EVOLUTION AND FLUCTUATIONS—A CREATIONIST EVALUATION

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Fluctuations are examined as a possible mechanism for molecules-to-man evolution. Dissipative structures offer promise as good models for certain existing nonequilibrium systems, but fail as proper models for origins. Often they are used as tools to avoid, in theory, the consequences of degeneration processes. The major problem with the evolutionary hypothesis is the lack of an explanation of how the universe moved out of the initial equilibrium condition. The use of fluctuations to accomplish the task appears unrealistic. Creation of the original order is a sensible alternative.

Introduction

Recently the hypothesis of molecules-to-man evolution received a needed boost. The introduction of the concept of fluctuations has been heralded as the possible driving force for evolution.[1]

As stated by Prigogine, Nicolis, and Babloyantz,

> For reasons to be explained later, we shall refer to this principle as *order through fluctuations.*[2]

Obviously the scientific world considered the work to be of such importance that Ilya Prigogine was awarded a Nobel Prize in 1977 for his efforts.

The entire subject falls within the domain of irreversible thermodynamics and the arguments must be evaluated thermodynamically. An interested reader may find a comprehensive development of the thermodynamics of structure and fluctuations in reference 3. For a creationist interpretation of irreversible thermodynamics, see reference 4.

Unrealistic Starting Conditions

It is well-known that all entities in the inorganic world proceed toward a state of equilibrium fairly rapidly. The attainment of equilibrium is much slower in living systems[5] but is still evident.

Thus to model his systems as close to "the desires of nature" as possible, an evolutionist should start the molecules-to-man process at an equilibrium state and work "upward." However upon investigation of many evolutionary schemes from astronomy to biology, it is found that the usual initial state is one of *nonequilibrium*. Evolutionists need preexisting order to provide any hope of success in their hypothesized process since the equilibrium state is one of maximum disorder.[6]

As for the first law of thermodynamics, order can bring forth more order.[7] For example, living systems can replicate themselves. Therefore a nonequilibrium state is no proper place to start any molecules-to-man scheme; since the biggest problem has been avoided, getting the system out of the equilibrium state, while all known natural "forces" want to maintain that condition. Nonequilibrium states are entirely unrealistic as starting points for molecules-to-man evolution. This very assumption completely *voids* the idea as a sensible theory of origins.

The work of Prigogine *et al.* deals totally with nonequilibrium states.

> The main idea is the possibility that a prebiological system may evolve through a whole succession of transitions leading to a hierarchy of more and more complex and organized states. Such transitions can only arise in nonlinear systems that are maintained far from equilibrium; that is, beyond a certain critical threshold the steady-state regime becomes unstable and the system evolves to a new configuration.[8]

The subject of origins is beyond the scope of the concept and this is admitted by the authors.

> This picture of selection through "survival of the fittest" already implies the existence of self-maintaining and self-reproducing systems. Strictly speaking therefore, it is not a theory of the origin of life.[9]

When the work is carefully investigated it is found that it is not a proper basis for evolution.

Dissipative Structures

To maintain the artificial nonequilibrium state, even in theory, a number of imaginary structures must be invented.

> As might be expected, the stability of thermodynamic equilibrium implies the stability of states *near* equilibrium. This is the reason why all nontrivial stability problems cannot be approached by linear thermodynamics of irreversible processes. The possibility of new types of organization of matter past an instability point under the influence of non-equilibrium conditions, occurs only when the system is sufficiently far from equilibrium. The study of such a new organization, the so-called *dissipative structure*, arising from the exchange of matter and energy with the outside world, appears as one of the most fascinating subjects of macroscopic physics.[10]

The equilibrium state can be defined away if one invents a dissipative structure which has as its sole purpose the ability to reject entropy faster than it can produce or receive it! Then order can be maintained and useful information can be transferred between structures.

Such a construct has definite advantages.

> It is therefore possible, *a priori*, to have a number of new effects, for instance: the system may not decay monotonically to the steady state belonging to the thermodynamic branch, once it is perturbed from it; in the limit it may even never return to this state but evolve to a time-dependent regime: under similar conditions it may finally deviate and evolve to a new stationary regime corresponding to a branch different from the thermodynamic one. This transi-

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> tion will manifest itself abruptly as an *instability*, i.e. as a fundamentally discontinuous process.[11]

Since the entropy of an isolated system is a monotonically increasing function of time,[12] dissipative structures are a very neat way of avoiding the degenerating influences in nature. In the marriage of kinetics with thermodynamics to form the science of irreversible thermodynamics, the tail (kinetics) has begun to wag the dog (thermodynamics). This writer warned about such a possibility in 1971.[13] The system under study is conveniently kept away from equilibrium by theoretical dissipative structures.

> It is therefore very tempting to associate biological structures with chemical instabilities leading to a spontaneous self-organization.[14]

Once the imagined system gets far enough away from equilibrium, life spontaneously generates!

> Summarizing, we may say that instabilities in the thermodynamic branch of solutions can lead to time or space organization and to a change in functional behavior in open systems undergoing chemical reactions.[15]

The creation of order by virtue of instabilities is an example of imagined ever-onward-upward evolution.

> It would be thus very tempting to think that dissipative instabilities act as a kind of phase transition leading to a *new state of matter*.[16]

This new state of matter is one in which the second law of thermodynamics has been overcome. At last the evolutionist has triumphed over observable phenomena.

> It is exciting to realize that the analogy between dissipative and biological structures may lead to the idea that life and absence of life are just two states of matter separated by a chemical instability.[17]

Thus a totally atheistic, mechanistic, and naturalistic picture of life has evolved from the consideration of dissipative structures. Such structures may be excellent models for studying the maintenance of existing nonequilibrium living systems, but they cannot explain how these systems originated.

Order Through Fluctuations

The general path supposedly taken by fluctuations and dissipative structures is that to higher and higher order. Such a process can be visualized in Figure 1.

A nonequilibrium state (a) exists and is made stable by conservation processes. Suddenly a system fluctuation at time t_1 drives it to a more highly-ordered state (b). This state is stabilized for a while by conservation processes until another fluctuation occurs at time t_2 driving the system to an even more highly ordered state (c). This state is made stable by conservation processes, and the net system order has increased by such imagined processes.

It should be noted that when fluctuations of the right kind are needed, they occur. When conservation processes are needed, they operate. When thermodynamic considerations (conservation) need to be overcome, kinetics (fluctuations) can do the job. You systematically allow for what you want to happen. It is unfortunate that nature is not that cooperative with evolutionary necessity. Yet fluctuations and conservation processes

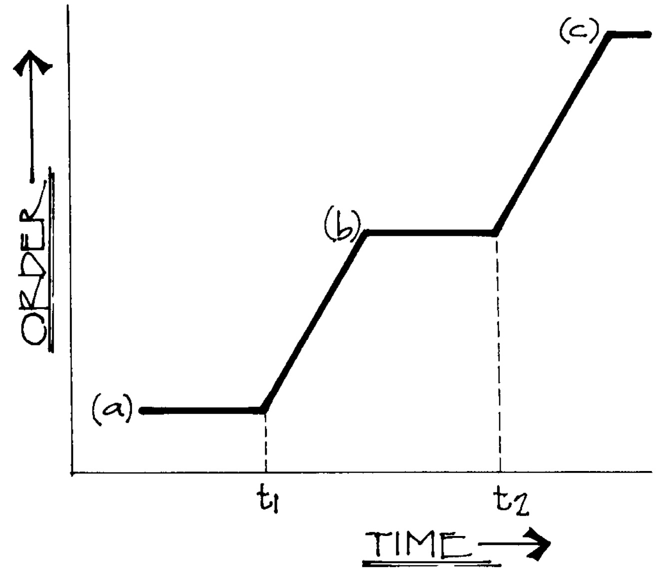

Figure 1. Schematic diagram of an increase in order by fluctuations and stabilization of the order by conservation processes.

seem never to interfere with each other and degeneration processes seem reluctant to act! Evolution by "blessed events"[18] can operate.

The seemingly perfect working-together of fluctuations and conservation processes are totally unnatural. These changes exist only in the minds of evolutionary scientists. Men can intelligently plan and cause changes that apparently lower the entropy of a system. Constant maintenance of the system at a low entropy state by energy inflow and outflow is necessary to hold back the degenerating effects. Yet eventually even the preservation processes of the ordered open system coupled to its surroundings cannot stop the degeneration.[19] It appears that God has created into the living organisms certain conservation processes that slow down the inevitable, yet the state of maximum entropy or disorder is eventually reached.[20,21]

If thermodynamic principles were left free to perform in the naturally-expected manner, the net result of the fluctuation process might be as follows.

The original created order state (a) is stabilized by conservation processes. A fluctuation occurs at time t_1 driving the system to a new metastable state (b) of lower order. Conservation processes maintain state (b) until another fluctuation occurs at time t_2 driving the system to state (c) of even lowered order. This type of behavior would be expected with the interaction of conservation and degeneration processes.[22]

At best the level of ordering expected in the interaction of conservation and degeneration processes[23] is shown in Figure 3. The original created order is shown as state (a).

The same fluctuation-conservation-degeneration pattern is seen at states (b) and (c) and at times t_1 and t_2 as shown in Figure 2. However at time t_3 a fluctuation causes the system to change to state (d) which is more ordered than states (b) or (c). Such an ordering process can be imagined as long as it results in a state with less order than (a). No change or fluctuation can generate

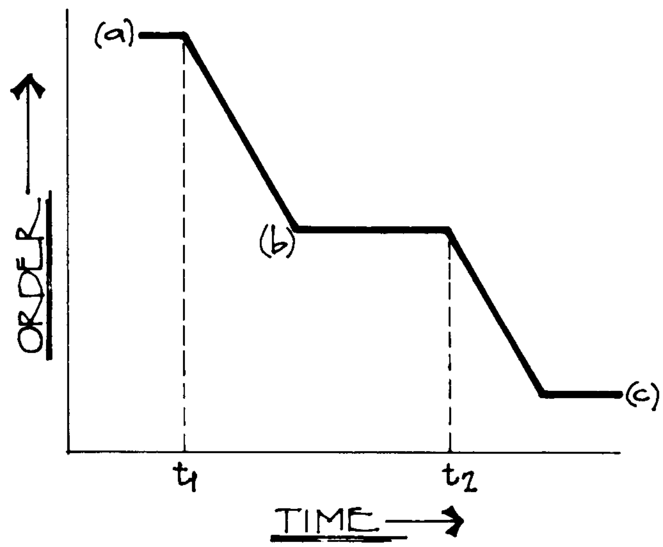

Figure 2. Schematic diagram of a decrease in order by fluctuations and stabilization of the order by conservation processes.

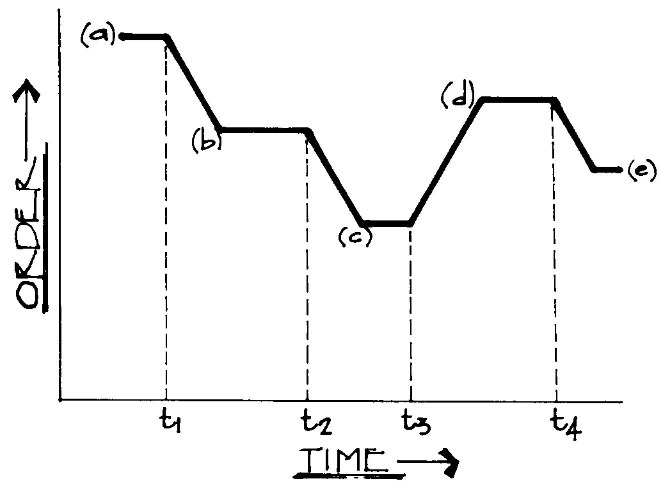

Figure 3. Interaction of fluctuations, conservation and degeneration processes to produce temporary order.

more order than the original state (in this case the created order). Possibly such a change is a model of what occurs in genetic recombination. A further change noted in Figure 3 fluxes the system at time t_4 from state (d) to a state (e) of lower order.

It would seem that the postulated changes illustrated in Figure 2 and 3 provide a more realistic model for natural situations. Order can bring forth other order (conservation processes) but order can never arise spontaneously out of disorder (equilibrium state).

Do fluctuations honestly lead to states of higher order? This question was asked of Prigogine.[24]

> **J. Keck:** I would like to comment on Professor Prigogine's remarks about generation of order from disorder.
>
> What you have described to us was the decay of a metastable state into a more ordered state. In the same sense, an explosion would be an example in which a degree of order is created out of disorder by releasing energy.
>
> I wonder if you would make a distinction between your example and mine. I don't really think these are examples of the creation of order out of disorder. The systems were metastable to begin with.
>
> **I. Prigogine:** The order to which I referred corresponds to situations which are sufficiently far from thermodynamic equilibrium, and which permits to transform the flow of energy into structure. We go then from our branch of the solution of the conservation equation to another branch.

The above exchange lays bare the inadequacy of the evolutionary scheme. Order is not created out of disorder. If an explosion in a print factory can generate *Webster's Unabridged Dictionary*, then molecules-to-man evolution can occur by the proposed fluctuation mechanism.

Fluctuations at Equilibrium

Essentially for fluctuations to be of importance in the evolutionary hypothesis of *origins*, they must be able to bring a system out of equilibrium state into a stable nonequilibrium state. This concept will be developed using fluctuations in entropy of an ideal monatomic gas system at equilibrium for simplicity. An ideal gas at known temperature, pressure, and volume is considered a macrostate. The actual arrangement of the atoms at this state cannot be observed; however statistical considerations can be introduced as a model for what is happening on the atomic level.

The atoms of gas are in constant motion in a state of disorder. Yet if it were possible to take a photograph each instant, the positions of the atoms in one photograph would be different from their positions in other photographs. Yet each would be of a disordered arrangement. These would represent various microstates of the system, that make up all of the possible arrangements of the equilibrium macrostate designed by W_e. Suppose a fluctuation causes the atoms in the gas to assume a slightly ordered arrangement. This new macrostate is represented by W_{ne} since it is a nonequilibrium condition.

The entropy change in going from one macrostate to another can be calculated using the Boltzmann formula as follows.[25]

$$dS = k \ \ln \frac{W_{ne}}{W_e} \qquad (1)$$

where $dS = S_{ne} - S_e$, S_{ne} = entropy of the nonequilibrium state, S_e = entopy of the equilibrium state, and k is Boltzmann's constant.

Starting with the first law of thermodynamics for an ideal gas

$$dU = dQ + dW \qquad (2)$$

where dU = internal energy gained or lost by the system, dQ = heat gained or lost by system, dW = work done on or by system, $dW = -PdV$ (mechanical work only), P =

pressure of gas, and V = volume of gas.

Thus (2) becomes

$$dU = dQ - PdV \tag{3}$$

From the classical definition of the change in entropy, $dS = dQ/T$. T is the absolute temperature; (3) becomes $dU = TdS - PdV$, or

$$dS = \frac{dU}{T} + \frac{PdV}{T} \tag{4}$$

The internal energy of an ideal gas is a function of temperature only so that $dU = C_v dT$. Also $C_v = 3R/2$. Here R is the ideal gas constant.

Therefore (4) after substitution can be written as

$$dS = \frac{3}{2} R \frac{dT}{T} + \frac{P}{T} dV \tag{4'}$$

By the ideal gas law $PV = nRT$, or $P/T = nR/V$, where n = number of moles of gas, then

$$dS = \frac{3}{2} R \frac{dT}{T} + \frac{nRdV}{V} \tag{5}$$

Indefinite integration of (5) yields

$$S = \frac{3}{2} R \ln T + nR \ln V + S_o \tag{6}$$

where S_o is the integration constant.

If $n = 1$, then $nR = Nk$. Here N is Avogadro's number; and (6) becomes[26]

$$S = Nk(\ln VT^{3/2} + \frac{S_o}{R}) \tag{7}$$

This equation represents the entropy of one mole of an ideal monatomic gas at temperature T and volume V.

$$S = NkC$$
$$C = (\ln VT^{3/2} + \frac{S_o}{R}). \tag{8}$$

Return to equation (1). When the fluctuation occurs the entropy decreases since $W_e > W_{ne}$ and dS is negative.[27]

Equation (8) can be written as

$$dS = NkCx \tag{9}$$

where x is the fractional decrease in entropy due to the fluctuation.

Equate (1) and (9):

$$\frac{W_{ne}}{W_e} = e^{-NkCx}$$

If the gas is assumed to be helium at 273 °K and 1 atm.,[28] $C = 14.96 \approx 15$, and $W_{ne}/W_e = e^{-15Nx}$.

Suppose an entropy decrease of one part in a million occurs as a result of the fluctuations, or $x = 10^{-6}$, then $N = 6.02 \times 10^{23}$; and $15Nx \approx 10^{19}$, or $W_{ne}/W_e = e^{-10^{19}} \approx (2.7)^{-10^{19}}$.

Thus the chance of an infinitesimally small entropy decrease is about 10 raised to the -10^{19} power.[29] The odds against any sizeable entropy decrease would be astronomical. Fluctuations offer no hope to the evolutionist to drive a system out of an equilibrium state.

Even if minute ordering fluctuations do occur somewhere in the system, immediately upon another fluctuation the short-range order would be destroyed. Another area of order may appear simultaneously in some other part of the system. Yet it will be dissipated by the next fluctuation.

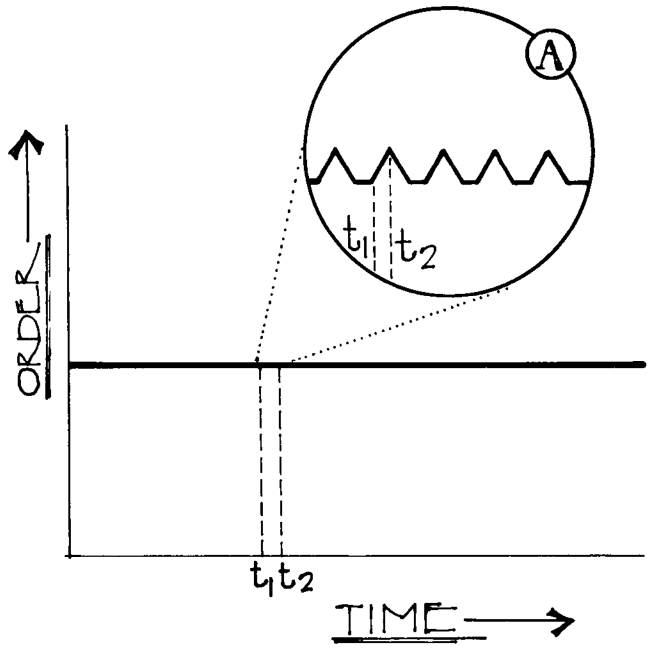

Figure 4. The production of short-range order in a gaseous system subject to fluctuations at equilibrium. The inset A represents a small section of the curve greatly magnified; it shows how the curve of order vs. time may be "bumpy" due to microscopic fluctuations.

The process can be schematically represented in Figure 4. The macroscopic entropy of the system does not change. However during system fluctuations, short-range order can develop, dissipate, develop elsewhere, dissipate, etc. A fluctuation occurs at t_1 causing the appearance of short-range order. Another fluctuation at time t_2 causes the order to dissipate in that area. No lasting order can be built up by such a process. Molecules-to-man evolution needs ordering fluctuations of monumental magnitude and unnatural locking mechanics to stabilize any generated order as degenerative forces attempt to drive the system back to equilibrium. Such schemes can be created on paper, but the operation of them in nature is doubtful.

Such a hopeless procedure appears to be doomed to failure. The primary need of any evolutionary hypothesis—to move the system away from equilibrium—is highly improbable. Actually fluctuations tend to disorder a system,[30] and if the improbable does happen on one fluctuation, the probable will occur in succeeding fluctuations destroying any temporary order.

Conclusions

Although there are fluctuations in natural systems such as shock waves and other catastrophic events, it is unreasonable to assume that they can be used as a driving force for molecules-to-man evolution. Nonuniform conditions can exist briefly as illustrated by the Zhabotinski reaction.[31] However, like all real systems, it is driven toward equilibrium and does not proceed to higher states of order.

Dissipative structures offer considerable promise as good models for living systems and certain temporary nonequilibrium states found in nature. However they cannot be used as models for the origin of such systems.

The major problem that must be faced by evolutionists is how their imagined universe moved out of the preferred natural state of equilibrium. Natural means seem fruitless. This writer prefers to believe

> In the beginning God created the heaven and the earth

as the origin of natural order.

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[27]Williams, 1966. *Op cit.*, p. 20.

[28]Crawford, *Op cit.*, p. 519.

[29]*Ibid.*, p. 520.

[30]Williams, 1973. *Op cit.*, p. 42.

[31]Glansdorff and Prigogine, 1971. *Op cit.*, pp. 261-263.

The Zhabotinski reaction goes as follows. A solution of $Ce_2(SO_4)_3$, $KBrO_3$, $CH_2(COOH)_2$, H_2SO_4 and a few drops of Ferroline (redox indicator) are mixed and stirred by magnetic agitation. The solution changes color periodically from red (excess of Ce^{+3}) to blue (excess of Ce^{+4}) and back, etc. Depending upon concentration, temperature, and mixing conditions the entire solution will change at once or in "bands". The system reaches equilibrium, staying a single color, usually in less than thirty minutes.

THE SPECIES CONCEPT IN LYELL'S *PRINCIPLES OF GEOLOGY*

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Lyell's book had also something to say about biology; and his views on that subject are investigated here. It turns out that he was not so much of a Darwinian as is often supposed; in fact, his doctrine was more like the one now commonly called Progressive Creation. Creationists who have not read the work may be surprised to find that some of his arguments and illustrations may still be useful to them.

This article will summarize the concept of biological species in Sir Charles Lyell's *Principles of Geology.* The book was first issued in 1830 (vol. I), 1832 (vol. II), and 1833 (vol. III), and its original full title was *Principles of Geology, Being an Attempt to Explain the Former Changes of the Earth's Surface, By Reference to Causes now in Operation.* After the 5th edition (1837), the contents were split into the *Principles* (6th and later editions), dealing mainly with processes now seen in operation on the earth's surface, and *The Elements of Geology* and *Manual of Elementary Geology* which dealt with "geology proper". This article is based on the 9th edition (1853) of the *Principles*, whose full title is *Principles of Geology; or, the Modern Changes of the Earth and its Inhabitants Considered as Illustrative of Geology*, and which was published by John Murray of

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