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The Science of Spiritual Biology

Bhakti Madhava Puri, Ph.D.

Living systems are cognitive systems, and living as a process is a process of cognition.

H.R. Maturana, *The Biology of Cognition* (1970/1980)

Applied mathematician, Samuel Arbesman, is an expert in scientometrics, the science of science, or metascience, and he has written a very recent book, *The Half-life of Facts: Why Everything We Know Has an Expiration Date*, (Sept. 2012), in which he investigates the frequency of changes in scientific facts, paradigms or theories. Knowledge in different fields of science evolves in systematic and predictable ways, and such changes have a powerful impact on our lives.

The massive accumulation of data on the bio-molecular constituents and processes in living organisms has really only begun in the last few decades. Powerful new instruments for better observing the microscopic world of the cell, and techniques for studying its dynamics have only recently become available. In the world of Darwin in 1853, when he wrote his *Origin of Species*, nothing was known about DNA or genes, proteins, enzymes, or cellular organelles. Even Mendel's discoveries of the heritable traits which he found in his experiments with pea plants in 1866, were unknown to or disregarded by Darwin and others at that time. It was not until the beginning of the

20th century that the significance of Mendel's work became recognized and the scientific discipline of genetics was established.

In his book, *Darwin's Black Box: The Biochemical Challenge to Evolution* (1966/2006), Michael Behe posed the question whether Darwin would propose his theory of evolution by natural selection today, if he had all the information we currently know about the living organism. Knowledge of the internal workings of the cell was almost completely lacking for Darwin, thus for him the cell was basically a "black box." His understanding of heredity was based on the vague conception of *pangenes*, which was generally believed at that time, a blending of factors throughout the cells of both parents. This was shown to be wrong by Mendel's discoveries of what eventually became known as genes, localized discrete units produced from a DNA template.

Today, that concept of "gene" is now evolving into a more dynamic and inclusive conception. A tentative definition of a gene is now "a union of genomic sequences encoding a coherent set of potentially overlapping functional products." Gerstein Mark B. et al. (2007). "What is a gene, post-ENCODE? History and updated definition". *Genome Research* 17 (6): 669–681. The reason is that an oversimplified understanding of living organisms in terms of discrete interacting molecules does not have any actual explanatory significance. Living

organisms are dynamically complex functional entities not reducible to simple mechanical-chemical descriptions.

Darwin wrote in his *Origin of Species*, “If it could be demonstrated that any complex organ existed, which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down. But I can find out no such case.” It was on this point that Michael Behe claimed modern biology could challenge Darwin, due to the presence of “irreducibly complex” structures within living organisms, such as the bacterial flagellum, as well as numerous biological cell processes. These require the cooperative effects of a multiplicity of parts and processes in order to have any functional value for the organism, implying that a successive development would involve contingent intermediate stages that would be of little or no use to the organism.

In 1967 Arthur Kornberg first presented the elucidation of the proofreading and editing functions of DNA polymerase. The remarkable fidelity of the DNA replication process such that only one mistake is made for every 10^9 nucleotides copied, demonstrated the highly regulated and controlled nature of the cell. The reason is that random mutations generally result in debilitating or lethal effects to the cell. The existence of such tightly regulated and controlled systems not only challenges the idea of a sequential evolutionary development of life, but implies that randomness at the cellular level is deleterious or lethal to such systems. The idea that evolution could proceed by way of random mutations in the fundamental genetic makeup of the cell is thus called into serious doubt.

Barbara McClintock, Nobel Laureate in Physiology and Medicine in 1983, was a distinguished cytogeneticist who made many fundamental discoveries in her early years. By the 1950's she discovered what are now known as transposons and the theories that explain how genetic information is used to turn physical characteristics on or off.

The implications of her research led her to conclude that the cell was able to ‘sense’ when changes to its own DNA were necessary under stress. This led to much skepticism and alienation from the scientific community but she persisted, basing her views on her research rather than the consensus prejudices. Thus she concluded:

Organisms can do all types of things; they do fantastic things. They do everything that we do, and they do it better, more efficiently, more marvelously.... Trying to make everything fit into set dogma won't work.... There's no such thing as a central dogma into which everything will fit.... So if the material tells you, 'It may be this,' allow that. Don't turn it aside and call it an exception, an aberration, a contaminant.... That's what's happened all the way along the line with so many good clues.

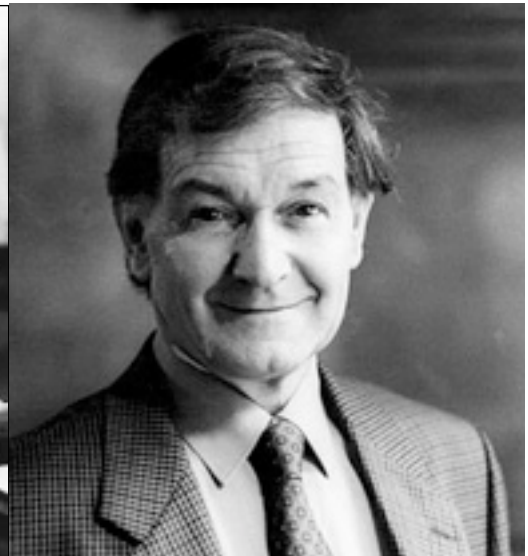
Today, the multidisciplinary field of Cognitive Biology has become an established scientific discipline. Mathematical physicist Roger Penrose wrote in 1994:

If we are to believe that neurons are the only things that control the sophisticated actions of animals, then the humble paramecium presents us with a profound problem. For she swims about her pond with her numerous hairlike legs — the cilia — darting in the direction of bacterial food which she senses using a variety of mechanisms, or retreating at the prospect of danger, ready to swim off in another direction. She can also negotiate obstructions by swimming around them.

Pictured:

Barbara McClintock
1902-1992 (Right)

Roger Penrose
1931- (Far Right)



Moreover, she can apparently even learn from her past experiences — though this most remarkable of her apparent faculties has been disputed by some. How is this all achieved by an animal without a single neuron or synapse? Indeed, being but a single cell, and not being a neuron herself, she has no place to accommodate such accessories.

Shadows of the Mind: A Search for the Missing Science of Consciousness (1994) p.357]

Pamela Lyon, cognitive biologist at the University of Adelaide in Australia reported:

...what is believed to be the simplest metazoan visual system yet discovered was recently characterized in the larvae of a type of jellyfish, one species of which (the box jellyfish) is the sometimes-fatal scourge of swimmers of the northeastern coast of Australia (Nordstrom et al. 2003). The visual system does not rely on neurons or axonal connections between different cell types or tissue layers. In short, there does not appear to be a mechanism for the exchange of information between cell and tissue types characteristic of animals with nervous systems, yet the behaviour of the larvae is indistinguishable from that of related cnidarians possessing neuron-based vision. The adult form of the box jellyfish has neurons but no brain; nevertheless, it is capable of surprisingly complex differential behaviour. Now we can declare, as did Lamarck, that nothing without a nervous system or a brain can be genuinely cognitive, but whereas this claim previously could be made without argument, I suggest this is no longer the case.

Pamela Lyon, "The Biogenic Approach to Cognition," *Cognitive Processing* (2005)

Scientific work on a wide range of cognitive functions in animals, plants, and bacteria can be found online in the recent book, *Cognition and Decision in Non-Human Biological Organisms* (2011). Günther Witzany, *Life: The Communicative Structure, a new philosophy of biology* (2000) provides a perspective on the essential role of communication at all levels of life. These bold new approaches to scientifically understanding life spurn the eliminative materialism of the reductionist school, and try to understand life as it is observed, rather than attempting to fit it into an artificially contrived, presupposed conception.

Oxford University Press has recently published a book by atheist philosopher, Thomas Nagel, entitled, *Mind and Cosmos: Why the Materialist Neo-Darwinian Conception of Nature Is Almost Certainly False* (2012). The description reads:

The modern materialist approach to life has conspicuously failed to explain such central mind-related features of our world as consciousness, intentionality, meaning, and value. This failure to account for something so integral to nature as mind, argues philosopher Thomas Nagel, is a major problem, threatening to unravel the entire naturalistic world picture, extending to biology, evolutionary theory, and cosmology.

A concise presentation of how traditional views of evolution are inadequate to explain the latest research findings, can be found in molecular biologist James Shapiro's book, *Evolution: A View from the 21st Century* (2011). This important new book presents the evidence that leads to an interpretation of life as characteristically intelligent, cognitive systems. All these revolutionary perspectives come from scientists working within the scientific community as colleagues, and not from the theistically-oriented section.

Carl Linnaeus set forth in his *System Naturae* in 1735 a particular form of biological classification. This rank-based taxonomy classified life forms into three kingdoms (Animal, Vegetable, Mineral), divided them into classes, which were further divided into orders, genera and species, following the ideas developed by Plato and Aristotle. It was only later that this system of classification was considered from a new perspective: the ancestral relation of species that was introduced with the idea of evolution. Thus the concept of a Tree of Life was born. At first, the classification scheme was primarily based on morphological and behavioral similarities which were then interpreted as related to evolution. Latter developments in microbiology introduced the field of comparative genetics into what became known as the neo-Darwinian theory of evolution. In many cases, relations established on the basis of morphological similarities were contradicted by the comparative genetic data.

In addition, the discovery of the importance of horizontal gene transfer from the environment undermined the whole concept of the linear descendants of species being understood through progressive internal changes in cells that were thought to explain the branches of evolutionary development. Now species had to be understood as related to each other more as a bush or network, a delicately balanced web of life, in which originally unsuspected micro-organisms played a



Pictured:

James Shapiro, *Evolution: A View from the 21st Century* (Right)

“Why Darwin was wrong about the tree of life,” Graham Lawton, *New Scientist*, 21 January 2009 (Far Right)

central role in all of life, and under a set of rules unique to them. There is no idea more central to Darwinian evolution than the tree of life, yet this icon of evolution is now gradually being replaced by the concept of a web of life due to the discoveries of the enormous role of bacteria. [“Why Darwin was wrong about the tree of life,” Graham Lawton, *New Scientist*, 21 January 2009. “Uprooting Tree of Life,” W. Ford Doolittle, *Scientific American*, February 2000.] It is now known that a large percentage of the human organism is composed of bacteria, as is essential for most multicellular organisms. It is the extensive biocommunication network within the biosphere that is the essential factor in keeping us all alive, as Witzany explains in his previously mentioned book. As an English poet wrote, “No man is an island, entire of itself. Each is a piece of the continent, a part of the main.” [John Donne, *Devotions upon Emergent Occasions* (1624)]

Just as the cell has gradually come to be understood as a highly regulated and functionally integrated whole, so too is the biosphere now recognized as a finely balanced ecological whole in which local disturbances can create world-wide climatic catastrophe. The oversimplified ideas of biology that characterized the field in its immature beginning led to the theories of a progressive cumulative development or evolution to explain the present state of Nature. However, today, a more mature understanding of biology has brought with it the realization that Nature can not be the product of a gradual development, based only on the reductionist principles of chemistry and physics. In an ideal situation, where there are no strong interactions with the environment, isolated and purified chemicals may react in a mechanically simple manner, but in a living organism there are no isolated molecules. Everything within the cell interacts with everything else. The constituents of a cell are produced by the cell as much as they produce the cell itself. As the German philosopher Immanuel Kant understood, the unique judgment that allows us to identify a living organism as distinct from non-living matter, is that a living organism is both the cause and effect of itself. Thus, the life of a cell, as much as the life

of the biosphere, can only be properly understood as an integrated organic whole.

The ancient aphorism of the *Sri Isopanisad*, *om purnam adah purnam idam*, gives us the root idea of how the creation of Life and Nature comes about through the production of wholes from wholes, and of life from life. It is these empirically verified principles that form the basis of the true science of spiritual biology. And biology should be the scientific study of dynamic life, not merely an analysis of the mechanisms of inanimate matter. Chemistry provides some idea of the processes of material Nature, but insentient matter can never rationally be expected to explain the sentient nature of life. Empirical science is easily applied in trying to understand the object-world or positive pole of reality, but has fared poorly in attempting to comprehend the subject or the negative pole. It would be considered poor science to know about only one pole of a magnet without knowledge of the opposite pole. Yet the subject can also be made object of itself by what is called introspection. This important field of knowledge has been known and carefully studied for centuries in India, but forgotten by modern scientific positivism.

Today, many biologists are being trained in outdated conceptions of biology, by teachers who know nothing else. A 21st century revolution in biological education is needed if this vicious cycle is to be broken. Progress in scientific knowledge benefits by following the sage advice of those like the Bengali saint, Srila Bhaktivinoda Thakur, who wrote in a poem, “The Jiva Soul,” *Saragrahi Vaisnava* (1874): “Forget the past that sleeps, and ne’er the future dream at all. But act with times that are with thee, and progress thee shall call.”



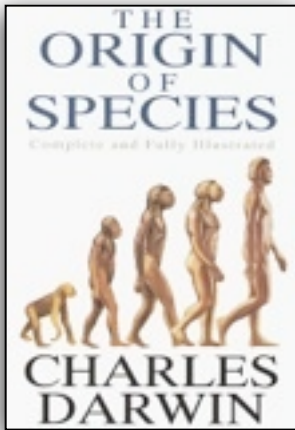
Srila Bhaktivinoda Thakur

21st Century Biology Refutes Darwinian Abiology

Part One

Bhakti Niskama Shanta, Ph.D.

Dangerous Consequences of Darwin's Theory



More than one hundred and fifty years after the publication of *The Origin of Species*, the world is witnessing the intense agony from the detrimental outcome of seismic change in attitudes that began with its publication. The present society is habituated to grow up with the education of Darwin's theory in the schools. Most individuals accept this theory automatically without concern for the technical shortcomings that this theory has

suffered throughout its history. However, the scenario was completely different in the mid-Nineteenth Century, when this theory was first proposed:

A good deal of the initial resistance to Darwinism sprang from a perceived threat to the moral order. Adam Sedgwick, Darwin's former mentor in natural science at the University of Cambridge, expressed this fear poignantly in a letter to Darwin in 1859, shortly after reading *The Origin of Species*. He stated, "Passages in your book...greatly shocked my moral taste"¹

Sedgwick further stated: "humanity, in my mind, would suffer a damage that might brutalize it, and sink the human race into a lower grade of degradation than any into which it has fallen since its written records tell us of its history"²

Darwin and his faithful followers never gave any serious consideration to all such good advice from the thoughtful minds of that time. Less than seventy five years after Darwin's book, originally entitled *On the origin of species by means of natural selection or the preservation of favored races in the struggle for life*, the world has witnessed Adolf Hitler, Holocaust, fascism, communism and two world wars.³ Darwinism greatly changed the view of common people and the harmonious society based on centuries of religious teachings began to erode. People started doubting the very existence of realities such as soul and God. Thus, modern science embarked on a path to completely transform the world into an atheistic civilization.

Most biologists and geneticists recognize that their research does not verify objective evolution.⁴ However, they take for granted that geology proves it. On the other hand, geologists identify that geological evidence undermines objective evolution,⁵ but expect that the biologists and geneticists have established objective evolution. In this way the materialistic conception of life is imposed on the mass at large in colleges and universities. Objective science has become so influential

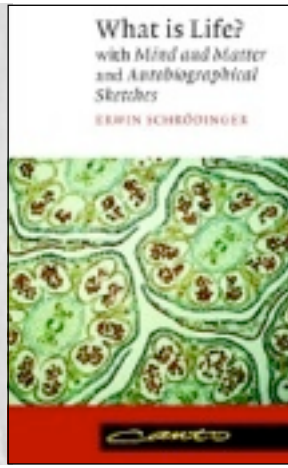
that many scientists believe they have no need of a God at all. Modern science now even threatens to completely eliminate every religion from the face of our earth. Considering life as a mere combination of molecules, educated people in science do not hesitate to grossly disrespect life and nature to its highest degree. The grave consequences of this advanced materialism has already started threatening the entire human civilization in the form of environment pollution, highly stressful mechanistic lifestyles, increased suicide rates, terrorism and the list is neither complete nor ever-ending.

Fortunately, the last three decades of the 20th century witnessed increasing research findings that rigorously challenged the assumptions of both Darwinian and Neo-Darwinian theories, which provided the foundations for most biological research during that century. Rose and Oakley stated that, "The foundations of that 'Modernist' biology had thus largely crumbled by the start of the 21st century. This in turn raises the question of foundations for biology in the 21st century."⁶ Hence, it is necessary that every thinking person must show a keen interest in understanding life very deeply from the perspective of 21st century biology in order to find a lasting solution to the problems that civilization is now witnessing. We should not be under a misconception that biologists are the only ones with a monopoly to study and understand life. In this regard Schrödinger can be an inspiration for all. Although a quantum physicist, not a biologist, Schrödinger in 1944 wrote a classic monograph entitled, *What is life?*⁷

The present article is an attempt to inform the general public about the present stand of biology and hence aims to introduce the basic technical changes that have lead to the downfall of Darwin's misconceived biology or *abiology*. We hope that this humble attempt will bring some awareness in the thoughtful society and help eliminate the ignorance—*tamaso ma jyotir gamaya*.

Arrival of Novelty: A Mortal Blow to Darwinism

The outcome of frontier molecular biology has continuously been incrementally complex, to the point where it has become difficult to clarify current knowledge by conventional evolutionary theory or Darwinism. Darwin proposed natural selection as a critical part of the mechanism of evolution. The major problem with natural selection is that it accounts for altering existing traits but does not explain the generation of new traits or new species. Dogs may differ largely due to selective breeding, but they constantly remain within the species of dogs. Without novelty, natural selection becomes completely handicapped and has nothing to act upon. The concept of novelty appears throughout the evolutionary literature. Elucidating the evolution of morphological novelty and behavioral innovation are the major focus in contemporary evolutionary biology. This area is essentially



...living matter, while not eluding the “laws of physics” as established up to date, is likely to involve “other laws of physics” hitherto unknown, which however, once they have been revealed, will form just as integral a part of science as the former.

Erwin Schrödinger
1887 - 1961

multidisciplinary and involves several controversies at the fundamental level. One well known controversy is definitional disagreements (a novel trait according to one definition is not a novel trait according to another). Much beyond that, there is a palpable tension among Darwinists when prominent modern biologists start asking the question: how does novelty arise in evolution?⁸

Developmental genetic research into the origin of novelties must explain how body parts become developmentally individualized. In a multi-cellular organism, individualized body parts emerge from the implementation of organ-specific programs of gene expression during development. This organ-specific pattern of gene expression is originated by a blend of signals that guide the activation of a core set of transcription factors that regulate the expression of genes involved in the physiological work of the cell. It is the commencement of these tissue-specific genes that provides the tissue a distinct identity that is discrete from other tissues. The key for the developmental individuality of a body part is the network of genes that mediate between the commencing signals and the expression of organ specific genes. In other words, appearance of novelty requires the evolution of a new gene regulatory network that integrates signals into a gene expression pattern specific to that organ.⁹ How do novel regulatory elements arise? In the answer to this question we find one of the major fatal blows that late 20th century molecular biology presented to Darwinism.

Undermining the Darwinian Black-Box Approach

Darwin proposed that all organisms have descended with modification from a common ancestor and, in addition, advocated natural selection as part of the mechanism of evolution. During the first half of the 20th century, the integration of genetics and population biology into Darwinian evolution led to a Neo-Darwinian theory of evolution, also known as Modern Synthesis. Neo-Darwinism recognized the importance of mutation and variation within a population. Natural selection then became a process that altered the frequency of the appearance of viable genes in a population and this defined evolution. The short summary of this conventional evolutionary theory, or Darwinism, is: the environment poses problems and the organisms posit

solutions, of which the best is at last chosen. But Darwinism made several over-simplifying assumptions which are no longer valid in contemporary biology. We will discuss in this section the scientific refutation of two major false assumptions, which are the foundation of Darwinism.

The first false assumption of Darwinism is that it tries to elucidate internal properties of living beings, their adaptation, exclusively in terms of external properties, which are the natural selection pressures in their independent external environments. Both Darwin's and Neo-Darwinian theories consider organisms as passive objects altered by an independent external influence called natural selection. Thus, philosopher Godfrey-Smith termed Darwinism as externalist because it considers the external environment as its explanatory reference device, which is independent of organisms.¹⁰ However, life is both active, as well as reactive. To be able to live, organisms have to extract the resources from their external environments and thereby are bound to select and upset definite resources within their environments. In that process organisms must alter a few of the selection pressures in their environments. Shockingly, Darwinism completely missed this primary aspect of life.¹¹ Lewontin first technically presented this problem of Darwinism.¹² Lewontin summarized Darwinism in two equations:

$$dO/dt = f(O, E), \quad (\text{Eq. 1})$$

$$dE/dt = g(E). \quad (\text{Eq. 2})$$

In Eq.1, dO/dt is the evolutionary change, which is assumed to be dependent on both organisms' states, O and environmental states, E . On the other hand, in Eq.2, environmental change, dE/dt , is assumed to be dependent on environmental states, E only. Lewontin suggested the real situation by correcting Eq. 2 as:

$$dE/dt = g(E, O), \quad (\text{Eq. 3})$$

where, the environmental change, dE/dt is also dependent on both the environmental states, E and environment-modifying activities of organisms, O . This modified Lewontin's equation (Eq. 3) introduced an extra underlying cause for environmental change, which Odling-Smee termed niche construction.¹³ Hence, rejecting the Darwinian concept of

organism, the present concept of contemporary biology explains that genes, organisms and environments are in reciprocal interaction with each other. Thus, the organism is considered to be both a cause of its own development and a cause of its own selective environment.

The second false assumption of Darwinism is that inherited novelty was the result of chance and accident. Darwin stated in Chapter 6 of *Origin of Species*: "If it could be demonstrated that any complex organ existed, which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down. But I can find out no such case."¹⁴ Modern synthesis also followed the same dogmatic approach, and for past six decades Darwinists based their studies on this false assumption that inheritable novelty is the consequence of chance or slight accidental modifications or mutations. Towards the end of the first half of the 20th century Darwinists established a molecular interpretation for this standpoint. In the 1940s, the nexus between genetic information and proteins was explained by the 'one gene one enzyme' proposition of Beadle and Tatum. This nexus was the foundation for the functioning of the genetic code for amino acids. Latter, the Central Dogma of Molecular Biology claimed that the two major functions of DNA sequences were to encode their own replication and the amino acid sequences in proteins. The encoded proteins would decide the natures of cells and organisms. This vision of the way DNA worked was translated into conventional evolutionary theory, and random mutations were considered as copying errors that changed the DNA sequence one base-pair at a time, and, as a result, changed protein sequences one amino acid at a time. This scheme was in line with the Neo-Darwinian view of gradual accidental change. It supplied a molecular depiction of how proteins, the working molecules of the cell, could evolve new structures and functions.¹⁵ The errors in replication processes are presented as the molecular interpretation of chance or accident. They insist that all genetic alteration happens accidentally and randomly. They believe that the organism has no control over the alteration process, and that the genome mechanically decides organism characteristics. For them genome is a read-only memory (ROM), which is modified only by accident. This claim of Darwinists about randomness and accident became dogmatic with the intent to reject all possible revivals of the role of a supernatural agent found in religious explanations as the cause of origin of diverse living organisms.

However, the whole scenario has been changed because the massive amount of empirical data collected in the last 50 years was found to be in disagreement with this concept of randomness and accident in producing variation. Despite the fact that the knowledge of the molecular minutiae of living organisms is undergoing a revolutionary growth, unprejudiced consideration of the consequences of these findings are very rare. A pioneering biologist, James A. Shapiro, Professor of Microbiology, University of Chicago, states:

We have progressed from the Constant Genome, subject only to random, localized changes at a more or less constant mutation rate, to the Fluid Genome, subject to episodic, massive and non-random reorganizations capable of producing new functional architectures. Inevitably, such a profound advance in awareness of genetic capabilities will dramatically alter our understanding of the evolutionary process. Nonetheless, neo-Darwinist writers like Dawkins continue to ignore or trivialize the new knowledge and insist on gradualism as the only path for evolutionary change.¹⁶

In the same article Shapiro also states that:

The past five decades of research in genetics and molecular biology have brought us revolutionary discoveries. Upsetting the oversimplified views of cellular organization and function held at mid-century, the molecular revolution has revealed an unanticipated realm of complexity and interaction more consistent with computer technology than with the mechanical viewpoint which dominated the field when the neo-Darwinian Modern Synthesis was formulated. The conceptual changes in biology are comparable in magnitude to the transition from classical physics to relativistic and quantum physics.

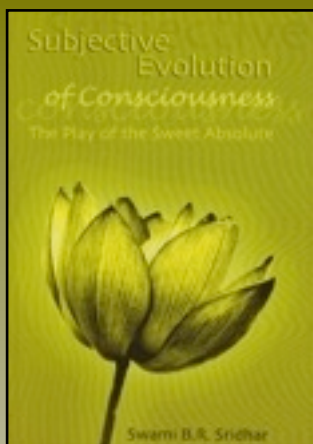
Research shows that proteins evolve by accumulating and rearranging polypeptide domains and not by a series of individual amino acid alterations. Hence, the evolutionary genomic alterations are not stochastic, localized point mutations, but exchanges of DNA encoding segments. The DNA substantiation does not verify the slow gathering of random gradual changes transmitted by restricted patterns of vertical descent, as claimed for 50 years by Neo-Darwinian theory.¹⁷ It is being reported that cells have the ability to modify themselves adaptively and to change their own heredity. Upsetting the speculations of the past mechanistic views, it is well acknowledged that recombination has the capability to produce information and to modify the content of the genetic storage. Barbara McClintock's findings have shown that organisms can engineer their DNA.¹⁸ Following the same line of research, Shapiro coined the term 'natural genetic engineering', which corresponds to the ability of living cells to manipulate and restructure the DNA molecules that make up their genomes.¹⁹ Large parts of DNA alteration in bacteria and eukaryotes are a result of a coordinated

accomplishment of natural genetic engineering. Hence, the traditional understanding of genome variation as stochastic events or unpredictable accidents is now replaced by a controlled and coordinated accomplishment of cellular biochemistry. This paradigm shift is a major setback to Neo-Darwinism, because cellular biochemistry is based on guided mechanisms and thus acts in predictable ways. In contrast to Neo-Darwinism, DNA changes are now known as non-random with respect to time, physiology and life history.²⁰ As a result of all these developments, frontier biology rejected the dogmatic faith of Darwinists: genome is a read-only memory (ROM), which is only modified by accident. The emerging alternative view of 21st century biology explains the genome as a read-write memory (RW) system subject to nonrandom change by dedicated cell functions. The genome is actively modified in a coordinated and controlled mode by the sentient cell functions and hence new biology views life forms as self-modifying beings. The ability of living organisms to modify their own heredity is irrefutable and thus shows the failure of the black-box approach of Darwinism in incorporating this fundamental feature of life.

To be continued...

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Subjective Evolution of Consciousness

Evolution is generally thought of as something merely objective. But objective evolution is a misperception of reality. Evolution is actually based on consciousness, which is subjective. Subjective evolution, however, seems to be objective evolution to those who are ignorant of this perspective.

Consciousness seems to be the unessential embedded in a concrete substance, but actually it is just the opposite. Consciousness is the substantial and its objective content or world is floating on it connected by a shadowy medium like mind. This view finds surprising support in advanced modern science from which physicists like Paul Davies have concluded that it is necessary to adopt “a new way of thinking that is in closer accord with mysticism than materialism.”

The dynamic super-subjective living reality that produces as much as is produced by its constituent subjective and objective fragmental parts or moments is in and for itself the embodiment of ecstasy, i.e. forever beyond the static reification of materialistic misunderstanding. With an irresistible passion for truth, Srila Bhakti Raksak Sridhar Dev-Goswami Maharaja, the author of *Subjective Evolution of Consciousness* takes us to an incomparable synthesis of thought from Descartes, Berkeley and Hegel in the West to Buddha, Shankara, and Sri Chaitanya in the East to reveal the ultimate conception of reality in all its comprehensive beauty and fulfillment.

To obtain the book *Subjective Evolution of Consciousness* please contact us at:
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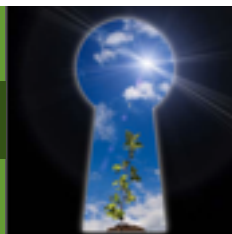
A Scientific Spiritual Conception is Necessary in Biology

Bhakti Vijnana Muni, Ph.D.

Increasingly, biological studies of organisms like bacteria, plant and animals are focusing on sentience. Shapiro along with others have emphasized this time and again¹⁻²⁸. Following the work of Barbara McClintock, Shapiro concludes that cognitive intelligence is necessary to properly explain the behavior of cellular and genomic processes.

Intelligence is defined by Stenhouse²⁹ as “Adaptively variable behavior within the lifetime of an individual.” Generally behavior is equated with movement. Time lapse imaging has indicated that not only animals but also plants exhibit adaptive movement, although their time scales are much slower than that of animals. It must be stressed that such movement is only an expression of intelligence, but is not intelligence itself³⁰. Intelligent behavior is considered to be a property of the individual organism as a whole. Thus intelligence is a holistic property of the individual. Statistics eliminates individual variation by averaging. The average or mean does not represent the behavior of the individual, and is meaningful only to those who study whole populations and is misleading for the study of individual intelligent behavior³¹.

Life requires Cognition at all levels



The 20th century focused on finding a genetic basis for explaining plant and animal behavior, but was unsuccessful in confirming its mechanistic assumptions. Moreover intelligence or cognition is found necessary to explain the metabolic operations that are constantly on-going while the organism is alive. Plant and animal behavior includes aspects of cognitive error detection and cognitive response. Examples include DNA replication proofreading as a paradigm for the whole variety of intelligent bacterial processes. Information is constantly being processed by cells from both intracellular signals as well as from external environmental stimuli, and thus allowing cells to function adaptively. Preferential detection of nutrients as studied by Monod³² in the case of *E. coli*, shows that they can discriminate between the sugars glucose and lactose. Shapiro outlines the steps involved in these metabolic operations in *E. coli*, which can be programmed as a computer algorithm³³. Thus he explains how cellular computations apply to the evaluation of sensory signals and direct action by the cellular transcription apparatus. He further makes it clear that there is no sharp

dividing line between cellular information transfer and cellular operation. There is no Cartesian dualism in the *E. coli* cell, meaning that there are no separate molecules that carry information and another set that executes that information. All the molecules together participate in sensing the information transfer and processing it, in addition to their other operations and functions³³.

Bacterial behavior is a self-guided activity. The bacterial apparatus is able to guide swarming over chemical concentration gradients of more than six orders of magnitude. Bacteria successfully utilize chemotaxis to search for nutrients, avoid toxic chemicals, pH sensing, as well as interact with other organisms during pathogenesis and symbiosis. Therefore this is a cognitive system and its functionality and adaptability is cognitive in quality, which guides the bacteria towards a goal meant to sustain its self-identity. Every step in the adaptive process, i.e., cellular computation, involves functional decisions and cognitive operational processes³⁴.

Shapiro has coined a term *natural genetic engineering* to denote the kind of cognitive circularity that is observed in the cellular computation processes. The whole organism engineers the modification of its own genetic structure in response to stress or to achieve a goal. How do *E. coli* bacteria change their genomes? Basically *E. coli* can rearrange

its DNA. Autonomous plasmids can also promote DNA transfer between the bacterial cells. Bacteria are masters in manipulating the DNA molecules. This is well recognized in the studies involving antibiotics in medicine and agriculture¹.

Earlier it was thought that resistance was acquired by bacteria as a result of successive mutations. Mutations would change the cell structure so that the cells were no longer sensitive to the action of the antibiotic. This was confirmed experimentally, but the theory of successive mutations leading to insensitivity has been proven fallacious for the vast majority of bacteria in hospitals around the world³⁵. Rather it has been confirmed that these naturally developed antibiotic resistances are a result of new functions which express themselves for inactivating the antibiotics. Often these functionalities were encoded by plasmids, phages, and other transposable elements. Thus the mobile genetic elements play a major role, and that calls for the cooperative participation of these other cell organelles, and thus it is not a result of mutational changes in the DNA³⁶.

According to Shapiro, the recognition of the role of natural genetic engineering has only increased after the complete genome sequencing was made. The operons that encode multiple antibiotic resistances have integrated within them the lambda-like integration systems called integrons. These can expand and contract by insertion and excision of single protein coding sequence cassettes. These integrons have a role in many functional processes, although their full significance is not understood. Often it is also felt that large DNA segments can be imported from other species and they help in diverse adaptive functions. These are thus thought to be products of natural genetic engineering. Of course, these come from just comparative genomic data study, but the full significance of how these get integrated is not well understood. These examples involve external proteins and thus are proofs of DNA rearrangements and protein engineering³⁷.

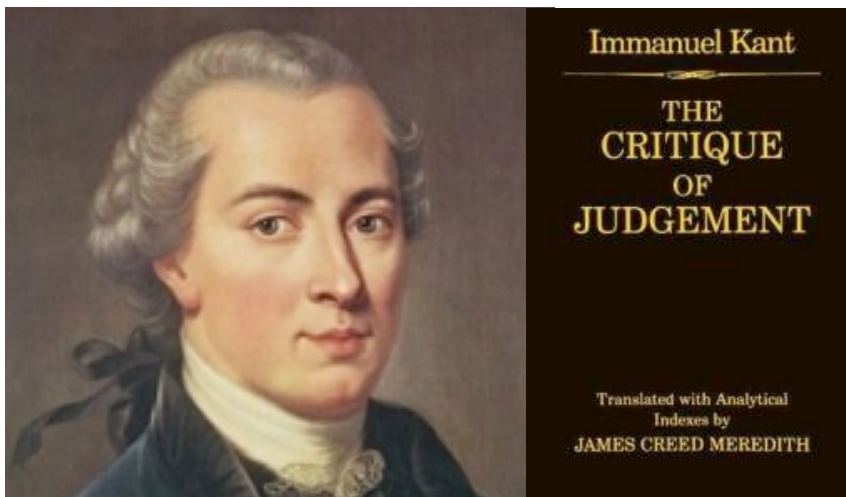
This new realization in the 21st century biology that most DNA changes in bacteria and eukaryotes occur by natural genetic engineering has removed the source of variation of genomes from the category of stochastic events (mutations or accidents), and instead placed it in the context of cellular biochemistry, which is functioning in accord with a cognitive logic. Thus DNA changes are non-random and are self directed. Bacteria invoke their cognitive capabilities to achieve results that are meant for the self-preservation of their identity. These provide proofs of the adaptively variable intelligent behavior of the living organism, which is a manifestation of its cognitive capability³⁸.

Earlier Barbara McClintock had shown in her research with Zea Maize that DNA rearrangements are a regular feature of cellular processes. It was thought that genetic material changes only by mutation or by errors during replication. But McClintock showed that this was a natural process by which the cell contains the wherewithal to rearrange its genetic makeup by a self-directed process. She concluded her Nobel prize lecture by saying:

In the future attention undoubtedly will be centered on the genome, and with greater appreciation of its significance as a highly sensitive organ of the cell, monitoring genomic activities and correcting common errors, sensing the unusual and unexpected events, and responding to them, often by restructuring the genome. We know about the components of genomes that could be made available for such restructuring. We know nothing, however, about how the cell senses danger and instigates responses to it that often are truly remarkable.³⁹

The studies of McClintock indicated circularity in the cellular processes between its genetic components and the whole cell. This is significant because it overthrows the mechanistic concepts of pre-genomic paradigms as well as the Central Dogma proposed by Crick⁴⁰. This has thrown into question the whole intellectual basis of molecular biology, as was already anticipated by Francis Crick himself in case the Central Dogma would be shown to be violated in nature. In retrospect this outcome concerning the logic of cellular biology has come to confirm the philosophical conclusions about the nature of organisms developed by Immanuel Kant in his *Critique of Judgement*, in which he showed that organisms are intrinsically teleological or embodied natural purpose (*G. Naturezweck*), and therefore non-mechanical by nature. In turn this has come to show that the 20th century assumption of gene centrism has proved to actually be a poor-fitting Procrustean bed and that scientists needed to find a new concept for comprehending living organisms, or go back to earlier concepts like that of Kant to find a more properly fitting biological paradigm⁴¹.

These new discoveries have consequences for evolutionary studies also. Evolution theory was mostly based on a genetic



Immanuel Kant showed that organisms are intrinsically teleological or embodied natural purpose (*G. Naturezweck*), and therefore non-mechanical by nature.

Immanuel Kant
(1724-1804)

basis as a cause for morphological changes. It has been shown in numerous studies that it is impossible to get a new species from these genetic changes alone, whether they have been induced artificially or by natural genetic engineering. Although the cell contains mobile genetic elements, which can be engineered for achieving regular and urgent necessities, they do not lead to any species change⁴². At most they lead to certain functional changes fulfilling certain needs within the definition of the species. Koonin⁴³ has remarked from his research that a formal demonstration of the universal common ancestry hypothesis has not been achieved. Instead of a tree, what genetic analysis shows are several bushes. Several lines of evidence prove that convergence cannot be achieved and is therefore not a viable explanation for the extensive sequence similarity that may be observed among universal proteins. Thus the whole biological concept of the branching tree of evolution has instead been found to be a very tangled web of nature.

Take the example of a banyan tree. All the information of a huge tree is already contained within the seed. When suitable conditions manifest like water, suitable season and proper nurture, the seed can grow into a tree. The life within the seed is the source of the mature tree. The immediate cause of a tree is its seed yet the immediate cause of a seed is the tree. This is circular causation (*Table 1*). The cause is the effect of its effect, or the effect is the cause of its cause. This has been called self-determinism in philosophy. All the information that is necessary for manifestation of the biological organism is self-contained. In other words the biological organism is simultaneously the cause and effect of itself. Moreover as the seed produces the tree or the zygote develops into an embryo, and manifests consciousness, the potential for consciousness must be existing from the very beginning itself. Now that it is being increasingly recognized that cellular processes are cognitive, it can be deduced philosophically from the *Science of Logic*⁴⁴ that cognition, consciousness or sentience is the immediate existential Concept of life. This confirms that intelligence is a necessary feature of organisms and points to the role of a subject, which is a well developed concept in philosophy.

Table 1: Logic of Life – Each Beginning is also a Result

Analytical Logic	Circular Logic
Complete is sum of parts	Complete comes from Complete
Not shown experimentally	Only experimentally evident fact
Analytical logic infeasible : Cell is irreducible to any molecule (DNA or genome).	Cognition is Life's immediate existential Concept

It is only from the most recent modern research in biology that a turn of events in the biological sciences has confirmed the idea that Kant proposed concerning the mechanical

inexplicability of living organisms. It also confirms the ancient Vedantic ideal which is the rational conception of a spiritual foundation to life, and which is now churning out from the evidence of modern biology itself. It is life from which life comes⁴⁵. Evidently it must be that the subjective role of consciousness will be a defining feature of new biology. The author would like to share with all his indebtedness and gratitude towards Sripad Bhakti Madhava Puri Maharaja and Sripad Bhakti Svarupa Damodar Maharaja for teaching him and helping him with these subject matters. They have spent much time and energy in introducing and clarifying the subject again and again.

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