Cosmic Bio-Radiation: Casting Gurwitsch in the light of Vernadsky

By Cody Jones

Upon growing up in a home permeated with the tones of his sister's professional-level piano playing of the greatest classical composers, Alexander Gurwitsch set out to pursue an artistic life of his own, as a painter, but in failing his entrance exams to the academy of arts, embarked instead on a path that would forever change the course of science. Though he never lost the passion for the classical arts, and spent many hours of his own playing through the works of Beethoven in particular, Alexander Gurwitsch's revolutionary contributions to human progress would come out of his works in the domain of biology, the implications of which are only now becoming recognized for what they imply pertaining to the universal domain of what we call "cosmic radiation". In his first year of medical college Alexander's mind was shaped in a fundamental way through intensive work with a relative of his, later a famous member of the Soviet Academy of Sciences, Leonid Mandelstamm, who worked him through the newly published works of Einstein, on the theory of relativity. It was out of this work that Gurwitsch was led to introduce into biology, for the first time in modern history, the concept of the field.

Now, unlike many subsequent attempts at introducing field concepts into biology, Gurwitsch left open the idea that we were not just dealing with an expression of already known electromagnetic fields, only now in biological circumstances, but rather, that there may be a distinct, as-yet-undiscovered, unique biological field. (This is an idea which has remained largely undeveloped, as the discovery of electromagnetic fields in biological organisms have been put forward to explain the whole story, so to speak. Instead, Gurwitsch preferred to see the electromagnetic characteristics as adjuncts to, or subsumed by, the higher biological field, for which we have yet to develop the proper experimental techniques and methods to test and quantify.)

The work of Gurwitsch gets broken down into two main paths of pursuit, though they would be better thought of as conjugates of each other. The first being that of the already mentioned biological field, and the other, his work on mitogenic radiation. (This is a phenomenon which is now referred to as biophoton emission, though it is a name which suffers from the implied particulate nature of radiation.) Essentially what Gurwitsch concludes out of his discovery of mitogenic radiation, achieved through his experimental work—such as his famous onion root experiment, in which it is demonstrated that cell mitosis can be induced in an onion stem via extremely low-intensity ultraviolet (UV) emissions from the root of another onion—is that chromatin (as in chromosomes, DNA) is the source of this biological radiation, measured by him in the UV range, and that this radiation stimulates and regulates the mitosis of other cells. In other words, UV radiation emanating from one cell can trigger the act of mitosis in another cell. Also, Gurwitsch thought that this biogenic radiation could provide an energy source to maintain biological micro-structures, or what he called molecular constellations, within and among cells, in contradiction to entropic decay and the so-called laws of thermodynamics.

This, then, has to be viewed in connection with, and feeding his work on the biological field. For Gurwitsch the biological field was that which bounded and determined the morphological development of an organism, which was intimately connected with the direction and rate of mitosis of cells, such that the field would become structurally and materially filled out by that process, and such that the new stage in the developmental process itself generated the conditions for the next stage in the development of the organism. In other words, each stage in the developmental process is pregnant with the next, such that the living form can only come

from a preceding living form, though this isn't necessarily a linear process. (Gurwitsch did achieve a certain level of predictability, though the characteristics of how the field expressed itself in terms of the mode of change from step to step in the unfolding process changed for different fauna, rendering it non-susceptible to a simple mathematical formulation.)

Within the context of the general field concept, Gurwitsch developed three nested levels of field structures, arranged according to complexity and spatial extent, ranging from the molecular (his molecular constellations), to the cellular (relations among cells), to the organismic levels (the different organs and systems that constitute a single organism). Each nested field could be described in terms of different mechanisms as to how the morphology advanced for any particular structure, yet they were all unified towards the realization of definite future state of existence. For reasons which are unclear, perhaps because they were obvious to him, or because he lacked the means to follow it through, he never expanded his theory into the level of the biosphere as a whole, despite reports of a close relationship to V. I. Vernadsky. (His grandson reports that he was close friends with Vernadsky and that they were at the same institution together in Crimea.)

It is precisely in realizing the connection of Gurwitsch's discoveries of mitogenic radiation and the biological field, to the breakthroughs of Vernadsky that we must take this investigation, to now nest the biological field at the organismic level in the biosphere as a whole, and flesh out the connection of the individual organisms to the radiant field of the biosphere as a whole, and subsequently the radiant field of the biosphere to the domain of cosmic radiation. That is, to investigate, in the light of Gurwitsch's discovery of mitogenic radiation and the biological field concept, Vernadsky's idea of the biosphere as a whole, now nested in the domain of cosmic radiation. To this end, couple the work being done on galactic and intergalactic cycles (62 & 140 million-year cycles of earth's movement through and around the galactic plane, etc...), which have thus far simply drawn correlations between galactic cycles, changes in cosmic ray intensity, and biodiversity and extinction cycles, but which hint at the idea that there is an organized radiant field on the galactic scale whose changes are intimately connected to the biospheric-field.

In this light we also have the work of Frank Brown, who carried out experiments demonstrating that the metabolism of living processes is connected to external cosmic processes, and that living creatures will respond to external electromagnetic field radiation. In other words, we expand Gurwitsch's idea of the directed field of biological development as it is connected to bio-radiation, and expand it to the level of the biosphere in the cosmos. Also, it is crucial to keep in mind that as we develop an idea of a nested set of structures of bio-radiation, that these are not then thought of as filling up an otherwise empty void of space, but rather, each nesting represents a nonlinear boundary change within a physical space-time curvature, which is characteristically living and creative, such that "cosmic radiation" defines a physical space-time which is everywhere characterized by creative change.

So, it is in the context of the above discussion that all of what follows must be couched.

With that idea in mind, it is now appropriate to introduce some of the theory and experimental work done to investigate the means by which biological functions are achieved, as developed by those who have taken a quasi-non-reductionist, radiant approach to biology. Of course, in modern times, experiment and theory often have a Jekyll and Hyde relationship.

Beginning even a cursory look into the domain of biology, one is struck immediately with the realization that

characteristic processes of the biological organism are fundamentally paradoxical from the standpoint of popularly accepted standard physics. The sustained organization of living organisms, the directed movement of enzymes, morphological growth and differentiation, all seem to operate against the accepted laws of entropy and thermodynamics. This is a point that did not go unnoticed by some of the more prominent names of early 20th century physics, such as Ernest Schrödinger, Niels Bohr, and Max Delbrück. While Bohr attempted to kill biology, as he had been doing in quantum physics, with reductionist philosophy, and claimed that anything that couldn't be reduced to pairwise relations with a 100 percent certainty were fundamentally unknowable, others, such as Delbrück, saw in biology an opportunity to discover new physical principles, which might, in fact, bring clarity to anomalies found in abiotic physics. This is an approach which is being revived today, but now with an explicit recognition that it must flow top-down, from mind, to biology, to abiotic, as nested hierarchical phase-spaces.

The first person to introduce into the domain of biology, in a specified and applied way, the then-newly discovered phenomena associated with the paradoxical qualities of quantum physics, is Herbert Fröhlich. Starting from the discovery, that in biological systems, in particular, across cellular and intracellular membranes, a 100,000 volt/cm electric field can be generated, it was then postulated that this had the potential to effect the generation of oscillating, highly polarized states in such structures as proteins, producing long-range microwave range (GHz range) frequency coherence. The interactions that arise from these coherent states are then used to explain how what are considered to be highly paradoxical phenomena, as understood from a thermodynamic molecular-biology stand point—such as coordinated cell growth and differentiation, and the directed movement of enzymes towards their target areas, for example—could occur.

The coherent states generated from this condition were likened to that of Bose-Einstein condensates, as typified in superfluids and superconductivity, as well as lasers, but with the fundamental difference being that in biological systems this occurs in states far from thermal equilibrium, and at much higher biological temperatures than the supercooled temperatures (near absolute zero) needed in the laboratory. This is indicative of the fact that qualities of effects that are commonplace, and occur under relatively normal conditions in what Vernadsky would classify as the higher domain of the biological, are then only approximated as projections in the lower domain, but only under extreme conditions, or at the boundaries of certain parameters of the abiotic domain, such as pressure and temperature, and are expressed in ways that are paradoxical relative to the domain itself.

This seems a lawful condition if we recognize that for this to be a coherent universe, yet, one with a nested set of hierarchical phase spaces, as Vernadsky discovered, the lower domain must be susceptible of expressing such higher-domain qualities, in order for the higher domain to exert control over the lower, yet in such a way that the lower domain can reflect the intention of the higher. Limited credit can be given to Fröhlich and his circles for leaving open the possibility that biological processes are a function of principles and laws totally outside the domain of what they have introduced as quantum processes, but as it stands, they still suffer from a form of bottom-up approach in attempting to carry over, however cleverly, laws from the abiotic to the biotic, in attempting to account for the acknowledged paradoxes. (Better on this front is a direct student of Gurwitsch and a close collaborator (and friendly critic) of those from the Fröhlich school, Michael Lipkind, who makes a fundamental distinction between the processes of the biological field and phenomena of the abiotic.)

Where the work of this school gets particularly interesting is when it moves into the experimental domain. Operating from the hypothesis that structural and organizational order is created and maintained through the

internal generation of microwave and other electromagnetic radiation, sustained through metabolism, they move to see what non-lethal, non-thermal effects externally applied radiation can have on the internal dynamics of the biological organism. The idea being that if the integrity of biological structures and processes are maintained in a non-equilibrium state at highly specific, internally generated frequencies, then those states and structures can be enhanced, changed, regulated, etc., by externally applied radiations, which have a harmonic relationship to those internal frequencies. (Note: An adjunct to this is a model, used by those in the Fröhlich tradition, derived from non-equilibrium thermodynamics, or chaos theory, and employing a process known as bifurcation, which essentially states that states of stable organization can transition to other stable states in a nonlinear way, under suitable conditions. This is put forward as a means of explaining the process of evolution of biological structures, and, perhaps, even species, as a function of externally applied radiation. Again, this model suffers from a bottom-up mathematical approach, and is either an attempt by those who wish to maintain the idea of an entropic universe in the main, to find a compromise, or an attack, veiled as an alternative to the non-reductionist approach of such as Vernadsky and Riemann. What it hints at, is a thought object that may find usefulness when re-approached from the higher Riemannian-Vernadskian method. That is, the image of a changing Riemannian surface moving through successive stages of non-linear ordering.)

Now, as to the experimental work.

One set of experiments which orient in the right direction, especially when viewed from our perspective of the relationship of biological organisms to cosmic radiation, is as follows. Biological structures were tested for susceptibility to change and variation under the influence of externally applied, specifically tuned, low power (i.e. weak), microwaves. For example, an experiment was set up to investigate the survival rate of bone marrow cells in living mice after exposure to x-rays. Investigators found about a 50 percent survival rate for the bone marrow cells after exposure to x-ray radiation alone, but when the cells were pre-treated with microwaves before exposure to the x-rays, they found survival rate increased to 80 percent for those cells. However, the increase in survival rate due to pre-treatment with microwaves only occurred at very specific microwave frequencies, within the range of frequencies applied by the researchers, with the effect dropping to a minimum in between those specific frequencies (Fig. 1).

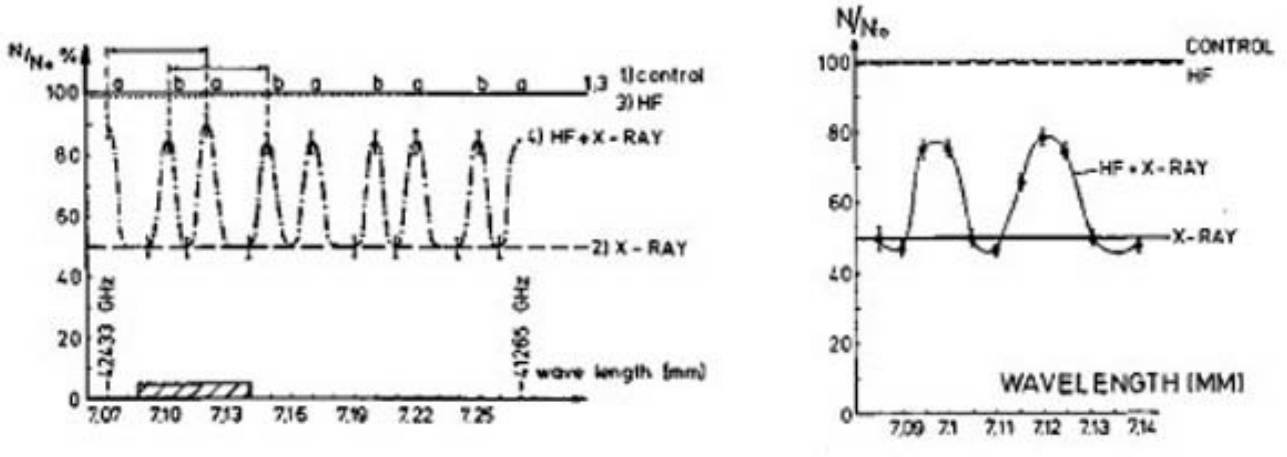

Fig. 1. *These graphs show frequency peaks where the effect of pre-treating with microwaves is the greatest. Note: HF=microwaves. (Images from:* Biological Coherence and Response to External Stimuli*, Herbert Frohlich, 1988.)*

Other studies were done on the influence of non-thermal microwaves on the growth rate of yeast cells, were it was found that the effect of either enhanced growth, no effect, or deteriorated growth rate, occurred in repeated studies at very specific frequencies. A significant difference of effect was demonstrated in a narrow microwave range around 42GHz (10^9 Hz), with a maximum increase in growth rates, relative to a baseline growth rate, occurring at 41.782 GHz and maximum decreased growth rates occurring at the 41.788 GHz. Interestingly, when the applied frequency range was doubled (from 42 to 84GHz range), the new frequency that corresponded to the maximum growth rate was double that of the maximum growth frequency of the previous tests (from 41.782 GHz to 83.564 GHz). These results again demonstrate a highly tuned quality of interaction of radiation with living processes, with fundamental differences of effect occurring within a very narrow range of frequency, as well as a periodicity of effects within a broader range of radiation quality (i.e. microwave), as seen with the growth effect occurring at doubled frequencies.

Another experiment demonstrated the ability to reduce enzyme synthesis in the *staphylococcus aureus* bacteria by 15 and 20 percent with the application of microwaves at two very specific frequencies, while no effect was produced with microwave frequencies of the same power along the continuum. Again, while the theory which prompted the experiments and line of investigation among this group of researchers itself suffers form a bottom-up approach, the experimental evidence, and aspects of the theory, raise interesting questions and lines of pursuit, especially when put in the context of our investigations of cosmic radiation and its role in evolutionary processes, and potential mechanisms and modes through which it acts. It is necessary, however, that this work be couched in the method of pursuit discussed above as the Gurwitsch-Vernadsky approach, if it is to bear the ripest fruit.

Also here, is a perspective that may turn one of the "proofs" for the Big-Bang on its head, where the observed cosmic microwave back ground has been claimed as an effect of an expanding, cooling universe. Instead, microwave radiation, when viewed from the foregoing research, may actually be an expression of the radiant field of a universe governed by the principle of life.

Fritz Popp is another leading figure in this school of non-reductionists, who compliments well the theories of Fröhlich and his related networks. In fact, it would be fair to say that Popp's foundation is a synthesis of the work of Fröhlich and A. G. Gurwitsch. In general, what Popp develops is a theory that can account for the needed radiant energy supply that must be pumped into the non-equilibrium, coherent structures, and create the coherent radiation field which facilitates the coordinated activity of the organism. Building from the discoveries of Gurwitsch of 1) the existence of a biological field for the organism, and 2) the emission and absorption of photons by biological structures, which he initially found to be connected with the induction of cell mitosis, which is why he named it mitogenic radiation, Popp investigates the many aspects of biological existence which are accompanied by what he generally terms bio-photon emission.

Popp describes a number of particular experimental observations carried out by himself and others, which he then uses as a foundation to develop what he sees as a refinement and development of that which came before him from Gurwitsch et al. One such experiment done with unicellular flagellate protists, know as dinoflagellates, demonstrated that when two different groups of the protists were brought into optical contact with each other, though still physically separated by quartz containers, they would start to engage in

synchronous bio-luminescent flickering among members of the the two different samples, whereas when in non-optical contact, the relationship of the flickering was random.

In another experiment, tests were done on the delayed luminescence from stimulated liver cells, of both the healthy and tumorous variety. It was found that as you increase the density of the healthy tissue, the rate of luminescence increased up to a maximum, at which point it started to decrease with further density increase, whereas with the tumor tissue there was a steady hyperbolic increase in rate of luminosity which continued irrespective of how dense the population of cells became. This was interpreted, in light of Gurwitsch's work on the role of bio-photon emission in stimulating cell mitosis, as a breakdown in a regulatory function in the tumor tissue, which did not occur in the healthy tissue.

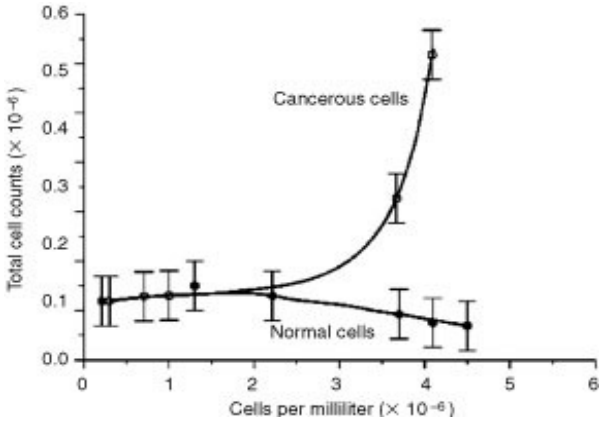

Fig. 2. *PHOTON COUNTS OF NORMAL LIVER CELLS VS. CANCEROUS CELLS. Normal liver cells (lower curve) have a relatively stable or even falling level of photon counts at increasing cell density, while cancer cells of the same cell type show an increasing photon count at higher cell densities. From this, it was concluded that populations of cancer cells have lost the harmony and coherence that is typical for healthy tissue. (Image from 21st Century Science and Technology magazine, Summer 2001.)*

Similar to this was an experiment on daphnia, or water fleas, which showed nonlinear biophoton increase, then decrease, then increase again as the population density rose, which was taken as evidence of a type of interference pattern that changed according to the density of the population. It is worth mentioning another series of experiments which show similar types of effects conducted by A.B. Burlakov, a Russian scientist following in the Gurwitsch tradition, who looked at the effect of optical contact between fish eggs of differing ages. What he found was that if a group of young eggs was brought into contact with another group just slightly older, the younger group actually accelerated its growth rate as if to catch up, whereas if the difference was of a greater interval, past a certain threshold, the effect was deleterious, resulting in mutations and higher death rates (Fig. 3).

Perhaps most intriguing is the reported result that in cases where mutations were developing, the mutations were able to be reversed with the application of different frequencies and polarizations. This can be seen as evidence that morphological changes are not simply the function gene expression, for in the cases of mutation and reversal of mutations the genes themselves were not changed per se, but the effect was brought about as an action on the organism as a system.

For Popp the results and observations of the numerous experiments just mentioned are explained using his mechanism of "photon sucking". Photon sucking is a model developed by Popp whereby the collection of cells or organisms maintains a biophotonic field, such that emitted radiation waves maintain internal and external fields, through constructive and destructive interference, mediated by biological membranes, with a radiation pressure gradient that holds the external coherent field at a lower pressure than the pressure of the internal coherent field, and facilitates energy storage and regulation, as well as provides a mechanism for mobility, and attractive and repulsive activity. It is this \photon sucking model which is then used to account for the various coordinated and regulative properties of life, otherwise paradoxical in standard theory.

This is just a brief sketch of Popp's work, but again, it should be emphasized, its foundation lies in the work of A.G. Gurwitsch, who, I would posit, holds a different ontological outlook than that of Popp. Where Popp builds up to the domain of life, utilizing models and language borrowed from an a-priori abiotic space and time of thermodynamics and quantum physics, Gurwitsch maintained the hypothesis that there was a unique biological field, by which the electromagnetic phenomena were subsumed, the characteristics of which were projections of this biological field. A direct student of Gurwitsch, Lipkind, also holds a similar criticism of Popp and those associated with him, saying: "The application of the concept of coherence to living systems has been dictated by the urge to understand unique specificity of the living state by means of alternative approaches, apart from the dominating dogmas of molecular genetics. However, the peculiarity of the situation is that the notion of coherence employed in biological systems has no formal definition anyway differing from the formal definitions using quantum physics. However, the concept of 'biological coherence' pretends to explain the specific specificity of the 'living state' that exceeds the limits of the immediate 'physical' definition. The outcome is that the notion of the 'biological coherence' is instilled by rather emotional content without sufficient axiomatic basis. Therefore, because of such discrepancy, sometime argumentation in such limits leads to negation of any unique specificity of living systems."

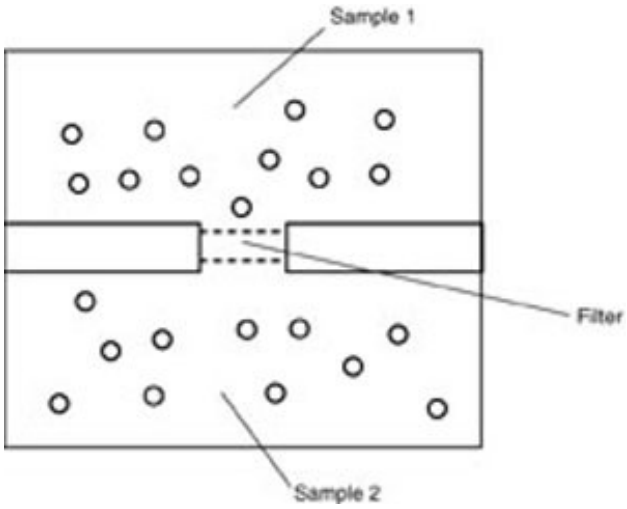

Fig. 3. *SCHEMATIC OF BURLAKOV'S EXPERIMENTS WITH FISH EGGS AND MITOGENETIC RADIATION. In these experiments, samples of fertilized fish eggs in different phases of development were brought into optical contact with each other. Burlakov found that if the age difference between the eggs or larvae was not too large, there was a significant acceleration in the development of the younger eggs relative to the older ones. However, if the age difference was large, the younger eggs showed a strong retardation in development; in some cases, deformities and higher death rates occurred. When Burlakov used normal window glass as a filter, all these effects disappeared, but with quartz filters, the effects could be observed. (Image from 21st Century Science and Technology magazine, Summer 2001.)*

Thus, Lipkind follows in the tradition and thinking of his teacher A.G. Gurwitsch, who left open the idea that there is a unique biological field governing the morphological development of an organism, that exists independent of, and above, any reducible electromagnetic field that may also accompany the biological field.

However, the limit of ontological acceptance, in Lipkind's adherence to the out look of Gurwitsch, breaks down at the point that he (Lipkind) moves from the domain of biology to that of mind. For Lipkind, mind, or more simply "consciousness", is the awareness, on the part of the organism, of the discrepancy between the idealized form of the particular biological field, and the current actual state of the organism, and the striving towards that idealized form, to which, in so striving, it may choose a number of available pathways towards that end. To the extent he recognizes the non-rigidity of the pathway towards realization of the form, as a top-down process, he echoes the dynamic sentiment of Gurwitsch, and the experimental evidence of such as Hans Driesche, but he fails in pushing this model to account for—in particular—the human mind.

To this effect relative to human mind he falls prey to the same folly as those whom he criticized relative to their approach to the biological. So, where Wolfgang Köhler sees the coherent properties of the brain as something

like a functionally connected projection from the higher domain of mind, they see mind as a kind of phantasm of the unique field-like coherent properties of the biological brain, which itself, is merely a unique state of the a-priori quantum, or thermodynamic, or entropy-governed matter/energy spatial universe.

We can add to the list of experimental phenomena that orient towards understanding the radiation expression of life, the work currently being done by Dr. Luc Montagnier, the discoverer of the HIV virus. What he has demonstrated is that microscopic fragments of the DNA of various viruses and bacteria in highly dilute solution produce detectable electromagnetic waves, even when the DNA fragments are so minute that they are undetectable by any other means. In one experiment, his lab set up a container of pure water that was in close proximity to a dilute solution that was emitting the measurable electromagnetic waves, but was not in material contact with it. When constituent genetic material (nucleotides, primers, polymerase) was add to the pure water solution there was a synthesis of DNA strands of the same sequence as that which was in the initial dilute solution. The electromagnetic waves of the solution produced in the pure water a characteristic shaped living space, that, when material was added, took the form of that shaped field. We see this as not only the role of radiation in living processes, but this brings into question we actually draw the bounds of what we consider the living substance: clearly in this case it extends far beyond what is conventionally recognized as living material.

So, it is clearly the case that life interacts with, and is expressed by modes much different than that which the material reductionist would lead one to believe. Thus, to get a truer sense of how life operates in, and effects our universe, we must move beyond the belief in a material, sensory-based reality, to one which is capable of seeing the true light of life, as characterized by a Gurwitsch-Vernadsky continuum, extending from the biosphere to the cosmos.

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