Electronic Journal of Sociology (2007)
ISSN: 1198 3655

The In-formation Field Hypothesis

Ervin Laszlo*
The General Evolution Research Group

Abstract

There appears to be an as yet unexplained form and level in coherence in the various domains of nature. This anomalous phenomenon involves a quasi-instant transmission of an active kind of information that correlates entities across space and over time. The first part of this paper presents evidence that this nonlocal form of coherence is widespread in nature, occurring in the microdomain of the quantum, in the macrodomain of the universe, as well as in the mesodomains of life and mind. The second part argues (i) that the nonlocal coherence phenomenon is logically interpreted as the transmission of "in-formation," a non-vectorial yet physically effective form of information, and (ii) that this transmission is realistically viewed as the effect of a universal in-formation field in nature.

The Principal Proposition

This paper presents evidence that phenomena obtain in the principal domains of observation that cannot be adequately explained in reference to presently recognized fields. The phenomena consist of a form of coherence that presupposes the transmission of information beyond the known physical or physico-chemical channels. The pertinent form of coherence suggests that the elements of the coherent system are nonlocally connected, i.e., are mutually "entangled." This

* Villa Franatoni
56040 Montescudaio (Prov. Pisa)
Italy <Laszlo@etrurianet.it>

implies, in turn, the presence of a particular form of information termed "in-formation" in nature.

In a realistic interpretation the presence of in-formation in the various domains of observation provides warrant for postulating an additional universal field: the universal in-formation field.

Part One: The Major Strands of Evidence

A. Coherence in the microdomain of the quantum: Quantum nonlocality

Prior to being measured or subjected to interaction quanta are known to be in a coherent superposed wave-state. The first experiment to demonstrate the coherence of quanta was conducted by Thomas Young in 1801. In his "double-slit experiments" light was allowed to pass through a filtering screen with two slits. When a second screen was placed behind the filter with the two slits, instead of two pinpoints of light, a wave-interference pattern appeared on the screen. As shown by widely repeated double-slit experiments, the interference fringes persist even when the light source is so weak that only one photon—presumably a corpuscle—is emitted at a time.

John Wheeler's "split-beam" experiment discloses the same effect (Wheeler 1984). In this experiment photons are emitted one at a time, and travel from the emitting gun to a detector. A half-silvered mirror is inserted along the photon's path, splitting the beam. On the average, one in every two photons is expected to pass through the mirror and one in every two deflected by it. This expectation is borne out: photon counters inserted behind the half-silvered mirror and at right angles to it register an approximately equal number of photons. But when a second half-silvered mirror is inserted in the path of the photons undeflected by the first mirror, all photons arrive at the same destination and none at the other. This suggests that the kind of interference that was noted in the double-slit experiment occurs in the split-beam experiment as well. Above one of the mirrors the interference is destructive (the phase difference between the photons is 180 degrees), so that the photon waves cancel each other. Below the other mirror the interference is constructive (since the wave phase of the photons is the same) and the photons, acting as waves, reinforce each other.

The interference-patterns of photons emitted moments apart in the laboratory is also observed when the photons are emitted at considerable distances from the observer and at considerable intervals of time. In the "cosmological" version of the split-beam experiment the observed photons are emitted by a distant star; in one case, by the double quasar known as 0957+516A,B (Wheeler 1987). This distant "quasi-stellar object" appears to be two objects, but is in fact one, its double image being due to the deflection of its light by an intervening galaxy. The photons of the light beam deflected by the intervening galaxy have been on the way fifty thousand years longer than the photons in the undeflected beam. Yet the photons, originating billions of years ago and arriving with an interval of fifty thousand years, interfere with each other similarly to those emitted seconds apart in the same laboratory.

The coherence of quanta is further shown by experiments with so-called which-path detectors. When the which-path detectors are active, the interference fringes diminish. In the experiment conducted by Eyal Buks, Mordehai Heiblum, *et al* at Israel's Weizmann Institute, a device less than one micrometer created a stream of electrons across a barrier on one of the two paths (Buks et al. 1998). The paths focused the electron streams and made possible the measuring of the level of interference of the electrons in the streams. The investigators found that the higher the detector is tuned for sensitivity, the less pronounced is the interference. With the detector turned on for both paths, the interference fringes disappear entirely.

Other experiments show that the interference fringes disappear when the detector is installed, and even if it is not turned on. In Leonard Mandel's optical-interference experiment of 1991 two beams of laser light were generated and allowed to interfere (Mandel 1991). When a detector was present that enabled the path of the light to be determined, the interference fringes disappeared. But the fringes disappeared regardless of whether or not the determination was carried out. The very possibility of "which-path-detection" appears to destroy the interference pattern.

The above finding was confirmed in 1998 by Dürr, Nunn, and Rempe in an experiment where interference fringes are produced by the diffraction of a beam of cold atoms by standing waves of light (Dürr et al 1998).When no attempt was made to detect which path the atoms are taking, the interferometer displayed fringes of high contrast. However, when information was encoded within the atoms as to the path they take, the fringes vanished. The labeling of the paths did not need to be read out to produce the disappearance of the interference pattern; it was enough that the atoms are labeled so that this information could be read out.

It appears that not only do individually emitted, and hence presumably corpuscular, particles or atoms interfere with each other as waves, also the which-path detecting apparatus is nonlocally coupled with the stream of particles or atoms to which it is tuned. These findings bear out the concept of "entanglement" suggested by Erwin Schrödinger in 1935. In his view quanta occupy collective quantum states, where the superposition of quantum states applies to two or more properties of a single particle, as well as to a set of particles. In each case it is not the property of a single particle that carries information, but the state of the ensemble in which the particle is embedded. The particles themselves are intrinsically "entangled" with each other, so that the superposed wavefunction of their ensemble describes the state of each particle in it.

B. Coherence in the mesodomains of life
Quantum-type coherence in the living organism

Quanta appear to be intrinsically coherent; the state of de-coherence applies only to macroscopic systems. However, at the mesodomains of life, this classical proposition is problematic: there are aspects of the living system that exhibit a quantum type of coherence.

The kind of coherence that comes to light in the living organism cannot is not likely to be the result solely of physical or chemical interactions among molecules, genes, cells, and organs. Though some biochemical signaling—for example, of control genes—is remarkably efficient, the speed with which activating processes spread in the body, as well as the complexity of these processes, makes explanation in reference to physics and chemistry alone insufficient. The conduction of signals through the nervous system, for example, cannot proceed faster than about twenty meters per second, and it cannot carry a large number of diverse signals at the same time. Yet there are quasi-instant, nonlinear, heterogeneous, and multidimensional correlations come to among all parts of the organism. It appears that in some respects the organism is a macroscopic quantum system.

Experiments for which Eric A. Cornell, Wolfgang Ketterle, and Carl E. Wieman received the 2001 Nobel Prize in physics show that living tissue can be considered a "Bose-Einstein condensate": a form of matter in which quantum-type processes occur at macroscopic scales. Under certain conditions separate particles and atoms interpenetrate as waves. Rubidium and sodium atoms, for example, behave not as classical particles, but as nonlocal quantum waves, penetrating throughout the condensate and forming interference patterns.

The coherence of the living organism suggests that distant molecules and molecular assemblies resonate at the same or compatible frequencies. For cohesion to occur among the assemblies, they must resonate in phase: the same wave function has to apply to them. This provision holds also in regard to the coupling of frequencies among the assemblies. If faster and slower reactions are to accommodate themselves within a coherent overall process, the respective wave functions must coincide. They appear to coincide, and thus the organism is describable in principle by an integrated macroscopic wave function.

The coherent evolution of complex species

The historical fact that complex species evolved on this planet is an indirect indication of an embracing level of coherence in the living world: coherence between genome and phenome in organisms, and between organisms and milieus in the biosphere.

Statistical as well as experimental evidence indicate that that there is no absolute separation between the genetic information encoded in the organism and the phenome that results from this information. Contrarily to the classical Darwinian doctrine, the genome does not appear to mutate purely randomly, unaffected by the changing states of the phenome. One strand of evidence is statistical, the other experimental. The statistical evidence concerns the search-space of genetic rearrangements. This space is so enormous that random processes are likely to take incomparably longer to produce new species than the time that was available for evolution in the biosphere. It is not enough for genetic rearrangements to produce one or a few positive changes in a species; they must produce the full set. The evolution of feathers, for example, does not produce a reptile that can fly: radical changes in musculature and bone structure are also required, along with a faster metabolism to power sustained flight. The development of the eye requires thousands of mutations, finely coordinated with one another. Yet the probability of a single mutation producing positive results is negligible: statistically only one mutation in 20 million is likely to be viable. By itself, each mutation is likely to make the phenome less rather than more fit, and if so, it will be eliminated in time by natural selection.

An additional factor speaking against the thesis of random mutations producing viable organisms is the possibility that complex organisms are "irreducibly complex." The parts of an irreducibly complex organism are interrelated in such a way that removing any one part destroys the function of the whole. Thus to mutate an irreducibly complex system into a viable system, throughout the mutation every part has to be kept in a functional relationship with every other part. According to Michael Behe, this level of precision is unlikely to be achieved by random piecemeal modifications of the genetic pool (Behe 1998).

In addition to the negative statistical probabilities, there is positive laboratory evidence for connections between the genome and the phenome. A. Maniotis described an experiment where a mechanical force impressed on an external cellular membrane was transmitted to the cell nucleus—this produced a mutation almost instantly (Maniotis et al. 1997). Michael Lieber demonstrated that mechanical force acting on the outer membrane of cells is but one variety of interaction that results in a genetic rearrangement: any stress coming from the environment, mechanical or not, triggers a global "hypermutation" (Lieber 1998). These findings contradict the persistent myth of a full separation between genome and phenome, and contribute to a better understanding of the coherence of living species with their environment. Such coherence is a key factor in explaining the otherwise puzzling fact that complex species could evolve within the known historical timeframes.

Spontaneous coherence among human brains

At the cutting edge of brain- and consciousness-research a significant body of evidence has surfaced that the brain-functions of discrete individuals can achieve a form of coherence even in the absence of sensory contact among the individuals.

Telepathic, remote-viewing, and telesomatic phenomena have been subjected to increasingly rigorous experiments in parapsychology laboratories. The evidence regarding the phenomenon of "twin-pain" (where one of a pair of identical twins intuits or feels the pain or trauma of the other) has been exhaustively investigated. Guy Playfair reported that it occurs in about 25 percent of identical twins (Playfair 2002). Spontaneous coherence in brain-functions occurs also among genetically unrelated individuals. Laboratory tests show that personal contact, or an emotional bond, are often sufficient to produce the transference of induced stimuli among pairs of subjects.

At the National University of Mexico Jacobo Grinberg-Zylberbaum performed more than fifty controlled stimuli-transfer experiments (Grinberg-Zylberbaum et al. 1993).He paired his subjects inside soundproof Faraday cages and asked them to meditate together for twenty minutes. Then he placed them in separate Faraday cages where one subject was stimulated and the other not. In double-blind experiments the stimulated subject received stimuli (such as flashes of light, sounds, and short, intense, but not painful electric shocks to the index and ring fingers of the right hand) at random intervals. The electroencephalograph (EEG) brain-wave records of both subjects were then synchronized and examined for "normal" potentials evoked in the stimulated subject and "transferred" potentials in the non-stimulated subject. Transferred potentials appeared consistently in about twenty-five percent of the cases. In a limited way, Grinberg-Zylberbaum could also replicate these results: when one individual exhibited the transferred potentials in one experiment, he or she usually exhibited them in subsequent experiments as well.

A related ability of individuals is to achieve a high level of spontaneous synchronization of their cerebral functions. A series of experiments carried out by the Italian physician and brain researcher Nitamo Montecucco and witnessed by this writer showed that in deep meditation, the left and right hemispheres of the brain manifest identical wave patterns. More remarkably, the left and right hemispheres of different subjects become synchronized. In one test, eleven out of twelve meditators achieved ninety-eight percent synchronization of the full spectrum of their EEG waves in the entire absence of sensory input (Montecucco 2000).

Additional evidence of the transmission of physical effect between individuals in the absence of sensory contact is furnished by remote healing. Benor analyzed hundreds of cases of controlled experiments and found significant evidence that a positive therapeutic effect is frequently achieved (Benor 1993). An experiment related to remote healing was carried out in the presence of the writer in southern Germany in the spring of 2001. At a seminar attended by about a hundred people, Günter Haffelder, head of the Institute for Communication and Brain-research of Stuttgart, measured the EEG patterns of Maria Sági, an experienced natural healer, together with that of a test subject who volunteered among the participants (Sági 2002). The subject remained in the seminar hall while the healer was taken to a separate room. Both the healer and the subject were wired with electrodes, and their EEG patterns were displayed on a monitor in the hall. During the time the healer was diagnosing and treating the subject, her EEG waves dipped into the Delta region between 0 and 3 Hz, with a few eruptions of wave amplitude. The EEG of the subject, who sat in the hall in a light meditative state, exhibited the same Delta wave-pattern with a delay of about two seconds. Healer and subject had no sensory contact with each other.

C. Coherence in the macrodomain of the universe

In addition to the microdomain of the quantum and the mesodomain of life, nonlocal coherence is found also in the macrodomain of the universe.

The coherence of cosmic ratios

A number of noteworthy coincidences have come to light regarding the physical parameters of the universe. In the 1930s Sir Arthur Eddington and Paul Dirac noted that the ratio of the electric force to the gravitational force is approximately 10^{40}, and the ratio of the observable size of the universe to the size of elementary particles is likewise around 1040. This is all the more strange as the former ratio should be unchanging (the two forces are assumed to be constant), whereas the latter is changing (since the universe is expanding). In his “large number hypothesis,” Dirac speculated that the agreement of these ratios, the one variable, the other not, is not merely a temporary coincidence. But if the coincidence is more than temporary, either the universe is not expanding, or the force of gravitation varies in accordance with its expansion.

Additional coincidences involve the ratio of elementary particles to the Planck-length (which is 1020) and the number of nucleons in the universe (“Eddington’s number,” approximately 2 x 1079). These are very large numbers, yet harmonic numbers can be constructed from them. (Eddington’s number, for example, is roughly equal to the square of 1040.)

Menas Kafatos and Robert Nadeau showed that many of these coincidences can be interpreted in terms of the relationship on the one hand between the masses of elementary particles and the total number of nucleons in the universe, and on the other between the gravitational constant, the charge of the electron, Planck’s constant, and the speed of light (Kafatos and Nadeau 1990, Nadeau and Kafatos 1999). Scale-invariant relationships appear. The physical parameters of the universe turn out to be generally proportional to its overall dimensions.

The coherence of the universal constants

Coherence among the basic parameters of the universe is complemented by coherence among the values of the universe’s physical constants. The constants have precisely the value that allows complex structures to arise—a finding that gave rise to long-standing debates on the “anthropic cosmological principle” and other explanatory hypotheses (Barrow and Tipler 1986). The coherence of the constants involves upward of thirty factors and considerable accuracy. For example, if the expansion rate of the early universe had been one-billionth less than it was, the universe would have re-collapsed almost immediately; and if it had been one-billionth more, it would have flown apart so fast that it could produce only dilute, cold gases. A similarly small difference in the strength of the electromagnetic field relative to the gravitational field would have prevented the existence of hot and stable stars like the Sun, and hence the evolution of life on planets that are physically capable of supporting life. Moreover, if the difference between the mass of the neutron and the proton were not precisely twice the mass of the electron, no substantial chemical reactions could take place, and if the electric charge of electrons and protons did not balance precisely, all configurations of matter would be unstable and the universe would consist merely of radiation and a relatively uniform mixture of gases.

The numerical coincidences of the universe's basic parameters, and the coherence of its universal constants, suggest that the universe is nonlocally coherent as a whole: it approximates a supermacroscopic quantum system.

Part Two: Interpretation

Coherence is a well-known phenomenon in physics: in its ordinary form, it refers to light composed of waves with a constant difference in phase. Coherence means that phase relations remain constant and processes and rhythms are harmonized. Ordinary light sources are coherent over a few meters; lasers, microwaves, and other technological light sources remain coherent for considerably greater distances. But the kind of coherence discussed above is more complex and significant. It indicates a quasi-instant correlation among the parts or elements of a system, whether that system is a quantum, an atom, an organism, or a galaxy. As noted in Part One, this form of coherence crops up in fields as diverse as quantum physics, biology, cosmology, and brain- and consciousness-research. It is considered nonlocal in physics and biology, and transpersonal in some branches of consciousness-research.

The nonlocal/transpersonal coherence phenomenon has major implications. It suggests that in addition to matter and energy, there is also a more subtle yet equally fundamental element in the universe; an element that generally corresponds to our notion of information, but is specifically distinct from it. It is a form of information that, following a suggestion by David Bohm, I have termed "in-formation." (Laszlo 2004, 2007) In-formation is like information in that its transmission does not involve physical force or energy, does not contribute to the increase of entropy, and its wave propagation is not vectorial. In-formation is unlike information, however, in that its transmission produces nonlocal coherence, a measurable physical condition.

The field postulate

The evidence cited above—and documented in more detail in the recent books of this writer (Laszlo 1993, 1994, 1996, 2002, 2004, 2007)—suggests that nonlocal coherence is a *bona fide* factor in nature, and that its logical explanation is the presence of the variety of information termed "in-formation." If in-formation is indeed an element in nature, it should not be left suspended in some ideal space but be physically interpreted. Here we can follow establish usage. In most branches of empirical science spatially or temporally remote entities that prove to be interlinked are considered connected by an intervening field. The alternative to the field postulate is the classical but in a realistic context unacceptable notion of "action at a distance," a tenet that Einstein said is "spooky" (although quantum physicists are sometimes obliged to contend with it—e.g., in regard to the Bell inegality).

The evidence for an in-formation field, the same as evidence for other physical fields, is indirect and must be conceptually reconstructed. Fields are not themselves observable; they are inferred from observed phenomena that are taken to be their effect. For example, the gravitational field itself cannot be perceived: when an object drops to the ground, we perceive the object falling but not the field that makes it fall—we see the effect of the G-field but not the G-field. The same applies to the EM field, of which the effect is the transmission of electric and magnetic force; to the Higgs field, of which the presumed effect is the presence of mass in particles; and to the weak and strong nuclear fields where the effect is attraction and repulsion among particles at extreme proximity to each other. In the case of the proposed in-formation field, the evidence is the nonlocal form of coherence that comes to light in the physical and biological sciences, as well as in the transpersonal phenomena encountered in some areas of brain- and consciousness-research.

The universality postulate

The question, whether the proposed field is local, or universal, needs to be addressed. On this score, the evidence speaks clearly. The correlations that create the pertinent forms of coherence do not seem to depend on finite distances and finite intervals between the effectively correlated, and hence coherent, entities. In consequence the field that correlates them is logically viewed as universal.

Universality appears to be a speculative extension of the in-formation field postulate, yet the analogous step has been taken time and time again in the history of science. In the 19th century Faraday discovered that electric and magnetic phenomena are not separate physical effects, but can be traced to one and the same field. Faraday's electromagnetic field was seen as a local field, associated with given objects; it was Maxwell's insight that the EM field is universal. Modifications of this field travel in space at the speed of light; a changing electric field produces changes in the magnetic field, and this in turn produces changes in the electric field. This was a revolutionary tenet, for claiming that the electromagnetic field is universal means abandoning the notion of empty space as a mere vehicle for transporting the forces involved in the interaction of particles. Space had henceforth to be conceived as a continuous field through which electric and magnetic effects are conveyed, whether the particles are contiguous, or spatially and temporally remote from each other.

The field accounting for gravitational attraction among massive particles has a similar history. In Newton's theory gravitation is a local phenomenon, an intrinsic property of objects with mass (although Newton, the same as subsequently Ernst Mach, was puzzled by this property). It was Einstein who removed the gravitational force from individual objects and ascribed it to space-time itself. In the general theory of relativity, the G-field is a universal field.

In recent years still another universal field entered the world-picture of physics: the Higgs field. Similarly to gravitation, the Higgs field has to do with mass, but not with the property of massive objects, or with the action of fields on massive or massless objects. The Standard Model of particle physics suggests that the Higgs field is a universal field that, through interaction, creates mass in particles.

What these examples tell us is that when phenomena occur that require a physical explanation, the first attempt is to give an explanation specifically related to the entities that manifest the phenomena. However, as theories grow and mature, the explanatory concepts become more general. Electric and magnetic phenomena are now ascribed to the universal EM field; the mutual attraction of non-contiguous objects is ascribed to the universal G field; and the presence of mass is ascribed to the universal Higgs field. By the same reasoning we ascribe nonlocal coherence in the various domains of nature to a universal in-formation field.

Conclusions

Although fields, like other entities, are not to be multiplied beyond the scope of necessity, it seems evident that a further field is required to account for the kind of coherence that comes to light in diverse areas of scientific investigation. The indicated field complements and completes theories that view space (more precisely, the universal vacuum, or "nu-ether") as a medium for the transmission of physical forces and interactions. Electric and magnetic phenomena are seen to be transmitted by the EM field; attraction among massive objects by the G-field; and mass by the non-zero Higgs field. Since nonlocal coherence cannot be ascribed to the EM field, the G-field, the strong and weak nuclear fields, and to the Higgs field, there is warrant for recognizing an additional universal field. The In-formation Field Hypothesis suggests that the correlations that underlie the nonlocal forms of coherence observed in physics, biology, cosmology, and brain- and consciousness-research are transmitted by a distinct field: the universal in-formation field.

References

Barrow John D., and Frank J. Tipler (1986) *The Anthropic Cosmological Principle,* Oxford University Press, London and New York.

Behe, Michael J. (1998) *Darwin's Black Box: The Biochemical Challenge to Evolution.* Touchstone Books, New York.

Benor, Daniel J. (1993) *Healing Research* Vol. 1, Helix Editions, London.

Buks, E., R. Schuster, M. Heiblum, D. Mahalu and V. Umansky, (1998) "Dephasing in electron interference by a 'which-path' detector," *Nature*, Vol. 391 (26 February).

Dürr, S., T. Nunn and G. Rempe, (1998) "Origin of quantum-mechanical complementarity probed by a 'which-way' experiment in an atom interferometer" *Nature*, Vol. 395 (3 September 1998).

Grinberg-Zylberbaum, Jacobo, M. Delaflor, M.E. Sanchez-Arellano, M.A. Guevara, and M. Perez (1993) "Human communication and the electrophysiological activity of the brain" *Subtle Energies*, Vol. 3,3 (1993).

Kafatos, Menas, and R. Nadeau (1990) *The Conscious Universe: Part and Whole in Modern Physical Theory*. Springer Verlag, New York.

Laszlo, Ervin (1993) *The Creative Cosmos*. Floris Books, Edinbrugh

Laszlo, Ervin (1994) *The Interconnected Universe*, World Scientific, Singapore and London

Laszlo, Ervin (1996) *The Whispering Pond*, Element Books, Rockport and Shaftesbury

Laszlo, Ervin (2002) *The Connectivity Hypothesis*. State University of New York Press, 2002

Laszlo, Ervin (2004, rev. enlarged ed. 2007) *Science and the Akashic Field*. Inner Traditions International, Rochester, VT

Lieber, Michael M. (1998) "Hypermutation as a means to globally restabilize the genome following environmental stress." *Mutation Research, Fundamental and Molecular Mechanisms of Mutagenesis* 421:2 (1998).

Mandel, Leonard, (1991) *Physical Review Letters* 67:3, 318-321 (1991).

Maniotis, A., et al. (1997) "Demonstration of mechanical connections between integrins, cytoskeletal filaments, and nucleoplasm that stabilize nuclear structure." *Proceedings of the National Academy of Sciences USA*, 4:3 (1997).

Montecucco, Nitamo (2000) *Cyber: La Visione Olistica.* Mediterranee, Rome.

Nadeau, Robert and Menas Kafatos (1999) *The Non-Local Universe: The New Physics and Matters of the Mind.* New York: Oxford University Press.

Playfair, Guy (2002) *Twin Telepathy: The Psychic Connection.* Vega Books, London.

Sági, Maria (2002) "Healing through the Ψ Field: Two Experiments. In E. Laszlo, *The Connectivity Hypothesis.* State University of New York Press, Albany.

Wheeler, John A. (1984) "Bits, quanta, meaning" in *Problems of Theoretical Physics*, ed. A. Giovannini, F. Mancini, and M. Marinaro, University of Salerno Press, Salerno.

Wheeler, John A. (1987) "Quantum cosmology" in *World Science*, ed. L.Z. Fang and R. Ruffini, World Scientific, Singapore.

Biographical Note

Ervin Laszlo has a PhD from the Sorbonne and is the recipient of four honorary PhD's, from the United States, Canada, Finland, and Hungary. He is the author or co-author of forty-seven books translated into twenty-one languages, and the editor of thirty volumes of papers including a four-volume encyclopedia. Laszlo is Founder and Director of the General Evolution Research Group, Founder and President of The Club of Budapest, Chancellor-Designate of the World Shift University, Fellow of the World Academy of Arts and Sciences, Member of the International Academy of Philosophy of Science, Senator of the International Medici Academy, and Editor of *World Futures: The Journal of General Evolution.*
