Are Nuclear Processes In Biology Unique?

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February 2012

Since the published work of Louis Kervran in France in 1960, there has been serious debate as to whether nuclear reactions occur at normal body temperatures in organisms. Kervran reported what he claimed to be many instances. In none of these cases was there any indication of radioactivity or noticeable heat production, and the element formed in the proposed reaction was always stable. In his last book in 1982, he finally described in rigorous detail an experiment in which he sprouted oat seeds under artificial light for several weeks, and obtained a large and reproducible increase in calcium.[1] Hisatoki Komaki, a follower of Kervran in Japan, reported that cultures of fungi could form large amounts of potassium, which he attributed to the combination of sodium with oxygen nuclei.[2]

Louis Kervran
1901—1983

Kervran's handicap was that he had no laboratory of his own. Having been a high-ranking government official, he had been granted opportunities to utilize certain facilities run by the government, but not on any long-term basis and without collaborators. More recently, a professor of physics in Ukraine, Vladimir Vysotski, has made a major advance in this field. He has had the advantage of working with microbiologists, and he is an accomplished expert in nuclear physics and quantum theory. He has been able to demonstrate transmutation of elements in bacteria by an ingenious selection of experiments, which give rise to rare isotopes that can be unequivocally identified by spectroscopic and spectrometric methods, along with the use of appropriate controls.[3]

Vysotski's first such achievement was to demonstrate the formation of Fe-57, a rare but stable isotope of iron which ordinarily makes up only 2.2 percent of the iron found in nature. He utilized a bacterium that can grow in a medium containing D_2O (heavy water) in place of H_2O, to which he added a salt of manganese, atomic weight 55, the only stable isotope of manganese. After a few days of incubation the culture showed a significant gamma ray absorption band for Fe-57 using Mössbauer spectroscopy. As a control, Vysotski added Fe-57 to a culture of the organism and found the same spectroscopic band structure as was exhibited by the transmuting culture. He also confirmed this result using mass spectrometry, which showed that the amounts of Fe-57 yielded by the two methods were comparable.[4]

The Energy Relation in Biology

In another bacterial experiment, he was able to generate considerable amounts of another rare isotope of iron, Fe-54, normally 5.8 percent of natural iron. Vysotski hypothesized that there had been a combination of phosphorus (P-31) with sodium (Na-23). When phosphorus was ex-

1. C. Louis Kervran, *Transmutations Biologiques et Physique Moderne*, Maloine, 1982. There are also two English-language books by and about Kervran:
- Michel Abehsera and C. Louis Kervran, *Biological Transmutations and Their Applications in Chemistry, Physics, Biology, Ecology, Medicine, Nutrition, Agriculture, and Geology*. Swan House Publishing Company, 1972.
- C. Louis Kervran, *Biological Transmutations*. Beekman Publishers, Woodstock, NY, 1980.

2. Hisatoki Komaki, "Observations on the Cold Fusion or the Biological Transmutation of Elements." 1993 *Frontiers of Cold Fusion.* Universal Academic Press, pp.555-558.

3. Vladimir I. Vysotski and Alla A. Kornilova 2010, *Nuclear Transmutation of Stable and Radioactive Isotopes in Biological Systems*. Pentagon Press, New Delhi, 2010.

4. Ref 3, p. 16. See also: Rudolf L. Mossbauer, Zeitschrift fur Physik, Vol 151, 1958, pp.124-143 and T.E. Cranshaw, B.W. Dale, G.O. Longsworth, and C.E. Johnson, *Mössbauer Spectroscopy and Its Applications,* Cambridge University Press, 1985.

cluded from the original culture, no Fe-54 was found.[5] Provided the elements being transmuted were not radioactive to begin with, Vysotski's reactions, like Kervran's, produced only stable elements. On the other hand, Vysotski went on to show for the first time that bacteria can transmute radioactive elements into other radioactive elements.

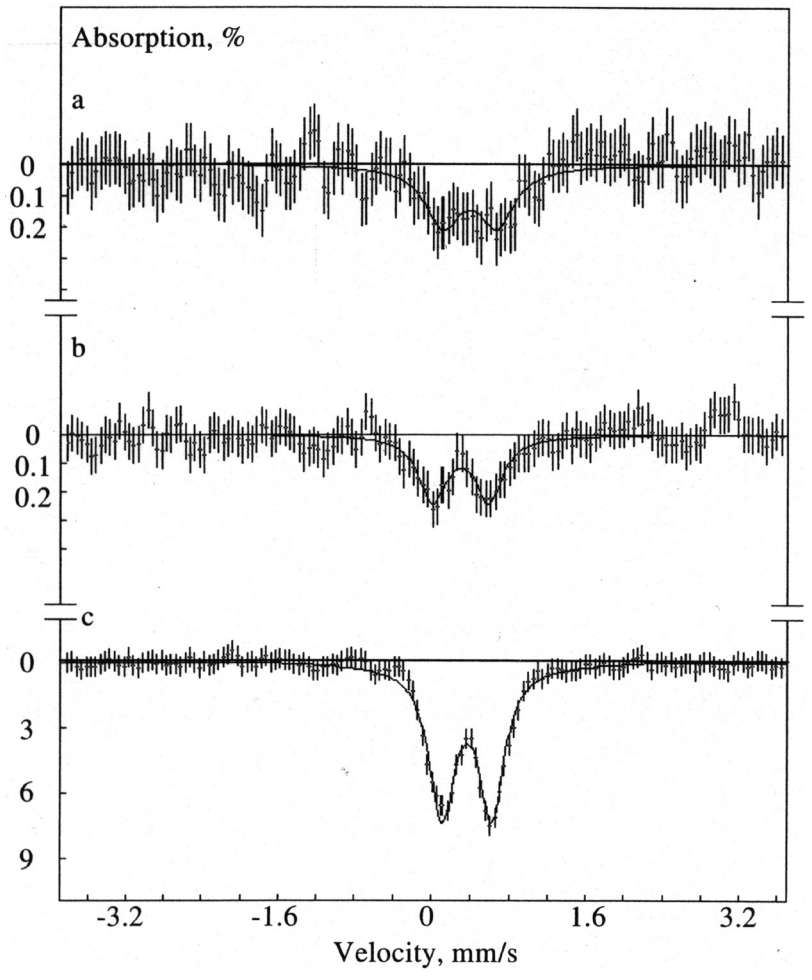
These results raise some fundamental questions. According to the Einstein relationship, $E = mc^2$, nuclear reactions can proceed from an energetic standpoint when there is a loss of mass, i.e. when the product atom weighs less than the two atoms that produced it. The loss of mass is accompanied by the release of energy. This law was recently con-

Mossbauer Spectroscopy

These graphs show the absorption of gamma rays by Fe-57 in Vysotski's bacterial culture. The first two represent the actual experiment, while the third is a control to which Fe-57 was added. The gamma rays were emitted in the course of radioactive decay of Co-57 nuclei present in the source to an excited state of Fe-57. The excited state of Fe-57 in the source in turn then emitted the rays which were absorbed by the nucleus of Fe-57 formed in the bacterial culture, and this is the absorption measured here.

Mossbauer spectroscopy takes advantage of the extremely narrow width of the nuclear absorption of gamma radiation to identify the absorbing isotope, and, by means of the absorption fine structure, to probe the environment of the absorbing nucleus. Mossbauer's discovery was how to overcome the principal problem in such spectroscopy. Because the line was so narrow, one needed a precise match between the emitted frequency and the absorbed frequency. Under certain conditions the emitter would recoil and the ray would lose energy, no longer matching the absorption spectrum of the target nucleus. Mossbauer found that cooling the source and the sample could reduce the recoil interaction with neighboring atoms. Vysotski kept them at 78 degrees Kelvin. Also by giving the source a very small velocity in the direction of the target, one very slightly increased the frequency of the emitted gamma ray to ensure its absorption. In Vysotski's graphs, the x-axis represents the velocity of the source in millimeters per second.

The purpose of the experiment shown in the third graph was to show that the particular shape of the spectrum in the first two was not an artifact. The third graph was produced by adding Fe-57 to a culture lacking Mn-55 and therefore serving as a control. The absorption pattern with its multiple humps was the same as in the growing culture.



**Reprinted from Vysotski, Nuclear Transmutation of Stable and Radioactive Isotopes in Biological Systems, by permission of Pentagon Press.

The Mossbauer specter for the grown culture Deinococcus radiodurans: a) and b) in D_2O with Mn-55; c) in D_2O without Mn-55 and with admixture of small amount of Fe-57 isotope.

firmed by Simon Rainville et al in 2005. They bombarded silicon-28 and sulfur-32 with thermal neutrons (having very low energy), resulting respectively in silicon-29 and sulfur-33. The reactions were exothermic, causing the release of energy in the form of a gamma ray. When the decrease in mass was determined, it was found equivalent to the energy of the gamma ray to within 1 part in 10 million. [6]

But how do we know whether the Einstein relation also holds in biology? Vysotski argued that the relationship does hold. He noted that until we get to the upper end of the periodic table, the combination of two stable atoms, one of which is a light atom, results in a loss of mass. Vysotski believes that in such cases, bacteria have a remarkable facility to carry out the transmutations they need for their growth and metabolism. That is to say, if a necessary element is lacking in their environment and the raw materials are present, the organism can synthesize a substitute by transmutation.

As an example, Vysotski found that in the absence of potassium in the medium, bacteria could transmute Cesium-137 into Barium-138, barium being a substitute for potassium.[7] He argues, citing the work of Syroezhkin, that elements with comparable atomic radius, such as barium and potassium, are significantly interchangeable.[8] Moreover, he believes this capability to transmute elements includes an extraordinary ability to overcome the so-called Coulomb barrier which is supposed to prevent two positively charged nuclei from coming close enough to interact and form a new nucleus.[9]

In what principled way might the biological context change the nature of the process? Vysotski believes that fundamentally we are dealing with a broadened application of quantum mechanics and presents a thorough plausibility argument based on potential wells and overlapping wave functions.[10]

LaRouche on Anti-Entropy

Taking another approach, Lyndon LaRouche, in a 1998 article entitled "The Astrophysics of Gurwitsch Radiation," discussed the way in which the laws of inorganic physics are "bent" or modified due to the higher universal physical principle of life, which is not simply reducible to inorganic physics.[11] Russian biologist Alexander Gurwitsch discovered in the 1920s that living cells release radiation, which he initially believed to be electromagnetic radiation in the ultraviolet. The presence of this radiation could only be demonstrated at that time by its ability to promote cell division, because no instruments to detect it had been invented as yet.[12] Gurwitsch found that successive stages of embryonic growth could be conceptualized as being mapped from a field that changed its form as growth proceeded.[13]

In recent years, Gurwitsch's biophotons have finally been measured by instruments and found to have anomalous properties. Unlike sunlight, the biophoton radiation is coherent. If their spectral distribution is graphed, it is found that the energy intensity is the same across a wide range of frequencies, whereas ordinarily one would expect the lower frequencies to have much higher intensities as the expression of an equilibrium state.[14]

LaRouche defined a principle of powers characterizing the successive domains of the cognitive, the biological, and the non-living. These domains interact in such a way that the higher domain permeates the lower, such that processes that appear to be part of the lower domain may actually be shadows of a higher domain at work.[15] This is a metaphor taken from the Riemannian idea of multiply extended manifolds, whose perceptual spatial characteristics are formed by determining *physical* principles.[16] This same metaphor was used by Russian biogeochemist Vladimir Vernadsky who developed his concepts of the *biosphere*[17] and the *noösphere*.[18] The anomalous behavior of biopho-

6. Simon Rainville, et al. "A Direct Test of E = mc^2" *Nature,* Dec 2005, Vol. 438, pp. 1096-1097. The authors state that this result is 55 times more accurate than the previous best test of E=mc^2, which was performed by comparing the electron and positron masses to the energy released in their annihilation as a gamma ray, for which, see Greene, G.L. Phys. Rev. D 44 R 2216-2219, 1991. In Rainville's experiment, the limiting factor in determining the binding energy was the wavelength of the gamma ray, determined by diffraction to only 10 to the minus 7.

7. Ref 3, p. 45

8. Ref 3, pp. 128-139 for a full discussion of substitution of one metal for another missing metal in bacteria.

9. Ref 3, page 113 "Possible scenario of running barrierless nuclear synthesis in growing bacterial systems."

10. Ref 3, chapter 4.

11. Lyndon H. LaRouche, Jr. "The Astrophysics of Gurwitsch Radiation: The Reciprocity of Extremes," *21st Century Science and Technology*, Fall 1998, pp 14-17.

12. Michael Lipkind, "Alexander Gurwitsch and the Concept of the Biological Field" (Parts 1 and 2), *21st Century Science and Technology*, Summer 1998 and Fall 1998.

13. *Ibid.*

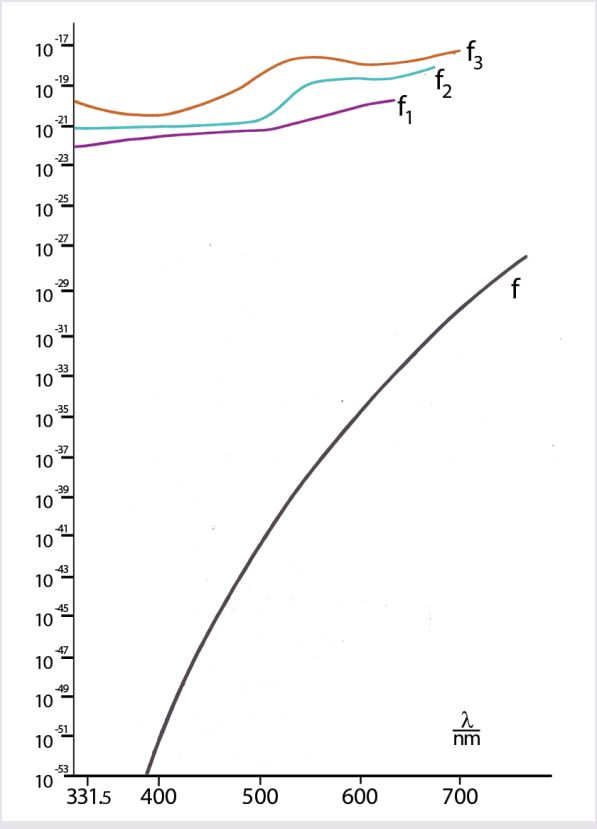
14. Fritz-Albert Popp, "Biophotonen—Neue Horizonte in der Medizin," von der *Grundlagen zur Biophotonik,* Karl F. Haug Verlag, Stuttgart, 2006, p. 69.

15. Lyndon H Larouche, Jr., "Vernadsky and Dirichlet's Principle," *21st Century Science and Technology* Winter 2005-2006 pp 18-38.

16. Bernhard Riemann, "On the Hypotheses Which Underlie Geometry," David Smith, ed., *A Source Book in Mathematics,* Dover Publications, 1959, pp. 411-425.

17. Vladimir Vernadsky, *The Biosphere*, Nevraumont Publishing Co, New York, NY, 1997, translated by David Langmuir.

18. V. Vernadsky, "Some Words about the Noösphere," Dec 1943, translated from Vernadsky's book *Biosfera* (Russian) by Rachel B. Douglas and Jonathan B. Tennenbaum, in *21st Century Science and Technology* Spring 2005 pp. 16-21.



*Adapted from Fritz-Albert Popp, "Biophotonen – Neue Horizonte in der Medizin," in Grundlagen zur Biophotonik, 2006, p. 69

A Crucial Difference Between Living and Non-living Systems

These graphs portray a relationship between the wavelength of the light being emitted in nanometers, as the x-axis, and the relative intensity or energy flux density at the particular wavelength as the y-axis. The lower graph depicts an isolated system in equilibrium with its environment, usually a non-living object. Thus in the isolated system, the longer wavelengths, i.e. the lower energy ones, are where the most energy is emitted. This is the so-called Boltzmann distribution. The three upper curves represent radiation of biophotons by seeds: f_1 are untreated seeds, f_2 are seeds poisoned by Cialith, and f_3 are seeds poisoned by acetone. Poisoning causes an increase in biophoton release relative to the healthy state, because ordered structures break down and their energy is released, according to Gurwitsch's writings. However in all three cases, the pattern is entirely different from the bottom curve, because living processes are far from thermal equilibrium and therefore so-called excited states of higher energy (and therefore shorter wavelength) are much more highly represented than would be seen in thermal equilibrium.

tons expresses the higher power of the principle of life with respect to the inorganic domain.

Supposing however that the life principle doesn't alter the Einstein relation, $E=mc^2$, this might seem to restrict transmutations in living organisms to those involving no more than very small quantities, primarily the cases of microorganisms and transmutation of trace elements in higher organisms. Thus, to take the example proposed by Komaki, Na + O = K in microorganisms. Were 100 mg of sodium to be thus transmuted in the human body as proposed by Kervran, nearly 2,000 kilocalories would result! This is about the daily caloric intake of a human being!

Coupled Reactions and Biogenic Migration

This raises yet another question. Just how might a biological transmutation, such as those demonstrated by Vysotski, get integrated into the living process as a whole? It is a striking fact that biochemical reactions are coupled, so that when a reaction produces energy as adenosine triphosphate (ATP), that ATP is at once utilized in another process.[19] In coupled reactions, there is at least one substrate, or intermediate, common to both. In many other cases, a biochemical reaction can be coupled, not with another reaction but rather with a process that transports compounds or ions across a membrane or does some kind of mechanical work.[20] This prevents entropy formation and dissipation of energy as heat. How could one expect to couple a transmutation producing thousands of electron volts in energy with processes using a fraction of an electron volt, like biochemical processes?

Vysotski's carefully obtained experimental findings are suggestive of this interconnectedness or coupling of biological processes. After doing the monoculture experiments just described, he repeated them using a culture containing thousands of species of bacteria mixed togeth-

19. Donald and Judith Voet, Fundamentals of Biochemistry: Life at the Molecular Level, John Wiley and Sons, Hoboken, NJ 2006, pp. 407-411.

20. Mae-Wan Ho, *The Rainbow and the Worm: The Physics of Organisms*, World Scientific, Singapore, 1993. See chapter 4, "*Energy Flow and Living Cycles*."

See also, James P Isaacs and John Lamb, *Complementarity in Biology: Quantization of Molecular Motion* pp. 37-43, "The Radically Open Nature of Metabolism," Johns Hopkins Press, Baltimore, 1969. In this book it is argued that the extraordinary amount of coupling leads necessarily to quantization of many processes within the cell, and coherent behavior, such as Gurwitsch radiation, which the authors predicted would be coherent. This book was written before biophoton detection devices were invented.

er. The results were dramatically different. Instead of growth stopping in a few days, the mixed culture could go on for weeks and produce a much greater yield of Fe-57. Also, when the mixed culture was placed in a highly radioactive environment, it was able, after a few days, to grow vigorously and break down a number of radioactive elements by transmutation, whereas the monoculture couldn't survive at all in this environment.[21]

The more interconnected system would have more degrees of freedom and a greater flow of energy and molecular constituents, what Vernadsky called the "biogenic migration of atoms." [22] Vernadsky asserted as an empirical generalization that the biosphere evolves in such a way as to increase the biogenic flow of atoms and favors those species that contribute to that purpose. LaRouche draws out in great detail the anti-entropic analogy of Vernadsky's increasing biogenic migration of atoms to the progressively increasing rate of flow of ideas, raw materials, and manufactured products in an economy when it is functioning anti-entropically.[23]

Vysotski observed that sometimes adding elements or compounds not directly involved in the transmutation could greatly speed up or slow down the process, again suggesting that the transmutation was integrated into the cell's total interconnected activity. He found that adding Cesium-133 to the medium increased the yield of Fe-54, although there was no increase in the rate of growth of the culture. He suggested that the presence of Cs-133 reduces the Coulomb barrier in a way that needs to be determined.[24]

He also found that exposing the culture to very low frequency waves dramatically altered the rates of bacterial cell division and of the transmutation reactions.[25] He correlated this with the ability of these waves to alter the physical properties of water. In analogy with biochemical reactions, one can propose that a biological transmutation goes through a transition state of specific geometry whereby the activation energy of the process is reduced. This calls for a geometric model for the atoms involved, especially the nuclei (see below).

Transmutation and Geology

Vysotski conceives the ability to transmute elements as a necessary feature of evolution. Bacteria, and in his view higher organisms, will find a creative way to defend their uniquely characteristic composition.[26] He cites the empirical generalization of Vernadsky that each species has a signature chemical composition, especially as regards the trace elements.[27] If a necessary element is lacking, the bacteria will utilize the raw materials, if available, to produce it. Or, as cited earlier, if those raw materials are lacking, the bacteria will produce a substitute element which can fulfill the functions required.

Kervran, likewise, strongly believed that new biological transmutations emerged at specific epochs in the history of life. For example, he devoted a lengthy chapter to the possible formation of iodine from tin by seaweeds, particularly *Laminaria flexicalis*, which grows attached to granite rocks on the coast of Brittany.[28] Citing the work of Freundler,[29] who found significant amounts of tin in the *Laminaria*, Kervran proposed that the plant absorbed tin through its "crampons" attached to the rock, and that the plant then converted the tin into iodine. Freundler, on the other hand, believed that the plant absorbed iodine from the seawater and that the tin formed from the iodine at a late stage of the plant's life cycle. This case is typical of the numerous bold but unproven hypotheses that Kervran generated, and which deserve careful evaluation. It is easy to underestimate the extraordinary capability of organisms to greatly concentrate elements present in the medium in extremely small concentrations, like the known case of how tunicates extract vast amounts of va-

21. Ref 3, p. 52.

22.Andrey Lapo, *Traces of Bygone Biospheres*. Synergetic Press, London, Mir Publishers, 1987. Starting from page 147, he develops Vernadsky's three biogeochemical principles, and, as subsumed by them, the necessarily increasing biogenic migration of atoms.

23. Ref.15.

24. Ref 3, p. 45.

25. Ref 3, pp. 85-87.

26. Ref 3, p. 117. "The very phenomenon of low-energy transmutation of chemical elements and isotopes in biological systems and creating conditions for sustaining it, is lodged upon the heuristic proposition that if some of the required elements or microelements is not present in the living environment (or nutrient media), then, given that certain prerequisites are met, it will be synthesized as a result of the transmutation. In fact, such an approach unambiguously suggests that the ratio of all necessary elements in each type of living organism is fixed."

27. For Vernadsky's identical view, see "Problems of Biogeochemistry: On the Fundamental Material-Energetic Distinction between Living and Non-living Natural Bodies of the Biosphere" 1938, p. 307, translated by Jonathan Tennenbaum and Rachel B Douglas in Lyndon H. LaRouche, Jr., *The Economics of the Noösphere,* EIR News Service, Washington, 2001.

"There are no stoichiometric properties in the gross chemical composition of living bodies. But their chemical composition is strictly determined, and more constant than the chemical composition of isomorphic mixtures in natural minerals. This composition is typical for a given species, race, etc, constituting a chemical signature of each form of living matter"

28. C. L. Kervran, *Transmutations Naturelles non Radioactives,* Librairie Maloine, 1966. See chapter on iodine and tin, pp. 113-133.

29. P. Freundler, *Introduction a L'Etude des Complexes Biologiques*, Paris, Paul Belin Publishers, 1928.

See chapter 12, "Les Algues Marines," for description of the habitats, life cycles, and biochemistry of different seaweed species that one finds on the coasts of La Manche and Pas de Calais.

Also note page 173. He observes that Laminaria flexicalis grows on granite whereas Laminaria cloustonii more often grows on schist. *"It is only understandable if the elements in the rock serve directly the nutrition of the algae."*

nadium from seawater.[30] Lacking this knowledge, Kervran suggested the tunicates produce vanadium by transmutation.

It was the view of Vernadsky that the entire Earth's crust was ultimately the result of living processes.[31] This theory, for a long time considered impossible, was dramatically elaborated by Minik Rosing, et al. in an article in 2006, "The Rise of Continents—An Essay on the Geologic Consequences of Photosynthesis." His argument is that granite is the result of living processes, and only appeared on Earth concurrent with the appearance of photosynthesis.[32] The process of the Earth's crust is dominated by the energy of photosynthesis, which he estimated to be several times the flow of heat energy from the inside of the Earth! Processes such as weathering and the movement of material from the land to the ocean are a function of life.

In that light one might consider the proposal put forth by French geologists Jean Lombard and Georges Choubert in the 1940s and 1950s, even prior to Kervran's work, asserting that granite must be the product of transmutation of elements.[33] Both geologists were very enthusiastic supporters of Kervran, and helped him to publish in their journal.[34] Based on their observations of huge granite intrusions in Northern Africa and the corresponding coast of Brazil, they asserted that the formation of granite involved anomalies of composition. In particular, the differences in composition between the granite and the surrounding strata suggested that the only explanation must have been the *de novo* formation of silicon, potassium, sodium, and sometimes calcium, and the simultaneous disappearance of iron, aluminum, and magnesium.

The possibility that silicon is being created is especially significant because silicon is the basis for clay, a major structural component of the soil.[35] Choubert and Lombard formulated this hypothesis before the revolution in geology prompted by the discovery of the role of mid-oceanic ridges in the process of subduction of oceanic crust beneath the continents.[36] Choubert's hypothesis was that these transmutations occurred deep underground in the violent tectonic processes which are known to occur during mountain building, in the course of which horizontal strata became folded and bent. Today it is believed that mountains are formed secondary to the subduction of tectonic plates under the continents, carrying oceanic deposits with them. This is why young mountains like the Andes are near the coast.[37]

In his book *Geochemie,*[38] Vernadsky devoted 40 pages to what he called the silicon cycle, much of which he said still remained a mystery. He emphasized that the kaolin mineral nucleus, composed of silicon, aluminum, and oxygen, was formed at great depths in chemical combination with a number of different metal ions utilizing energy from inside the Earth. When these aluminum silicate compounds entered the biosphere in the course of volcanism, granitic intrusions, and weathering, they underwent chemical transformation by living organisms, which are uniquely able to decompose the kaolin nucleus, especially in a watery environment, giving rise to silicon oxides such as quartz and opal, and releasing the energy of formation of the kaolin nucleus, which he presumed to be radioactive in nature. These compounds of silicon form large oceanic deposits due to the activity of plankton such as diatoms, which utilize the eroded, silicon-rich soil washed out to sea.

In the stage of the cycle not yet known to Vernadsky, the silicon deposited on the ocean floor is pushed under the continental coasts during tectonic subduction and returned to the earh's crust or the upper mantle, and the cycle can be completed. The Choubert/Lombard hypothesis of neo-formation of silicon, if it is valid, has to be situated in the context of this larger cycle.

Is There a Nuclear Model Consistent with Known Physical Principles and the Periodic System?

In order to be able to intelligibly represent the processes of low energy transmutation, we are going to need an appropriate model of the dynamics and principle of trans-

30. Edward D Goldberg, William McBlair, and Keith Taylor, "The Uptake of Vanadium by Tunicates," Scripps Institute of Oceanography, La Jolla, *Biological Bulletin* 101: 84-94, August 1951

31. V. Vernadsky, "Some Words about the Noösphere," Dec 1943, translated by Rachel Douglas from *Biosfera* and printed in *21st Century Science and Technology* Sept 2005, pp. 16-21. "The granitic envelope of the Earth is the area of former biospheres."

32. Minik T. Rosing, et al., "The Rise of Continents—An Essay on the Geologic Consequences of Photosynthesis," *Palaeogeography, Palaeoclimatology, Palaeoecology*, Vol. 32, (2006) pp. 99-113

33. Georges Choubert, "Note sur le Mécanisme Probable des Granites: Application à Certains Granites Africains" in *Comptes Rendus du Colloque sur les Granites de L'Ouest Africa*, March 1965, Publication UNESCO tome VIII, des *Recherches sur les Ressources Naturelles* pp. 53-93.

34. C.L. Kervran, "Bilans Metaboliques Anormaux et Transmutations Biologiques," in *Revue Generale des Sciences*, July-August 1960, Vol 67, pp.192-206. Also see preface to reference 28 written by Jean Lombard.

35. M.R. Ashman and G. Puri, *Essential Soil Science*, Blackwell Science, 2002. See Chapter 3, "Soil Surfaces, Acidity, and Nutrients"

36. Edward Tarbuck and Frederick K. Lutgens, *An Introduction to Physical Geology*, Prentice Hall Publishers 2008. See chapter 2, "Plate Tectonics"

36. Edward Tarbuck and Frederick K. Lutgens, *An Introduction to Physical Geology*, Prentice Hall Publishers 2008. See chapter 2, "Plate Tectonics"

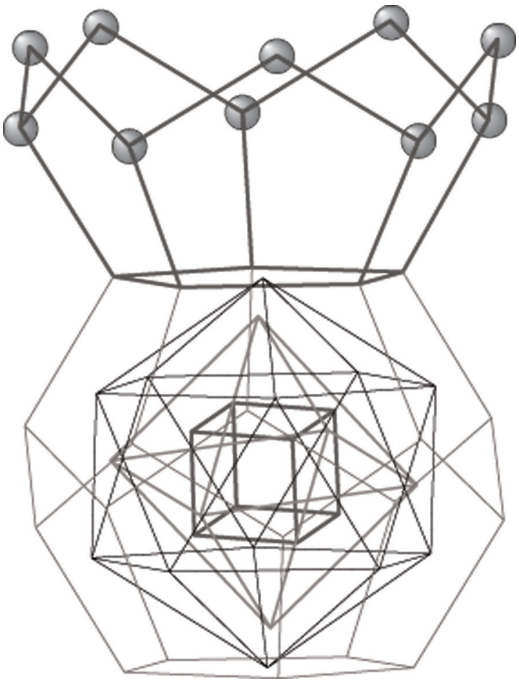
37. Ref 36. See chapter 14, "Convergent Boundaries. Subduction and Mountain Building"

38. V. Vernadsky, *Geochemie,* Leipzig 1930 Akademische Gesellschaft pp. 90-139

formation of the atomic nucleus. The Moon-Hecht model is the first step in that direction.

The Moon-Hecht model grew out of discussions Dr. Robert Moon held with Lyndon LaRouche in 1985, in which LaRouche's emphasis on the importance of Kepler's method for the history of science resonated with Moon's struggle for an intelligible representation of the quantization of space at the atomic level. The Moon-Hecht model of the nucleus, like Kepler's model of the solar system, is based upon successively nested platonic solids. Thus the first four nuclear "shells" are the cube, the octahedron, the icosahedron, and the dodecahedron. Protons are located at the vertices so that starting with the cube 8,the octahedron 6, the icosahedron 12, and the dodecahedron 20, we end up with a spherically symmetrical structure for palladium, atomic number 46. These spherically symmetrical filled shells remarkably coincide with some of the most abundant elements: i.e. oxygen, a completed cube, with Z=8; silicon, a filled octahedron around the cube with Z=14; and iron, with a filled icosahedron, having Z=26.[39] With palladium, the first structure is completed and the next shell starts from the outside with up to 10 protons giving the lower half of a second dodecahedron, like a scalloped dish for barium-56.[40] Next inside this structure go a second cube and octahedron, providing for the 14 member lanthanide series. The second structure is completed with a new palladium unit giving uranium-92, the two palladium units being loosely joined as might befit a fissionable element.

This nuclear model has the further crucial advantage that rather than having to postulate new forces restricted to the nuclear domain—the so-called strong forces—it is based upon a force long known to exist outside the nucleus, the classical Ampère-Weber longitudinal force. Weber showed that at sufficiently short range and high enough relative velocity, like charges will attract instead of repelling, as would be observed with static charges. Hecht proposed that the longitudinal force would stabilize the nucleus. The attracting longitudinal force can be exerted between the protons situated at diagonally opposite vertices of each platonic solid, oscillating back and forth towards and through each other and through the center of the platonic solid at relativistic speeds. In the case of the cube, the angle subtended at the center of the cube between the paths of protons at adjacent corners is 109 degrees 28′, while the two angles formed by these paths with their common cube edge is 35 degrees 16′. Using the original Ampère formula for the force between current elements one gets a zero interaction for this mutual orientation. This implies an unusually stable structure for the cube. The pairwise interaction of diagonally opposite protons could help explain why the most abundant elements throughout the periodic table have an even number of protons.[41]



Building the Moon Nucleus

To reach Ba-56, ten protons are added to the completed dodecahedron of Pd-46, beginning the formation of the second dodecahedron.

This for the first time suggests that a chemical property—the tetrahedral bonding of carbon—might be related to the dynamic geometry of the nucleus. In contrast, the currently hegemonic, chemically based view is that the tetrahedral bonding of carbon is purely a function of its three 2p electron orbitals and their "hybridization" with a 2s orbital.[42] Also, the current chemical model is based on a hermetic separation of the nuclear and electronic do-

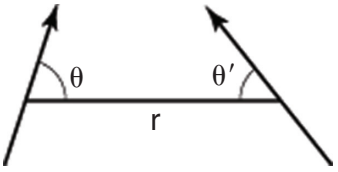
39. Laurence Hecht, "Mysterium Microcosmicum: The Geometric Basis for the Periodicity of the Elements, " *21st Century Science and Technology*, May-June 1988 pp. 18-30.

Robert J. Moon, "Space Must Be Quantized," *21st Century Science and Technology*, May-June 1988 pp. 26-27.

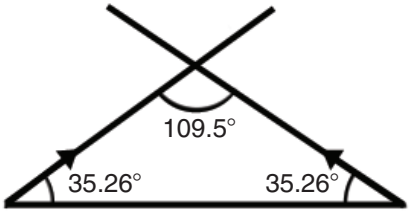
40. L. Hecht, New Explorations with the Moon Model by Laurence Hecht with Charles B. Stevens, *21st Century Science and Technology*, Fall 2004, pp. 59-73. This article first identifies a spin axis for the nucleus. The symmetrical distribution of protons and perhaps also neutrons around or on this axis serves to minimize angular momentum and increase stability. Such a consideration led to the scalloped dish for barium. The axis helps account for which elements like tin and calcium have the most naturally occurring isotopes. The next section discusses at length how the Ampère-Weber longitudinal force can stabilize the nucleus, especially in the case of the cube and the proposed structure for barium.

41. Ibid. page 72.

42. Francis Marion Pottenger, III, *Fundamentals of Chemistry*, Scott Forseman and Co 1976, pp. 287, 442.



AMPÈRE'S VIEW OF TWO CURRENT ELEMENTS
The two current elements are represented by arrows; θ and θ′ are the angles which the current elements make with the line connecting their centers; r is their distance apart.



AMPÈRE'S ANGULAR FORCE FORMULA
When the angles θ and θ′ are equal to 1/2 (arc cos 1/3), or 35.26 degrees, for two parallel current elements, the force between the current elements goes to zero, regardless of the current strength. As the two current elements at the base of the cube in the earlier igure (page 50) move toward the center, they trace the sides of an isosceles triangle, which has an apex angle of 109.5 degrees and base angles of 35.26 degrees – and zero force between them.

mains. The distribution of electrons in their orbital shells is based upon an interpretation of the form of the solutions to the Schrödinger wave equation for the hydrogen atom, in which the potential is the electrostatic potential derived from Coulomb's law for interaction of non-moving charges.[43] There are no exact solutions to the Schrödinger equation for more than two bodies.

Furthermore, the Schrödinger equation's only explicit reference to the nucleus is its inclusion of *Z*, the atomic number, in the Coulomb potential Ze^2/r . The current view of atomic structure and chemical bonding is based on quantum mechanics, which gives very little physical picture of what the electrons are actually doing in their "energy levels." Although the electrons are supposed to be in motion, there is no present means of portraying these motions geometrically, or even for describing how such moving electrons are interacting with each other electrodynamically. Any interactions among them are instead attributed to Coulomb's law, which applies to non-moving charges!

Moon hypothesized that so-called empty space consists of a lattice of nested platonic solids similar to his nuclear model, only composed of electrons. The unit structure consisted of three of the palladium structures instead of the two in the uranium nucleus. He proposed that it held 137 electrons or 68.5 pairs. This lattice would be responsible for the transmission of electromagnetic waves in empty space with a known characteristic impedance. This impedance, 376 ohms, is equal to the quantum Hall resistance in ohms divided by 68.5.[44] The implication for Moon was that the Hall resistance involved the action of single pairs of electron charge carriers in the famous Von Klitzing experiment. The experiment measured the Hall resistance in a very thin semiconducting wire at extremely low temperature.[45] Hecht added to Moon's space lattice the concept that the electrons were organized dynamically as Weber pairs, all of which are involved in wave propagation.

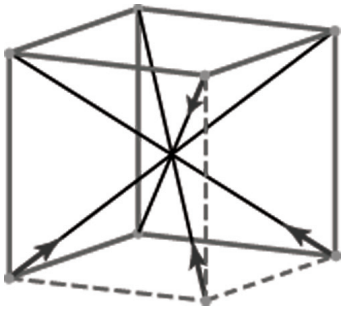
We find that in chemical compounds, the chemical bond consists of one or more pairs of electrons arranged directionally according to the structural chemistry of the molecule. The Weber pair concept might be applicable there as well.

As an example of a similar approach to the chemical bond, G.N. Lewis, one of the founders of 20th century structural chemistry, in 1916 sharply criticized the Bohr atom as violating electromagnetic principles. He went on to define a methodological approach which still makes sense today. "Indeed, it seems hardly likely that much progress can be made in the solution of the difficult problems relating to chemical combination by assuming in advance definite laws of force between positive and negative constituents of an atom and then building up mechanical models of the atom. We must, first of all, do a study of chemical phenomena, learn the structure and the arrangement of the atoms, and if we find it necessary to alter the law of force acting between charged particles at small distances, even to the extent of changing the sign of that force, it will not be the first time in the history of science that an increase in the range of observational material has required a modification of generalizations assumed upon a smaller field of observation. Indeed, in the present case, entirely aside from any chemical reasons, a study of the mathematical theory of the electron leads, I be-

43. Linus Pauling and E. Bright Wilson, *Introduction to Quantum Mechanics,* Dover Publications 1963, p. 113, The Hydrogen Atom.

44. Robert Moon, "Space Must Be Quantized", *21st Science and Technology,* May-June 1988, pp. 26-27.

45. K. Klitzing, G. Dorda, M. Pepper, "New Method for High-Accuracy Determination of the Fine Structure Constant Based on Quantized Hall Resistance, *Phys. Rev. Letters* 45(6): 494-497, 1980.



THE SELF-SUSTAINING CUBE

The current element proceeding from vertex A is attracted by the three nearest current elements. The direction of attraction is along the three edges shown as dashed lines. The vector sum of the attractions is in the direction of the diagonal that the current element is already pursuing. Weber pairs placed along the four axes of a cube thus produce an electrodynamically stable configuration.

lieve, irresistibly to the conclusion that Coulomb's law of inverse squares fails at small distances." Lewis went on to propose a cubical arrangement for the outer group electrons involved in bonding reminiscent of tetrahedral system described earlier.[46]

Kepler's Method

In fact, historically, the only rigorous approach to solving a many-body problem has been Kepler's. Kepler was able to derive remarkably precise values for the relative distances of the six known planets from the Sun, utilizing (1) the relative angular velocities of the planets in their orbits, slightly adjusted to criteria of overall harmony; (2) the inverse square relationship of planetary distance to angular velocity, as seen from the Sun; (3) his Third or periodic law, relating the period of the planet to its mean distance from the Sun.[47]

Kepler recognized discrepancies between the implications of his initial archetype of the five Platonic solids and his second archetype, the requirement for universal musical harmony among the planetary angular motions, and he made adjustments to bring them into coherence.[48] He believed that the metaphor of two musical scales, with modulation to connect them, which he called hard and soft scales, was ultimately decisive in ordering the relative motions and distances of the planets. Furthermore, he used the metaphor of four-voiced polyphony, only recently created in his day, to portray the harmonic interaction among the planets.[49]

What forced Kepler to recognize and remedy these paradoxes in his thinking was his insistence that a physical model based on terrestrially known forces first be hypothesized to account for the findings, rather than resorting to a largely mathematical scheme, such as today's quantum theory, to "describe" the results. Thus, after years of unsuccessfully trying to fit the orbit of Mars to non-uniform motion on a circular orbit, it became clear to him that this would be inconsistent with Tycho Brahe's precise data, nor could Kepler devise a physical mechanism that could cause such a motion.[50]

So now he was forced to account for a two-fold motion by Mars: first, a circular motion around the Sun, and, secondly, a motion towards and away from the Sun. Again, Kepler was not willing to simply offer a mathematical formula to describe this complex motion. Rather he required a physical model, in this case a magnetic interaction, drawing on the recent work of William Gilbert on the earth as a giant magnet.[51] Kepler proposed that Mars, too, had a magnetic axis which interacted with the Sun as a monopole. The magnetic axis, when the planet was at its apsides, i.e. the points nearest and farthest from the Sun, would be at right angles to the line joining the apsides. At the first quadrant, i.e. at 90 degrees from the aphelion, its axis would point directly at the Sun, presenting the pole drawn towards the Sun. At 270 degrees, it would again point directly to the Sun, but present the pole repelled by the Sun. This magnetic power would cause Mars to approach and recede from the sun, with a power depending on the angle between the magnetic axis and the line from the planet to the sun.

When Kepler finally arrived at the ellipse as the shape of the planet's orbit, it was not from testing the ellipse *as a shape*. Rather, Kepler found that the motion created by this dynamic model created (surprisingly) an ellipse, on which areas swept out by the planet measured the time to traverse the corresponding arc. This model gave calcu-

46. G. N. Lewis, "The Atom and the Molecule" *Journal of the American Society,* Vol 38, num 4, April 1916, pp. 761-785. Lewis introduces the cubical atom on page 767.

47. Johannes Kepler, *The Harmony of the World*, translated by E.J. Aiton, A.M. Duncan, and J.V. Reid, American Philosophical Society, 1997. See Proposition 48 pp. 483-488 for his precise prediction of relative distances of planets from the Sun.

48. For Kepler's adjustments to the angular motions as seen from the Sun, see "A Posteriori Arguments," pp. 462-480 in *Harmony of the World*.

49. For four-voiced polyphony, see chapter VIII, p. 449, *Harmony of the World*.

50. For his abandonment of non-uniform motion on a circle, see chapter 44 of his *New Astronomy*.

51. For the magnetic force model, see chapter 57, *The New Astronomy*.

lated positions that agreed precisely with Brahe's observations . . .[52]

Kervran in Russia

Although Kervran's work was largely discounted in European and North American scientific circles,[53] in Russia he was taken seriously by some prominent scientists during his lifetime. This has much to do with the legacy of Vernadsky. Two Soviet geologists, P.A. Ko-

52. For Kepler's proof of how to determine and apply the properties of the elliptical orbit see chapter 59, *The New Astronomy.*

53. O. Heroux and D. Peter, "Failure of Balance Measurements to Predict Actual Retention of Magnesium and Calcium by Rats as Determined by Direct Carcass Analysis," *Journal of Nutrition* 1975, pp. 1157-1167. Despite meticulous work, the researchers found that on a low-magnesium diet, the rats had more magnesium in their carcass plus cumulative excreta than they had consumed. How to explain it? On page 1166 of this hilarious report the authors note: "The remote possibility of biological transmutation of Na into Mg in the body, which has been proposed by Kervran in 1965, is an intriguing explanation for the negative balances observed under low intake, but it must be regarded as extremely speculative, to say the least." This tells how important was the achievement of Vysotski in establishing by rigorous methods of nuclear physics that biological transmutations are real!

A Short Biography of Louis Kervran

I know of no biographies of this extraordinary man! He was born in 1901 and became a physician. His first published writing in the late 1930s concerned the non-applicability of Ohm's law to the human body and appeared in 1937 in *Revue Générale de l'Electricité*.[1] As the Departmental Director of Work and Manpower in Paris, he wrote the paper "Interpretation of Measurements of Impedance on the Human Skin by the Wien and Nernst Bridges" which appeared in the *Archives de Maladie Professionelles* in 1939 and in *L'Usine* the 11th of April, 1940. He subsequently supervised the chapter on the physical effects of electricity which appeared in Simonin's *Précis de Médicine du Travail* in 1950.[2]

During the war he was in the Résistance, and in 1944 became a Prefect by order of the General Assembly of the Committee for Liberation of the Savoy after having been a prisoner of the Nazi occupation. [3]

After the war he resumed his position in occupational health as a member of the Paris Board of Health (Conseil d'Hygiène de Paris).[4] It was in this capacity that he encountered paradoxical cases of carbon monoxide poisoning in welders in which the levels of carbon monoxide inhaled by the victim were far too low to account for their blood levels. This finally prompted his hypothesis that the nitrogen which passed over the hot metal underwent a change which was completed in the body with the transfer of a proton from one nitrogen to the other to form carbon monoxide.[5]

He became a member of the Jury for oral examinations at the Faculty of Medicine at Paris for specialty certification (presumably in industrial health). He held the title of Director of Conferences at the University of Paris.[6]

He was an official consultant to the French government in the area of radiation protection and had top-level security clearance.[7] In 1959, he was sent to the Sahara by the French government to investigate the anomalous results for thermal, mineral and electrolyte balance in workers living and performing under extreme heat for long periods. These results prompted him to assert that the anomalies were due to transmutations, some of them endothermic.[8]

Kervran's controversial work was endorsed early on by some highly distinguished scientists. Dr. Louis Tanon, who wrote a preface to his first book in 1962,[9] was a professor of industrial health and in 1964 became President of the French Academy of Medicine. The same book also had a preface by Dr. Albert Besson, Inspector General of Health and member of the Commission of the Superior Council of Scientific Research.

In 1975 the Nobel Committee for Physiology or Medicine received from one of their nominators, Professor Hiroshi Maruyama of the Faculty of Medicine of Osaka University, the recommendation of Kervran for the Nobel Prize.[10]

For more high- level endorsements see the section "Transmutations in Geology."

References

1. Kervran, C. Louis. *Transmutations Biologiques et Physique Moderne,* 1982, p.14.
2. Ibid.
3. Ibid.
4. Kervran, C. Louis. *Biological Transmutations.* Beekman Publishers, 1971. Front page.
5. Ibid. Several references to the carbon monoxide research in his official capacity.
6. Ref. 4, front page.
7. Ref. 1, p.13.
8. Ref. 4, p.51 on his going to the Sahara.
9. Kervran, C. Louis, *Transmutations Biologiques. Métabolismes Aberrants de l'Azote, le Potassium, et le Magnésium.* Librairie Maloine, 1962.
10. Ref. 1, p.23 shows excerpt of letter by Maruyama.

rolkoff (Ukraine) and V.B. Neiman corresponded with Kervran based on their strongly held view that anomalies found in geology called for transmutations such as Choubert had reported.[54]

Secondly, Alexander Dubrov, author of *The Geomagnetic Field and Life,* had been in correspondence with Kervran from the early 1970s and made Kervran's transmutations the centerpiece in his book.[55] Dubrov's book is a very extensive phenomenology of the interaction of living systems with the geomagnetic field.

Dubrov argued that the geomagnetic field is physically dissymmetric, and can therefore be expected to produce physically dissymmetric effects in accordance with the theory of Pierre Curie. Dubrov noted that the widespread occurrence in biology of left- and right-handed morphologies was strongly influenced by the geometry of the local geomagnetic field, especially at the time of conception. He proposed that:

1. Transmutations such as Kervran's involve a change of atomic "symmetry" when one compares the electronic quantum states of the element transmuted and the element it becomes, such inversion being facilitated by the geomagnetic field.

2. The geomagnetic field can change the chirality of an asymmetric carbon atom, thereby inverting chirality of the molecule of which the carbon was a part and leading to mutation.

Dubrov acknowledged that data in support of his hypothesis are sparse. However, his is a bold hypothesis, relating, as he puts it, the universality to the microcosm. He presents it after a thorough review of how living systems are often exquisitely sensitive to magnetic fields. Experiments to test Dubrov's hypothesis concerning the role of the geomagnetic field in biological transmutations are feasible and ought to be done, now that Vysotski has established a degree of reproducibility.

54. *Preuves en Géologie et Physique de Transmutations à Faible Energie*, Maloine Editeur, Paris 1973. See chapter "Recherche en Russie."

55. Aleksandr P. Dubrov, *The Geomagnetic Field and* Life, 1980, Putnam Press. See page 135 for why, contrary to common belief, the geomagnetic field is dissymmetric. See pp. 153-155 for his analysis of Kervran's findings in terms of the effects of the geomagnetic field.

This article is dedicated to
the memory of Jerry Pyenson.
—Ernest Schapiro