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Cosmology and Organic Evolution

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Summary

In keeping with the Einstein concept of unified fields, a general cosmological problem (GCP) is proposed which requires not only a physical basis for the unification of gravitation and electromagnetism but the incorporation as well of the origin and dynamics of the phenomenon of organic evolution, for the case of a living system existing in Opik's oscillating universe.

To effect this unification, the assumption must be made that in its final analysis the universe consists of a single entity viz., a subquantum mechanical "ether" referred to as "cosmic entropy" and all events in the physical universe constitute perturbations in the local field of this fundamental continuum or entity. Using a hypothetical model cell, an attempt is made to derive a biophysical analog of the Einstein relation $E = MC^2$ and which under certain boundary conditions reduces to a similar form. One can effect the solution (GCP) by simply defining the living process as the annihilation of infinitesimal quantities of matter and Life as the production of cosmic entropy. Organic evolution therefore is a natural consequence in the effort to increase the efficiency of the conversion process.

General Cosmological Problem

From one philosophic platform, the (GCP) may be viewed as comprising three quantities viz., Entities (mass, energy, space and time), Processes (oscillating universe and the origin and course of organic evolution) and Fields (gravitational, nuclear, magnetic and electric) although the latter may be considered under entities and the problem defined as the identification of the unifying principle and its mathematical form. The most important consequence of the proposition is that a correspondence and or parallelism is assumed to exist between the so-called cosmological forces of the expanding universe and the origin and dynamics of the phenomenon of organic evolution. This implies that at Time-Zero (Lemaître's atom primitif), the forces which would eventually give rise to the phenomena of organic evolution, were present along with those responsible for the present observed expansion.

On the assumption that the unification of gravitation and electromagnetism may eventually proceed via an Einsteinian metric, we are left with the problem of mathematically defining Life. Before proceeding however, to develop the principle hypothesis, it is of interest to review certain aspects of the nature of the physical universe.

The Physical Universe

Expansion

The concept of a cyclic universe as envisioned by Tolman, Opik and others, has considerable epistemological appeal since not only have we reduced the number of so-called unanalyzables, but Time is no longer infinite and only refers to a succession of events. The total duration of a cycle (Opik) is of the order of 30,000 million years, and in the compressed state the radius of this primordial mass would be equal to about the orbit of Mars with the nuclear fluid weighing about 250 million tons per cubic centimeter. At the present time the average density ($\rho$) of matter in space is about $10^{-30}$ cm$^{-3}$. 

Ether

Although the theory refrained from an investigation of the medium in which the electromagnetic event occurred, the Lorentz invariance was the most important aspect of special relativity. In general relativity however, Einstein made the following comment: "According to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, an ether exists. In accordance with the general theory of relativity, space without an ether is inconceivable. For, in such space there would not only be no propagation of light, but no possibility of the existence of scales and clocks, and therefore no spatio-temporal distances in the physical sense. But this ether must not be thought of as endowed with the properties characteristic of ponderable media, as composed of particles the motion of which can be followed; nor may the concept of motion be applied to it."

Gravitation

It has been noted by Bohr that a steel cable having the diameter of the earth would not be strong enough to hold the earth in its orbit around the sun. Gravitational interactions remain the least understood for the following reasons. In the hydrogen atom the gravitational force between the electron and the proton is $5 \times 10^{-10}$ that of the electrostatic interaction, and therefore on a per particle basis compared with other forces it is extremely weak. Gravitational fields are unidirectional and experimentally a qualitative distinction separates gravitation and electromagnetism, since there is no way to so alter the properties of a body (matter) so that it may move through a
gravitational field as if the field were not present. The gravitational field is steady and continuous and does not appear to be associated with the expenditure of energy. Bodies that move in a gravitational field do not reduce the intensity of the field. From the point of view of Mach's principle, the inertial mass of a particle is determined by distant matter, i.e., acceleration is not relative to empty space. This differs from Einstein's theory where in another way by beginning with a field, construct a satisfactory theory of matter which, among other things, would explain the asymmetry of electrical charge. To Einstein the idea of a continuous field combined with that of material points discontinuous in space appeared inconsistent. Another factor of great importance that must be mentioned was Heisenberg's Principle which led to a renunciation of causality in the atomic domain. In an attempt to bridge the gap between micro and macrophysics, Eddington discovered that certain combinations of the universal constants gave dimensionless numbers, which indicated that the strength of gravitational interaction is related to both the scale of the universe and the strength of strong atomic interactions. Jordan, holding that our knowledge of the macroscopic universe resides in six constants, also discovered combinations however, which equal unity. If future unified field theories are to retain the plurality, i.e., both the continuum and the concept of quantization, then it would appear that the field was the manifestation of a more fundamental entity, thereby rendering it to a passive role.

Unified Fields

The purpose of the field theories upon which Einstein spent the last thirty years of his life was to effect the synthesis between general relativity and quantum mechanics or put in another way by beginning with a field, construct a satisfactory theory of matter which, among other things, would explain the asymmetry of electrical charge. To Einstein the idea of a continuous field combined with that of material points discontinuous in space appeared inconsistent. Another factor of great importance that must be mentioned was Heisenberg's Principle which led to a renunciation of causality in the atomic domain. In an attempt to bridge the gap between micro and macrophysics, Eddington discovered that certain combinations of the universal constants gave dimensionless numbers, which indicated that the strength of gravitational interaction is related to both the scale of the universe and the strength of strong atomic interactions. Jordan, holding that our knowledge of the macroscopic universe resides in six constants, also discovered combinations however, which equal unity. If future unified field theories are to retain the plurality, i.e., both the continuum and the concept of quantization, then it would appear that the field was the manifestation of a more fundamental entity, thereby rendering it to a passive role.

Thermodynamics

Equilibrium is the static and time invariant state of a system where no spontaneous processes take place and all macroscopic quantities remain unchanged and applies to so-called "closed systems". However, if a system is open to its environment and exchanges mass-energy under time invariant conditions, we have an equilibrium of a second kind, viz., a steady state. The entropy production or entropy source strength refers to the time derivative of entropy as developed by Onsager, De Groot and Prigogine. The observation that equilibrium is never maintained by a cyclic process at the molecular level is known as the principle of Microscopic Reversibility. Finally, the effects of variables such as pressure, temperature and concentration on the position of chemical equilibrium are summarized by the principle of Le Chatelier, on the basis of this principle, has made a generalization which he refers to as the biological principle resulting from his analysis of natural and artificial stabilization. He concluded that Le Chatelier's principle could be taken as a general guide to the behavior of systems in equilibrium not because there is an inherent tendency in the nature of things for stable systems only to be created, but because unstable ones, if formed, had little chance for survival. All of these principles are a reflection of the well known variational principle so fundamental to theoretical physics, and a summary has been made by Cox with reference to irreversible processes.

It is of interest to note that all so-called theories of non-equilibrium thermodynamics refer to states not far removed from equilibrium yet have produced important results, that is because of the applicability of linear laws, and is the subject of a number of interesting discussions.

Hypothetical Model Cell

The hypothetical model cell (HMC) refers for theoretical convenience to the smallest or simplest of living organisms existing in Opik's oscillating universe. Recently Morowitz has referred to the pleuropneumonia-like organisms as among the smallest autonomous self-replicating entities found and having diameters in the order of 1000 Å, a volume of $1.7 \times 10^{-15}$ cm$^3$ and a non-aqueous mass of $5 \times 10^{-16}$ g or $3 \times 10^8$ molecular weight units. Taking the average molecular weight of the biological material as 8 he obtained $3.75 \times 10^7$ atoms. Based on biochemical data, Morowitz has calculated a minimal unit with a diameter of 80 Å. Schrödinger, by means of the law has questioned the validity of statistical laws within the domain of the living cell and expects to find new principles in view of the construction of the cell being different from anything as yet tested in the physical laboratory.

Chemical Information Theory

Equation (1) represents an oversimplification of a chemical reaction that results each year in the United States alone in more than 10 billion dollars worth of damage viz., the corrosion of ferrous metals.

\[ \text{Fe}_3 \text{O}_4 + 3 \text{O}_2 = 2 \text{Fe}_{2}\text{O}_3 \]  

Let us look in on a young chemist seated at his desk and looking out of his office window at a wooden fence. The latter is held together by iron nails which have begun to rust. "A rather simple phenomenon", he chuckles to
himself, and numerous equations flash through
his mind. Depending on the individual's back­
ground we could say that he possessed varying
degrees of Chemical Maturity. It would shock
most theoretical chemists who are not working in
electrochemistry that after 30 years of research
we still do not know the role of chloride ion in
the stress-corrosion of steel. The physicist in
contrast to the theoretical physical chemist is
fortunate in that his subject is more amenable to
mathematics and he at least can attempt an attack
on his so-called "many-body problems", whereas
the chemist even knowing what the physicist
knows, must continually proceed by the experi­
mental method. As an example, solid state physics
is already a science while solid state chemistry
is still an art. There is one basic problem in
chemistry and in all science for that matter viz.,
the relation between atomic-molecular structure
and property, i.e. chemical, physical, mecha­
nical, biological etc. and it is amazing how little
chemical maturity even the greatest chemist has
in this respect.

To add further complexity to eq. (1) we may
wish to know the rate at which the process takes
place and so we then enter the field of chemical
reaction kinetics. Perhaps the chemist can im­
prove his lot by attempting to put more information
into his equations and then taking advantage of
various forms of mathematics, he may perhaps
come upon new principles. What we refer to to­
day as Chemical Physics is actually a form of
physical chemistry from the physical side and
what we need is a physical chemistry from the
chemical side, especially one that will con­
cern non-equilibrium chemical processes.

Some of the parameters that control or in­
fluence the rate of chemical processes are:
the solvent, temperature, pressure, concentra­
tion, state of subdivision and under certain
conditions the intensity or flux of electrical,
magnetic or gravitational fields. It is of in­
terest to note that in very rapid reactions
such as an explosion, the reaction proceeds al­
most adiabatically, since there is almost no
heat exchange with the environment.

Returning to the problem of what may be
called chemical information theory, one is re­
minded of a statement by Mach viz., "If all the
individual facts - all the individual phenomena,
knowledge of which we desire - were immediately
accessible to us, a science would never have
arisen", i.e. eq. (1) may be further complicated
by the introduction of defect structure variables
such as cation and anion lattice vacancies in
addition to the fact that the chemical constitu­
ten themselves may be non-stoichiometric.

Mach's statement is particularly applicable
to the mechanics of the above hypothetical model
cell in that it will subsequently be shown that
one could not write an overall chemical equation,
even if such were possible, without introducing
into the equality the spatial orientations of the
individual molecular constituents as a function
of time within the confines of the system,
and then some mathematicians might say chemistry
has matured because it has now been reduced to
geometry.

In summary, chemical processes are classi­
cally described by eq. (2) which reads, the

$$\sum A + \sum B = \sum C + \sum E$$  (2)

sum of the reactants is equal to the sum of the
products plus the sum of the energy changes.

The Minimum Time Problem

Let us imagine that a piece of sodium can
be placed in an infinite reservoir of water in
the absence of a gravitational field. The
Minimum Time Problem (MTP) then asks the follow­
ing question. From what set of first principles
would we attempt to calculate the minimum absolu­
tle Time required for the disappearance of the
metal given a set of environmental conditions?
The following data is taken from Enders and
Horne and refers to the observed Time (minutes)
required for the disappearance of rectangular
blocks of metallic sodium in a large excess of
normal amyl alcohol at 27°C., and rods of me­
tallic zinc in 37.6 % HCL at 25°C. respectively.

<table>
<thead>
<tr>
<th>Weight in Grams</th>
<th>Required Time</th>
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<tbody>
<tr>
<td>1.5</td>
<td>21</td>
</tr>
<tr>
<td>2.3</td>
<td>57</td>
</tr>
<tr>
<td>3.2</td>
<td>103</td>
</tr>
<tr>
<td>6.0</td>
<td>218</td>
</tr>
<tr>
<td>7.9</td>
<td>263</td>
</tr>
<tr>
<td>16.3</td>
<td>319</td>
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<table>
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<th>Weight in Grams</th>
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<td>2.9112</td>
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<tr>
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<tr>
<td>5.1635</td>
<td>5h</td>
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<tr>
<td>6.9286</td>
<td>5h</td>
</tr>
</tbody>
</table>

In this work experiments in which any kind of
particle disintegration or fragmentation occurred
were not considered.

In practice, most chemical processes re­
sent non-equilibrium systems and as such may
be said to be in unidirectional motion. Dimen­
sionally (tensor) a chemical reaction is a
scalar quantity and cannot couple with a vector.
transport process (Curie's Law) unless it is spa-

tially variable. At the present time there is no

theoretical basis for an attempted solution of

the (MTP) since there is no apriori knowledge of

the degree of disorder as a result of the systems

past history. Likewise, in addition to such con-

siderations as surface area, geometry can give

rise to various electron-phonon interactions in-

cluding the phenomenon of acoustical resonance

which may have a profound effect on the kinetics

and all such phenomenon can be classed as non-

linear and as such Gibbs function is not strictly

applicable. Now the presence or absence of a

gravitational field will not only affect the

three dimensional motion of the sodium in the wa-

ter reservoir but also such things as heat trans-

fer across the solid/liquid interface. A number

of zero-gravity effects appear in the literature.

The most interesting aspect of the (MTP) en-

tails a theoretical basis for a calculation of the

WORLD LINE of the sodium particle and this is

precisely the reason for considering the (MTP)

viz., the introduction of space coordinates into

classical chemical information theory as a pre-

lude to a description of the hypothetical model

which can undergo a chemical decomposition,

would as a result of the transport of thermal

energy via phonon scattering give the sem-

blance of world line intersections.

It is of interest here to introduce the

idea of the dissociation of a world line, that is,

the splitting of a molecule. For example,

if in the course of a chemical reaction a func-

tional group were to leave the central molecule,

then in that interval of space-time we would

have a line representing the residue as well as

another line from the same point of origin re-

presenting the departing functional group.

One may terminate the subject with the

following question. Does the transmission of

genetic information, prior to the subdivision

of a single cell, constitute a dissociation

(world line) or an action at a distance?

Returning to the original question concerning

the topological characterization of the world

band of the (MTP) in contrast to the chemical

reaction in the beaker, the comparison would

have to be made within a so-called Frank-

Condon time interval and under these condi-

tions (which essentially entail electronic

transition times) one would reasonably expect

a topological difference in the models.

The question, therefore, remains that if

it were possible to duplicate this topologi-

cal manifold on the molecular level which one

may refer to as the dream of physical bio-

chemistry, then would this constitute a li-

ving system? The mechanist might say yes and

the vitalist no and the question could only

be resolved by observation. It is of interest

to note that regarding observation, Komar23

in a discussion of the proof of Von Neumann's

theorem concerning the outcome of a measuring

process being independent of the way in which

one describes the effects of measuring appara-

tus and the question of hidden variables etc.,

mentions the possibility of teleological for-

ces in nature, Rashevsky24, in his treatment

on the geometrization of biology, points out

that since the characteristic and basic pro-

perties of life being of a relational charac-

ter rather than of a metric one, it is the

topological relations between the intersections

of world lines that are important, and he

examines the problem in terms of Artin's mathe-

tical theory of braids and concludes, after

citing the example of Einstein, that perhaps

some well developed branch of topology may

carry in it the solution of the geometriza-

tion of biology.

Topological Chemistry

On the assumption that there are (n) parti-

cles within the hypothetical model cell, then

the world band (Minkowski) of the cell would

consist of (n) world lines and one would assume

that we had a topological analog of a living

system. Now the question is that if it were

possible to effect a four dimensional charac-

terization of molecules in a beaker undergoing some

kind of hydrolytic mechanism, would the world

band of this system differ in character from

that of the (HMC)?

Before we can answer this question we must

examine the problem in more detail viz., what

does the (n) represent, individual atoms,

electrons or molecules or their combinations?

If we were to plot the world line of an electron

in a benzene ring (being mindful of Heisenberg's

principle) we would find a certain cyclic

character that is the electron would appear

to return to its starting point, provided of

course that we neglected the spatial orienta-

tions of the molecule as a whole during a

given time interval. This cyclic character

would be reflected by all resonating systems

and there is some indication that enzyme ca-

talysis may involve some kind of resonance,

and subsequently we shall advance the hypo-

thesis that the living system is the apex in the

hierarchy of communal action and resonance.

If we examine the activated state concept of

Eyring et al, we come to the realization that

when we contrast this with the collision theory

of chemical reactivity that in the latter we are

dealing with an intersection of world lines, al-

though the addition of thermal energy to a solid

which can undergo a chemical decomposition,

would as a result of the transport of thermal

energy via phonon scattering give the sem-

blance of world line intersections.

The Principle of Cosmic Entropy

In its final analysis, the

UNIVERSE consists of a single entity and all

real events reflect its numerous manifestations. 

For the want of a better name let the eschato-

logical field, particle, continuum or entity

be known as "COSMIC ENTROPY" or simply the

quantity (X).
Postulate (II) Every Event (mass or energy displacement or field perturbation), System, or molecular aggregate has a \( (T) \) value of unity. Eyring's transition state then has a value of zero, thereby retaining the symmetry of all mechanical equations of motion of individual particles with respect to Time.

Postulate (III) In a given volume of the universe the local properties of space are determined by the total number of Events \( (Z) \) and depending on the absolute magnitude of \( (Z) \) as a function of Time, there may arise different manifestations or planes of activation of quantity \( (X) \) giving evidence to the presence of gravitational or electromagnetic fields and mass-energy.

Representation of Chemical Events by Quadrants

From an operational standpoint the central theme of the Quadrant Mechanical Hypothesis is that the dynamical behavior of real (non-equilibrium) chemical systems can only be realized via algebraic equations containing universal constants empirically derived by means of (MTP) considerations for an \( (n) \) dimensional continuum. These equations would concern relations between so-called packages of chemical information and one may propound a macroscopic Equivalence Principle of Chemical Information viz., that reaction rate information will depend on reactant information once the non-linear laws are known. Thus, for every set of potential reactants in the system \( (J) \), the reaction rate and the set of corresponding products is dependent upon the amount of parameter information available. In summary, a macroscopic chemical system (sodium) may be described or characterized by an Information Matrix or package consisting of four elements, namely, \( T, E, M, \) and \( W \) (medium) and each matrix must be associated with a set of space coordinates \( (u,v) \). In the present hypothesis, the package of information is referred to as a "QUADRANT" and the new treatment as the QUADRANT MECHANICAL HYPOTHESIS (QMH).

In the new language equation (2) may be re-written as shown in eq. (3) thus enabling

\[
\sum F + \sum \xi = \sum F + \sum \xi
\]

reaction dynamics to reflect some of its cosmological character. The equation reads: The sum of the primary quadrants \( (P) \) plus the sum of the cosmic entropy \( (X) \) within the system is equivalent to the sum of the final quadrants \( (F) \) plus the sum of the perturbations of the cosmic entropy within the system.

The laws of the quadrant mechanical universe consist then of the algebraic correspondence between the respective quadrants or information matrices.

Catalysts used in the chemical industry can be regarded as carrying informational entropy encoded in their structure and which is capable of manifesting itself in either material or thermodynamic form. In fact, there are some catalysts that carry so much information that they must be sealed in glass vials since exposure to air may generate large quantities of heat. Chemists often blame poor experimental results on the past history of their starting materials e.g., the time/temperature factor during preparation or the use of slightly different raw materials, thereby introducing trace impurities which often have a pronounced effect.

The question of whether a crystal contains a certain absolute amount of information is a difficult one particularly if we think of information storage in terms of atomistic disorder. For example, some crystals when bent in air are very brittle and will fracture. These same crystals however, if bent underwater now behave as if they were ductile. The fact that a material is ductile indicates a certain capacity to dissipate energy in a given time, in a similar fashion the electrical resistivity of a thin film semiconducting device may in addition to any temperature dependence be a function of the partial pressure of the gas with which it is in contact. These examples illustrate the importance or the role of the chemical environment.

Quadrant representation is a sort of feedback in that observation of non-linear behavior will help us construct information equations which in turn will help to understand the storage of information in crystals etc., and eventually the non-linear laws. Finally, the above equivalence principle must conform to the second law as shown by Brillouin.

The Quadrant Mechanical Universe

The objective of the quadrant mechanical hypothesis is the derivation of a quasi-thermodynamic equation for the hypothetical model cell existing in a cyclic or oscillating universe and which would serve as a biophysical analog of the Einstein mass/energy equation and eventually be subject to experimental verification.

The approach stems from the view of the chemical kineticist and emphasis has been given to the description of non-reversible chemical events in (n) dimensional space. One can argue that if we can describe the geodesics of a comet, why not make a similar attempt for the sodium in an infinite reservoir? There was a time when it was very useful to speak of the planetary electrons or Prout's hypothesis and it should not be strange to think in terms of so-called chemical geodesics whose behavior would be determined by the empirical laws of quadrant transformations.

The thermodynamic approach with regard to model cell considerations would appear a necessity, keeping in mind that Carnot's research on heat engines made clear that the operation of heat devices was intrinsically independent of the working substance involved, in fact, his
thermodynamics needed no picture of the nature of matter at all. However, we cannot isolate a living system since its existence depends on its environment and a philosopher may even distort this to make it appear as a reflection of Mach's principle.

The quantity \( (X) \) is the single unanalyzable, a finite quantity, yet in terms of expansion/contraction cycles, capable of changing an infinite number of times without degradation.

At the point of maximum expansion one would expect \( \rho \) the mean density of the universe to either vanish or have its minimum value and at Time-Zero (the beginning of a new cycle) its maximum value. At the point of maximum expansion assuming that \( \rho \) vanished, the total number of events in the universe would be a constant, since all that would remain would be the field of cosmic entropy, however, this would represent an unstable situation and must be followed by a contraction.

The solution of the General Cosmological Problem here proposed and the quantity \( (X) \) force the logical implication that there be some relation between the so-called forces or dynamics of organic evolution and the quantity \( \rho \). As Cudero has pointed out, in Lemaitre's hyperdense or quasi-point like state, our ideas of space, time and matter lose their accustomed appearance when applied to it. Therefore, since at Time-Zero the thermodynamics of the cyclic universe predetermines that \( \rho \) eventually be minimized, then the appearance of living systems on cooled celestial bodies must correspond to the principle that there is a natural tendency to annihilate mass and that the mechanics of the living state entails the annihilation of matter.

As Kompaneyets has pointed out, "It is sometimes said that a mass of one gram is capable of releasing an energy of \( 9 \times 10^{20} \) ergs. However, if the substance consists of atoms the possibility of generating this energy is still questionable since up to now not a single process is known in which the total quantity of protons and neutrons is changed. This is why the relative change in rest mass in nuclear reactions is always measured in fractions of one percent. The possibilities of various reactions are also limited by the conservation of total charge. In order to annihilate the whole mass we would have to first prepare "anti-matter" but this would require a like expenditure of energy."

It is interesting to note that if the design of the living state were contained in Lemaitre's radioactive bomb at Time-Zero, then there would be an Information Loss and a gain in entropy with the subsequent appearance of living systems. It would thus appear that the state of affairs at Time-Zero would constitute the highest state of material organization. Therefore the general expansion would result in an increase of entropy which would reach a maximum when \( \rho \) becomes zero.

If we assume that presently the hypothetical model cell represents the highest state of material organization known, then we are confronted with a possible decrease in entropy. Schrödinger has considered this: "Thus a living organism continually increases its entropy - or, as you may say, produces positive entropy - and thus tends to approach the dangerous state of maximum entropy, which is death. It can only keep aloof from it, i.e. alive, by continually drawing from its environment negative entropy."

We now come to the fundamental theme of this paper viz., that in the process of order creating order (HMC) the nature and the number of Events are such that stability can only be maintained by the annihilation of infinitesimal quantities of matter and therefore, the living state entails the conversion of matter into cosmic entropy.

The cyclic universe presents us with two instabilities viz., at the point of maximum expansion \( \rho \) is minimized or vanishes and therefore the number of events in a given volume segment of the universe is likewise minimized and we have an unstable state. On the other hand, at Time-Zero the number of events in a similar volume segment is maximized due to the hyperdense state which is also unstable, otherwise, why the expansion? One may therefore refer to the cyclic model of the universe as the paradox of instabilities, nevertheless, as mentioned earlier, this assumption reduces the number of unanalyzables.

Now returning to the hypothetical model cell as a volume segment of the universe, one may draw the following conclusions viz., that, since it represents a high state of material organization and therefore on a relative basis, associated with a large number of events, the conversion of matter into cosmic entropy is the mechanism by means of which the system sustains its stability. Einstein has emphasized that all one ever sees in actual measurements are coincidences of pairs of marks. As Swann points out: "These events as we have called them are qualitative phenomena which exist in their own right. When we come to study the restricted theory of relativity, we shall find that events are fundamental in our thinking, much more fundamental than positions and times."

The concept of the number of events or perturbations of \( (X) \) in a given volume segment may perhaps eventually serve as the means of differentiating not only between the various fundamental fields, but perhaps even serve as the conceptual basis for an understanding of that magic number 137, the fine structure constant.

On the basis of the hypothesis that has here been developed, a World Cycle of the Quadrant Mechanical Universe is as follows:

**TIME ZERO**

1. The fundamental field of cosmic entropy is all that is in existence except momentarily perhaps for a small quantity of matter during which interval it is in a quasi-equilibrium state.
The pure field contracts and matter is created or if a small quantity of primordial material were already present, its mass would have increased as the field contracted.

The primordial material now begins to subdivide (explosion) and the GENERAL EXPANSION begins.

Living Systems begin to make their appearance on cooling fragments and the Process of Organic Evolution begins.

During its Life Cycle, each living system converts infinitesimally small quantities of matter non-reversibly into cosmic entropy.

While the Universe continues to expand, the total mass represented by living matter is becoming more nearly equal to the combined mass of non-living matter.

The driving force for the biological evolutionary process is manifest by an inherent tendency of the universe towards a state of maximum cosmic entropy (this should not be confused with Boltzmann-Gibbs entropy). There is therefore a so-called cosmic pressure exerted on all matter throughout the universe to continually reorganize. In living systems this quasi-pressure attempts, via numerous atomic-molecular variations, to continually produce a more intricate internal geometrical design or structure and in such a direction that the machine will have increased in efficiency as a generator, regardless of whether it's Mass remained constant.

The total Mass of the universe has been reduced to an insignificant quantity as the Universe reaches its point of maximum expansion.

The universe has completed another cycle and is now in a state of Time Zero₂.

As a consequence of this phenomena, the so-called FORCES OF ORGANIC EVOLUTION are continually striving to reorganize a given quantity of living matter in order to increase its efficiency as a generator.

Returning to equation (3), if we now add the term $(X₀)$ as shown in eq. (h) we obtain a

$$\sum F + \sum X = \sum F + \sum A_X + X₀ \quad (h)$$

generalized Field Equation for the Model Cell which reads: the sum of the primary quadrants plus the sum of the cosmic entropy within the system is equivalent to the sum of the final quadrants plus the sum of the changes of the cosmic entropy plus the sum of the cosmic entropy produced or generated.

Equation (h) therefore, serves as an approximation of the required unifying principle for the (OCR) as proposed. Once upon a time the earth was devoid of life. Slowly the Ratio of living to non-living matter has increased. It is in part the relative abundance of these quadrant mechanical entities scattered throughout the universe that determines its Temporal State. It is of the greatest importance to note from equation (h) that these quasi-chemical machines are independent of chemistry and geometry, i.e. we cannot require the mode and Form of all living entities in the heavens to resemble those on the earth.

**An Elementary Derivation of a Field Equation for a Hypothetical Model Cell**

The following derivation of a quadrant mechanical field equation for the hypothetical model cell has several advantages. Although it makes use of the principle of cosmic entropy, it does not require a formal knowledge of the quadrant algebra of eq. (h), conforms to a physical model of the oscillating universe and reduces to the Einstein equation for the condition $(n) = 1$ and is based on four simple assumptions:

1. The number of disturbances $(dX)$ in the system is exactly equal to the number of Events $(s)$.
2. The number of Events can be approximated by the product of the mass and the quantity $(2^n - 1)$.
3. Assume a linear dependence between change of Events and change of Energy.
4. Assume a linear dependence between change of Energy and change of Cosmic Entropy $(X)$.

On the basis of the proposed cyclic mechanism we may DEFINE "LIFE" simply as the PRODUCTION OF COSMIC ENTROPY, a process which results in the annihilation of infinitesimal quantities of matter.
We now consider the model cell.

\[ (z) = \text{events per second} = (2^n-1) \text{ m} \]

\[ Z = \text{total number of events} \]

\[ Z = \int (z) dt = (z)t + Z_0 = (2^n-1)mt + Z_0 \]

\[ W = \text{total energy} \]

Now if \( (z) = f \left( \frac{dW}{dt} \right) \) and assuming linear dependence between change of events and change of energy, then

\[ f \left( \frac{dW}{dt} \right) = C_1 \left( \frac{dW}{dt} \right) \]

\[ X = \text{total cosmic entropy} \]

Now if \( dX = f \left( \frac{dW}{dt} \right) \) and assuming a linear dependence between change of energy and change of cosmic entropy, then

\[ dX = C_2 \left( \frac{dW}{dt} \right) \]

Therefore

\[ dX = C_3 (z) dt \]

Also

\[ c_3 = c_2 / c_1 \]

Then

\[ X = c_3 (z)t + X_0 \]

Or finally

\[ X = c_3 (2^n-1)mt + X_0 \quad (5) \]

When \((m)\), \((t)\), or \((n)\) are zero, we obtain

\[ X = X_0 \]

Referring to the constant \( X_0 \), it can be a function of \((m)\) and \((n)\), however, this would be determined by initial conditions.

**Action at a Distance**

Newton 32 once wrote that to suppose "that one body may act upon another at a distance through a vacuum, without the mediation of anything else... is to me so great an absurdity that I believe that no man, who has in philosophical matters a competent faculty for thinking, can ever fall into it." Newton conjectured that gravitation might be associated with a variation in density of the ether from one place to another, with a body being pushed from a region of high density to a region of low density.

Although Einstein's theory of gravitation has to be considered a monument to intellectual achievement and he disposed of the "old mechanical ether", he nevertheless presented us with a profound conceptual dilemma viz., the geometrical properties of a vacuum or so-called empty space i.e. one could conceive of points in a space even in the absence of matter.

Einstein's vacuum was filled with massless test particles whose geodesics described the geometrical properties of space. In a sense the vacuum is to the cosmologist as protoplasm is to the biologist since both are bounded and all effects must be transmitted through them, though the action of both remains an enigma.

Now in chemistry there are numerous examples in a restricted sense of an action at a distance e.g. a functional group on one end of a long molecular chain may produce events at the other end, however, it proceeds via electron delocalization 33. Likewise certain polarization phenomenon may also be considered in this manner.

Although the (QMH) and the field equations can only be considered a symbolic formalism, there is nevertheless the implication of events in so-called empty space thus in agreement with Dirac's finding that any point of space-time devoid of charge or matter retains a velocity. This being the case one might conjecture that gravitational interactions always proceed in the direction or towards a given volume segment of the universe containing the greatest number of events since all events constitute perturbations in the fundamental term (X). However, this raises another fundamental problem viz., why opposite charges attract and like particles repel each other? It may be possible to develop a theory of charge based upon certain multiples of a fixed number of events in a given volume segment of the universe. It is logical to assume that only one entity exists viz., the quantity (X) and that everything else represents its multifarious manifestations. However, cosmic entropy and the concept of an event both represent unanalyzables nevertheless, we accept the idea of events in a vacuum or space (being perturbations of X) and yet if we think about Lemaître's atom primif in conjunction with the existence of anti-matter, we are forced to the conclusion, as fantastic as it may seem, that the incorporeal EVENT may have a directional character.

In the next few decades we may perhaps see that the problem of action at a distance may no longer be confined to the domain of the physicist but be extended into the biocosmos in view of so-called psychical and other phenomenon, a subject of considerable controversy.

If we examine the field equation, the very large number of events which takes place during a random interval of the organism's life represents a highly coupled physico-chemical system and it would be difficult to conceive of this type of a quasi-oscillator not giving off some type of energy or radiation, especially in view of the continual annihilation of matter and perhaps this class of so-called unexplained phenomenon falls into this spectrum.

**Discussion**

In this paper we have proposed the hypothesis that the origin of Life is a universal, natural phenomenon, independent of chemistry and geometry, an integrar factor in cosmological mechanics, and that the living state
is associated with the annihilation of infinitesimal quantities of matter.

The hypothesis revolves around the concept of cosmic entropy, the ultimate "ether" from which the universe is constructed. It is further suggested that the ultimate laws of the macroscopic world must make themselves evident in the algebra of information matrices which describe chemical events in a (n) dimensional space, therefore, it is an attempt at unification from the viewpoint of the chemical kineticist.

A field equation has been derived on the basis of a hypothetical model cell, the simplest of living organisms, existing in Opik's oscillating universe.

It is of interest to list those factors which form a basis for the (QMH) and to examine them in terms of available knowledge.

1. The existence of an "ether" referred to here as cosmic entropy.
2. The Quadrant representation of chemical events and their significance.
3. The oscillating universe hypothesis.
4. Life as the production of cosmic entropy.
5. Exobiology.
6. Action at a distance phenomenon in the biocosmos.
7. Unified field theories.
8. Quadrant mechanical field equations.

There is hardly a serious student of natural philosophy who, at one time or another has not been forced to consider the existence of some type of ether either to explain the propagation of gravitational or electromagnetic effects or interactions between elementary particles. In the macroscopic world in which we live, space without reference to matter is meaningless and since there is evidence, even if mathematical, that matter can affect space and space can affect matter, it is not unreasonable to assume a common origin or basis.

Einstein did not destroy the ether on the contrary, he distilled from it an essence that eventually elevated him to the rank of another Newton.

At the present time chemical reaction kinetics, contrary to its fundamental importance, essentially remains an art, due in part to its inherent complexity as well as the fact that it has been unable to escape the law of mass action as well as the equilibrium concept. To describe macroscopic non-reversible chemical events in terms of Minkowski's world lines in a multi-dimensional space, would represent a considerable advance. If we examine the data in Tables I and II one can foresee the possibility of calculating the total number of events from a knowledge of length and shape of the world line. Perhaps one might even say that this could be the most important challenge in natural philosophy. In recent years there has been too much emphasis on statistical calculations concerning equilibrium systems. The greatest advances in reaction kinetics will eventually emerge from applications of the mathematical theory of information to non-equilibrium chemical systems.

The great work of Onsager, Eyring, De Groot and Prigogine etc. in this century can be considered as among the pillars of theoretical chemistry, however, the very nature of the hypothetical model cell requires the introduction of geometry into our chemical equations, and this can only be done via some type of quadrant representation.

The concept of an oscillating universe eliminates the problem of either a beginning or an end and precludes the idea of an infinite universe. As expressed by Opik, "an unlimited variety of combinations and of prospects of evolution would be possible during each phase of the oscillation." Hoyle, who along with Bondi and Gold in 1948 pronounced the "steady state hypothesis" has recently rejected it in favor of an oscillating model in view of extragalactic radio data.

With regard to the foundations of general relativity, Einstein has said: "The idea that Mach expressed, that inertia depends upon the mutual action of bodies, is contained to a first approximation in the equations of the theory of relativity..." but this idea of Mach's corresponds only to a finite universe bounded in space, and not to a quasi-Euclidean infinite universe.

From the standpoint of epistemology it is more satisfying to have the mechanical properties of space completely determined by matter, and this is the case only in a space-bounded universe.

There are two rather striking features found in the physical nature of things viz., order (e.g. snow flakes) and cyclic change, and from the viewpoint of the hypothetical model cell, a cyclic universe would appear a necessity, otherwise there would be no driving force to explain its natural origin.

There should be no conceptual difficulty in understanding the proposed quasi-thermodynamic definition of life, viz., the production of cosmic entropy since in the operation of all machines one can say that a certain amount of matter has been converted into energy. In a conventional chemical process the only way to increase the number of atomic-molecular interactions or events is via an increase of the thermodynamic entropy. In the (QMC) however, we have an equal or greater number of events with the entropy held constant if not decreased.

The space age has naturally focused considerable attention on the question of life elsewhere, and substantial sums of money are being spent in this area. According to the (QMH) the probability of finding some form of life on cooled planetary bodies is about the same as for the condensation of a warm gas upon a cooled surface.
It would indeed be surprising if some form of micro-organisms were not found on the lunar surface.

Although there are a number of examples in the biological world that could be interpreted as action at a distance, these generally have some kind of physico-chemical explanation e.g. the ability of an organism to detect what would constitute a single foreign molecule and thus cause the organism to act in some manner.

Likewise, a number of outstanding scientists feel that a correspondence may exist between physical laws and psychological laws, among them Russell. However, in going beyond this realm the possibility exists of an unknown spectrum, which once again would be amenable to physical analysis, after all, both cosmic radiation and extragalactic radio emission were with us for a long time before they were discovered.

In view of the order that man observes in the world around him, it is both logical and natural that some attempt be made at unification.

During the first quarter of this century the world of physics became separated into a discontinuous micro- and a continuous macro- cosmos viz., the world of the atom was determined by Planck's constant and that of the expanding universe by the gravitational constant.

A freshman physics student, if pressed for a solution, could perhaps on purely political grounds suggest a compromise viz., either a discontinuous continuum or a continuous discontinuity.

There are indications of some relationship between atomic and cosmological constants as evidenced by the dimensionless numbers of Eddington and Jordan.

Among other factors Einstein objected to the idea inherent in quantum mechanics that the objective physical state of a system depended on the way in which it was observed. On the other hand physicists such as Pauli, Bohr and Heisenberg argue that a complete solution of the open problems of physics by a return to classical field concepts is impossible.

As Pauli has pointed out, "the atomicity of electric charge has found its expression in the specific numerical value of the fine structure constant and whose theoretical understanding is not yet known".

Recently Stakilevich, referring to the well known fact that gravitational forces are weak among the fundamental particles, notes that "it is not entirely obvious that the energy of all elementary particles is concentrated within the limits of their classical radius, and for particles with a radius much less than the classical, the gravitational forces may play a substantial part."

Note, in a very interesting work entitled "Cosmology and the Structure of Elementary Particles" accepts the revolutionary idea that G is not a universal constant but is equal to its classical value outside matter only, but assumes very large values within fundamental particles such as electrons and protons, and concludes his unified field theory by showing the interior of a particle as being a region in which the geometry of space-time departs drastically from Euclidean geometry, and in which the gravitational constant has the value \(\frac{\Delta c}{m^2}\), which means that in any closed system the value of the gravitational constant is equal to the product of the angular momentum of the system and the speed of light divided by the square of the mass of the system.

Mott further shows that this leads to a closed Einstein universe in which the gravitational constant can be related to the radius and the mass of the universe.

From an operational standpoint, the fundamental concept in the (QMH) is the EVENT and if we examine the arbitrary function \((2^nl)\) and assume that \((n)\) refers to all of the atoms, contained in the mass of the earth, it is obvious that we would have a very large number of events and one might assume that this gives rise to the gravitational field experienced upon its surface. However, since the quantity \((X)\) exists even in the absence of matter i.e. the implication of events taking place in a vacuum, then any change in the quantity \((X)\) resulting in the formation of an elementary particle by any process whatsoever, results in the concentration of a very large number of EVENTS in a given volume segment of the universe, therefore, there is a conceptual basis for the variation of \(G\) within and without elementary particles.

To continue this reasoning one step further for the benefit of those who may be thinking about so-called anti-gravity devices, the implications are that, regardless of the size of the device, it must be capable of producing the same number of events as all the atoms of the earth and as such is almost beyond our power to imagine.

Finally, with regard to the derivation of quadrant mechanical field equations based on the concept of cosmic entropy, I can only see in this a tool which can hasten our understanding of the quasi-thermodynamics of the hypothetical model cell.

The present equation, contrary to the fact that it appears restricted to the (HMO), conforms to the requirements of the oscillating universe viz., that when \((n, m; or t)\) equal zero, the quantity \((X)\) equals \((X_0)\). In the Einstein equation a gram of mass is equal to \(9 \times 10^{20}\) ergs and in terms of the present hypothesis one gram of mass would be equivalent to \((10^{30} \text{ cm}^3)\). It is of interest to note that since one gram molecular weight of any gas at S.T.P. occupies 22.4 liters, this volume would be equivalent to the annihilation of an elementary particle weighing on the order of \((10^{-26} \text{ grams})\) on the basis of \((\rho)\).
Conclusion

An attempt has been made to mathematically define life and the dynamics of the living state from the viewpoint of the chemical kineticist. In the words of Schrödinger taken from his book "What is Life?," a scientist is supposed to have a complete and thorough knowledge, at first hand, of some subjects and, therefore, is usually expected not to write on any topic of which he is not a master.... I can see no other escape from this dilemma (lest our true aim be lost forever) than that some of us should venture to embark on a synthesis of facts and theories, albeit with second-hand and incomplete knowledge of some of them - and at the risk of making fools of ourselves.

In view of the fact that the number of technical journals exceeds 60 thousand, the role of the generalist is most difficult but nevertheless necessary.

However, the salt of any hypothesis, whether we advocate a formal or model approach to the solution of physico-chemical problems, must eventually reside in the power of experimental verification.

The most crucial test of the proposed hypothesis would stem from a demonstration that the living state violated the first law of thermodynamics and which could only be possible through the invention of a new variety of energy.

With regard to the abundance of life, Urey\(^5\) has recently made a review of biological material in meteorites and perhaps a better understanding will be gained after the Apollo program. In a restricted sense there is a biological analog of the anti-matter concept in that optical isomers are of two types which are mirror images of each other.

Garenko and Gurjian\(^6\) have reviewed the biological role of gravity and refer to the development of a new branch of science viz., gravitational biology. The importance of this factor cannot be over-emphasized and will undoubtedly determine the geometry of forms found elsewhere (extraterrestrial life). In this vein one cannot help but remember the relativistic story that since gravitation as well as velocity both change Time, a man on a mountain top therefore, lives a little faster than the people below, however, in real life it is just the other way around.

Sisakyan et al\(^7\) have considered the effects of space flight factors on some biological objects. Neglecting radiation factors, the question of whether prolonged weightlessness or variations in gravitational field strength on the mode and kinetics of chemical processes is therefore of considerable interest.

Des Coudres\(^8\) and Tolman\(^9\) respectively, near the turn of the century studied the effects of gravity and centrifugal force on the electromotive force of galvanic cells and a theoretical treatment has been given by MacInnes\(^10\).

More recently some work by the author\(^51\) on the electromotive force of partially frozen thermogalvanic cells under conditions approaching nearly free fall, indicates an initial drop in potential resulting from the reduced gravity field, however, the work is only preliminary.

With regard to the physical and biological reality of the Clock Paradox, Benedikt\(^52\) states that "Insofar as living beings can be conceived of as mechanical systems, their aging can be expected to be affected by their motion in a gravitational field."

Photons are massless, spin 1 quanta of the electromagnetic field that transport energy and there are those who hope to find the graviton\(^53\), a massless, spin 2 quanta which determines the gravitational field, since some particles are freed of coulombic forces as the result of the acceleration of a given body. The origin, evolution and dynamics of terrestrial life has been the subject of numerous studies\(^54-59\), especially during the past decade. Living substance is found everywhere and it is capable of withstanding great variations in temperature and environmental conditions.

Regarding the cosmological role of Life, Jeans\(^60\) wrote "We can still only guess as to the meaning of this life which, to all appearances, is so rare. Is it the final climax towards which the whole creation moves, for which the thousands of millions of years of transformation of matter in uninhabited stars and nebulae, and of waste of radiation in desert space, have been only an incredibly extravagant preparation? Or is it a mere accidental and possibly quite unimportant by-product of natural processes which have some other and more stupendous end in view? Or, to clench at a still more modest line of thought, must we regard it as something of the nature of a disease, which affects matter when it has lost the high temperature with which most of the matter in the universe would at once destroy life? Or, throwing humility aside, shall we venture to imagine that it is the only reality, which creates instead of being created by the colossal masses of the stars and nebulae and the almost inconceivably long vistas of astronomical time?"

Within the living cell geometry (dissymmetry, molecular conformation, hydrogen bonding, gel rheology and scale-up) and resonance are paramount, and with regard to transport processes the work in quantum biochemistry, molecular biophysics and bioelectrochemistry will eventually lead to important findings and perhaps applications in bionics.

With regard to the unified field theories of physics which are concerned with the formidable problem, their real value is more often in the conceptual domain i.e., a possible fact which has previously been overlooked or which may in turn lead to new experiments or ideas.
resky refers to his interesting paper as "a possible step toward the ultimate attainment of complete generalization."

Physicists have been mainly concerned with things that can be measured and the emphasis as Einstein put it has not been on the understanding of a phenomenon but on a physical proof of it. Physical proof is naturally desirable but it should not necessarily be the most important element.

In all probability, since unified fields deal with the more subtle aspects of natural phenomenon, they will not be as amenable to experimental verification as other more selective physical theories. Chemistry and physics both need a few philosophers from time to time, progress depends on it.

It is difficult to terminate a discussion of this nature without a comment on the role of causality, Weyl provides an excellent summary. To Schroedinger, quantum indeterminacy had no biologically relevant role that, even if the workings of the ([HMC]) were not completely deterministic, they were at any rate statistically deterministic.

Causality has always been a difficult question, and in a metaphysical sense is somewhat associated with the so-called quasi-principle of asymptotic paradoxes, which may be operative in biology (mutations) and in wave mechanics in the form of environmental induced perturbation imposed upon the wave state since its complete isolation is impossible.

Eddington, one of the great minds of this century realized the real issue when he wrote, "a rather serious consequence of dropping causality in the external world is that it leaves us with no clear distinction between the Natural and the Supernatural."

The concept of a topological, relativistic or informational chemistry as proposed in this paper will not in its experimental aspects be concerned or governed by any uncertainties since we are observing the world lines of macroscopic chemical bodies under non-equilibrium conditions. In the absence of experimental data it is difficult to comment on the potential value of observations of this kind, and to what extent and direction the results can be extrapolated, more important, however, the possibility exists that some day we may find a so-called law of chemical geodesic that may be somewhat similar to the law of Constant Heat Summation by Hess.

The challenge does not concern the experimental aspects but resides in the incorporation of the new data into the new chemical algebra. In "The Chemical Conception of the Ether," one of the last papers of Mendeleev, is written: "If the Newtonian theory of gravity revealed the existence of forces acting at infinitely great distances, the chemistry of Lavoisier, Dalton, Avogadro and Gerhardt, on the other hand, disclosed the existence of forces of immense power acting at infinitely small distances, and transmitted into all other forms of energy, mechanical and physical..."


28. Prout, W., (1815): Twelve Years after Dalton suggested his six point atomic theory, Prout, another great mind, proposed that the weights of all atoms were simple multiples of the weight of the hydrogen atom and that hydrogen was thus the fundamental material out of which all other elements were constructed.


31. The quantity \(2^n-1\) describes the maximum number of combinations of the quantity \(n\) in a given time interval.


35. The law of mass action or G.M. Goldbergs law of chemical equilibrium published in 1864, recognized that chemical equilibrium is dynamic and not static and is concentration dependent in addition to being specific under a given set of conditions. However, the concept of concentration dependence had been noted by Claude Louis de Berthollet in 1801 in his famous book: Essai de statique chimique. It should be noted that a catalyst changes the rate of a reaction, not the position of final equilibrium. In view of his classical work in 1850, L. Wilhelmy may be called the "father" of chemical kinetics. In essence to study chemical reactions under so-called equilibrium conditions represents in effect a "trade-off", information-wise.


21. Emsanian, M., (to be published); This work involved thermogalvanic cell made in the form of straight tubes in contrast to U-tubes used in other work reported in J. Electrochem. Soc., 112, 6 (1965).


34. Oseen, C.W., Neuere Methoden und Ergebnisse in der Hydrodynamik, (1927), Leipzig.

66. Hess, G.H., (1840): It was observed by A.L. Lavoisier and P.S. de Laplace in 1780 that the quantity of heat required to decompose a compound into its elements is equal to the heat evolved when that compound is formed from its elements. As was pointed out by J. Thomsen in 1853, the law of Hess is a direct consequence of the law of conservation of energy.