A matter of life or death

by Lyndon H. LaRouche, Jr.

In a recent proposal on the subject of medical civil-defense measures, I proposed that a generalized, international research protocol be adopted, covering all categories of diseases of aging of tissue and closely related matters. The included argument is, that the medical professionals employed in research and related preventive-medical activities represent, in significant part, a reservoir of professional capabilities which can be drawn down temporarily during an emergency, but without damaging the continuity of the longer-term, primary function they perform.

On the matter of the research protocol itself, it was my included duty, in that location, to state the functions and implications of such research programs from the standpoint of economic science. Contrary to the views of certain insurance officials, who would prefer that people die quickly—preferably with unprotesting dignity—at first sign of post-retirement-age illness, increase of longevity is an indispensable correlative of economic progress, and maintenance of function during the so-called post-retirement age-range permits this portion of the population to contribute variously directly and indirectly to national productivity. In economic science, we are concerned principally not only with technology's contributions to increase of the average productive powers of labor, but also with the fact that the longer a person lives, the longer that person continues to contribute a return to society's investment in the education and general experience of that person. We might choose to call this the "President Charles de Gaulle" or "Chancellor Konrad Adenauer" principle of political-economy.

Economic science also bears directly upon certain among the internal features of medical-research practice. Since the work of Luca Pacioli and Leonardo da Vinci at the close of the 15th century, we have known that the process of life is distinguished from non-living processes in an elementary and unique way. All living processes are distinguished in morphological features of growth and function by an harmonic characteristic called the Golden Section. The principle underlying this is also the fundamental principle of economic processes; this may be startling information to the ears of the non-professional at first hearing, but brief


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An elderly renal dialysis patient.

reflection begins to eliminate incredulity on this point. Societies are organisms defined by the kinds of activities specific to human beings, and economy began with the agricultural revolution's development. It ought not to be astonishing, therefore, that the permeating principle distinguishing successful from failed economies should prove to be a reflection of the same principle distinguishing living from non-living processes.

The specific aspect of economic progress which directly expresses such a connection is the definition of *technology* first provided by Gottfried Leibniz approximately 300 years ago. Through the fundamental discoveries of Karl Gauss at the beginning of the 19th century, and the work of Gauss's leading successor, Bernhard Riemann, the coherence of the underlying principle of technological progress and the central principle of life is most precisely accessed. This connection has direct bearing upon certain elementary features of research into such matters as the aging of living tissue, and diseases such as cancer which are situated within that general category of research.

Since these observations on the principle of life were made in the indicated paper, a number of specialists and others have approached me, requesting restatement and further elaboration on the point. I restate the proposition at this time. I begin with the general background matters, and situate the crucial point within that.

The significance of the Golden Section

The rediscovery of what is known today as the isoperimetric theorem of topology, by Cardinal Nicholas of Cusa during the 15th century, was the central feature of Cusa's work founding modern European science and setting a rigorous physical science into motion among Cusa's successors. This rediscovery was indispensable for elaborating a rigorous understanding of the contents of Plato's *Timaeus* dialogue, the elaboration on which the entirety of modern European mathematical science's fundamental contributions depends.

The three central features of that *Timaeus* dialogue are, first, the isoperimetric principle, the proof that only five kinds of regular polyhedra can be constructed in visible space, and a principle described by Plato as the *hypothesis of the higher hypothesis*. The formal problem which European science faced in attempting to comprehend the *Timaeus*'s contents, until Cusa's work, was that this isoperimetric principle was present in the *Timaeus* only by implication, and that Europeans were burdened by the mistaken view that Plato's principles of geometry were in agreement with the axiomatic, syllogistic structure of the version of *Euclid's Elements* written more than a century after Plato's lifetime, in Egypt. Cusa's rediscovery of the isoperimetric principle led in the direction of the elaboration of a non-Euclidean geometry of the type of Prof. Jacob Steiner's 19th-century elaboration of a synthetic geometry, a geometry without axioms or syllogistic structures, based solely on the principle of construction starting only from the isoperimetric principle.

It is necessary to stress this point, since, beginning the close of the 16th century, a school of mathematical physics contrary to the work of Cusa, da Vinci, Kepler, et al. was developed in England and elsewhere, around the influence of Francis Bacon, Galileo Galilei, Réné Descartes, Robert Fludd, and others. This contrary school continues to premise itself upon axiomatic-syllogistic structures like those of the Egyptian versions of *Euclid's Elements,* with increasing emphasis on the assumed primacy of such axiomatic-syllogistic structures, less on geometry, than upon simple arithmetic. The Russell-Whitehead *Principia Mathematica,* modern logical positivism, and the so-called new math introduced to schools approximately at the close of the 1950s, are radically extreme versions of this axiomatic-syllogistic system. The hegemony of this radical, positivist current in universities and among professionals, especially since the middle of the 19th century, and most emphatically since the Versailles Treaty, has caused a general ignorance of the rigorous principles governing fundamental discoveries of European physical science even among otherwise gifted professionals today.

It is the included distinction of my own work in economic science that my original discoveries first established during 1952 are based most immediately upon the work of Karl Gauss's great successor, Bernhard Riemann, such that to develop more adequately my own discoveries in economic science it has been necessary that my associates and I reconstruct the internal history of European science's progress from Cusa's beginnings, through Kepler, Leibniz, Euler, the Ecole Polytechnique, Gauss, and so forth, relying on both neglected primary manuscripts in archives and primary published materials from the leading scientific workers of the period from Cusa through Riemann, Weierstrass, and Cantor during the 19th century. We were obliged to strip away much of the elaborated, syllogistic superstructure of modern, prevailing mathematical physics, and to reexamine the fundamental assumptions of method and ontology underlying present-day scientific inquiry.

The situation today, is that modern scientific workers are unaware that much of the superstructure of mathematical physics today depends upon underlying assumptions which had been demonstrated empirically to have been wrong, even absurd and arbitrary, at the time they were first introduced, beginning with the wildly false assumptions introduced by Bacon, Fludd, Galileo, Descartes, and so forth. Professionals, as well as laymen today, are unaware of the degree to which statements among scientific subject-matters are products not of empirical inquiry into nature, but are products of the methods superimposed upon description of nature, methods which are rooted in provably false underlying assumptions. In ordinary circumstances, the defective mathematical apparatus of modern science does not appear to be faulty in the general practice of engineering, for example. The mathematical apparatus appears adequate as long as application does not venture in practice into areas in which fundamental ontological assumptions play an important part in the work being done.

Hence, when I or others submit certain statements bearing upon fundamental questions, whether in matters of economic science or otherwise, the initial reaction even among gifted professionals is one of not only incredulity but also anger. The initial reaction is to assert that generally accepted methods of mathematical physics appear to work very well, even to the degree that such methods are not to be considered suspect in any respect. Yet, as we have demonstrated in a number of published locations, there is nothing absurd, even wrong, in our criticisms, if only the professional would shift his attention from the present-day textbooks to the primary manuscripts and published sources contributed by the leading minds of scientific progress over the course of the recent 500 years of the rise of European science.

This difference between two opposing currents of method in modern European science has the most profound practical implications whenever our attention is concentrated on the effort to compose a rigorous ontological definition of life. As the case of the Wiener-Shannon doctrine of "information theory" underlines this fact, the methods for defining living processes today are based axiomatically either upon statistical mechanics or upon opposing, mystical doctrines akin to Bergsonian vitalism. As I shall indicate, before the work of Descartes it had already been proven that the phenomena of life must be defined differently. The empirical basis addressed by Pacioli and da Vinci first, and by Kepler later, had supplied that proof. The contributions of Leibniz, the fundamental discoveries of Gauss, and the work of Riemann, provided the rigorous means for a new, fresh, more profound approach to the empirical matters considered earlier by da Vinci and Kepler.

This, then, situates the controversial element in what I now report.

A contemporary and collaborator of Plato's working at the Temple of Ammon in Cyrenaica had proven that only five kinds of regular polyhedra can be constructed within the geometry of visible space. As Pacioli showed, on the basis provided by Cusa, and as Leonhard Euler provided a fresh, more rigorous proof later, all five solids have a unique, functional interconnection, to the effect that four of them are derived from the construction of one, the one being the 12-sided duodecahedron whose 12 sides are each equal, regular pentagons. In this construction, the Golden Section harmonic arises not only in the construction of the pentagon from the isoperimetrically defined circle; the same Golden Section harmonic characterizes the construction of the duodecahedron itself.

My associates and I have added an important correction to Kepler's treatment of this principle in his derivation of what have been proven to be the only valid derivation of the astronomical laws of our universe. We have proven that the correct laws are based on an harmonic system congruent with the well-tempered musical polyphony of Bishop Zarlino and J. S. Bach. In other words, the principles of Bach's well-tempered system of polyphony actually existed as fundamental laws of the universe before the first musician existed.

The relevance of that correction is summarily this, as relevant to the point being addressed in this paper.

In first approximation, the apparent significance of the Golden Section for mathematical physics on the surface of this planet of ours, is that it appears only as the characteristic principle of morphology of living processes. This appears to be explained in part as we compare the Golden Section with what is known as the Fibonacci Series. The Fibonacci Series is an idealized representation of simple population-growth. As the Fibonacci Series progresses, its harmonic characteristics converge upon those of the Golden Section. There is nothing mysterious about this convergence; an elementary geometric construction of the Fibonacci Series shows why such a convergence must necessarily occur. If cell-population growth or any similar sort of biological activity is viewed from this standpoint, all mystery vanishes.

If our own correction of Kepler's harmonics is taken into account, a more profound insight appears immediately.

The fact that Kepler's astronomical laws are uniquely correct, with two qualifications, is crucial here. The shortcomings of Kepler's laws is that they should employ well-tempered harmonics instead of simple diatonic harmonies, and that they are inadequate in their given form for treatment of relativistic phenomena. Otherwise, they are valid. These laws are derived from both the isoperimetric principle, and from the principle of the five platonic solids. That is, the fundamental principle underlying Kepler's laws and the principle of gravity derived from those laws is the Golden Section—the same Golden Section which Pacioli, da Vinci, and Kepler insisted to be characteristic of living processes, as opposed to non-living processes. In other words, the laws of astronomy show that the universe as a whole is governed fundamentally by the same principle otherwise characteristic of living processes. In modern language, the fundamental laws of our universe are those of a universally negentropic process.

What does this astronomical fact really signify? The answer was implicit in the work of Plato, but the significance of that answer was not adequately comprehended within mathematical physics until the fundamental discoveries of Gauss and later Riemann.

Plato already recognized and emphasized that the universe as we see it is not exactly the universe as it is. In modern language, we say that the organization of our mental-perceptual apparatus causes our mind to distort the image of the universe in a lawful way, a lawfully consistent way. The business of science is to discover, first, what those principles of lawfully consistent distortion are, and with aid of that discovery to find rigorous, empirical methods for achieving an adequate image of what the universe is apart from that distortion.

The proof of Plato's argument is the demonstration that certain geometric forms which exist in visible space can not be constructed within visible space. An example of this is the case of the regular seven-sided polygon, the heptagon. This can be constructed only by helping-figures which are means for constructing transcendental functions. In other words, the real universe, as distinct from the distorted images of that universe comprehended by our mental-perceptual apparatus, is based on principles underlying what we call transcendental functions.

All transcendental functions are reduced to their most elementary form as either what we call a self-similar spiral on the outer surface of a cone or on the outer surface of a cylinder. In economic science, the self-similar spiral on the outer surface of a cone represents *work,* and on the outer surface of a cylinder of indefinite length is the normal form of *coherent, radiated energy.*

In the case of the self-similar spiral on the outer surface of a cone, the so-called logarithmic spiral, the projection of the image of that spiral upon the circular base of the cone is a plane spiral whose characteristic features are the Golden Section. Treating this as a projection of the characteristics of a duodecahedron upon the plane, we divide the circular base of the once into 12 equal sectors, which divides the arms of the spiral into segments whose harmonic relationships of length are those of the well-tempered system of polyphony. The interval of the fifth, the interval corresponding to the Golden Section, defines by a system of complements, all the harmonic relationships of the well-tempered system of polyphony.

The essential meaning of this relationship was discovered by Gauss in his solution to the general notion of elliptic functions, a solution derived from his determination of what is called the arithmetic-geometric mean. This solution is based on the principled features of a self-similar spiral generated upon a cone or some derivative of a conical function. This signifies, to make short of the point, that the laws of the universe are based on the fact that the real universe, which we see only in its lawfully distorted form as the visible universe, is governed by the root-principle of least action in which least-action of work occurs in the form of self-similar spiral conical action, and that what we see as characteristics of behavior in visible space are projections of the higher-order real universe upon the lower-order powers of comprehension of our mental-perceptual apparatus. As the Apostle St. Paul says, "We see only as if in a darkened mirror."

Thus, to focus upon the immediate point at hand, the fact that living processes exhibit the characteristic of the Golden Section in morphology of growth and function, merely reflects the fact that in the real universe the cause of this apparent result is action according to the principle of least action within the complex domain.

It follows, therefore, that the investigation of the physical principles of living processes must shift the choice of empirical materials of investigation, away from particles of matter defined within a Cartesian manifold, to select specific kinds of physical transformations of living processes which display the characteristics of negentropic transformation in a Rie-

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Ned Rosinsky, M.D., describing the necessity of developing medical civil-defense capabilities at the Sept. 16 Club of Life conference on "Medical Science and the Fight Against Genocide" in Washington, D.C.

mann-Gauss manifold. In that sense, we must employ an adequate comprehension of the mathematical physics of Bernhard Riemann not only in measuring living processes' characteristic features, but also in defining the choice of empirical subject-matter.

In other words, we must expel statistical mechanics from biology.

There are three aspects of Riemann's work which bear upon this sort of inquiry in the most obvious way. First, Riemann's definitions of a new method of mathematical physics provided as a preliminary statement in his 1854 habilitation dissertation, *On The Hypotheses Which Underlie Geometry*. Second, Riemann's approach to electrodynamics, with emphasis upon Riemann's elaboration of the notion of retarded potential. Third, Riemann's application of the principle of electrodynamic retarded potential to the case of the generation of accoustical shock-waves, in his 1859 paper, *On The Propagation of Plane Air Waves of Finite Magnitude*.

In the last of these three items, Riemann revives the argument for hydrodynamics made earlier by Leonardo da Vinci, that the propagation of sound-waves in air occurs in what we would call today a sine-wave form, rather than being propagated through percussive interaction among molecules. Riemann treats such sine-waves as self-similar spiral waves on the outer surface of a cylinder of indefinite length. He treats the cause of the sound-wave as such a self-similar-spiral cylindrical wave, and assumes that this wave is electrodynamic, rather than molecular-percussive. For this wave to propagate through the atmosphere, it must render the atmosphere transparent to the propagation of itself. We call this in laser physics today *induced self-transparency of the medium*. This self-transparency requires a configuration of the air-molecules. This configuration can not be propagated more rapidly than the average motion of the air-molecules permits. This is a case of retarded propagation of electrodynamic potential. Then, as a piston or some other device accelerates toward and beyond the average velocity of the air-molecules, the rate of propagation of sound-waves overtakes the limiting condition of retarded potential of propagation in air. This generates a singular condition which we recognize as the shock-wave.

As Lord Rayleigh argued strenuously, if Riemann's notion of shock-waves is correct, then the entirety of statistical mechanics is overthrown in respect to its fundamental underlying assumptions. On this premise, Rayleigh pronounced Riemann's 1859 paper absurd. Then, later, the work of the German physicists Ludwig E. Pandtl and Adolf Busemann proved that Riemann was correct and Rayleigh's argument absurd. Erwin Schroedinger used the same point of departure by Riemann for his famous work on the nature of the electron, and the same principle forms the basis for the doctrine of isoentropic compression in plasma physics today. Riemann was proven correct on this point repeatedly, and yet the devastating implications for statistical mechanics noted by Rayleigh have not been adequately noted generally even today.

Taking Riemann's method as a whole, we must be led to the same approach in biology, for example, which my associates and I have successfully proven for economic science. In all experimental work bearing upon fundamental questions, we must shift the design of experiments from emphasis upon the assumedly self-evident particular thing, such as the particular molecule, the gene, and so forth, to treat as primary empirical data only those transformations in the process which correspond to something equivalent to a phase-shift in the characteristic of the process as a whole. We must define such transformations in terms of some singular feature of transformation. Transformations subsuming such a singularity must be treated as the data which is ontologically primary.

This is most emphatically required for living processes. We must cease to treat living processes by methods appropriate to study of dead things, must cease to define life as merely non-deadness, as something which defies the statistical laws of dead things. The term "negative entropy" is most unfortunate, for that reason. We treat the universe as axiomatically entropic—even though Kepler already proved conclusively that that assumption was false—and elaborate an axiomatic-syllogistic mathematical apparatus based on the assumption that the universe is primarily a dead thing whose time-direction is assumedly given by entropy. We then attempt to define living processes by such a mathematics of death. This mathematics, which by its nature excludes causation from the equations constructed, obliges us to define the empirical data of living processes as primarily composed of dead things. So, the ideas of living processes derived from such a mathematical approach and experimental designs measure life as death. It is not living processes which bring investigation to such conclusions; the conclusions are not provided by living processes, but are provided by the death embedded axiomatically in the mathematics superimposed upon the design and description of experiments.

The primary datum, around which biological experiments ought to be constructed, is life. Life is defined mathematically as those forms of work which lift matter to a higher state of organization through a transformation subsuming a singularity. Such data are the irreducible experimental data of biology.

A final set of remarks aids in making this more comprehensible.

How to think about life

To comprehend life, it is indispensable that we devise a mathematics which by its nature can mirror the principle of life. In other words, we must be able to construct geometrical images which, as mirror-images of living processes considered, are topologically congruent with the living quality of such processes. To accomplish this, we must begin with isolation of some principle of human mental life which, by its nature, is congruent with the negentropic feature of living processes.

The problem, the task, here is not that of measuring behavior of living processes statistically. Norbert Wiener et al. were absurd on this point at issue. Wiener's sort of mathematics was not tolerated even by the great Hilbert at Göttingen, *EIR* contributing editor Uwe Parpart-Henke has reported from his researches, to say nothing of the problems of defining a mathematics appropriate to comprehension of living processes. The problem is that of constructing a mental image of living processes, a mental image—a conception—of the active principle of living processes. It must be a practical conception, which, by the nature of its construction and application, points our efforts toward useful operations through which to steer desired phase-shifts within the self-elaboration of living processes.

This task is the central matter of economic science. Even the person who is an ingenue in economic science, but who has general, professional scientific training, can readily grasp this feature of that subject-matter.

The general measure of economic performance by societies is *increase of* what we define as *the potential relative population-density,* such that population-density measures the number of persons which that society's activities sustain per average square-kilometer of habitable area. This increase correlates broadly and necessarily with increases of the number of kilowatt-hours-equivalent of usable energy employed per-capita. In the terms of reference of elementary chemistry, this signifies an increasing of the per-capita "reducing-power" of a society.

The rigorous treatment of this aspect of economic processes was assembled initially by Gottfried Leibniz, in his elaboration of the general principles of the heat-powered machine. Broadly, in first-approximation, it appears that the relative productive power of labor increases by means of efficient increases in the number of usable kilowatt-hours of energy employed by the machine. However, as Leibniz was first to emphasize, there is a crucial anomaly to be considered. This anomaly is exemplified by the case of two machines consuming the same amount of coal per hour, but enabling the operative to accomplish the same kind of useful work at different rates. This distinction within the organization of the machine is Leibniz's definition of *technology*.

The geometrical-physical content of technology so located and defined, is, in first-approximation, the physical correlative of the isoperimetric principle, which Leibniz defines as *the principle of least action*. The substance of technology in machines is defined by the machine-cycle. This machine-cycle has two elementary features. The first feature is rotational action, or ordered changes in direction, effected through rotation, of the work-effort transmitted by the machine. The second feature is increase of the energy-flux density of action, such that the machine delivers more energy per square-meter of applied effort to production of output than is represented by the concentration of energy powering that machine's actions as a whole—its input-energy. The combining of these two features takes the form of conical rotation, as opposed to simpler, circular rotation.

The most elementary features of this relationship are defined as follows.

Given an elementary form of self-similar conical spiral (an elementary geometrical statement of a complex variable). Consider two successive cycles of this spiral (two successive rotations of the spiral around the cone). Consider the circular cross-sections of the cone located at the beginning of the two cycles, and at the close of each of the two cycles. Let the circular areas measure energy-flux density. (It is useful to think of lasers concentrating input energies of so many kilowatts per square meter into areas of application as low as 10^{-8} meters, for example. In this case, we are most interested in the circumstances in which the original energy-supply, applied to the target at relatively lower energy-flux densities, produces no change in state of the target-system, but in which the more concentrated application of energy does introduce such a phase-shift. Such phase-shifts are paradigmatic of our notion of *work*.

In this configuration, the elementary complex variable defining the generation of the spiral has the spiral as its first integral, and the volume subtended by such a spiral's cycle as the definite integral of the spiral-action itself. Additionally, the characteristics of the volume subtended are Gaussian: the iterative elliptic division of the volume according to the arithmetic-geometric-mean relationship, and the volume and displacements associated with the smallest of such iterative sub-divisions permitted. That smallest value is treated as equivalent to Leibniz's definition of the smallest division corresponding to the "delta" of differential calculus, and is also ontologically congruent with the notion of a quantum of action.

We reduce all notions of *work* to this ontological form. We consider, then, the work of producing energy, in which *energy* is defined normally as equivalent to the coherent form of energy radiated in a directed beam: the monochromatic cylindrical self-similar spiral form of action. We then consider the work accomplished as work by application of this energy. The comparison of the work of producing energy with the work obtained by its employment, is the elementary definition of work for the individual case in economic processes.

Such an approach is implicit in Riemann's 1854 habilitation dissertation. Given the principle of least action as self-similar conical-spiral action. The universe so evolved (elaborated) by action of this principle upon itself universally, defines a universe of order N, such that effective work as defined here produces a new state of the universe, $N + 1$. This relationship signifies that action upon the universe is delimited in some way by the order of the universe N. This implicitly defines a limit for the division of the action added, a limit expressed as a limit for iterative elliptic division of the volume of an interval of cyclical action: the quantum of action. The change from order N to order $N+1$ of that universe, or the phase-space considered, from order N *to* $N+1$, is therefore associated with a change in the metrical (quantum) characteristics of that domain. It is such changes in the metrical characteristics of action in phase-space which are the substance of empirical measure of the transformation effected, the substance of work.

In the case of economic processes (societies), this metrical change is reflected as an increase of the potential relative population-density. The only form of work accomplished by society is an increase of that potential. The only work accomplished within a society is activity which is functionally efficient in contributing to such an increase of potential by the society as a whole.

These changes, this work, are accomplished by means of willful advances in technology.

The question posed is, therefore, *what is the nature of the action by which societies produce advances in technology?* This question directs our attention to the principled features of the required mathematical apparatus for comprehension of living processes. *What is the comprehensible principle of creative scientific discovery?*

The answer required is obtained by examining Plato's notion of the *hypothesis of the higher hypothesis*. We restate that notion as simply as possible here. From that described vantage-point, we are able to identify more or less efficiently the state of mind which corresponds to creative-mental life. Those characteristics of creative-mental life, in turn, specify the requirements of a form of mathematics appropriate for comprehension of life.

There are three levels of mental life possible, as mental life can be defined by the notion of hypothesis.

Simple hypothesis: on the lowest level of rational mental life, we attempt to comprehend a problem by aid of the assumption that prevailing opinion is broadly correct. We seek to define a description of the problem which is credible and acceptable to prevailing assumptions of general opinion. This is what is sometimes described as the "other-directed" state of mind, the state of mind which limits thoughts to those sorts of thoughts of which the proverbial neighbors, some peer-group, or the prevailing authorities are assumed to approve. In scientific work, the peer-group of reference is the relevant body of professional opinion, the prevailing assumptions of scientific work in general, or also those assumptions specific to some specialized aspect of professional work.

Persons in this state of mind will never discover anything of useful importance bearing on the advancement of knowledge in general.

Higher hypothesis: In this approach, the thinker rejects the "other-directedness" of simple hypothesis, and makes the central feature of his inquiry an effort to discover and overturn some relevant sort of prevailing assumption. The creative thinker is inherently an iconoclast, a person of polemical disposition of mind relative to the prevailing scientific and other assumptions of his age. He is "inner-directed," relying on the possibility of proving empirically and conclusively that even the most authoritative opinion of his age might be absurd on some one or more points of prevailing, underlying assumptions.

The higher hypothesis is addressed to some selection of empirical evidence appropriate to prove that certain prevailing, underlying assumptions of his age must be overturned. If he is successful, a greater or lesser scientific revolution—or the equivalent—results. The entire edifice of mathematical knowledge resting upon the flawed assumptions comes toppling down, and a new edifice must be constructed based on the correction effected.

The measure of whether such discoveries are valid or not is ultimately the demonstration of an implied increase of the potential relative population-density of society: Does the discovery produce or fail to produce an increase in mankind's per-capita power of practice over nature as a whole?

Hypothesis of the higher hypothesis: The fact that successful applications of the principle of higher hypothesis leads to increase of potential relative population-density, implies that a succession of scientific revolutions so effected has an ordered character, that the higher hypothesis accounting for this has also an ordered character. The question of empirical proof of such an ordering-principle is also properly the subject of hypothesis, an hypothesis of a generalized notion of higher hypothesis.

Such an hypothesis of the higher hypothesis is, in other words, a principle of ordered successsions of creative scientific discovery. It need not, and perhaps can not be perfect, but its mastery over the course of human progress does describe a process of increasing perfection.

It is in this latter activity—formulating the hypothesis of the higher hypothesis—that true human scientific creativity lies. It is from the standpoint of conscious grasp of this activity that a mathematics susceptible of comprehending life implicitly emerges.

The corrected view of the platonic hypothesis of Plato, St. Augustine, Dante Alighieri, Cusa, Pacioli, Kepler, Leibniz, et al., as accomplished to a large degree through the successive work of Gauss and Riemann, provides us the needed reference-point in practice for the work of today. Riemann's 1854 habilitation dissertation has this exemplary significance and implications.

The discrete object, deemed self-evident in the false view of nature corresponding to the Cartesian manifold, becomes for us relatively a determined ephemeral of a continuing process, a continuing process located for us in reference to the hypothesis of the higher hypothesis. Time, space, and matter, lose for us their naïve self-evident character as sensory data, and only the self-elaboration of processes which adequately subsume the relativistic interdependency of all three as determined aspects of a continuing process have any longer any authority for scientific work. Reality, truth, is located for us in the "in-betweenness" of those transformations which define relativistic phase-shifts in processes. Thus, we direct ourselves to effect a qualitative shift from the naïve, hedonistic outlook. We no longer view discrete sense-objects as irreducible self-evident things, but rather define the irreducible, substantial form of reality as of the form of the verb "to create," "to cause to exist." It is only negentropic transformations in processes which represent the substantiality of the universe, the substantiality of the continuous manifold, of the complex domain of the continuous manifold.

The Judeo-Christian standpoint in science

Scientific progress was generally at a standstill from approximately the 4th century B.C. until the 15th century A.D. in Western Europe. Important work was done during the interval, by the Arab Renaissance, and so forth, but with respect to physical science this work was chiefly a matter of reaffirmation of work accomplished by the time of the combined work of the Cyrenaic temple of Ammon and the Academy of Athens during the 4th century B.C. We must not deprecate such reaffirmations, but we must also not confuse that relative merit with generalized progress in the human mental condition.

The genius of Western Judeo-Christian civilization, exemplified by the influence of Philo of Alexandria for Judaism, and the defense of the work of the Apostles (against Byzantine Gnosticism) by St. Augustine, is the essential force without which the great explosion of scientific progress from the 15th-century work of Cusa (most notably) onward would not have been possible.

In part, this specific genius of Judeo-Christian culture is located in the injunction of the Book of Genesis, that mankind must: "Be fruitful and multiply, and fill the earth and subdue it." This is a commandment which enjoins Jew and Christian to conduct technological progress. The possibility of sustained scientific-technological progress was elaborated by the work of Plato's Academy at Athens—Solon's at Athens—to an effect expressed in the most concentrated manner by Plato's *Timaeus,* in which the principles of creative scientific discovery are shown to cohere with a certain kind of monotheism, the monotheism of Philo and the Christian Apostles.

In Plato, the principle of the hypothesis of the higher hypothesis is defined as the activity through which mankind may perfect the agreement between human knowledge and the universal will of God, the *Logos,* the consubstantiality of Composer and lawful, universal principles of efficient composition of the universe. The correct view of this by St. Augustine, in formulating the *Filioque* principle of the Western Latin liturgy, defines Christ as the perfected state of mortal existence, such that the will of the Composer, the Logos, flows efficiently from Christ as from the Composer, and that the primary duty of mankind is to live in imitation of Christ on this account.

Thus, the embedding of this cultural outlook of Judeo-Christian civilization within the republican currents of Western civilization, from St. Augustine onwards, gave to Western European civilization a superior potential for production and assimilation of scientific progress, as this cultural outlook defined mortal man's proper relationship to the Composer to be that of following the pathway of the hypothesis of the higher hypothesis. It was the more fulsome elaboration of this potentiality by Cusa et al. during the Golden Renaissance, which unleashed the potentiality as the genius of Western European civilization's accomplishments during the recent 500 years.

It is the fresh affirmation of this standpoint of the Golden Renaissance, affirming this view of mankind and of the individual within society, in opposition to the hedonistic sort of materialist viewpoint, which directs the passions of the individual in those directions most fruitful for scientific work—away from the sterility of empiricism and positivism, to the standpoint of Cusa, da Vinci, Kepler, Leibniz, Gauss, Riemann, et al.

In that respect, the chief obstacle to scientific progress today is not want of formal education, but lack of adequate moral education, lack of a sense of personal identity consistent with the implications of the hypothesis of the higher hypothesis, lack of such "inner-directedness."

Thus, the choice of combat against diseases of aging as the focal topic of fresh, more vigorous inquiry into the principle of life, affirms the moral view of man which is indispensable for successful scientific inquiry in such directions. There is coherence between the moral choice of work and the quality of the work accomplished.