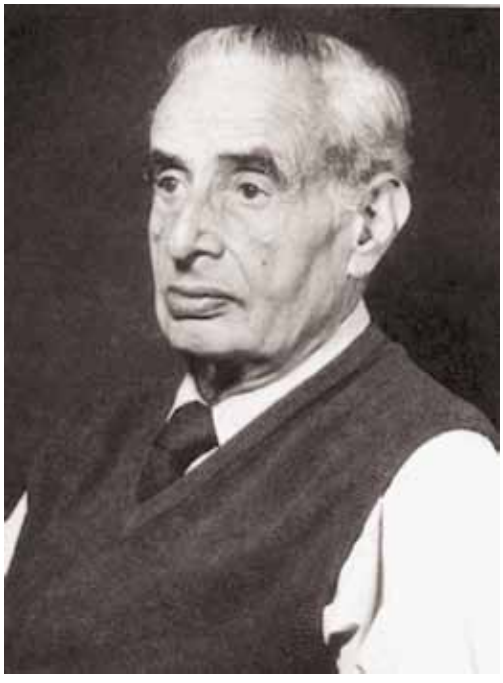
BIOLOGICAL SCIENCE

Overthrowing the Mind-Body Dualism: Walter Elsasser's Major Contribution

by Dr. Ernest Schapiro

Jan. 7—Lyndon LaRouche's account—in his own major discovery—of the role of the subjectivity of science and the necessary role of metaphor, casts light on the groundbreaking work of Walter Elsasser (1904-1991).[1] A serious scientist is forced to recognize his own ignorance when faced with a paradox that his peers do not wish to recognize.



Walter Elsasser

Elsasser, starting early in the 1930s, was convinced that mechanistic causal explanations, particularly involving mathematics, do not always apply to biology and social processes. His major discovery bears on the difference between living and non-living processes. Two experiences helped greatly to force the confrontation. First was his intense dissatisfaction with John von Neumann's book, *Mathematical Foundations of Quantum Mechanics* (1932) which asserted the completeness of quantum mechanics. The second was the discovery of his own creativity, which grew out of his own psychoanalysis and his insight into the role of the unconscious.

As a uniquely qualified expert in quantum theory and therefore in the principles bounding it, Elsasser began to increasingly recognize the domains in which it could *not* apply. Over a lengthy period of decades, he struggled for a better approach to understanding biological processes.

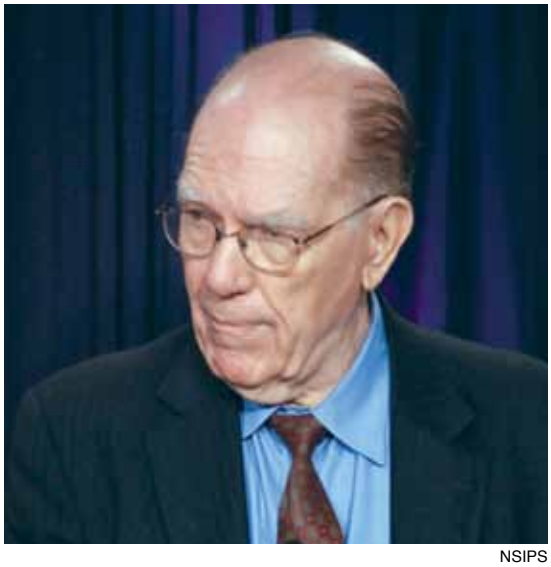
Finally, he developed a metaphor to resolve the problems of the widely-held, rife-with-paradox view, which he called "metaphysical," that mind and living matter are separate substances with no direct relation between them. Elsasser's unexpected resolution was a metaphor for the creativity that could subsume the "unfathomable complexity" of both, which paradox made causal explanation in mathematical terms impossible. He came to the recognition that organisms, because they are not automata, are creative even in simply morphologically reproducing themselves and in constructing their cerebral processes. In his 1987 book, *Reflections on a Theory of Organisms: Holism in Biology*, Elsasser specified that in so redefining creativity he was *not* referring to biological evolution.

In Lyndon LaRouche's unpublished 1985 preface to an intended translation by himself of Bernhard Riemann's *Zur Psychologie und Metaphysik*, he stressed his understanding of Riemann, and particularly Riemann's view that in the mind's expression in the form of what Riemann called "thought masses," mind is as substantial as "matter." LaRouche went further in the 1994 paper titled, "On LaRouche's Dis-

1. Harry Rubin. "Walter M. Elsasser, 1904-1991: A Biographical Memoir." National Academies Press, 1995. Pp. 65. Available at http://www.nasonline.org/publications/biographical-memoirs/memoir-pdfs/elsasser-walter.pdf

covery," in which he described how he (like Elsasser) was provoked to make his discovery in angered response to the information theory of Norbert Wiener and the equivalent radical positivism of von Neumann.

Elsasser arrived at conclusions equivalent to those of LaRouche, but by a very different route. Because the different routes imply a different way of hypothesizing, the implications of the developed ideas are somewhat different, because the hypotheses that generated the discoveries lead in particular directions.



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Lyndon LaRouche

LaRouche's discoveries were derived from his study of physical economy, Vladimir Vernadsky, and classical culture, so that the individual organism is subsumed from a higher standpoint.

Elsasser started from the standpoint of physics and information theory. He found that living matter couldn't be accounted for by our knowledge of chemistry and physics, even including quantum mechanics. He developed a negative proof from the standpoint of information theory that the sheer complexity of a single cell, that is, the number of ways it can be configured, is vastly larger than the number of living cells on the Earth. The cell, in replicating itself, therefore, can't be following a script or program, but rather is choosing to select a particular path that will result in a cell very similar to itself but not identical.

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Claude Shannon

Life an Anomaly for Mechanistic Causality

The organism is thus not an automaton, contrary not only to Descartes but to all of today's reductionist biology. Furthermore, organisms display a genetic stability over millions of years, as shown by the paleontological record, which violates the formulation of the second law of thermodynamics as applied to the genetic code by Claude Shannon[2] as a form of information. Elsasser writes,

> In terms of the usual reasoning of the physicist, the information transfer observed in heredity has very often been described as a violation of the Second Law of thermodynamics . . . The mathematician Shannon showed that if a "message" (i.e. a set of symbols) is processed in a computer, or a communication system, any possible source of error will have a cumulative effect upon the message; one can find a quantity (the entropy, a measure of disorder) which always increases, never decreases. This result is known as "Shannon's Law" and is best taken as a parallel to the general statement of the statistical behavior underlying the Second Law of Thermodynamics.[3]

The faithfulness of replication over vast periods reflects the creative power of the organism. The genetic code serves a function of "operative symbolism," that is, it is used by the creative power of the organism as a guide to reconstruct the whole. According to Elsasser,

> This makes clear the relationship of the two processes of information transmission, that of homogeneous replication and that of heterogeneous reproduction. We are no longer forced to look for a purely particularate (or as the mathematician says, discrete) scheme of genetics to explain all

2. Claude Shannon (1916-2001). He was lauded by *Scientific American* magazine, among many others, as "the Founder of Information Theory." Readers may consult his 1940 doctoral dissertation, "An Algebra for Theoretical Genetics."

3. Walter Elsasser. *Reflections on a Theory of Organisms: Holism in Biology.* Johns Hopkins University Press, 1987, p. 44.

heredity. We now interpret the discrete genetic message as a symbol of the complete reproductive process. Here a symbol is defined as an incomplete message, from which the organism can reconstruct a structure by the process of heterogeneous reproduction such that the final structure is similar to an ancestral structure. A machine would be totally unable to reconstruct information which was not present at an intermediate time. We have added the term "operative" to make clear that if we speak of "symbolism," we do not have in mind any return to a dualistic philosophy.[4]

Gottfried Wilhelm Leibniz (1646-1716)

A further bold step was his discerning an equivalence between the physical replication of the morphology of the organism and the function of cerebral memory. The order of complexity of the processes, again, required by the central nervous system is so unfathomably vast as to preclude any specifiable mechanistic basis.

If one accepts Elsasser's hypothesis of "operative symbolism," it suggests that there are what Wolfgang Köhler (1887-1967) called memory traces in the brain. These "memory traces" are used to reconstruct an entire thought or gestalt. The Cartesian dualism between mind and matter is thereby discarded.[5]

I am reminded of Leibniz's *New System of Nature and the Communication of Substances, as Well as the Union of Soul and Body* (1695) in which he presents us with an ordered series of his hypotheses, which began in the late 1670s with his groundbreaking hypothesis of "living force" and culminated in pre-established harmony. He says there:

> I realized that the sole consideration of an extended mass did not suffice, and that we must emphasize the notion of force which is very intelligible despite its springing from metaphysics. It seemed to me also that the opinion of those who transform or degrade animals into pure machines, though a possible one apparently, is against appearances and even against the order of things.[6]

Leibniz hypothesized that the universe is composed of monads, each possessing a spontaneous impulse to act, but shaped by its perception of other monads, implying the freedom of the highest monads, and the spontaneity of all monads as implied by Elsasser.[7]

Rudolph Schoenheimer

Multilevel Space-Time of the Organism

Elsasser proposed that the exercise of the creative selection of pathways is favored by instability; in particular, he cited the self-organizing of plasmas when experiencing instabilities. He suggested that electric charges are an obvious source of instability in the organism. This calls to mind the many anomalous phenomena which reveal—from the intracellular and molecular level up to at least the organ level—that the organism is under pressure to continually recreate itself.

We find the pressure on the organism to recreate itself in the original observations of Rudolph Schoenheimer (1898-1941), presented in his posthumously published book, *The Dynamic State of Body Constitu-*

4. Elsasser, *ibid*., p. 45.
5. Wolfgang Köhler. *The Place of Value in a World of Facts*. New York: Liveright, 1938, 1966. Available at: https://archive.org/details/placeofvalueinaw029252mbp/page/n7
6. Philip P. Wiener. *Leibniz: Selections*. Scribner, 1951, p. 106.
7. *Ibid*., p. 533.

Many anomalous phenomena reveal—from the intracellular and molecular level up to at least the organ level—that the organism is under pressure to continually recreate itself. Pictured here is a time-lapse photo of an Amaryllis bud developing and opening into a flower.

ents (1942). Schoenheimer's discoveries were never accounted for and rarely discussed.

He was one of the first biochemists to have access to isotopes of hydrogen, carbon, and nitrogen. Using those isotopes, he was able to begin to explore intermediary metabolic steps, hitherto a black box. He fed rats isotopically labeled fats and sampled their body fats after several days, finding that their body fat deposits were heavily isotope-labeled in most of their different kinds of fat molecules. This was so despite a caloric intake designed to maintain a steady body weight. To me this suggests a lability of the chemical bonds and a high energy-flux density. Such an increase in lability is indicated by the observation that low-energy transmutation of elements has been observed in biology, without any evidence of release of energy as would be expected in a nuclear reaction.[8]

On a higher level, within the organelles of the cell there is a similarly high rate of flux only discovered in recent years, in the form of autophagy. The cell continually breaks down and recycles the material of its organelles, such as the mitochondria. In addition to a basal rate of this process of autophagy (self-eating), it increases greatly under starvation conditions as an energy source, and in disease processes.

On a still higher tissue and organ level, is the phenomenon of the trophic function of lymphoid elements. The small lymphocyte is the most mobile cell in the body and spends its short life span migrating from its site of formation in the lymph nodes, spleen, thymus or bone marrow into the tissues, where it donates its energy-dense protein and nuclear material, especially in tissues in which there is a rapid turnover, such as the lining of the small intestine or the uterus or a lymph node. The lymphocyte has been seen microscopically penetrating epithelial cells and then decomposing, a process called emperipolesis (to wander about inside).[9]

These multilevel instances of rapid flux and turnover from molecular to cellular to organ level, are compatible with Vernadsky's biogenic migration of atoms, and the progressive increase in flow of materials in a healthy economy driven by increases in energy-flux density and human creativity.[10] One can ask how the

8. Ernest Schapiro, "Are Nuclear Processes in Biology Unique?" *21st Century Science & Technology*, Spring-Summer 2012.

9. Jack Shields, *The Trophic Function of Lymphoid Elements*. Thomas, 1972.

10. For a discussion of biogenic migration of atoms, see Benjamin Deniston, "Biospheric Energy-Flux Density," *21st Century Science & Technology*, Spring 2013, p. 22, available at https://21sci-tech.com/Articles_2013/Spring_2013/Biospheric_EFD.pdf Further discussion of this topic can be found in Andrey Lapo, *Traces of Bygone Biospheres*,

physical space-time of the organism is so structured as to facilitate these kinds of processes of rapid molecular turnover.

Inverse Relationship of Mass to Cycle Speed

In the placental mammals, there is an inverse relationship of mass to the speed of cyclical processes, across an extraordinarily wide range of cycles of different duration, such as nerve activation and life span. There is also an inverse relationship of mass to metabolic rate. The product of these two relationships gives a number for the calories expended per gram of tissue during the given cycle. One such cycle is lifetime. This can be seen as energy-flux density or as "action" per unit of mass, the "action" being the energy expended in a process, summed over time, which is an invariant in evolution, being remarkably similar in a wide range of placental mammals.

In the course of elaborating the implications of Vernadsky's ideas about space-time in biology, Benjamin Deniston has been the first to relate the above empirically known relationships to a relativistic principle of biological space-time. I see this as a fundamental discovery.[11] Remarkably, action is invariant in special relativity, unlike energy. It is relevant that Planck's constant is in units of action.

This phenomenon can be described as follows. The *lengths of a wide range of biological cycles*, over many orders of magnitude, scale as the one-fourth power of the mass (an inverse relationship). The *metabolic rates*, also over a comparably wide range, scale as the three-quarter power of the mass (also an inverse relationship, because the power is again less than one). Multiplying these two relationships gives energy times time, divided by mass to the first power, yielding so many kilowatt-hours per kilogram of body mass. In the case of the lifetime, viewed as a cycle, one gets energy (kilowatts) expended per unit of mass over a lifetime. This number is remarkably constant for the placental mammals from the mouse to the elephant.[12]

Universal Principles or Empiricism?

It is remarkable that until the work of Lyndon H. LaRouche and his associate, Deniston, no one apparently had thought of relativity as extending from the original application by Albert Einstein to the domains of respectively physical economy and biological evolution, the latter also subsuming the individual organism. This is because the relevance of the work of Bernhard Riemann to these domains has been overlooked and considered of interest only to specialists in general relativity. More broadly, it is because the Platonic notion of universal physical principles has given way to empiricism, including its extreme guise as information theory. LaRouche has seen the Riemannian manifold of "dimensions" as the metaphor for interacting universal physical principles. He discusses relativistic physical economics and economic time in his 2009 book-length article in *Executive Intelligence Review*, "Economics as History."

Concept of Action as a Measure

Physicist Martin Ruderfer addresses the question, why "action" is so crucial in a 1949 groundbreaking article in *Science* magazine, "The Concept of Action as a Measure of Living Phenomena." Ruderfer says,

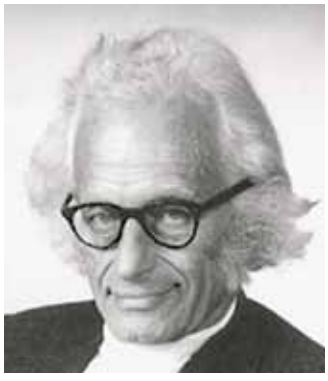
> There are two universal properties of living things upon which such a measuring rod [for living things —ES] could be based. First, every living thing absorbs and emits energy throughout its life span. Second, every living thing has a finite life span. These properties are common to all living substances from the single cell to the largest animal. The desideratum is therefore a measure which quantitatively unites these two properties, contains no other components, and is capable of being precisely determined.
>
> Since the units of these properties are respectively energy and time, the physical concept of action suggests itself, for action is the product of energy and time. This choice is not adventitious, because action is one of the most important properties of inert matter. The macroscopic properties of inert things—gravitation, electro-

Synergetic Press, 1988, p. 139 and *passim*, and in *Geochemistry and the Biosphere: Essays by Vladimir I. Vernadsky*, edited by Frank Salisbury, Santa Fe, New Mexico: Synergetic Press, 2007.

11. Benjamin Deniston. "Time for a Solar Noösphere," *Executive Intelligence Review*, Nov. 28, 2014; Vol. 43, No. 49, pp. 43-49. For a detailed discussion of these scaling relationships, see S.L. Linstedt and W.A. Calder, III. "Body Size, Physiologic Time, and Longevity of Homeothermic Animals," *Quarterly Review of Biology* Vol. 56, No. 1 (March 1981), pp. 1-16. The article neither takes the product of the two scaling relationships nor arrives at a concept equivalent to energy-flux density.

12. G.J. Hyland. *Herbert Fröhlich: A Physicist Ahead of His Time*. Springer, 2015.

Louis Pasteur



Herbert Fröhlich

Wolfgang Köhler

> magnetic propagation, and mechanics—have been summed up in a single law, the Principle of Least Action; with the exception of entropy, action is the only invariant property that has survived the relativity theory; the curvature of space time is determined by the action at each point in the universe; and finally, the most important quantity in atomic physics is a quantum of action—Planck's constant, *h*. Nature's emphasis on action strongly suggests it as a universal quantitative measure of life.

Ruderfer showed that, despite their difference in life expectancy, men and women expend the same quantity of action in their lifetimes. Based on his 1949 results cited above, Ruderfer concluded that "the members of each living species may be associated with a finite value of action within narrow limits."

In the Footsteps of Louis Pasteur

The fact that physicists other than Elsasser have made such unique contributions to biology suggests to me that what is holding back progress in medicine and biology is the reductionist axiomatics predominating in those domains. A gifted outsider can leap over the group-think in pursuit of a challenging insight or observation. One can think of Louis Pasteur, whose entry point into biology and medicine was his highly original discovery that only living processes can produce a net yield of optically active molecules—molecules that he first studied for his doctoral dissertation as a chemist, then examining the work of the leading physicists of his time.

Herbert Fröhlich, who had done outstanding work in solid state physics, saw that his knowledge of dielectrics was applicable to the cell membrane potential and went on to elaborate a new approach to the role of electrodynamics in biology.[13] Fritz-Albert Popp, who participated in the Jan. 8, 1989 Fusion Energy Forum seminar in Germany on The Implications of Negative Curvature in Physics and Biology, is a physicist who has done pioneering work on the crucial role of biophotons.[14]

Wolfgang Köhler, who was trained as a physicist and was an associate of Max Planck, developed the idea that the laws of physics are relevant to the behavior of "traces" in the brain. He first proposed that brain processes are isomorphic to the "contexts" they represent, that is, there is a discernible relationship between the mental process and the physical phenomena giving rise to it. The phenomena of the creation of visual gestalts is an example of the enormous creativity of the nervous system.[15]

A fundamentally new approach to the education of

13. G.J. Hyland. *Herbert Fröhlich: A Physicist Ahead of His Time*. Springer, 2015.

14. Fritz-Albert Popp. *Biophotonen—Neue Horizonte in der Medizin: Von den Grundlagen zur Biophotonik*. Third revised and expanded edition. Stuttgart: Haug Verlag, 2013; and Mae-Wan Ho, Fritz-Albert Popp, and Ulrich Warnke, eds., *Bioelectrodynamics and Communication*, World Scientific, 1994.

15. Wolfgang Köhler. *The Place of Value in a World of Facts*. See note 5.

specialists in biology, chemistry, and physics is needed that takes this history into account. More broadly, Elsasser often makes references to the history of science. For example, he refers to the replacement of the Enlightenment view since World War II by "Post-Rationalist Reconstruction." He wrote,

> While the extreme rationalist assumes as a matter of course that all problems can be solved by sufficiently clever analysis, our approach to the same question, as dictated by historically founded preconceptions, will be that Nature has aspects that are "irrational," in particular aspects of spontaneity, that are by their very nature not amenable to analysis.

Marie Curie in her laboratory at the University of Paris in 1925.

In my view, Elsasser has overcome the mind-body dualism of the last 350 years and allowed us at last to see many things in a new and different light.[16] Thus, an implication of Elsasser's discovery that cerebral memory is creatively generated and maintained, is that there is a succession of memories which in effect have access to their predecessors and incorporate them. This calls to mind LaRouche's statement that the simultaneity of eternity is the most important principle in science.[17] Such a process of creative memory is suggested to me in particular for biological evolution by the work of paleontologist Martin Lockley in his 1999 book, *The Eternal Trail*. Discussing convergent evolution, he says:

Lauren Harnett

A NASA Johnson Space Center's "Bring our Children to Work Day" activity engages the mind of a child.

> It behooves us to look at the cyclic pattern of ascending and descending forces that characterize the growth cycle of all individuals, species, and larger groups. It should be clear by now that all groups that we have examined and many more, besides, seem to show transitions from small, narrow, environmentally sensitive beginnings to large, wide environmentally emancipated endings.... Note the remarkable convergence between ancestral forms among dinosaurs, birds, and mammals.... The similarities in form reiterate throughout the entire evolutionary history of groups. So, there is not just a convergence of various isolated species, but a coherent reiteration of morphodynamic patterns throughout the evolutionary cycle of entire groups. Between cycles, the old morphologies seem lost, but then they are "taken up" again, as Herman Poppelbaum says in *A New Zoology*. One might describe it as evolution spiraling around a cone, so that each cycle resonates with the [past —ES] forms that manifest at that point in the cycle.

The forms that resonate all lie on a line from the apex of the cone to its base and therefore lie at the same phase angles in successive rotations around the cone.

The famous and hitherto unexplained embryological observation, "Ontogeny recapitulates phylogeny" is also relevant here.

16. See the latter section of Ernest Schapiro, "Leibniz from LaRouche's Standpoint," *Executive Intelligence Review*, Aug. 4, 2017, available at https://larouchepub.com/eiw/public/2017/eirv44n31-20170804/54-72_4431.pdf to see why I say my view of the mind-body problem has changed after reading Elsasser.

17. Lyndon LaRouche. "Jesus Christ and Civilization," *Executive Intelligence Review*, Sept. 22, 2000: "It is no mere coincidence, that this notion of simultaneity of eternity, is the most interesting, important, and profitable idea in all of physical science. (There, it appears most frequently reflected, today, in its reflection as *the relativity of time*.)" Also, see LaRouche, "The Truth about Temporal Eternity," *Fidelio*, Vol. 3, No. 2 (Summer 1994).