levels, in the light of his principle of coherence and his principle of the unity of mechanism and structure. The within of things, or their vital principle, is not something contrary to natural selection, but an essential part of its mechanism.

Some may reject a "mysterious vital principle" because they identify it with superstition or idealistic philosophies. Huxley, for example, argues that life was not created supernaturally because:

> Living substance consists of the same matter as lifeless substance; it transacts its operations according to the same general rules. There is no trace of any special "vital force" which can be detected or measured. Both the inorganic and the organic worlds are built of the same matter, and work by means of the same energy. To postulate a divine interference with these exchanges of matter and energy at a particular moment in the earth's history is both unnecessary and illogical.[45]

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45. HUXLEY, Evolution in Action, p. 20.

Teilhard would be in almost complete accord with the above quotation. He would agree that a vital force cannot be measured, that the same energy and matter are found throughout the world, that there is no necessity for divine interference. He would maintain, however, that a "vital force" can be detected at the higher levels of development, at least in man, and that, in the light of coherence and homogeneity, a vital principle must exist at all levels. The concept of a within in Teilhard does not necessitate belief in divine interference, or intervention; indeed, it may be used to argue against intervention. The within may be considered to be mysterious in the sense that it is beyond the grasp of the scientist today, but it is, according to Teilhard, eventually going to be an object of natural science.

Another criticism of Teilhard is presented by Stephen Toulmin in a rather unusual refutation of Teilhard's concepts of the within, and orthogenesis. Referring to Teilhard's "Note on Progress"[46] written in 1920, where

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46. cf. TEILHARD, "Note sur le Progrès", in: L'Avenir de l'Homme, p. 21ff.

Teilhard "surmised" that the phyla possessing the higher psychic attributes have absorbed all the forces at life's disposal, Toulmin says the following:

> ... Teilhard evidently took the activity of a creative "vital force", directing the course of biological evolution toward the appearance of man, as an acceptable scientific hypothesis. This belief was in fact a misconception. No "halt in terrestrial evolution", such as he took for granted, no "diminuation of vital" pressure in branches of life other than the anthropoids, has any support in the findings of paleontology.[47]

From this refutation of a point which is certainly not essential in Teilhard's thought, Toulmin not only rejects the notion of a "vital force", but also states, apparently as a consequence of his refutation: "The 'orthogenetic' doctrines on which Teilhard originally based his religious interpretations of evolution are, by now, generally discredited."[48]

He goes on to say that, although by 1945 Teilhard came to accept many of the essentials of Darwinian evolution

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47. Stephen TOULMIN, "On Teilhard de Chardin" in: Commentary, Vol. 39, No. 3, p. 52.

48. Ibid.

unfortunately his belief in "vital pressures", which were concentrated in the higher primates, influenced his whole thought.

This would appear to be another criticism based on misinterpretation or, more likely in this case, lack of familiarity with the subject.[49] Toulmin identifies Teilhard's thought with Lamarck and the "early idealist philosophers, notably Herder".[50] He sees the within as an idealistic vital force, mysteriously acting outside of the physical process of evolution, rather than as an integral part of natural selection itself.

Another criticism of Teilhard's concept of the within and the role it plays in evolution is found in Father Rabut's work.[51] He states that although natural

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49. One is lead to this conclusion by the statement: "The publication of Teilhard's remaining essays in The Future of Man thus has one helpful effect." Ibid. This would imply that Toulmin is familiar only with the English translations: The Phenomenon of Man and The Future of Man.

50. Ibid.

51. cf. Olivier RABUT, Dialogue Avec Teilhard de Chardin, Paris, Editions du Cerf, /1958/, p. 67.

selection plays a really creative part in determining the development of organisms, the explanation of this process should not appeal to causes which are remote from experience. The statistical law of accumulation should not lead to a physical or psychical force, compared to gravity, extending throughout evolution. If according to this author, there is a within of things, the role that it plays in evolution is negligible.

Father Rabut seems to think that psychic energy is not the inner aspect of each individual element which makes natural selection "creative", and which is a necessary principle of development. Instead he sees it as a force like gravity extending throughout evolution. Contrariwise, Teilhard sees gravity as a form of psychic energy, rather than seeing psychic energy as a form of energy analogous to gravity.

Moreover, Rabut, along with many evolutionists today, considers natural selection to be the sufficient explanation for evolution. He concludes, accordingly, that no other force, such as psychic energy, is required. It is quite possible, however, that he sees natural selection

to be sufficient precisely because he sees within it the energising principle, that is the within of things, but doesn't recognize it. If no active principle were seen, how could Rabut refer to natural selection as "creative"? The problem seems to be that many authors have given to the term 'natural selection' certain powers of causality and creativity, whereas it is simply a way of referring to a certain activity of living things. It is within these beings then that the sufficient reason for natural selection must be found.

Fr. Forsthoefel, whose criticism of Teilhard's Lamarckian principle was discussed above, also criticizes Teilhard's concept of orthogenesis as signifying nothing more than a predetermined evolutionary process.[52] This criticism would be valid if Fr. Forsthoefel had used the term predetermined in the sense that the occurrence of "snake-eyes" is predetermined by the throwing of a large number of dice. Fr. Forsthoefel, however, appears to use

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52. FORSTHOEFEL, Op. cit., p. 107.

the term in its stricter sense, for example, in the sense that the development of Hegel's Absolute Spirit is pre-determined. This sense of the word is not compatible with Teilhard's definition of orthogenesis as a statistically oriented distribution.

Regarding the validity of Teilhard's concept of a non-determined universe, it may be stated that modern science strongly favours this view. Although classical physics with its strict set of laws left room for determinism, modern physics, especially quantum mechanics with its statistical laws, closed the door on any notion of a determined universe. According to Herman Weyl:

> In quantum physics the elementary processes are not determined by strictly causal laws. If thus the world appears to us today to be much less fettered by "inviolable laws" than at Laplace's time, it must also be emphasized that the only really consistent form of determinism which maintains the unconditional necessity of everything that happens, has never found a support in physics.[53]

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53. Herman WEYL, Philosophy of Mathematics and Natural Science, Princeton, Princeton University Press, 1949, p. 211. Re: the effect of relativity physics on determinism as an epistemological problem, cf. Ibid. p. 210.

On the other hand, neither vitalism nor orthogenesis has found support in physics, and Teilhard's acceptance of these concepts causes him to differ with many natural scientists.

> Pour des raisons qui me paraissent illégitimes ou obscures, on continue d'habitude à opposer entre eux, comme irréduables, les deux phénomènes de mutation et d'orthogénèse.[54]

Regarding the Teilhardian acceptance of Lamarckianism and orthogenesis, and the rejection of these by science, it need only be repeated that whereas science rejects Lamarckian principles in toto, Teilhard simply uses a modified version of one of Lamarck's principles to explain the activity of the vital principle or the within in the mechanism of natural selection. Teilhard's acceptance of chance further indicates that his notion of orthogenesis does not imply an absolutely determined development.

A further criticism of Teilhard is voiced by George Gaylord Simpson. In his review of The Phenomenon

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54. TEILHARD, "La Structure Phylétique du Groupe Humain", in: L'Apparition de l'Homme, p. 197.

of Man he writes:

> As to the mechanism of evolution, obviously a, or indeed the, crucial point of the scientific part of the inquiry, Teilhard accepted both Darwinism and neo-Lamarckism as partial factors. He called Darwinism evolution by chance (although natural selection is the only objectively established anti-chance evolutionary factor) and therefore considered the non-chance neo-Lamarckian factors more important (although, as he knew, most biologists consider them not merely unimportant but nonexistent).[55]

We have already maintained that Teilhard does not subscribe to all of the Lamarckian factors, but merely uses one of them in his own way. It is true that he refers to Lamarckian anti-chance, while Simpson points out that Darwinian selection is established as the anti-chance factor. Later in his article Simpson states that Teilhard repeatedly contrasts selection with orthogenesis, treating them as opposites.[56]

What Teilhard does contrast is mutation, as a chance event, and orthogenesis, as design. It is quite

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55. G.G. SIMPSON, in: Scientific American, April 1960, p. 204.

56. Ibid. (This would imply an opposition between Darwin and Lamarck).

possible that Teilhard refers to the element of mutation within the modern Darwinian theory, when he speaks of Darwinian chance. Also, he could have in mind the chance aspects of natural selection, for example, the chance of being born in a particular location, or at a particular time, or the chance of meeting a particular mate or predator. Neo-Lamarckian anti-chance is not something apart from natural selection, but rather a necessary element of it; it is the psychic element. If this point of view is correct, it would be true to say that the Neo-Lamarckian factor is actually the anti-chance element of Darwinian natural selection.

Simpson also states that "imprecision or contradiction in definition is one of the constant problems in the study of the Teilhard canon."[57] Though this criticism has some justification, the essential point in Teilhard's argument is clear, namely that psychic energy is at work throughout the processes of evolution. Psychic energy is

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57. Ibid.

the anti-chance element, and whether it be called neo-Lamarckian or not is of secondary importance.

It would seem that Simpson has missed this essential point, for he quotes from The Phenomenon of Man as follows: "We shall assume that, essentially, all energy (i.e. both material and spiritual) is physical in nature."[58] The word "physical" here is an incorrect translation of the original "psychique", that is, "psychic", the exact opposite.[59] Apparently Simpson was not aware of this error, which completely distorts Teilhard's thought. Undoubtedly his interpretation of Teilhard's views of selection and Lamarckian factors were influenced by it.

In conclusion, we can say that Teilhard does not use a specialized version of the mechanism of evolution according to the Darwinian school, but he does understand and accept its basic principles and explanation. His theory of orthogenetic development definitely does not

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58. Ibid.

59. Error is found on p. 64 of the first English edition (also in first English paper-back edition). cf. TEILHARD, Le Phénomène Humain, p. 62 for original.

contradict the general Darwinian position. Indeed, his theory is based on it. His inclusion of the within as the source of psychic activity is seen to be the explanation of the creative aspect of natural selection which is now recognized within the Darwinian school. Furthermore, his "Lamarckianism" is no more than the inclusion of the within as an integral part of the explanation of evolution. It neither contradicts the Darwinian explanation through natural selection nor can it be separated from that explanation.

Moreover, Teilhard does not accept chance as an explanation of development, nor does he see evolution as determined. His concept of a statistical necessity seems to be scientifically and mathematically acceptable, and it includes the concepts of chance and teleology.

Finally, Teilhard's vitalism is not mysterious nor based on superstition, but is an essential part of his hyperphysics, based on the coherent principle that the within of things is coextensive with the without. Whether or not this position, as well as others considered in this chapter, is scientific, will be discussed in Chapter V.

CHAPTER V

Teilhard's Theory of Orthogenesis as Scientific

In his introduction to The Phenomenon of Man, Sir Julian Huxley says, "...many scientists may, as I do, find it impossible to follow him /Teilhard/ all the way in his gallant attempt to reconcile the supernatural elements in Christianity with the facts and implications of evolution..."[1] In the light of the context from which this passage is taken it is evident that Huxley is troubled mainly by Teilhard's extrapolation to Omega. Without Omega as a terminus for development, evolution would not be truly orthogenetic, and therefore to question the validity of the theory of development to Omega is to question the validity of the whole of Teilhard's theory of orthogenesis.

Huxley refers to Teilhard's gallant attempt to reconcile Christianity and evolution. Indeed Teilhard's theory is a reconciliation of Christianity and evolution,

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1. HUXLEY, in TEILHARD, The Phenomenon of Man, p. 19.

but it is presented by Teilhard primarily as a good scientific theory. For example, Teilhard does not merely show that an ultimate destiny for man is compatible with the physical theory of evolution, but actually presents an argument for an ultimate destiny with Omega based upon the physical theory of evolution. To overlook this attempt by Teilhard to present a scientific theory, and to consider only his reconciliation of science and Faith is to seriously misinterpret Teilhard's objective. He intended his theory of orthogenesis to be scientific, and must have hoped that scientists would be able to "follow him all the way".

The scientific nature of Teilhard's theory has already been introduced in this thesis; indeed, it has been a constantly recurring theme throughout. We have discussed the general scientific background of Teilhard himself, the scientific basis of his theory, the compatibility of his theory with modern scientific theories in thermodynamics and evolution, and something of the nature of hyperphysics. In the present chapter we will use some of the conclusions of these discussions and, in the light

of the criteria for good science, we will attempt to justify the position that Teilhard's theory of orthogenesis is scientific.

We have presented evidence that Teilhard's theory of orthogenesis is an integral part of his hyperphysics. Any analysis of the nature of this theory, consequently, involves some discussion of the nature of hyperphysics itself, and we will begin with such a discussion.

A. On the Nature of Hyperphysics:

Many authors have studied the problem of the nature of hyperphysics,[2] and some of their opinions will be presented here.

Teilhard's hyperphysics is, first of all, a synthesis. In the words of Francoeur:

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2. cf. for example: J.P. BLANCHARD; Méthode et Principes du Père Teilhard de Chardin, Paris, La Colombe, 1961. Emile RIDEAU, La Pensée du Père Teilhard de Chardin, Paris, Editions du Seuil, 1965, Ch. II, (esp. p. 49ff). Madeleine BARTHELEMY-MADAULE, Bergson et Teilhard de Chardin, Paris, Editions du Seuil, 1963, Ch. X. Claude TRESMONTANT, Pierre Teilhard de Chardin, Baltimore, Helicon Press, 1959, esp. Ch. I., R. T. FRANCOEUR, (ed), The World of Teilhard, Baltimore, Helicon Press, 1961, esp. Introduction, p. 11ff.

> Following the spirit of the great scholastics and the "nouvelle théologie", Teilhard tried to synthesize and reunite the scientific contributions of the 20th century with Revelation. This is the first time since Albert the Great and Thomas Aquinas that a scholar has attacked the problem of the unity of all knowledge on such a broad scale.[3]

In agreement, Barthélemy-Madaule writes:

> De même que Descartes avait emprunté aux mathématiques un raisonnement déductif d'une nouvelle sorte, qui devait supplanter le syllogisme, de même Teilhard emprunte à la biologie un type de raisonnement qui dépasserait le positivisme bergsonien et ses analyses limitées; il réintroduirait la synthèse, mais une synthèse inspirée du devenir et non plus de l'immuable, du vivant et non plus de l'abstrait.[4]

Philosophers and historians of philosophy have had much difficulty classifying the synthesis of Aquinas. It is not surprising that the classification of Teilhard's synthesis, more extensive than St. Thomas' inasmuch as it encompasses a broader spectrum of sciences, should lead to divergent views. The complexity of the problem is seen in a selection from the work by Fr. Rideau:

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3. R. T. FRANCOEUR, op. cit., p. 11.

4. Madeleine BARTHELEMY-MADAULE, op. cit., p. 569.

> Une première approche de la vérité s'effectue par les méthodes de la science. A partir d'elle, il s'est élevé cependant à une connaissance supérieure, d'ordre philosophique. Dans le sens le plus général et le plus profond du terme, cette philosophie peut s'appeler phénoménologie. Cette phénoménologie est positive et scientifique.
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> Distribuée et reconstituée en secteurs hiérarchiques la phénoménologie de Teilhard comprend une cosmologie, une anthropologie, une métaphysique et une ontologie. Elle s'associe, dans un ordre distinct, une théologie.[5]

Unless a person sees a fundamental unity in reality, it would be difficult to accept the possibility or validity of such a broad synthesis. Blanchard states, for example:

> A peine admettront-ils, ces gens évolués, que dans le cerveau du même individu il y ait plusieurs casiers, l'un pour les connaissances scientifiques, l'autre pour les options philosophiques, l'autre pour les croyances religieuses. Il n'y a pas unité fondamentale de l'esprit. Il n'y a même plus unité fondamentale du monde.

He goes on to say:

> A tel point qu'aux yeux de certains, et malgré son /Teilhard's/ image des seuils (qui sauve tout), il ne respecterait pas suffisamment les

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5. Emile RIDEAU, op. cit., pp. 49 & 51.

différences indubitables.[6]

For Teilhard, of course, "pigeon-holes" exist neither in reality nor in the mind. Hyperphysics, as a further development of physical and biological science, and as a replacement for metaphysics is the one synthesis.[7] It is in this vein that Francoeur writes:

> Teilhard rejects any attempt to classify his thought in airtight compartments, for his synthesis is not a "system" nor a closed syllogistic discipline of one brand of knowledge. Teilhardian thought is fecund, open, free, and all-inclusive.[8]

It may be pointed out again that Teilhard's denial that his work is metaphysics is not a limitation of his system, but a rejection of metaphysics as he knew it.[9] His view of the universe as a continuous spectrum of being leads him to a view of science as a continuous spectrum of

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6. J. P. BLANCHARD, op. cit., p. 91.

7. Only theology would be considered by Teilhard to be outside of his hyperphysics, although a further synthesis of knowledge through hyperphysics and theology is possible.

8. R. T. FRANCOEUR, op. cit., p. 11.

9. Ch. I above.

knowledge. Apart from theology, there is one science, that is, hyperphysics, which is based on and includes modern natural science, and which extends far enough to replace metaphysics.

Many consider this hyperphysics to be philosophical, at least to the extent that it is concerned with the whole man.[10] Some, however, think that he is wrong in combining science and philosophy, which they regard as two radically distinct levels of explanation.[11] Others see his work as completely unscientific.[12]

If hyperphysics were considered a science, then the theory of orthogenesis, a major and integral part of hyperphysics, would be also considered to be scientific. In the light of the above, however, it is clear that we cannot appeal to such an argument, for there is no general

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10. cf. for example: F. G. ELLIOTT, "The World Vision of Teilhard de Chardin", in: International Philosophical Quarterly, Vol. I, No. 4, esp. p. 621.

11. cf. Joseph DONCEEL, "Teilhard de Chardin: Scientist or Philosopher", in: International Philosophical Quarterly, Vol. V, No. 2, p. 255.

12. cf. for example: Stephen TOULMIN, "On Teilhard de Chardin", in: Commentary, Vol. 39, No. 3, p. 50ff.

agreement on the nature of hyperphysics. We must, therefore, look at the theory of orthogenesis itself and attempt some judgment on its scientific content. Furthermore, because of the central position held by orthogenesis in hyperphysics, any evaluation of the theory of orthogenesis will assist greatly in determining the nature of hyperphysics.

In our discussion of the scientific nature of this theory to follow we will consider its conformity with established facts and theories, its internal consistency, and its principles and method. We will also discuss the theory as philosophical.

B. The Conformity of Teilhard's Orthogenesis with Established Facts and Theories:

A good theory must be based on facts, or on other well established theories. The main foundations for Teilhard's theory of orthogenesis are the general theory of evolution, most of which must be considered to be a well-established theory, and a reflection upon the human phenomenon itself, that is, the self-consciousness and

material complexity of man.

There is, however, no evidence of psychic activity at the lower levels of material beings, and consequently no evidence for the kind of orthogenesis which Teilhard presents. He admits this lack of direct empirical evidence. But, since he predicts that some day the physicist will recognize psychic energy and moreover, since he bases his panpsychism on a scientific principle of coherence he insists that his theory is truly scientific. Accordingly, two points must be considered: the truth or verifiability of scientific principles, and Teilhard's use of the principle of coherence.

Scientific principles must have some objective foundation; they must be true in the sense that they must conform to reality. Otherwise, as Nagel indicates, "... only a moderate logical and mathematical ability would be required for explaining any fact in the universe without leaving one's armchair".[13]

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13. Ernest NAGEL, The Structure of Science, New York, Harcourt, Brace & World Inc., 1961, p. 43.

However, Nagel goes on to say that the truth of these objective premises need not be known.

> This requirement does not carry us far in judging the worth of a proposed explanation if we are not in a position to say whether or not the premises are false. The Aristotelian requirement that the premises must be known to be true thus provides an apparently effective criterion for eliminating many proposed explanations as unsatisfactory. But this requirement is much too strong. Were it adopted, few if any of the explanations given by modern science could be accepted as satisfactory For in point of fact, we do not know whether the unrestrictedly universal premises assumed in the explanations of the empirical sciences are indeed true, and, were the requirement adopted, most of the widely accepted explanations in current science would have to be rejected as unsatisfactory.[14]

Nagel concludes, then, that there is no point in adopting the Aristotelian requirement that the truth of premises be known. Some condition, however, is needed, namely: "that the explanatory premises be compatible with established empirical facts and be in addition adequately supported (or made 'probable') by evidence based on data other than the observational data upon which the acceptance of the explicandum is based."[15]

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14. Ibid.

15. Ibid.

Teilhard satisfies Nagel's first condition that premises must be compatible with established empirical facts for the following reasons: First, the Teilhardian principle that all energy is psychic does not contradict any established facts. The nature of the fundamental energies in the physical universe, that is, gravitational energy, electrostatic energy and nuclear energy, is, as yet, unknown. But what is known is compatible with pan-psychism. Regarding gravity for example, recent experiments at Princeton University lead to the conclusion that "gravitational effects - like electromagnetic ones - are due to the interaction of matter with one or more of three kinds of classical field", which possibly is "a single tensor field."[16] This field theory of gravity, and the field theories of electrostatic and nuclear forces, are compatible with Teilhard's concept of psychic energy. Insofar as a field is considered by the physicist to be an area of influence, or the space throughout which a force

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16. R. H. DICKE, P. G. ROLL, & J. WEBER; Gravity Experiments, in Modern Science and Technology, edited by Robert COLBORN, Princeton, N.J., D. Van Nostrand Co. Ltd., 1965, pp. 3 & 4.

operates, field theories can be regarded as the quantitative descriptions of fundamental psychic activities.

Secondly, Teilhard does not contradict the generally accepted Darwinian-Mendelian theory of the mechanics of evolution. He recognizes chance mutations and natural selection as necessary elements in development. The Lamarckian principle which he uses is not the rejected principle of inheritance of acquired characteristics, but an amended concept of inner need, which is compatible with today's theory of evolutionary development.[17]

Thirdly, Teilhard does not contradict the generally accepted view that evolution follows a meandering complex of paths, resulting from the randomness of mutations and selection. Orthogenesis refers to a principal or privileged axis within the maze, which itself does not necessarily follow a straight and determined line.

Fourthly, Teilhard's theory of orthogenesis does not contradict the law of entropy, but, on the contrary,

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17. cf. Proceedings of the Teilhard Conference, (1964), New York, Fordham University, p. 37.

accepts it as a valid physical law which must be constantly kept in mind while looking into the future. Because of this he sees the necessity of a transformation in the future to free the radial from the tangential energy completely, and thus from the thermodynamic effects.

Fifthly, the concept of a within does not contradict any findings of modern science. A statement like Huxley's or Toulmin's that there is no scientific evidence for a within certainly does not rule out its existence. Teilhard recognizes that the within is not the object of present-day physical science, but this does not preclude the possibility, if not probability, of its being an object for physical science in the future. Accordingly, the concept of the within belongs to a hyperphysics.

Not only must a good theory be compatible with established facts and theories; it must also be without any internal contradictions. In keeping with this criterion the essential elements of Teilhard's notion of orthogenesis show the self-consistency necessary for a good theory. He adheres to his principle of unity of mechanism and structure throughout, even to the point of presenting man's

self-consciousness as a part of the continuous process of evolution, the development of society in terms of "divergence-convergence-emergence", and the Incarnation as a "prodigious biological operation". His consistency is evident, for example, when he admits the possibility of failure of the orthogenetic process leading to the destruction of the noosphere because of his acceptance of "Darwinian chance" as a mechanism of evolution at every level from the atomic to the self-conscious.

C. The Principles and Method of Teilhard's Theory of Orthogenesis:

Teilhard also satisfies Nagel's second condition that the premises must be adequately supported, or made probable, by evidence based on data other than the observational data upon which the acceptance of the explicandum is based. Teilhard's theory of orthogenesis is an explanation of development of complexity-consciousness and as such is based on his panpsychism and the related principle of unity of mechanism and structure. The main support for these principles is the principle of coherence, based on

objective evidence.

With regard to the principle of coherence in itself, Van Laer writes:

> It is clear that any knowledge to which the name 'science' is given must show a certain coherence. It must constitute a coherent whole of interconnected things and their parts that is appropriately ordered.[18]

No coherence, however, within a scientific system can be produced by logic alone and remain realistic. The coherence of the system must reflect an objective coherence discovered in reality; some unity and continuity must be found by the scientist in the diversity of the physical world surrounding him. To discover this unity and continuity in nature to permit the development of a coherent picture of the world is his principal task as a scientist. With regard to this point, Albert Einstein states:

> Science is the attempt to make the chaotic diversity of our sense-experience correspond to a logically uniform system of thought. In this system single experiences must be correlated with the theoretic

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18. P. H. VAN LAER, The Philosophy of Science, (Part One), Pittsburgh, Duquesne University, 1956, p. 8.

> structure in such a way that the resulting coordination is unique and convincing.
>
> The sense-experiences are the given subject-matter. But the theory that shall interpret them is man-made.[19]

Through the modern physical theory of evolution we have a picture of continuity on the level of complexity based on sense experience. Teilhard sees a more extensive coherence in which there is a continuity of complexity-consciousness. This continuity leads directly to the conclusion that there is a within and without at every level, and the activity of psychic energy throughout. A principle of continuity first formulated by Leibniz may be recalled in connection with this conclusion. This principle of continuity, "rests upon the impossibility of proper division of a uniform continuum. It is scientifically unsound to exclude, as Euclid does, the null angle and the straight angle from the notion of an angle".[20]

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19. Albert EINSTEIN, "The Fundamentents of Theoretical Physicis" (1940), in: Out of My Later Years, New York, Philosophical Library, 1950, p. 95.

20. LEIBNIZ, quoted in: Hermann WEYL, Philosophy of Mathematics and Natural Science, Princeton University Press, 1949, p. 160. cf. also p. 155.

Similarly, if the universe is seen to be a continuum of complexity-consciousness it would be scientifically unsound to divide the continuum so as to exclude psychic energy from some segment of it.

This conclusion is scientifically sound, however, only if the principle upon which it is based is scientifically sound. The scientific validity of Teilhard's principle of coherence must be considered. We may do this in the light of Newton's Rules of Reasoning in Philosophy. He states the rules as follows:

> Rule I: We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances.

This is based on the notion that Nature does nothing in vain, and accordingly, will not use more causes than are necessary.

> Rule II: Therefore to the same natural effects we must, as far as possible, assign the same causes...
>
> Rule III: The qualities of bodies, which admit neither intensification nor remission of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed

> the universal qualities of all bodies whatsoever.[21]

The continuity of the axis of complexity is, of course, based on the theory of evolution. The extension of the axis of consciousness from the uppermost levels of development to the lowest is not based directly upon empirical evidence, but it does follow Newton's rules. We know that certain activities of living beings, such as their awareness of their environment and their appetites are psychic. We may, then, postulate psychic energy as the cause of similar activities whose causes are at present beyond our grasp. In other words, a <u>within</u> exists at every level and evolution is a development of complexity-consciousness.

Consciousness is not evident at the lower levels of creation, and yet Teilhard insists that the physical scientist will eventually have to recognize it. The physical scientist, however, is at present concerned only

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21. Sir Isaac NEWTON, <u>Philosophicae Naturalis Principia Mathematica</u>, Motte translation (1729) revised by Cajori, Berkely, University of California Press, 1960, p. 398.

with that which is empirically verifiable, or at least, empirically verifiable in principle. The general theory of evolution is not actually empirically verifiable, but since it deals with the development of complexity it is potentially verifiable by empirical means, or verifiable in principle. The proposition, "There is a continuous axis of complexity", is, therefore, scientific in the sense that it is empirically verifiable. On the other hand, consciousness cannot be empirically observed. Hence the proposition, "There is a continuous axis of consciousness coextensive with the complexity axis", is not empirically verifiable, even in principle. The proposition regarding consciousness is, consequently, not scientific in the same sense as is the proposition regarding complexity. Furthermore, if one limits science to strict empirical methods, then, according to such a definition Teilhard's parameter of consciousness is not orthodox science. Many scientists today, however, are in favour of a less rigid definition of the scientific method, or, in other

words, of more "unorthodox" science.[22] Nagel, for instance, writes:

> ... the conclusions of science, unlike common-sense beliefs, are the products of scientific method. However, this brief formula should not be misconstrued. It must not be understood to assert, for example, that the practice of scientific method consists in following prescribed rules for making experimental discoveries or for finding satisfactory explanations for matters of established fact. There are no rules of discovery and invention in science, any more than there are such rules in the arts. Nor must the formula be construed as maintaining that the practice of scientific method consists in the use in all inquiries of some special set of techniques (such as the techniques of measurement employed in physical science), irrespective of the subject matter or the problem under investigation. Such an interpretation of the dictum is a caricature of its intent; and in any event the dictum on that interpretation is preposterous.[23]

This viewpoint would leave room within the field of science for the inclusion of Teilhard's theories insofar as it permits deviation from the strict empirical method. A more positive statement by Nagel further justifies the

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22. cf. for example, R. G. COLODNY (ed.), Beyond the Edge of Certainty. Englewood Cliffs, N.J., Prentice-Hall, 1965, p. 4.

23. Ernest NAGEL, op. cit., p. 12.

inclusion of hyperphysical theory within the scientific spectrum; he defines scientific conceptions as:

> ... formulations of pervasive structural properties, abstracted from familiar traits manifested by limited classes of things usually only under highly specialized conditions, related to matters open to direct observation only by way of complex logical and experimental procedures, and articulated with a view to developing systematic explanations for extensive ranges of diverse phenomena.[24]

Teilhard's conception of consciousness as a property of all material beings is abstracted from the familiar activities of a limited class, namely man, and the higher animals. Its purpose is to develop a systematic explanation for the most extensive range of diverse phenomena, and Teilhard's explanation is truly systematic. The relationship between this concept and matters open to direct observation are by way of logical rather than experimental procedures; for example, there would appear to be no experimental evidence to show that psychic energy causes a tree to send out tap roots, or a union of oxygen and hydrogen. This in itself, however, should not bring

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24. Ibid., p. 11.

about the exclusion of Teilhard's theories from the world of science, unless it is held that the empirical method must be used to obtain all scientific knowledge, without exception.

The lack of experimental method in Teilhard's approach to consciousness does not, in itself, result in a lack of certainty. We have no experimental evidence of the consciousness of higher animals, and yet we are certain of its existence. We observe that animals have activities similar to our own, and since we know through reflection that our consciousness and appetites are at the root of our activities, we reason that animals have consciousness and appetites. According to Teilhard, it is only our unfamiliarity with the activities of things farther down the scale of evolution that makes us less certain of their possession of psychic energy.

Since Teilhard's concept of consciousness is derived primarily from man and then attributed to other things according to their degree of development, this concept is analogical, the analogy being one of proper proportion and the primary analogate being man. This is

entirely consistent with his principle of coherence through which he sees a uniformity, continuity and similarity throughout the material universe, but at the same time sees radical differences along the axis of development. With regard to the use of analogy in science we may quote further from Sir Isaac Newton:

> We are certainly not to relinquish the evidence of experiments for the sake of dreams and vain fictions of our own devising; nor are we to recede from the analogy of Nature, which is wont to be simple, and always consonant to itself.[25]

This use of analogy in devising a theory is quite valuable in science, even when it is recognized that the theory may be modified by future experimental evidence. Weyl gives the following example:

> We meet the principle of analogy in perhaps its most significant application in the establishment of the atomic theory. The mechanical laws, which had been derived from the behavior of ordinary visible bodies and had been most precisely confirmed by the planets are carried over to atoms. One anticipates that the facts may later enforce corrections, but without this preliminary adoption of the mechanical laws no beginning of atomic research is thinkable.[26]

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25. NEWTON, op. cit., p. 398.

26. WEYL, op. cit., p. 161.

The scientist may also anticipate that the existence of the analogous perfection in the subject will eventually be proved, or disproved, experimentally. To one who insists that this be the case, once again Teilhard's theory falls outside the definition of science. If, however, diversity of method is permitted to bring about a systematic explanation with some degree of probability, then Teilhard's use of analogy may be scientifically acceptable.

From what has been presented above we can conclude that Teilhard's theory of orthogenesis is not empirical science in the strict sense of the word. That is, if empirical science is defined in such a way that only the experimental method may be used, and only concepts empirically verifiable may be considered, then his theory must be excluded inasmuch as it is based on principles that are not empirically verifiable and uses non-experimental methods. If, on the other hand, we accept the position that empirical sciences can, and possibly must at times deviate from a strict empirical approach if they are to develop, then we may classify Teilhard's theory as

scientific

Teilhard's theory, as well as any scientific theory which introduces non-empirical elements, may be in some way philosophical. This possibility was introduced in Chapter I, and will be discussed further here.

D. Teilhard's Theory of Orthogenesis as Philosophical:

Once again such a fundamental question about the nature of the theory of orthogenesis can only be discussed within the context of hyperphysics, of which it is an integral and major part. In Chapter I[27] we stated that Teilhard was a philosopher at least insofar as he studied the whole man. If it is suggested that hyperphysics is scientific and also philosophical, then the following question immediately arises: Does natural science "evolve" continuously into philosophy, forming a continuous spectrum of knowledge? That is to say, does it evolve into a hyper-physics?

In answering this question we might take cognizance of what Maritain says about the difference between

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27. P. 25ff.

experimental science and philosophy. He maintains that a certain continuity or solidarity exists between the specifically rational part and the specifically experimental part of knowledge. Whereas the sciences at the lower end of the spectrum of knowledge, such as physics, still use an almost purely mathematical method, the sciences higher up the spectrum, such as biology, include a philosophical approach. Maritain states that, unlike physics,

> ... experimental biology and experimental psychology do not undertake to reconstruct a closed universe of mathematicized phenomena, and it is quite normal that the type of deductive explanation whose attraction they undergo should be of a philosophical type and not of a mathematical type.[28]

Teilhard would not deny that there are essentially different or radically different kinds of knowledge, any more than he would deny the existence of essentially different kinds of beings. For him, however, the existence of essentially different beings does not mean that evolution is discontinuous, nor that there is no unity of structure or mechanism, nor that there is a lack of

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28. Jacques MARITAIN, The Degrees of Knowledge (translated by G. B. Phelan), Condon, Geoffrey Bles, 1959, pp. 64-65.

coherence in the universe. This picture of the real world is reflected in his epistemology. Within hyperphysics both empirical methods and rational or philosophical methods are used, but it remains one continuous science, somewhat in the sense that Maritain speaks of continuity of science. The biologist, says Teilhard, has already recognized the existence of consciousness as a biologist, and to this extent, has already become a philosopher. Indeed, according to Maritain:

> ...it is only by using the equipment of the philosopher, by becoming philosophers themselves, that they (biologists and psychologists) will be able to give a proper and adequate solution to supra-experimental problems that their own experience compels them to envisage...[29]

To state that Teilhard's thought evolves into the philosophical is not to say that it encompasses all philosophy. His philosophy does not comprise an explicit ontology nor an explicit epistemology and his theodicy is a natural or physical theology rather than a metaphysical theology. Although metaphysical principles are used, as they are in any science, there is no developed metaphysics.

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29. Ibid., p 66.

There are, however, philosophical starting points,[30] and philosophical methods such as deduction and analogy leading to some philosophical conclusions, the existence of Omega, for example.

E. The Role of Faith in the Theory of Orthogenesis:

Separate from hyperphysics, the natural science, but converging with it, is Theology, the supernatural science. Faith and revelation do not, for Teilhard, form a part of hyperphysics, but constitute instead a separate knowledge which leads to the same conclusions as hyperphysics. From the convergence of the divergent knowledge through Faith and science emerges the total picture of reality.

The theory of convergence upon the Omega Point, discussed above, appears to be based on Teilhard's hyper-

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30. cf., for example, P. H. VAN LAER, The Philosophy of Science, (Part One), Pittsburgh, Duquesne University, 1956, p. 51. "The philosophical sciences have their starting point in an intellectual reflection on the general data of experience with respect to the being of man and things outside man". (See also this author's discussion of the starting points of other sciences, ibid).

physical principles. Certain conclusions about the Final Cause, however, are, for Teilhard, based on Faith. At the end of an analysis of socialisation as an essential phenomenon of hominisation he states, for example:

> ... le phénomène humain, vu dans sa totalité, faisant mine de dériver vers un point critique de maturation (et peut-être même d'évasion psychique) marqué par Réflexion collective centrée sur un même foyer, de toutes les réflexions élémentaires de la Terre.
>
> Au-delà de quoi nous ne distinguons plus rien, et notre dialectique s'arrête; - sauf dans le cas du chrétien qui, utilisant une source complémentaire de connaissance, peut encore (c'est ce qu'il nous reste à montrer) faire un pas de plus en avant.[31]

The difficulty lies in attempting to define the line of demarcation between that part of Teilhard's theory which is based on phenomena and that part based on Faith. Within his total world vision, however, this should not be surprising. Just as one form of material being blends into the next within the continuous spectrum of the evolutionary process, so too one form of Teilhard's thought blends into another. The discussion of Omega

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31. TEILHARD, "Agitation ou Génèse?" (1947) in: L'Avenir de l'Homme, p. 284.

may be considered to be on the borderline between phenomonology and Theology. just as the virus is on the borderline between non-life and life. He states, for instance:

> Du point de vue chrétien (qui coïncide en cela avec le point de vue biologique convenablement poussé jusqu'au bout de ses exigences) la "collection" de l'Esprit graduellement développé au cours de "l'enroulement" de l'Univers se fait en deux temps, et par deux degrés;...[32]

The above analogy between the Omega and the virus is used merely to indicate the lack of defining limits within the Teilhardian synthesis. It does not imply that Teilhard's Faith or Theology is a further development of his phenomonology. He arrives at the same conclusion from two different directions. The study of the phenomena leads Teilhard to probable conclusions which coincide with articles of Faith about which he is certain. If, for example, the Pleroma does not develop naturally through reflexion of the Noosphere, and this, according to Teilhard, is possible, Omega, or God, and the immortality of man would still be facts for him. He accepts them as

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32. Ibid., p. 285 (italics mine).

facts based on Faith independently of his phenomonological synthesis.

> Il faut, devant l'incertitude pratique du lendemain, s'être abandonné, dans un vrai porte-à-faux intérieur, sur la Providence .....; - il faut, dans le remords de la faute commise, dans l'irritation de l'occasion manquée, s'être forcé à croire, sans hésiter, que Dieu est assez fort pour convertir ce mal en bien.[33]

St. Thomas Aquinas, using the best philosophy available to him and interpreting it for his own purposes, presented rational demonstrations for the existence of the God whom he already knew through his Faith. Teilhard, using the best in scientific theory available to him, and interpreting it in his own way presents his theory of orthogenesis which leads to the concept of Omega, which is the God he knew from the beginning through Faith. There is a convergence of Teilhard's theory of orthogenesis and Faith, but the two do not become one until the concept of Omega-God is reached.

F. Conclusion

Just as Teilhard sees evolution as a process in

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33. TEILHARD, Hymne de l'Univers, p. 142.

which divergent beings converge, so too he sees hyperphysics as the convergence of different sciences. Hyperphysics is based on modern physical and biological science, and therefore is empirical. It moves beyond these sciences, however, to become philosophical in its object and method. And finally, the fully developed hyperphysics itself converges with theology. together to encompass all of man's knowledge. It is within this context that the hyperphysical theory of orthogenesis must be viewed.

Teilhard's theory of orthogenesis is self-consistent, and does not contradict any major facts or theories established by modern science. It is based, however, on principles which are not empirically verifiable, and uses non-empirical methods. Such a deviation from the traditional method of experimental science appears to be gaining acceptance today, and inasmuch as this is the case, Teilhard's theory may be considered to be scientific.

To the extent that Teilhard goes beyond experimental principles and methods, his theory is philosophical, though not metaphysical. Teilhard himself states that hyperphysics is not metaphysics, but is an all-inclusive

science which will look at the whole man in his total human context. Such an objective is certainly philosophical, and demands philosophical methods.

Although the conclusions of the theory of orthogenesis correspond to some articles of Teilhard's Faith, the theory itself is not based on Faith nor does it use Faith or theology in its development. Hyperphysics does not depend on Faith for its principles or method, but does converge with Faith insofar as their conclusions to some extent coincide.

CONCLUSION

Advances in modern physical science are giving man an increased optimism about his immediate future on earth. Science, however, presents a very pessimistic view of the distant future: the view of a cold, lifeless universe in ruins. The scientist, as scientist, sees no ultimate perfection, no Pleroma, no Final Cause for the development he studies. If he does see a true purpose for the evolutionary process through his Faith, the more positivistic-minded may accuse him of superstition, mysticism or dreaming.

Teilhard de Chardin believed that there was a purpose and an ultimate end for the development that he studied as a physical scientist, and furthermore he held that this belief was compatible with modern scientific theory. He was not, however, satisfied with merely reconciling science and Faith; that is to say, he was not content simply to show that his faith in an ultimate state of perfection did not contradict the established facts and theories of modern science. Teilhard's object was to present a scientific theory of a truly directed evolution

towards a state of ultimate perfection in union with Omega.

In this work we have seen that Teilhard's theory of orthogenetic evolution is neither poetry nor mysticism. It is a major and integral part of hyperphysics which, according to Teilhard, is the natural extension of modern physics. Hyperphysics, and consequently the theory of orthogenesis, is based on Teilhard's scientific background, or, as we have called it, his scientific world vision. His total world vision, however, is more extensive than that of the physical scientist. As well as a continuous parameter of developing complexity, Teilhard saw a continuous parameter of developing consciousness, so that evolution was for him the evolution of complexity-consciousness. It is from this wider view that Teilhard's theory of orthogenesis flows.

If Teilhard is to be understood he must be studied within this world vision, and within the context of hyperphysics. This requires a knowledge of the modern general theory of evolution and the awareness of a dynamic, homogeneous universe that follows from it. The acceptance of hyperphysics, at least as a working hypothesis for the

study of Teilhard, implies an effort not to attempt to break his synthesis into parts, but to see all science as one, reflecting the homogeneity of the universe. If either continuity of reality or of thought is rejected, then Teilhard's synthesis is rejected at the outset.

The continuity of reality seen in the modern general theory of evolution, and well established by science, is a continuity of material complexity. The continuity of reality seen by Teilhard is a continuity of complexity-consciousness. This position is not based on empirical evidence but on an extended principle of coherence. It is based on a belief in a fundamental unity of mechanism and structure, and entails a rejection of the idea that the consciousness so evident at the higher levels of evolutionary development is an epiphenomenon. This extended principle of coherence and the law of complexity-consciousness deduced from it may be considered to be the primary principles of Teilhard's synthesis. Or, since Teilhard states that they are what must be <u>seen</u> in the light of modern science, they may be considered to be the primary "vision". It seems that there is no way to

demonstrate this primary vision, nor is it self-evident. Nevertheless, Teilhard does not present it as an arbitrary postulate nor a working hypothesis or heuristic structure. It is presented as a real principle of which he is quite certain; it is a law that, within the context of his total world vision, he sees. For Teilhard, within the context of a developing and homogeneous universe, this law is evident. Since it cannot be demonstrated but must be seen, the acceptance of this law of complexity-consciousness may come, borrowing Father Elliott's words, only from living within the vision of Teilhard for a while and allowing it to work its full power within you.[1]

A determination of the exact nature and validity of hyperphysics would, of course, demand a much more intensive study of the nature and validity of this first principle. For our purposes the law of complexity-consciousness has been accepted as a theory which has value inasmuch as it does explain certain facts and established theories without

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1. F. ELLIOTT, S.J., "The World Vision of Teilhard de Chardin", in: International Philosophical Quarterly. I, 4, p. 647.

contradicting any facts or theories. Since the Teilhardian theory of orthogenesis is a consequence of the law of complexity-consciousness, it follows that it too is presented only as a theory, although some attempt has been made to present it as a good theory and even as a scientific theory. This has been done by showing the theory of orthogenesis to be consistent in itself, and compatible with modern science.

With regard to the internal consistency of the theory, it has been shown that it is a logical consequence of the law of complexity-consciousness and the principle of coherence. From the law of complexity-consciousness flow the concepts of the within and without and the two energies. The concept of unity and mechanism of structure follows from the principle of coherence. An analysis of the evolutionary process in the light of the two energies and the principle of unity of mechanism and structure leads to the conclusion that development is irreversible in the direction of greater consciousness and is directed toward its ultimate goal in union with a real and personal terminus called Omega. Although these conclusions

correspond to Teilhard's Faith and were therefore known to him before he conceived his hyperphysical theory, nevertheless they are developed completely and consistently within the context of hyperphysics. The fact that the conclusion reached through hyperphysics was known to him from the beginning through Faith does not in itself lead to the conclusion that his synthesis is unscientific. The scientist often has some foreknowledge of the conclusion before the experiment is performed; in fact, without some prevision of the result, the experiment could not be designed. Foreknowledge of the conclusion does not, in itself, make a work unscientific.

With regard to the compatibility between Teilhard's theory of orthogenesis and modern science, two major problems arise. The first of these is related to the law of entropy. If orthogenesis is to refer to more than the temporary back-wash in the main downhill evolutionary current, the irreversibility of the complexity-consciousness process must be demonstrated. If, however, orthogenesis is to be in any way scientific, this demonstration must not conflict with the established laws of thermodynamics,

especially the second law. It has been shown that Teilhard succeeds in presenting a demonstration consistent within hyperphysics and compatible with the law of entropy. In fact the law of entropy becomes a part of hyperphysics, tangential energy being defined in terms of this law. Entropy is recognized and respected throughout as a law governing the axis of complexity, and, inasmuch as complexity is essential to consciousness, as a law which must be dealt with in any discussion of the parameter of consciousness. It is because of this relationship between complexity and consciousness, and the subsequent influence of entropy on both parameters that Teilhard sees the necessity of a transformation which will free radial energy from tangential.

This is not to say, of course, that the theory of irreversibility need be accepted by the physical scientist as a good theory. Acceptance of this theory depends upon an acceptance of hyperphysics itself. Nevertheless, whether it is accepted or rejected it cannot be said to contradict the first and second laws of thermodynamics.

The second major problem is that of Teilhard's

vitalism and Lamarckianism,neither of which is accepted by the scientific community. That Teilhard is a vitalist cannot be denied, nor can it be denied that he showed some Lamarckian tendencies. This is not surprising for vitalism and Lamarckianism are generally associated with orthogenesis. The position that we have taken is that Teilhard's vitalism and his "Lamarckianism" are both consistent within his system, and compatible with modern Darwinian theory. For him, moreover, they are necessary elements of the mechanism of natural selection; and the idea that there must be within beings a creative principle to explain the creative nature of the evolutionary process seems today to be successfully competing with the older mechanistic approach. As has been shown, Teilhard's vitalism is not based on superstition, nor is it a mysterious principle, but rather it is a necessary element of his synthesis. Similarily, his particular use of Lamarck's principle that a new need produces a new organ follows logically from his concept of psychic or love energy. As such they may be rejected on the grounds that hyperphysics itself is rejected, but not because they contradict the

accepted theory of evolution.

Not only is the Darwinian theory respected, it is used by Teilhard as an essential part of his own theory. Certainly his use of a Lamarckian-like principle cannot be attributed to a lack of understanding of Darwin, for it is used only within the context of Darwinian natural selection and chance. Teilhard's Lamarckian-like principle of psychic selection is the creative aspect of natural selection, and the factor that gives evolution true direction.

Teilhard's explanation of evolution in terms of Darwinian chance and the within as a vital principle leads to a reconciliation of chance and design in terms of statistical necessity which may be accepted both by traditional philosophy and modern science. It leads neither to absolute determinism nor to the position that chance is the ultimate explanation of the universe. Purpose is seen in the universe, but possibly more on the phylogenetic than on the ontogenetic level. Teilhard would probably agree with the evolutionist that we see because we have eyes rather than that we have eyes for the purpose of seeing. On the other hand, he would see a more ultimate

and general purpose as the true final cause of eyes, and of all the mechanisms of development. This general purpose would be to produce beings suitable for their total, that is, material and immaterial, environment. Consciousness, or psychic energy, are designed for this purpose.[2]

We may, therefore, conclude that Teilhard's theory of orthogenesis is a consistent and unified theory, based on established facts and theories of modern science, including the laws of thermodynamics and the Darwinian theory of evolution. It is compatible with these scientific theories, contradicting neither the law of entropy nor the principles of natural selection. A study of its principles and method indicates that hyperphysics is not orthodox science. However, there is today some tendency towards 'unorthodox' science. In other words, there is some tendency away from the rigid, traditionally prescribed 'scientific method'. Insofar as this is the case, the hyperphysical theory of orthogenesis may be considered to

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2. This position is very similar to one expressed by Bergson at the beginning of his Introduction to Creative Evolution.

be a good scientific theory.

Before the true value of Teilhard's synthesis is known, much more work must be done within the total context of his hyperphysics. Some suggestions for further research may be in order. A study of Teilhard's concept of psychic energy as an adequate and useful explanation of activity at the atomic and molecular level, and of modern field theory is needed. Further study of the relationship between the two energies at all levels, and especially the independence of radial energy in man could be made, using the results of experiments performed recently with electrocephalograms. The determination of the compatibility of hyperphysics with certain scientific theories not considered here, such as relativity, the uncertainty principle and homeostasis, would throw more light on the scientific nature of hyperphysics. The concept of statistical necessity within the Teilhardian context also deserves more attention.

Whether or not Teilhard's explanation of the mechanism of evolution is of value, one thing is certain:

he has reintroduced human values, specifically love, into the cold, objective, mechanistic universe of the scientist, - a love which comes from his own love of the material universe as created and enlivened by God. Whether or not a person accepts his theories, he cannot study Teilhard without being affected by Teilhard's great love for all of reality, a love which flows from his vision of the transcendental good in all things.

> Ne dis donc jamais, comme certains: "La Matière est usée, la Matière est morte!" - Jusqu'au dernier moment des Siècles, la Matière sera jeune et exubérante et nouvelle pour qui voudra.
>
> Ne répète pas non plus: "La Matière est condamnée, - la Matière est mauvaise!" - Quelqu'un est venu qui a dit: "Vous boirez le poison et il ne vous nuira pas." - Et encore: "La vie sortira de la mort", - et enfin proférant la parole définitive de ma libération: "Ceci est mon Corps."
>
> Non la pureté n'est pas dans la séparation mais dans une pénétration plus profonde, de l'Univers. Elle est dans l'amour de l'unique Essence, incirconscrite, qui pénètre et travaille toutes choses, par le dedans, - plus loin que la zone mortelle où s'agitent les personnes et les nombres. - Elle est dans un chaste contact avec ce qui est "le même en tous."[3]

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3. TEILHARD, "La Puissance Spirituelle de la Matière", (1919), in: Hymne de l'Univers, Paris, du Seuil, /1961/, p. 67.

At a time when there is a strong tendency to degrade the spiritual to the level of physical complexity, Teilhard has elevated matter by presenting it as enlivened by God-given psychic energy which directs it towards its ultimate goal. His synthesis of the physical and the spiritual has had, and should continue to have, a profound and beneficial influence on scientists, philosophers, and theologians. Herein lies Teilhard's true value.

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A. Books

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BARTHELEMY-MADAULE, Madeleine, Bergson et Teilhard de Chardin, Paris, Editions du Seuil, 1963, 686pp. This comparison between Bergson and Teilhard contains a general exposition of Teilhard's synthesis, including sections on orthogenesis, the two energies, finality and the nature of Teilhard's synthesis.

BLANCHARD, J.P., Méthode et Principes du Père Teilhard de Chardin, Paris, La Colombe, 1961, 190pp. This work is a demonstration, in Teilhardian terms, that science can and must lead to God, and through God to Christ. It contains some criticism of Teilhard's method, especially of his use of analogy.

CARLES, J., Teilhard de Chardin, Sa Vie, Son Oeuvre, Paris, Presses Université de France, 1964, 135pp. Contains a biography of Teilhard, an exposition of his philosophy, and some selected texts.

CHAUCHARD, Paul, La Pensée Scientifique de Teilhard, Paris, Editions Universitaires, 1965, 270pp. The author tries to show the scientific aspect of all of Teilhard's work.

CUENOT, Claude, Lexique Teilhard de Chardin, Paris, Editions du Seuil, 1963, 90pp.

Pierre Teilhard de Chardin, Les Grandes Etapes de son Evolution, Paris, Plon, 1958, 489 + LIIIpp. This is an excellent biography of Teilhard with an analysis of his thought development. Many quotations from Teilhard are used. Contains the most complete bibliography of Teilhard's works to date. English translation: Teilhard de Chardin, translated by V. Colimore, edited by R. Hague, Baltimore, Helicon Press, 1965, vi + 492pp.

Teilhard de Chardin, Paris, Editions du Seuil, 1962, 191pp. Contains texts of Teilhard with commentaries, biography, bibliography and vocabulary.

CUYPERS, Hubert, Pour ou Contre Teilhard, Paris, Editions Universitaires, 1962 (Volume 4 of "Carnets Teilhard"), 59pp. - includes brief criticisms of Teilhard's science, philosophy and theology.

Vocabulaire Teilhard, Paris, Editions Universitaires, 1963, (Volumes 5 and 6 of "Carnets Teilhard") - a lexicon of Teilhardian terminology with references to his works.

de WESPIN, Dominique, (general editor), Carnets Teilhard, (in sixteen volumes), Paris, Editions Universitaires /1962-1964/. A series of short works by a wide variety of authors on a wide variety of topics.

DUROUX, Paul-Emile, Histoire Naturelle de l'Humanité Selon Teilhard, Paris, Editions Universitaires, 1964, (Volumes 13 and 14 of "Carnets Teilhard"), - a brief account of Teilhard's theory of the evolution of man.

FRANCOEUR, Robert T. (editor), The World of Teilhard, Baltimore, Helicon Press, 1961, 208pp. A general critique and analysis of Teilhard's world by scientists, philosophers, psychologists, theologians, etc. such

as Weigel, Stern, Barbour and Bruns.

GRENET, Paul, Teilhard de Chardin, The Man and his Theories, translated by R. A. Rudorft, London, Souvenir Press, 1965, 176pp. - contains biography and some discussion of Teilhard as a scientist, theologian and philosopher. Also contains some selected writings of Teilhard.

GRENET, Paul-Bernard, Pierre Teilhard de Chardin ou Le Philosophe Malgré Lui, Paris, Beauchesne, 1960, 258pp. A critique of Teilhard's "philosophy" with specific sections on the "weakness" of his concept of The All, of his use of analogy, of his notion of novelty, of his concepts of matter and spirit, and of his notion of being.

MAGLOIRE, George, and CUYPERS, Hubert, Présence de Pierre Teilhard de Chardin, Paris, Editions Universitaires, 1961, 226pp. Contains a biography of Teilhard and an analysis of his thought; also a lexicon and bibliography.

MONESTIER, MISRAKI, et al., Pour Comprendre Teilhard, Paris, Lettres Modernes, 1962, 111pp. An introduction to Teilhard's thought with a lexicon and bibliography.

RABUT, Olivier, Dialogue Avec Teilhard de Chardin, Paris, Editions du Cerf, 1958. This is a critique of Teilhard, mainly from a scientific viewpoint. It contains interesting comments on Teilhard's methods, his use of the theory of evolution, his panpsychism and his concept of the two energies.

RIDEAU, Emile, La Pensée du Père Teilhard de Chardin, Paris, Editions du Seuil, 1965, 590pp. This is a very complete account of Teilhard's synthesis containing some material on all of the main topics considered in this thesis.

THYS, Albert, Conscience-Réflexion Collectivisation chez Teilhard, Paris, Editions Universitaires, 1964, 127pp. (Volumes 15 and 16 of "Carnets Teilhard"). This is an analysis of Teilhard's theory of the development of consciousness and the noosphere.

TRESMONTANT, Claude, Introduction à la Pensée de Teilhard de Chardin, Paris, Editions du Seuil, 1956, 134pp. English translation: Pierre Teilhard de Chardin, His Thought, translated by S. Attanasio, Baltimore, Helicon Press, 1959, viii + 128pp. This is a general introduction to Teilhard's thought. Containing a good analysis of his principle of coherence, auto-evolution and the nature of his works.

B. Articles

BARTHELEMY-MADAULE, Madeleine, "Teilhard de Chardin Neo-Marxism, Existentialism: A Confrontation", in International Philosophical Quarterly, Vol. I, No. 4, p. 648ff. This article contains some material on the philosophical dimensions of Teilhard's works.

BRUNS, J. E., "God Up Above, or Up Ahead", in Catholic World, Vol. 191, No. 1, 141, p. 23. Father Bruns agrees with Tresmontant that scientists disapprove of Teilhard because the specialist working on the microphenomenon can't grasp the validity of work performed on the macrophenomenon, and says that this may apply to theologians too. He agrees also with Cuénot's statement with reference to Teilhard that "the great line of the prophets of Israel is not dead".

CHENEY, Brainard, "Has Teilhard de Chardin Really Joined the Within and the Without of Things?", in The Sewanee Review, Vol. LXXIII, No. 2, p. 217ff. In this article the author presents some scientific evidence for the claim that Teilhard's theory of purposeful evolution is itself scientific.

DONCEEL, Joseph F., "Causality and Evolution: A Survey of Some Neo-Scholastic Theories", in The New Scholasticism, Vol. XXIX, No. 3, 1965, p. 295ff. This is a discussion of the problems of causality, specific differences and creation within the context of the modern theory of evolution, with special reference to the thought of Teilhard and Karl Rahner.

"Teilhard de Chardin and the Body-Soul Relation", in Thought, Vol. XL, No. 158, 1965, p. 371ff. The author compares Teilhard's thought on this problem with that of theologians such as Tahner, Troisfontaines, and Schoonenberg, suggesting that the union of Plato's soul-as-spirit and Aristotle's soul-as-form is not completely satisfactory, and that Teilhard's theory may help to clarify this problem.

"Teilhard de Chardin: Scientist or Philosopher?", in International Philosophical Quarterly, Vol. V, No. 2, 1965, p. 248ff. In this article Father Donceel states that there are, as Teilhard states, two levels of explanation, but says that the scientist as scientist cannot consider both. Teilhard was both scientist and philosopher.

ELLIOTT, F. G., "The World Vision of Teilhard de Chardin", in International Philosophical Quarterly, Vol. I, No. 4, 1961, p. 620ff. This is an excellent introduction to Teilhard's thought, with some comment on its nature.

ERNST, C., "Another View of Teilhard", in Clergy Review, 1961, p. 223ff. This is a criticism of Teilhard which states that he was neither philosopher nor theologian and that he violated or distorted these disciplines.

FORSTHOEFEL, P.F., "Beneath the Microscope", in The World of Teilhard, pp. 98-114. This is a very interesting analysis of Teilhard's explanation of evolution in which the author insists that it is based on

Lamarck's principle of the inheritance of acquired characteristics.

FRANCOEUR, Robert T., "A New World Vision", in The World of Teilhard, pp. 7-23. This introduction to The World of Teilhard by its editor gives, along with a general outline of his theory, an interesting analysis of the nature of Teilhard's thought.

GARRIGAN, Owen W., "Chemical Evolution", in Teilhard Conference Proceedings, New York, Fordham University, 1964, p. 23ff. This article contains a discussion on the evolution of the inanimate universe and the origin of life, with some interesting comment on and criticism of Teilhard's synthesis as a scientific work.

O'CONNELL, Robert J., "Teilhard's Synthesis: Some Criteria for Criticism", in Teilhard Conference Proceedings, New York, Fordham University, 1964, p. 1ff. This work contains a section on homogeneity and coherence and some mention of the law of entropy and the scientific nature of hyperphysics.

RUSSO, François, "The Phenomenon of Man", in America, Vol. 103, p. 185ff. A general commentary on Teilhard's theory as presented in The Phenomenon of Man with some criticism of his use of the theory of evolution.

SIMPSON, George Gaylord, "On the Remarkable Testament of the Jesuit Paleontologist Pierre Teilhard de Chardin", in Scientific American, April 1960, p. 201ff. This review of the English translation of Le Phénomène Humain, is partly complimentary, but especially critical of Teilhard's theory of orthogenesis.

STOCK, M., "Scientific vs. Phenomenological Evolution: A Critique of Teilhard de Chardin", in The New Scholasticism, 1962, p. 368ff. A critique based mainly on The Phenomenon of Man and centred around

the notion that Teilhard made the hypothesis of evolution a dogmatic presupposition of his theory.

Univers 1, Convergences, Publication annuelle de la Société Teilhard de Chardin, Actes du 3° Symposium International Pierre Teilhard de Chardin, Desclée De Brouwer, 1964, Introduction by Dominique de Wespin. This is a series of articles on the theme of Teilhard's theory of convergence. Of special interest to this thesis are:
LEYS, R., "Convergences"
LINSSEN, R., "Mystères Atomiques et Spiritualité de la Matière"
MEYER, F., "Les Obstacles à la Convergence"
HUXLEY, Sir Julian, "L'Avenir de l'Humanité par la Convergence des Races Humaines".

TOULMIN, Stephen, "On Teilhard de Chardin", in Commentary, Vol. 39, No. 3, 1965, p. 50ff. This criticism of Teilhard's concept of orthogenesis and psychic energy is based only on The Phenomenon of Man, and The Future of Man (English translations) and especially on an early text (1920) from the latter. See also Commentary, Vol. 40, No. 2, for letters in reply to the above article. (p. 6ff).

WALLACE, W.A., "The Cosmogony of Teilhard de Chardin", in The New Scholasticism, 1962, p. 353. This general explanation of Teilhard's theory as contained in The Phenomenon of Man states that at best Teilhard is proposing a theoretical view of the physical universe that is based upon a hypothesis.

THESIS ABSTRACT

The Theory of Orthogenesis
in the Synthesis of Teilhard de Chardin

by

John Thomson O'Manique

Modern physical science presents the picture of a dynamic continuously developing universe, and gives some explanation of the physical mechanism of this development. The general theory of evolution explains the emergence of more complex beings in terms of the accidental collocation of elements. Since, however, the formation of a more complex arrangement of elements requires energy, and the amount of available energy in the universe is limited, the evolutionary process cannot continue indefinitely. According to the law of entropy, the development of physical complexity will eventually stop due to lack of available energy, and the universe will regress to its least complex state.

Accordingly, the positivist, who believes that the complete explanation of reality is found within the empirical sciences, sees the universe as a purposeless, accidental

development which will ultimately end in ruins. Man himself is thought to be a chance occurrence within the evolutionary process, and has no future apart from the fate of the physical universe of which he is an integral part.

Teilhard de Chardin could not accept the position that the universe is purposeless, nor the associated forecast of doom. As a scientist he accepted the established facts and theories of modern science, while as a Christian he believed that man could achieve a final state of perfection in union with his Creator. Not satisfied with merely attempting to reconcile these two poles of knowledge, Teilhard built a theory of orthogenesis upon scientific foundations which leads to the same conclusion about man's destiny that he accepted through his Faith.

Teilhard's theory of orthogenesis is not strictly empirical science. It is based on modern scientific theory, but is expanded to include more than presently is considered by the physical scientist. This expanded science is called <u>Hyperphysics</u> by Teilhard, and is founded on the conviction that, coextensive with the continuous axis of complexity that is presented by the general theory of evolution, there

is a continuous axis of consciousness. He maintains that the universe as it exists today is the result of a continuous development of complexity-consciousness, and that this is the most coherent, and consequently the truest explanation of natural phenomena.

In conformity with the modern theory of evolution, Teilhard's theory does not hold that all development follows an absolutely determined path. Instead, it takes the position that within the complex pattern of the evolutionary process there is a principal axis, which is more or less directed towards the development of more perfect consciousness. This directed development is shown to be irreversible, and to culminate ultimately in union with the transcendent cause of all development, Omega. The arguments in favor of this theory are derived from the hyperphysical principles, although the conclusions reached coincide with Teilhard's belief as a Christian.

Two major problems immediately emerge from Teilhard's theory. First, the physical law of entropy would seem to preclude the possibility of presenting a theory of orthogenesis that is in any way scientific. Secondly, the Darwinian theory

of evolution is considered to be incompatible with the Lamarckian and vitalistic elements which are associated with orthogenesis. Before the value of Teilhard's theory of orthogenesis can be determined, these apparent conflicts must be studied.

With regard to the first problem concerning entropy, Teilhard recognizes and respects the laws of thermodynamics throughout. Indeed, his own theory is, to a great extent, determined by these laws. He defines energy in terms of entropy, and insists that if evolution is to continue there will have to be a radical transformation whereby consciousness will finally escape from the second law of thermodynamics It is through his analysis of the parameter of consciousness, not complexity, that Teilhard is lead to the conclusion that this radical transformation will take place.

The second major area of conflict is, between Teilhard's Lamarckianism and modern Darwinian theory. Once again, however, the conflict is only apparent and disappears under further study. Teilhard understands the accepted theories of evolution and is well aware of the rejection of Lamarck's principles. In spite of the accusations of some authors,

Teilhard does not use Lamarck's principle of inheritance of acquired characteristics. He does use the Lamarckian law that a new need produces a new organ, but he uses it in a phylogenetic sense rather than in the original ontogenetic sense. Furthermore, it is used within the context of Darwinian natural selection and chance. The existence of a new characteristic is explained in terms of the theory of accidental mutations, but the retention of the new characteristic within the species is explained in terms of psychic selection. In other words, the new characteristic will be maintained in the species only if it is needed, and 'recognized' as beneficial. This selection is brought about by the affinities and the awareness which find their source in the within. Psychic energy is, therefore, the active and creative agent in natural selection, and the creative capacity of natural selection is accepted by modern evolutionists

The compatibility of Teilhard's theory of orthogenesis with the aforementioned theories of modern science does not, in itself, make his theory scientific Teilhard decidedly goes beyond the limits of a strictly empirical science in both object and method, and moves into the realm of philosophy

If, however, a less rigid view of empirical science is taken, the position that Teilhard's theory is good science may be upheld. In fact, many today think that a less rigid, more unorthodox scientific method is necessary for further development in the empirical sciences Anyone who holds this position will recognize the value of Teilhard's hyperphysical theories as an aid to this further development