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The Origin of Living Things, by Julius Seiler, translated by Gerard Farley

Gerard Farley
Fordham University, gfarley@fordham.edu

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Translators Note

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The attached article by Julius Seiler is a reflection on the role of design and purposefulness in the emergence of the first living beings from inorganic matter.

Seiler’s arguments and the evidence he brings to bear in supporting them constitute in a modern context Aristotle’s contention in the first book of his Metaphysics that a proper understanding of living things cannot be achieved without reference to design and finality.

Seiler, like Aristotle, does not deny the role played by matter (material cause) and mechanical action (efficient cause). All four causes are for Seiler, as they were for Aristotle, necessary for a full explanation for the phenomenon of life.

This essay is relevant to current discussions on the role of design and purpose in nature.

Gerard C. Farley, Ph.D
Adjunct Assistant Professor
of Philosophy
Fordham University
A SHORT TIME AGO, the South-German Radio Network presented a series of discussions among leading specialists on the origin and development of living things from the points of view of biology and theology. These talks have now appeared in book form under the title, The Belief in Creation and the Theory of Evolution, A Series of Discussions.¹

The reader of the book is pleasantly affected by the mutual respect which the participating theologians and scientists show one another despite their many differences; this mutual respect is especially apparent in the highly informative concluding discussion which is almost entirely devoted to the question of the origin of the first living beings. Theologian Günther Bornkamm noted that it was generally a “refreshing relaxation of the battle-lines” between the natural sciences and theology, “an overall openness which our forefathers would not have believed possible.”²

The participants in this concluding discussion were completely clear as to the difficulty of the question posed by the emergence of the first living beings. The controversy revolves around the problem of whether the first simple organisms may be understood to have emerged from combinations of atoms and molecules according to purely natural laws or whether their explanation involves the adoption of “higher laws.” No unanimous opinion was reached. One scientist presented the view: “We have no reason to believe that it is necessary to have recourse to anything but physico-chemical laws.”³ Another scientist believed that the decisive transition to a self-propagating protein molecule and from there to the first living beings may have been accomplished through a “quantum leap,” i.e. through a micropysical process.⁴

This question concerning the causes of the first living beings was sharply formulated, but its answer left something to be desired; chiefly because not all apparently were clear as to what precisely required clarification. To some of the scientists it seemed obvious that living things are to be considered as no more than complex chemical structures; therefore they sought an explanation of the transition from simplicity to complexity. It is our conviction that only a person who grasps the organism as purposeful, i.e. as an intricate purposeful order, can see what truly requires explaining here. A living thing is not merely a complex chemical organization on a higher plane than the simpler chemical compounds. It manifests an orderly plan to a degree that is absolutely unfathomable to us. This conviction is not an abstract theory founded on a “world-view.” It is, rather, contained in the biological data and therefore is a scientifically ascertained fact, even if its recognition involves trespassing into the fields of physics and chemistry. This decisive teleological element, which was not fully appreciated in the discussions, throws the question of spontaneous generation into

Father Julius Seiler is a member of the Missionary Canons of Bethlehem, and teaches philosophy in their seminary at Immensee, Switzerland. His article appeared in THEOLOGISCHEN QUARTALSCHRIFT (IV, 1957). A previous essay, "Modern Physics and the Theory of Matter and Form," was printed in CROSS CURRENTS (Winter 1954).
an entirely different light. We believe therefore that the time is ripe to review once again the question of the origin of the first living beings from the standpoints of contemporary biology and philosophy.

1. The Problem

It goes without saying that this question as to the origin of the first living beings is of paramount importance. While thinkers who believe in God see a clear proof of a higher power in the very phenomenon of life, those who hold the opposite position take great pains to explain it solely in terms of natural law. The elucidation of that not entirely unfathomable mystery we name organic life stands today, and has stood previously, at the very center of the biological sciences. Therefore it is the serious responsibility of any thinker treating this question not to be led by personal expectations but by a peaceful evaluation of the factual arguments.

Biologists and philosophers have given three essentially different answers to the question. One view holds that life arose without any influence from a higher cause; a second view holds that life was created in time by God. The third and final view maintains that life has existed from eternity without beginning, i.e. it is as old as matter itself. The so-called pan-sperm or cosmic-life theory, according to which life existed originally on other heavenly bodies and subsequently arrived on earth, says nothing new about the beginning of life and does not constitute an independent theory to be placed beside the other three. This belief in an extra-terrestrial origin of the first living cell is burdened with great difficulties and has been rejected recently by authoritative biologists. Gerhard Heberer renders the contemporary view of this theory in the following words: "Today we can give only an historical value to this theory, since we know that ultra-violet rays alone would have killed a living cell that might have freed itself from another heavenly body. Secondly, it seems that the age of the earth is the same mathematically as the entire known cosmos; and finally, life has a character that is peculiar to the earth." It is also known that the age of the chemical elements which form the basis of organic life runs to about five billion years. According to the laws which hold for the disintegration of radioactive elements, the age of the earth-crust is somewhat more than three billion years. The age of living things certainly cannot be greater than these periods of time. In view of these considerations, contemporary biologists exclude the theory of the "eternal" existence of life.

Having thus eliminated the "eternity" theory there remain for further scrutiny the hypothesis of spontaneous generation and the theory of creation. Special attention will be given to the virus theory, a special form of the theory of spontaneous generation, and its implications for the frequently asserted possibility of the artificial production of living things.

In order to be in a position to make a sound judgment on this difficult question, we must first ask what life is. Or, to express it more precisely, we must first ascertain what are the characteristic signs of life. It must be asked: Is life made in such a way that natural factors, i.e., physico-chemical laws, suffice to explain its origin, or must life be unequivocally understood as a reality which calls for the co-operation of a higher intelligent cause? Before a decision can be made, it is necessary to view a few peculiarities of living things more closely, especially those relating to their purpose, that is, to view them in their teleological aspect.
2. Observations on Teleology in the Organic Realm

It is not necessary to present extensive evidence here for the existence of teleology. This would be impossible within the limits of such a short piece. I shall merely refer to the very rich literature on the subject. Many older and even a few recent writings on organic teleology are not entirely unobjectionable since their arguments on behalf of final causation are due to their own temporary deficiencies in physico-chemical knowledge.

We do not intend to present solitary instances of the existence of a purposeful order; instead we shall present a few general considerations of decisive importance. The average non-specialist in biology is aware of a few special purposive relations. The fact to which biologists refer as “co-relation” is decisive: it consists in the ordering to one another of the various organs in such a way that they correspond to a plan which seems to have been previously planned down to the smallest detail. This observation, however, shows us only individual ideological features—teleology in a potential form.

It is well known that mechanistically oriented representatives of the theory of evolution seek to explain purposefulness in terms of mutation and natural selection. Against this view, one can simply point out certain “special forms” of purposiveness in view of which any mechanistic explanation becomes absurd. We refer to the so-called “usefulness to others” or to primary purposefulness. Erich Becher calls this “usefulness to others” a peculiar, unilateral relation of service from one type of organism to another, (e.g. the relation between certain insects and gall-forming plants). In these cases the host plant is endowed with the ability to form organisms which are astoundingly well suited for the parasites, and which offer them shelter, protection and nourishment without return for their services. Such an “altruistic” relationship would have been eradicated by natural selection.

Gustav Wolff gives the name “primary purposefulness” to the strikingly purposeful behaviour of organisms, which, when placed in a situation of stress, never experienced by their predecessors, nevertheless liberate themselves without effort or hesitation. Wolff reports one such case (the subsequent regeneration of the eye-lens of the salamander; the lens was artificially removed while the other was spared), and he remarks: “The publication of the phenomenon of regeneration caused a bad nightmare for prevailing biology.” This case embarrassed the defenders of the theory of natural selection, according to which natural selection may be thought of only in those dispositions and forms which had involved numerous advantages for the forebears of the subject in question.

In view of the ideas and plans realized in the organic world, it is quite justifiable to speak of nature as a designer (we do not mean an impersonal nature, but rather the higher power which is revealed in it). The purposeful construction and activity of living beings is analogous to the way human beings purposefully combine the characteristics of matter and the laws of nature and use them to meet their needs. Purposefulness reveals the existence of an incomparably deeper knowledge of the laws of nature and of matter—a knowledge which moreover deals with its object in a spirit of free play. Laws which the physicist discovers at first cursorily and which he then probes and validates technically with infinite difficulty, to our astonishment, have already stood at the service of various purposes in organisms for millions of years. This inventiveness
shows itself, among other things, in an especially impressive way in the adaptation of many living beings to extreme environmental conditions (heat, cold, climate, enemies, predators, abnormal pressure, the darkness of the deep sea, etc.).

The history of evolution reveals an entirely new view of teleological reality; it seems that the basic plan or at least the characteristics of the basic plan which organisms have run through in their past must have been purposefully worked out down to the smallest detail. By convergence we refer to the phenomenon of distinct and widely separated species systematically and independently developing similarly constructed organs. It might be mentioned in opposition to this observation that similar tasks are mastered by various species with a copious variety of differing means. Just think of the plenitude of attack and defense weapons at the disposal of various organisms.

Teleology appears under still another aspect in the instinct of animals. Although in this instance it would not include the capacity for thought, it does include purposeful consciousness. It is not without reason that animal psychologists seek out the "purposes" of instincts, and in those cases where instinct seems to lack a purpose, the method for determining a purpose is to search for a possible purpose at an earlier stage of evolutionary development. Although contemporary literature on organic teleology speaks of human and brute consciousness as being "borne" by organic structures and processes, it neglects the consideration that these very structures and processes themselves are loaded with innumerable purposeful aspects. It suffices to think of the many disturbances of consciousness that rest on organic causes.

Purposefulness is usually considered inasmuch as it is directed toward the usefulness of an individual or a species. This "teleology of usefulness," however, is only one manifestation of a higher intelligence within the organic realm. Over and above the standpoint of utility, nature displays a super-experimentation with ideas and aesthetic forms; in certain areas she reveals herself to be a genuine artist. This significant experimentation is at times indifferent from the standpoint of utility; at other times it is clearly disadvantageous to both the organism and the species. For this reason an explanation of this phenomenon in terms of natural selection cannot stand.

Only a biological specialist is in a position to survey the multitudinous goals revealed within nature, and to anticipate the wealth of means adapted to them. And even such a specialist is constantly reminded that he is at most a modest beginner. The biological sciences reveal the wonder of organic purposefulness in a measure which overpowers all conceptions.

An impartial observer of organic life is most deeply impressed by the abundance of ideas and by the dynamic fantasy which surpasses itself endlessly in new plans and in the realization of new goals. The reality of underlying purposes and the reason which sustains them is manifest to any impartial judge. The precise inter-relation of these causal and final factors, however, remains hidden in darkness.

One of the participants in the discussion mentioned above expressed the view: "So long as the question under consideration remains purely physical, a 'higher order' can be spontaneously developed from the 'lower order'." Prescinding from the fact that the concept of "order" as it is used in this statement is entirely too vague, we hasten to point out that by restricting the question to physical events, the teleological order
and with it all that is essential to life is completely overlooked. Although ob-
servation of physical phenomena is cer-
tainly justified, it cannot contribute to
the question of the origin of the teleo-
logical order. It would seem that the
crus of the matter is to be found in a
discussion of the problem of spontane-
ous generation.

One might object to these considera-
tions by saying that the theme under
discussion is not our contemporary, fully
developed organic world, but the emer-
gence of those first, very primitive living
beings which presumably would have
shown no teleological features to a con-
temporary human observer. This objec-
tion may be answered immediately by
the consideration that those who uphold
the theory of spontaneous generation do
not admit to any subsequent introduc-
tion of a teleological order when deal-
ing with the higher development of the
original organisms. Biologists agree that
the fully developed teleology of today
was already present in the first organ-
isms. Even if the minuteness of the struc-
tures involved in the micro-organismic
world (which would include the first
living beings) sets a limit to our ability
to determine its nature, experts never-
theless agree that finality itself goes be-
yond this limitation to that which can
be observed, and is indeed a sign of
living things themselves. These observa-
tions on the purposeful order of contem-
porary organisms would merely bring to
light something which lay hidden in the
darkness of these minute structures
many ages ago. Only this viewpoint will
allow us to see the teleological disposi-
tions inherent in them.

As far as the remaining positions
which deny finality are concerned, it ap-
pars that they deny either the existence
of teleology or the possibility of proving
it with certainty, or, finally, the ability
to trace it back to a higher intelligence.
All of these positions are based on phi-
losophies and not on fact. They cannot
be overlooked because of the often-re-
peated comment that things often do,
in fact, exhibit a real or apparent lack
of purpose. So long as life itself remains
a great mystery for us, no one can ex-
pect to see all the goals of living nature.
Apparent exceptions to a law of pur-
pose, however, often reveal themselves
to a higher viewpoint as a well-ordered
striving for other goals. Exceptions to
purposefulness can also be explained by
the presence of certain blind factors as
well as a higher intelligence; the former
cause matter to prove obdurately op-
posed to certain intelligence.

Anyone who wants to explain the ap-
ppearance of the first living beings must
make the actuality of the purposeful or-
der understandable or else he will have
by-passed the real question. And purpose-
ful order of the proper dimensions can
have its basis only in a supernatural in-
telligent Being, Who, in the final analy-
sis, is identical with God.

3. The Hypothesis of
Spontaneous Generation

S
pontaneous generation generally re-
fers to the first appearance of a liv-
ing thing not derived by propagation
from living forefathers. If one uses the
term in this broad sense, it has three
possible interpretations: one is that liv-
ing things have been created by God;
the second states that they have evolved
through the operation of physico-chemi-
cal laws, and the third believes that
they can be produced artificially by man.
In practice, however, the term “sponta-
neous generation” is understood almost
exclusively as the emergence of organ-
isms as purely natural events, i.e. as
events determined solely by natural laws.
These events must be viewed as the re-
sult of chance or a sequence of chances.
The older champions of the theory of spontaneous generation (Huxley, Haeckel, Nägeli and others) postulated, in a rather vague form, that simple and later more highly organized living things formed themselves out of non-living matter. The contemporary advocates of this theory take pains to discuss this alleged “formation process” in close conjunction with present knowledge of chemical processes. They ask the question: “How could organic chemical matter have arisen from inorganic matter on the earth’s surface without the co-operation of living beings? They refer especially to the emergence of those two types of matter which are characteristic of living things, protein and the acids of the nucleus.” They also raise the further question of how protein can possibly propagate itself: this is most important because the self-propagation of protein is decisive in the formation of living beings. The advocates of spontaneous generation concede in all these debates that the question involves an uncertain groping. Bernard Rensch, an outspoken champion of the theory, makes the following observation: “The answer to this question, of great importance to philosophy, takes us outside the realm of biology. In any case an answer cannot be definite, for the relevant research is now in a period of lively development, and the foundations must be laid for much that is still hypothetical.”

An original suggestion was made by the Russian scientist A. J. Oparin. He rejects the theory of spontaneous generation held by western biologists who state that the first living things emerged suddenly at a definite point in time, since it cannot accord with dialectical materialism. Oparin suggests that life developed in a slow continuous process as a “special form of existence of matter in motion.”

The metaphysical position underlying the thinking of the majority of the representatives of the hypothesis of spontaneous generation is reflected in the following words of Gerhard Heberer: “No matter how you turn and twist the problem of spontaneous generation . . . it cannot be denied . . . At a definite point in time, the process which we call life must have begun. Spontaneous generation is and remains a ‘logical postulate,’ and biology agrees with Nägeli that to deny spontaneous generation is tantamount to proclaiming miracles. Thus the stages which eventually led to the emergence of the life-process may not be thought of as falling outside the general laws of nature.”

The firm a priori expectation that the cleft between the inorganic and the organic will be bridged in a purely natural way, i.e. without any creative influence, is clear in all these remarks. Spontaneous generation, as its advocates ever reaffirm, is not based on the propensity “to proclaim miracles.” Whoever admits miracles must also admit an extra-mundane creator. An unbiased position towards this momentous question would at least have to leave open the possibility of the creation of the first living organism.

Heberer’s assertion in the passage above that the emergence of life “may not be considered as beyond the limits of natural law,” may be countered by the statement: “The law for the emergence of a living being is: Omne vivum a vivo.” This proposition is just as much opposed to spontaneous generation as it is to the theory of creation. The teleological order which a theory of the emergence of life would have to explain is completely overlooked; how, therefore, can Heberer maintain his unreserved assertion that “all contemporary biologists recognize spontaneous generation.” At the present time there are quite a few leading biologists approaching this ques-
tion, without any preconceived opinions, who reject the theory of spontaneous generation and who are not at all disturbed by the consequences of this rejection.

The well-known specialist Ludwig von Bertalanffy says: Only one thing can be said about spontaneous generation by chance. "The emergence of life from an interplay of inorganic forces, compared with which the emergence of an automobile from an iron mine would be a trifle, simply could not have occurred. The Darwinian phrase that only the fittest of the many possible combinations would survive does not help at all for the simple reason that a 'struggle for existence' could have started only when those mechanisms, doomed to this deadly combat, were already in existence." 17

Among those most competent to deal with this question is Herman Staudinger, professor of chemistry at the University of Freiburg im Breisgau, and recipient of the Nobel prize in 1953 for his pioneering discoveries. His special area of research is macro-molecular chemistry, the chemistry of large molecules, (i.e. those carbon units whose molecular weight is over 10,000 and which therefore consist of somewhat more than 1500 individual atoms. The substances of primary importance for living beings belong to this group.)

Staudinger takes this attitude to the problem: "As a result of the broader development of the natural sciences, we are now at a turning point which forces us to revise our concept of spontaneous generation . . . [We must] return to the standpoint . . . that only a living organism is capable of producing its own macro-molecular substrate. Even if we should achieve a synthesis of individual macro-molecular substances, we will not thereby have produced a living organism any more than we could produce a building of a particular architectural style by chance placement of millions of different building materials. Just as the construction of such an edifice is the result of an ordering mind, it must be supposed that the disposition of elements for the macro-molecule of protein or indeed for the emergence of a living being is much more than a contiguous play of forces.

"That which happens so regularly cannot have chance as its basis. The prevailing unifying order in organic nature is subject to law in the highest possible degree, since that which evolves as living is not merely a spatial whole like a crystal; rather it is a functional whole. If this complexity in the construction of living matter is kept before one's eyes, the conception of a simple spontaneous generation of living matter from inorganic material . . . no longer remains tenable." 18 Thus the hypothesis of spontaneous generation does not find support in the results of contemporary biology.

For reasons quite different from those of the mechanistically oriented biologists, E. Ginter believed a few years ago that he should adopt the theory of spontaneous generation in order not to have to attribute the disharmony in the organic realm to God. He writes: "Today the possibility is seen of explaining even this event (the emergence of living things) in terms of purely natural laws. Once this is assumed, God is no longer the immediate author of present organic forms and their living activities and thus is not responsible for the disharmony in their life: for example, the lack of mercy in the life of predators." 19 Unfortunately this reasoning is not valid since Ginter attributes the purposeful order of things to chance. If he is referring to the advanced development of all presently living organisms, then it goes without saying that within the context of
our present discussion, God is not their "immediate author."

4. Artificial Production of Organisms

Once it has been settled that living things do not evolve spontaneously, the question then arises whether man might be able to produce such beings artificially. If the chemist were successful, then it might be possible that the same combination of substances which man brings together to produce life might at one time have come about accidentally; thus at least the possibility of spontaneous generation would be established.

The possibility of the artificial production of life has been constantly affirmed during the past few decades. The great biologist Roux himself thought seriously of it. Oparin observes: "At the beginning of our century many authors went so far as to assert that they had succeeded in producing life artificially... The artificial construction of life, the synthesis of living things, appears indeed as a distant, but nevertheless completely attainable stage on this path." Alexander Nilitschek expresses the view: "Perhaps in the next few years a scientist will be successful in a laboratory experiment... i.e., under the strictest control, in actually producing a living being from non-living substances and thereby answering the question of spontaneous generation with which mankind has so concerned itself for centuries." If all the statements on the artificial production of living beings made during the course of the last few decades are examined, it can be seen that, with the progress of research, they become ever more modest in their tone.

It is not surprising that the advocates of the theory of spontaneous generation and the mechanistic view of life hope for the artificial production of living matter. The fact is nevertheless that life as such and the processes of life have remained an impenetrable mystery right up to the present day. The artificial production of organisms would assume that the mystery of life has been solved and the secret of organic processes and structures has been disclosed. But how do leading biochemists view this question? Tadeus Reichstein, professor of chemistry at the University of Basle, who was awarded the Nobel prize in 1950, writes: "As of today, a living being has never been produced artificially. I hold the probability that it will happen extremely small." Paul Karrer, professor of chemistry at the University of Zurich, distinguished with the Nobel prize in 1937, writes: "Modern research has not even begun to show the possibility of artificial production of living cells." The chemist Paul Müller of the Ciba in Basle, whose synthesis of DDT was rewarded with the Nobel prize in 1948, observes somewhat more extensively: "So much is certain... that we are quite far from the production of artificial cells, much less the production of artificial living organisms. The mystery of the production of a new organism is something so marvelous that we pitiful denizens of the earth can only confess abashedly that we do not understand it. Overconfident scientists appear to me like little children who can break down a machine into its smallest parts. When they want to put it together again, that's quite a different story. They have not understood the mysterious force which drives the machine." The Freiburg chemist Staudinger expresses himself on this question in the following words: "Chemical understanding has grown in its knowledge of living beings (i.e. we presently understand more complex processes than we did previously) and at the same time, we have been forced to
withdraw from the mechanistic postulate of synthesis in a test tube."25

An objection might be made to these statements since their denial of the possibility of artificial production of life is based exclusively on our present knowledge. How will future research judge it? Such thoughts are silenced as soon as one thinks of the great caution expressed by unbiased scientists doing research in the field. This apparent timidity is the expression of our complete lack of knowledge and of our perplexity in regard to deeper biological laws. Therefore, as Paul Müller in the letter above so openly admits, even the greatest scientist can only stammer like a child when speaking of the ultimate mystery of life.

If in spite of all these indications, we still wish to assume that the synthetic production of the smallest living beings is possible, what would success in this area mean for the theory of spontaneous generation? Even if man should succeed, it would not mean that the theory of spontaneous emergence was established. It would only mean that man, by a singular achievement of his intelligence in well-planned experimentation, had been able to pass on the life he himself already possessed. If one were to conclude from an artificial production of organisms by man that the spontaneous generation of life had occurred without benefit of a planning intelligence, one would have to assume that the collective intellectual achievements of mankind, ranging from the invention of simple machines to automatic adding machines and on to the creation of the Beethoven symphonies might also have emerged by chance. No reasonable man would dare draw this conclusion, for life is more than a complex structure of elementary particles.

5. Are Viruses Intermediary Substances in the Spontaneous Generation of Life

A further possibility of proving their case has presented itself in recent decades to the advocates of the theory of spontaneous generation—viruses. An examination of this possibility leads us to ask what are viruses and how do they stand in relation to the spontaneous generation theory?

During the past century a successful search was made for the agents underlying many contagious diseases: these agents are microscopically small one-celled living beings, the notorious bacilli and bacteria. Despite zealous research, however, the agents underlying other contagious diseases were not discovered. It was conjectured, therefore, that they were so small as to remain unobserved even by the most powerful microscopes. They were called viruses, i.e. poisons. A great number of virus types have been discovered within the past thirty years by the electron-microscope which permits an enlargement a hundred times greater than did the light microscope. The newly discovered viruses exhibited tiny particles which were more simply constructed than any previously known microcosmic living beings. They appeared at first glance as intermediaries between lifeless matter and micro-organisms. For this reason many biologists believed that they could appeal to viruses as intermediaries in the spontaneous generation of life. This "virus theory" is thus a special form of the theory of spontaneous generation.

There have been many memorable results of virus research. Several hundred types of virus are recognized today as underlying agents of certain diseases. They are named after the diseases they cause: hoof and mouth disease, infantile paralysis, influenza and jaundice, to
name some of the best known. The virus particles attain a size of only a ten-thousandth to a hundred-thousandth of a millimeter in diameter. They share with living beings the ability to propagate themselves and the ability to mutate. By mutation we mean a sudden change in patrimony which persists and is manifested in succeeding generations. Viruses are composed of protein and the acids of the nucleus as are the chromosomes of truly living beings. Unlike living beings they do not breathe and they undergo no change of matter. Furthermore, viruses which attack plants can form crystals. Fundamentally, viruses differ from the microcosmic life we have known hitherto because they are able to breed only in living tissue.

How then do they multiply and propagate themselves? Authorities in the field believe that virus particles penetrate the living cells of plants and animals and cause these cells to produce similar virus particles: They insert themselves spontaneously into the reduplicating processes and utilize them for their own good. The cells of the invaded plants and animals respond to the lure of the viruses by bringing forth from their own substance the very poison which will cause their downfall. According to our present knowledge, viruses do not have the independent ability to reproduce themselves as do all genuine organisms.

Now the decisive question arises as to how these strange virus-particles came to exist in the first place. Not only the genuine living beings, but these viruses too, must have emerged somewhere at some time. Scientists have two views on the matter.

The first regards the virus as a distorted plasmic element, a deviation, a chemical compound departing from the norm. According to this view, an irregular atypical protein particle has emerged as the result of an accidental disturbance in the process of protein synthesis. This view holds that the atypical particle probably retained the ability to produce particles similar to it from other molecules.

According to another hypothesis, the viruses are the last remains of deteriorated parasites. We know that there are tens of thousands of parasites who live on other plants and animals (the hosts) and prosper at their expense. Many of these parasites have deteriorated and today possess only those organs which are absolutely essential for life. This process of deterioration is seen as having terminated at a point where only a minimal core of the original cell remains. This core, it is believed, is forced to reproduce itself via its host. The Basle chemist T. Reichstein observes in this connection: “There is a theory which identifies the virus as the genetic substance of extinct living beings. This would explain much about viruses, especially their capacity to duplicate under suitable conditions in a host cell. The viruses have remained as a peculiar quality of life from which life itself has been taken—i.e. they are the result of the nearly total deterioration of a parasitic kingdom.”

The question arises whether viruses are really living or non-living matter. Since they possess certain characteristics of living things (mutability and the capacity to propagate), one tends to classify them among living beings. On the other hand they do not possess certain other attributes equally characteristic of living things—digestion, irritability, and teleological behavior.

If mutability is understood as the capacity of highly complex molecules to break down under external influences (so called quantum-leaps), then it is not restricted to genes and chromosomes, but extends to complex, unstable non-living substances. In the case of living beings,
these changes become clear as genuine mutations only in the sequence of generations. Living beings alone have the capacity to reproduce without external co-operation. It is just this capacity for independent propagation that viruses lack. They can only propagate themselves with external assistance, through an alteration in the normal process of forming protein in atypical cells. The role that viruses play in this process cannot be called a vital one, it is rather a purely mechanistic result of the process. Therefore neither mutability nor the ability to propagate can be used to prove that viruses have life.

They lack the characteristic signs of life. They are merely highly complex individual molecules. Even the smallest living beings consist of a large number of differing individual molecules. Weidel observes: “Viruses, in contrast to cells, are completely lifeless constructions. This is explained by their lack of functional completeness.” Bernard Rensch has made a similar observation.

We should now consider the most important question raised by the existence of viruses: whether or not these forms are to be considered intermediaries in the complex process of spontaneous generation. It would be possible to speak of them as intermediaries analogously with regard to the few characteristics they have in common with the smallest organisms. William Troll says: “We would misjudge viruses if we claimed them in a speculative way for the purposes of the theory of spontaneous generation.” On the contrary, the spontaneous emergence of viruses may be considered a disturbance at the end of the protein synthesis process in cells (Troll). And, finally, the artificial production of virus particles is not impossible.

The chief argument used against viruses as the original form of life is the fact that they are nourished only by organic substances; they are parasites and must presuppose life. Adolf Budensandt (1939 winner of the Nobel prize for chemistry) expressed his view on the matter in this way: “It appears for these reasons that we may not view the viruses as the immediate predecessors of presently living cells. How could viruses have propagated themselves without the presence of a living cell? At the present it seems probable that viruses are backward mutations and extremely distorted parasitic organisms.”

Since it would appear conclusively that the theory of spontaneous generation does not hold true, and that life clearly seems to be the work of a supra-worldly intelligence, it would seem inevitable to turn to God as its first creator. This conclusion is, however, far from universal, and is hotly protested by some.

6. Opposition to Tracing Life to an Extra-Mundane Intelligence

For decades there has been no attack on the theory of the creation of life by God so violent as Nicolai Hartmann’s. Hartmann acknowledges teleology in the organic realm to its full extent and even regards it as the essential characteristic of life. He guards himself, however, from a view that would attribute the striving for goals which things exhibit to an intelligence, i.e. a cognitive consciousness: “Where in the processes of nature is there a consciousness or even an instance of anything functionally co-ordinated to a consciousness which would be able to project purposes into the future and to choose recurrent means for their attainment? Such an instance can be supposed in the form of an intellect or in the form of a world-reason; metaphysics has usually supposed one or the other of these without any scruples. Such a supposition, however, is not justified by the phenom-
ena, and the critique of the theory of knowledge has long since proved it to be untenable."31 "A final nexus . . . which one at first believes to be the factor underlying the emergence of a highly developed consciousness is self-prohibitive, for it depends on determination of ends as well as on predetermination of means. The life process, however, is nothing less than consciously directed, even in highly developed and conscious living beings. Consciousness does not know about its functions; it is rather carried along by them."32 Yes, Hartmann asserts, the disavowal of a final "world-form" is the "greatest achievement of contemporary thought, its liberation from the nightmare of teleology."33 He anticipates a special "form of determination" distinct from efficient and final causality which he names "nexus organicus," and to which he should like to reduce teleology. What this type of cause is and how it works cannot be stated at the present time. The answer to these questions would doubtless require "the discovery of further categories."34

It seems to us an astonishing misunderstanding on Hartmann's part if he believes that one desires to trace organic purposefulness to an individual living being, and that a teleology, borne by an intelligence, can be found only in living beings with highly developed consciousness. This philosopher appears never to have considered the possibility that an extra-mundane intelligent being might be the author of earthly purposefulness. So Hartmann, who handles other matters with sovereign reality, is taken unawares by passion when he objects to the explanation of teleology through God. Otherwise how could a dispassionate thinker experience the final intention of teleology as a nightmare? Instead of trying to explain this decisive and pressing question himself, Hartmann trusts to the future to do so.

Gerhard Heberer thinks along lines similar to Hartmann's when he claims: "The supposition of the parentless generation of every biological event by the theory of creation contradicts the Harwelian thesis (omne vivum a vivo). It is most improbable and cannot be seriously considered by a biologist."35 Heberer, an advocate of the theory of spontaneous generation, overlooks the fact that all the reasons he summons to attack the theory of creation argue equally well against the one he is defending which "contradicts the Harwelian thesis through its supposition of the parentless generation of every biological event."

Uncommonly informative in regard to this less and less popular position is the following citation by Heinrich Schmidt from the widely circulated *Philosophisches Wörterbuch*: "Order and purposefulness in nature must again and again be explained in terms of natural reasons and according to natural laws; AND EVEN THE WILDEST HYPOTHESES HERE ARE MORE TOLERABLE THAN SUPERNATURAL ONES."36 (author's capitals). Schmidt is no longer asking which explanation seems closer to natural events; he is, rather, asking which interpretation, daring as it may be, appears more or less tolerable.

We must distinguish between the genuine opponent of the theory of creation and the position of the man who says that we can know nothing about the origin of the first living beings. The latter states that it is impossible to decide whether life goes back to an act of creation, to spontaneous generation, or to some unknown origin. This position is agnosticism. "Man would surely not be man if he did not again and again find a new tree in God's garden behind which to hide himself from his creator."37 The "agnostic" position would be less objectionable were it formulated in this way: The question of the first appearance of
life lies outside the jurisdiction of biology. The latter is concerned actually with the operation of mundane causes. It must be kept in mind, however, that it is as a man, and therefore as a philosopher, that the biologist is confronted with this decisive question. The limitations of the sciences do not account for a man's responsibility towards his own conscience.

7. God as Creator of the First Living Beings; the Participation of Natural Causes

In the light of what has gone before, an extra-mundane, intellectual Power, the omnipotence and wisdom of the Creator, must be unequivocally recognized as the cause of the first living beings. This follows on the one hand from the purposeful order which surpasses all human understanding and on the other from the breakdown of all other proposed explanations. The following words by Wilhelm Troll indicate that many contemporary researchers acknowledge this conclusion: "Krönig speaks . . . of the creation of organic nature as the work of a 'reflective creator.' Lecomte de Nouy has undertaken the task of showing that a mathematical pursuit of the problem leads to the admission of an extra-terrestrial Power's intervention. This is the same solution to the problem of spontaneous generation that Reinke had already reached at the turn of the century. It was his well-founded conviction that the first cell could have emerged 'only through the intervention of cosmic Reason on the surface of the earth.'"

Having acknowledged the fact of divine authorship, we must confess that nothing is known about the particular way in which He created the first living being. Conceptions concerning the creative activity of God are necessarily inadequate. Just as God's existence cannot be adequately conceptualized, neither can his operations.

It is especially necessary to guard oneself from conceiving God's creative activity to be a violent intervention, an interference. Many a person who thinks of God's activity in the world in this way recognizes its inadequacy and is tempted to reject completely the power of God in the cosmos. It is quite correct to reject such an inadequate conception. It is incorrect however to believe for this reason that the creative activity of God and the divine origin of life must be rejected. If, for want of more suitable concepts, we are forced to speak of God's operation as an "intervention," we must be aware that this signifies an unnatural external influence. The difficulties disappear if we take the trouble to put aside our all-too-human notions of God. Just as the blossom unfolds from the bud and fruit ripens, so we can think of the first living things as arising from the creative breath of God.

Although the first organisms are the work and realization of the divine plan, it may be assumed that in one great event God placed his already existing physical and chemical laws at his service. Therefore it is an important task of the sciences to discover how far inanimate nature and its powers have contributed to the emergence of the first living beings. It is quite possible that those researchers who are advocates of the theory of spontaneous generation will contribute greatly to the clarification of this special question, for the discussion of this process of emergence solely in terms of natural laws presents many intricate aspects.

The scientific study of the emergence of the first living organisms must have as its point of departure the physical conditions which reigned on the surface of the earth at that far-off time. There-
fore the astro-physicists too have an important role to play. It seems that in that primeval atmosphere oxygen and carbon dioxide were either completely lacking or were present only in minute quantities. It would follow that the first organisms were neither animal nor vegetative beings in our current sense of the words; nevertheless they somehow possessed some interchange of matter.

The question now arises as to whether organic compounds, which were the preliminary steps toward the highly complex matter of which bodies of organisms consist, could have emerged under those conditions. Nobel prize winner Adolf Buttenandt reports a relevant experiment carried out by the American chemist Stanley L. Miller in Chicago in 1953. He allowed an artificially prepared primeval atmosphere, composed of methane, ammonia, hydrogen and steam to circulate in a simple glass apparatus. Energy was conveyed to the system via a continuous electrical charge which probably played an important role in the permutations of the primeval atmosphere. After a reaction time of eight days, the results of the experiment were worked out under the strictest sterile conditions and it was shown that masses of amino acids which could be weighed, especially glycol and alpha and beta alanin, had emerged along with small masses of asparagin and alpha-amino butter acids. The road from the emergence of amino acids to the formation of a protein molecule may be a great one; the road from a protein molecule to the organization of a living cell is even greater—however the question as to how organic compounds could have emerged without the co-operation of living beings in past historical periods is now experimentally possible.”

It is a self-evident and very serious duty of the natural sciences to clarify, in so far as they can, all the natural laws involved in this most significant process. If God is the author of the organic purposeful order and the Creator of the first organisms, it does not follow that he created the first living things from nothing at one stroke. The mystery of life becomes ever greater with the progressive clarification of the physico-chemical point of view; but by the same token, the force of a planning Reason which is thereby being realized, becomes ever more palpable. The believer has no reason to fear that research will ever give an explanation of life without God. Finally it is not fitting for a level-headed scientist to designate God as a “stop-gap” at “those places for which he cannot give a scientific explanation.”

The mystery of life is more than “a gap” in our physical knowledge.

Translated by Gerald Farley

FOOTNOTES

1 Alfred Kröner Verlag, Stuttgart 1955, cited in the following pages simply as Schöpfungsglaube (title translated above).
2 Schöpfungsglaube, p. 127.
5 Helmholtz wrote: “If all our efforts to produce organisms from inanimate matter run aground, it seems to me that it would be a perfectly correct scientific procedure to ask whether life has really evolved at all or whether it is just as old as matter itself.” Quoted by A. J. Oparin, The Emergence of Life on Earth, Berlin-Leipzig, 1947, p. 35.
7 Cf. Friedrich Dessauer, Teleologie in der Natur; Basle 1949, (He shows in an especially clear way the relation of the causal and final factors to one another); George Sigmund, Naturordnung als Quelle der Gotteserkenntnis, Freiburg im Breisgau, 1950, (A critical and impartial presentation of the teleological proof by a specialist in biology); E. S. Russell, Lenkende Kräfte des Organischen, Bern, J. J. Sammlung Dolp, 31, (He analyzes differing individual examples which exhibit the super-physical character of living things); Karl v. Frisch, Du und das Leben, Eine Moderne Biologie für Jederm
man, Berlin 1949 (One of the best-known researchers presents a number of extraordinarily instructive examples of purposefulness).
8 The purposefulness of the gall of plants in their usefulness to other beings, and the hypothesis of a super-individual soul. Leipzig, 1917.
9 Leben und Erkennen, Munich 1933.
11 Compare this with Adolf Portman's Die Tiergestalt; Studien Uber die Bedeutung der Tierischen Erscheinung, Basle 1948.
12 Schöpfungsglaube, p. 146.
13 Adolf Butenandt, ibid., p. 104.
16 Allgemeine Abstammungslehre, Göttingen 1949, p. 10.
18 Makromolekulare Chemie (Basle 1947), p. 141.
22 Private letter of 28 Sept. 1954. In Sept. 1954, the author asked several leading experts for their views on a few of the questions pertinent to our present discussion. Permission to publish their answers was also requested.
24 Letter of the 14th of Sept. 1954.
25 Makromolekulare Chemie, p. 6.
27 Umschau, 1953, p. 258.
28 Op cit., p. 337.
29 Das Virusproblem in ontologischer Sicht, Wiesbaden 1951, p. 131.
30 Schöpfungsglaube, p. 107.
31 Nicolai Hartmann, Philosophie der Natur, p. 332.
32 Ibid, p. 524.
34 Philosophie der Natur, (Berlin 1950), p. 662. See also his Teleologisches Denken (Berlin 1951).
35 Allgemeine Abstammungslehre 1949, p. 25.
36 Leipzig 1934, p. 236, “Gottesbeweise.”
37 Heimo Dolch, Schöpfungsglaube, p. 160.
38 For an extensive presentation of this argument, cf. Georg Siegmund’s Naturordnung als Quelle der Gotteskenntnis, p. 382. (See footnote 7 above.)
39 Das Virusproblem . . ., 1951, p. 145.
40 Schöpfungsglaube, p. 104.
41 Ibid, p. 154.
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