Charles Darwin and the Meaning of Life: Emergence and Inherency in Evolution

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ABSTRACT

While Richard Dawkins and Stephen J. Gould were often at odds on evolutionary theory, their debate framed a common ideology that has become known as Darwinism to both advocates and opponents. Darwinism as science has stood the rigorous tests of over one hundred years of scientific debate and experimentation but Darwinism as ideology has emerged largely unchallenged as the natural offspring of the science. Yet the real relation of Darwin's view of life and the ideology of what has popularly become known as Darwinism is problematic. This ideology has been termed evolutionary materialism by some theologians but it entails a much more explicit view of reality than mere materialism and evolution. It incorporates both a radical reductionism and a kind of naturalistic nihilism that are unknown in Darwin's original theory. These two elements actually represent principle aspects of a debate that has been raging in the field of evolutionary biology for many years. The principle elements that are missing from the ideology of Darwinism are adequate understandings of emergence and inherency. These concepts will be explored in light of recent developments in biology, physics, and philosophy.

INTRODUCTION

"I see no good reason why the views given in this volume should shock the religious feelings of any one."— Charles Darwin, *Origin of the Species* 2nd Ed.

Yet shocking religious sensibilities was an understatement of the effect of the publication of Charles Darwin's famous treatise on biological evolution by means of natural selection and on the 150th anniversary year of the publication of On the Origin of the Species and the bicentennial year of Darwin's birth there seems to be no abatement in the controversy that so divided the world then and now. Over the last several years there has been an explosion of books and articles on the subject of religion and evolution culminating with the phenomenal success of Richard Dawkins' "The God Delusion" (Dawkins, R 2006) which has sold over a million copies since its release. With the passing of Stephen J. Gould in 2002, Dawkins stands alone as the most influential populariser of evolutionary theory. From his first book on evolution, "The Selfish Gene," Dawkins has become famous by taking provocative stances that arouse controversy not only amongst the public but also in the field of evolutionary biology itself. Dawkins' engaging writing style and stage presence have made him the epicentre of this controversy. However, there are many other voices in this debate and publication of books by scientists and theologians of various persuasions on this subject has become almost a cottage industry.

THE NEW ATHEISTS

While prominent evolutionist like Dawkins, Gould and E.O. Wilson have been writing books directed at the public at large on evolution for decades, there seems to be a new more assertive stance among some popular writers to challenge the religious sensibilities of the public directly in ways that Darwin clearly demurred from. Darwinism has been transformed from a scientific theory to an ideology with a clear social and political agenda. Rather than dodging the implications of evolution for theology, this ideology has made atheism its central tenet. In addition to Dawkins, Christopher Hitchen's book "God is Not Great" (Hitchens, C 2007) and Sam Harris's missive, "A Letter to a Christian Nation" (Harris, S 2006) has also made the bestseller list in recent years. Hitchens is not a scientist and makes a largely secular argument against religion that is in the tradition of atheist intellectuals from Bertrand Russell. While the arguments are hardly new there is a stridency that was largely lacking in the matter of fact style of Russell and the resignation of existential atheists like Camus. Sam Harris, a journalist who has recently taken up the study of neuroscience is perhaps the most antagonistic toward religion. According to Harris, religion isn't just mistaken but is really the source of most of the wars and conflicts that have plagued humanity over the centuries and continues to be the prime source of conflict in our age.

DARWINIAN SCIENCE VS DARWINIAN IDEOLOGY

Darwinism as science has stood the rigorous tests of over one hundred years of scientific debate and experimentation. There has been modification of the theory especially in regard to inheritance and speciation and there continues to be modification in regard to the storage of information and the interaction of the genome with the environment but it has remained remarkably intact. While even the laws of physics have changed since Darwin first proposed his rather simple theory of change, the basic algorithm of evolution still astounds in its capacity to explain the unfolding details of the natural world. Religious conservatives who still cling to creationism often proclaim the status of Darwin's theory is uncertain but the simple fact is that there are few reputable biologists that question it. There is no field of biology that it hasn't shaped and biology as a modern science would be unthinkable without it. However, Darwinism as ideology has emerged largely unchallenged as the natural offspring of the science. Yet the real relation of Darwin's view of life and the ideology of what has popularly become known as Darwinism is problematic. I have used the writings of Richard Dawkins as the public epitome of Darwinism but his ideas represent only part of the popular conception of Darwinism. The popular ideology of Darwinism is drawn from

several sometimes conflicting perspectives of evolutionary theory but what emerges is immediately recognisable. Evolution is portrayed as a directionless process propelled foreword by selfish genes that manipulate life's events solely for the purpose of their own propagation. A corollary to this is that intelligence is subsequent to the material processes of evolution, is totally explainable by these processes, and is accidental.

This ideology has been termed evolutionary materialism by some theologians but it entails a much more explicit view of reality than mere materialism and evolution. It incorporates both a radical reductionism and a kind of naturalistic nihilism that are unknown in Darwin's original theory. Certainly Darwin's theory and in deed all scientific theories are bound to materialistic explanations of nature but this does not necessitate the ideology that has arisen as a kind of counter religion. It is my contention that evolutionary materialism is neither necessarily reductive nor nihilistic and the best observational evidence supports a view of nature that is more complimentary than oppositional to our traditional beliefs and values. The missing elements in the popular rendition of Darwin's theory whose absence reduce it to almost caricature are emergence and inherency. While not clearly defined in the original text, these elements are implied and are wholly congruent with Darwin's basic thesis.

In order to understand the relationship of Darwinian ideology to the science of Darwinism, it is necessary to understand how this science has developed over the last century. What I have called reductionism and nihilism might also be termed gene selectionism and contingent evolution. These positions represent principle aspects of a debate that has been raging in the field of evolutionary biology for the many years. Like all scientific debates it entails many views that only partially coalesce into the poles of opposition but the two most public faces of this debate were Richard Dawkins and Stephen J. Gould. Not only did they articulate the terms of the scientific debate but in their diverse ways they were principle architects of the ideology of Darwinism. Although this debate grew quite acrimonious at times, they have as much in common as opposition. I believe they are both right and wrong in different ways in regard to evolutionary theory and ideology. In fact their criticism of each others theories points to the basic flaws in their common perspective.

RICHARD DAWKINS AND REDUCTIONISM

Reductionism, the first element in Darwinian Ideology, is often assumed to have an almost intrinsic relation to science in general and evolution is particular. Reductionism is the primary process in any science and it is easy to see why it is often embraced as the essence of science. Richard Dawkins is perhaps the most prominent advocate for reductionism in evolution and is most famous for advocating the gene as the unit of selection in evolution. He states this premise quite concisely in his first published book "*The Selfish Gene*":

> I shall argue that the fundamental unit of selection, and therefore of self-interest, is not the species, nor the group, nor even, strictly, the individual. It is the gene, the unit of heredity.[1]

For Dawkins genes are not just repositories of information but rather are prime examples of a transcendent class of objects which he calls replicators. The individual in Dawkins theory of evolution is reduced to a passive vehicle whose every action is the result of purposive replicators struggling for their continuance.

The publication of "*The Selfish Gene*" by Richard Dawkins in 1976 sensationalised a concept that had been gestating in the field of evolutionary biology for some time. Even the idea of gene selection did not originate with Dawkins but is more properly attributed to George C. Williams in his seminal book *Adaptation and Natural Selection* (Williams, G.C. 1966). However, Williams was only making explicit what had been in practice in the field of genetics almost from its origin. The concept of the gene, of course, dates back to Mendel but did not inform evolutionary theory until its rediscovery at the turn of the twentieth century. The new field of genetics was from its inception reductionistic in its explanation of biological change. Its experimental orientation lead to the belief that the mutations observed in laboratory animals such as fruit flies were sufficient to explain evolutionary change without resorting to natural selection. Genetic change was viewed as discrete and particulate. In contrast to the experimental approach of geneticists, the followers of Darwin continued to concentrate on field studies of organisms in their natural settings. Rather than the gene the focus of genetic change for Darwinians was the individual. Rather than discrete, natural variation in organisms was viewed as continuous and evolutionary change was viewed as gradual. Darwin had no idea of what a gene was and the mechanism of selection was necessarily

[1] Dawkins, R., 1976. *The Selfish Gene*. (Oxford: Oxford University Press) p. 12

the differential survival and reproduction of the individual.

The controversy between geneticists and Darwinians was resolved in the 1930s with the "modern synthesis "of Mendelian genetics and Darwinian evolution (Huxley, J. S. 1942). This synthesis principally authored by R.A. Fisher, J.B.S. Haldane, and Sewall Wright showed how continuous variation could be the result of the action of many discrete genetic loci and the accumulation of small changes in gene frequencies over time could cause evolutionary change. A third element of the Modern Synthesis first articulated by Theodosius Dobshansky and elaborated by Ernst Mayr was the process of speciation which had been overlooked by Darwin who believed that the species was a nominal category. Mayr and Dobshansky showed that species emerged as real entities from the continuous process of genetic change by the evolution of isolating mechanisms (Dobshansky, T. 1935; Mayr, E. 1942; Mayr, E. 1954). The introduction of Mendelian genetics into Darwin's theory corrected a serious shortcoming in Darwin's explanation of variation within species and greatly strengthened his explanation of how evolutionary change occurred over time. However, the modern synthesis also made the gene a mathematical unit in the equilibrium equations pioneered by Hardy and Weinberg and the focus of evolutionary analysis began to change from the individual to the gene. Undoubtedly these equations have been quite useful in conceptualising genetic change in populations which has become the operational definition of evolution in population genetics. Yet mathematics often gives the illusion of describing a phenomenon rather than representing a process. Because equilibrium equations deal with gene frequencies in populations, it is easy to confuse selection with the outcome of selection.

For Darwin, selection was an actual event that occurred to individuals. The outcome of selection was not seen in individuals but rather in the species. Individuals were selected but it was the species that evolved. This point has been obscured in population genetics where it was convenient to assign a selection coefficient to a gene and ignore the selection of the individual. While this practice is useful for genetic analysis, it gave the false impression that genes were being selected individually. As early as 1959, Ernst Mayr pointed out the problem of what he termed bean bag genetics (Mayr, E. 1959). According to Mayr, population genetics was treating genes like beans in a bag, where each was pulled out and examined without regard to the other genes. As Mayr has noted genes are invisible to selection. It is the phenotype that the genes produce in

interaction with the environment that is selected rather than the genotype.

GOULD'S CRITIQUE

Despite its roots in population genetics, Dawkins shift of selection down to the gene was not well received in some circles. His most vocal critic on this issue was none other than Stephen J. Gould although many other even more prominent biologists including Ernst Mayr and Richard Lewontin had also taken issue with this position. According to Gould:

> Gene selectionists have correctly noted, but fundamentally misinterpreted, an important property of evolving systems: all evolution by selection, whatever its level of causation, is recorded by change in the frequencies of genes (the lowest level of the causal hierarchy). Since genes record all changes, some evolutionists have been fooled into assuming that genes therefore cause all changes. But scribes are not agents, and bookkeeping is not causality.[2]

The crux of the problem is the difference between benefit and selection which Dawkins failed to see. Selection acts on phenotypes which does not equate to the informational unit of the gene. If phenotypes were the sum of these informational units then genes could properly be equated to the unit of selection but they are not the sum but rather the product of the interaction of genes and the environment. The basic flaw in Dawkins perspective is the digitisation of information in to bits. Information in a gene is not unitary but relational and is not usually selected as a unit.

NATURE IS EMERGENT

Since Gould's original critique of Dawkins reductionism other important insights have been made in evolutionary biology that support and expand this point. The most notable developments have occurred in developmental biology. It may well be the network of developmental interactions, rather than the gene, is the most important determinate of the phenotype (Carroll. S.B. 2005). Sequencing and comparing whole genomes has revealed that there is surprisingly little variation in structural genes between extremely disparate organisms such as mice and men. Small variations in developmental and regulatory genes can have transformative effects. Organisms aren't built to specification from some gene blue print but unfold in an interactive way from environmental signals both internal and external to the organism. Organisms with identical genotypes may develop in to quite different forms given different environments. Biologists have long noted this developmental plasticity accounts for much of the phenotypic variation seen in nature. Different

[2] Gould, S. J. The Confusion over Evolution, *The New York Review of Books*, November 19, 1992, p. 49

regimes of nutrition, temperature, sunlight, and water result in varied phenotypic expressions and much of this variation is adaptive (Small organism require less food, dark pigmentation screens out harmful ultraviolet light, etc.). This physiological adaptiveness is of course also a trait that has been selected but it exists as a capacity rather than a particular characteristic. This capacity allows organisms to survive in environments from which they would be excluded and gives time for genes that are adapted to the new environment to arise and be selected. Adaptive structural genes are more reliable and energy efficient (as witnessed by the sun burn many of us pale individuals experience in our quest to be adapted for the beach each summer as opposed to our brown brethren). This phenomenon of development which allows organisms to thrive in an environment which in turn selects genes is called the Baldwin Effect and is further testament to organisms as active participants in their own evolution rather than passive vehicles to gene selection (Baldwin, M.J. 1896).

While the Baldwin effect was proposed very early in the history of evolutionary thought, the most important and seminal thinker in regard to development and evolution was C.H. Waddington (Waddington, C.H. 1966). He created a concept of development that pictured the process as a landscape composed of both genetic and environmental contours. Development would flow much like water through the valleys and around the hills of various gene and environmental signals seeking an equilibrium. As the environment or genetic structure changed, the flow might be altered but could often reach the same equilibrium by an alternate route. The path whether shaped by environment or genes "canalised" and over time deepened as genes are selected that make the path more ridged. The selection of genes to accommodate and make permanent an adaptive developmental process Waddington called "genetic assimilation." Thus remarkably a change in phenotype often precedes a change in genotype. There is growing evidence that genetic assimilation is a very important process in evolution. While the phenomenon has not been given the attention it deserves there are a number of cases that have recently appeared in the literature including bilateral shift to asymmetry in the animal kingdom, the shell shape in freshwater snails, viviparity in reptiles, sex determination in turtles, leaf form in buttercups, and ant attracting extra-floral nectar secretion in Acacia trees (Palmer, A.R., 2004).

While genetic assimilation illustrates the active role of the organism in selection it does not cross the famous "Weismann barrier" between the germ line and the environment. This concept of gene isolation from the environment has been a central tenant to evolutionary theory but it is

proving to be a generalisation that is being undermined with exceptions. Plants are an obvious exclusion since there is no real separation of generative tissue and somatic but most animals in fact exhibit little separation of germ cells from the body during development (Buss 1987). There is also growing evidence that germ cells are subject to environmental influence that can directly change their information content. Additionally there are mechanisms for passing information transgenerationally other than through genes. There has been great interest in these so called epigenetic mechanisms of inheritance in recent years. Jablonka and Lamb (2005) describe four types of "epigenetic inheritance systems": (i) systems based on self-sustaining regulatory loops; (ii) those that involve structural templating; (iii) chromatin marking systems; (iv) RNA-mediated inheritance. The extent of how often and how important this type of inheritance is in nature is controversial but there is growing evidence that it may be quite common. Jablonka and Raz (2009) cite 101 well-documented cases of epigenetic inheritance in 42 species.

The epigenetic turn as Jablonka and Lamb term it presents a model of evolution that is interactive rather than a passive system of random mutations. Mutation rates can be inherited and selected to adapt to changing environments in some organisms (Bjedov.I 2003; Foster, P.L. 2000). Heritable genetic changes can be acquired by gene silencing or activation in response to environmental signals (Whitehall, N.C and Whitehall, E 2006). Information can also be passed from generation to generation by somatic learning and in turn effect the selection of genes. Ecological niche construction (Lewontin, R. C. 1982; Odling-Smee et al., 2003), passed down from generation to generation through epigenetic means may be an important part of evolutionary adaptation. Behaviorally mediated transmission of information including social learning can make major contributions to the evolution of a species. Often there is a recursive relationship between genetic and epigenetic evolution. Human language is thought to be a good example of such a recursive process (Dor and Jablonka 2000).Language evolved from signalling systems into a symbolic system through cultural evolution and as it became more and more central to the lives of its speakers' selection pressure favored individuals with superior linguistic capacities. Thus behavioral transmission and genetic assimilation set in motion a spiralling process of linguistic ability. While these mechanisms don't contradict natural selection, they make it a dynamic process where organisms interact with their environment and organise their own evolution. This new paradigm stands in stark contrast to the reductionist view of the organism as a passive vehicle to

genes that are directly selected by the environment in a mechanistic fashion.

The restoration of the integrity of the organism as actor rather than vehicle not only matches our observations of nature but also validates an existential view of reality. From its very inception Dawkins objective was to expose the illusion of individual autonomy and reduce reality to a mechanistic product of mindless yet purposive natural forces. Dawkins is often condemned as an evolutionary materialist but his theory of gene control is really much more in the realm of a certain kind of idealism than materialism. Like Plato and other idealists, Dawkins has constructed a system where reality is determined by particles of information which have a putative existence outside of the organisms from which they are drawn. Just as in Platonic Idealism, the individual existence becomes illusionary and reality is determined by a transcendent biology that dictates both thought and action. Dawkins rather infamous metaphor for this state of affairs is a mindless robot programmed by selfish genes that direct its every action. While Dawkins later backed away from this controversial depiction claiming that it had mistakenly been taken to mean genetic determinism which was not his intent, he never really disowned the substance of the metaphor. Certainly Dawkins is not a simple minded genetic determinists in the sense that genes directly determine all behavior .He appreciates the interaction of the environment with genetic information that makes behavior possible and makes his genetic program dynamic much like the programs designed to play chess but there is nothing in Dawkins paradigm that transcends the sum of the parts.

Emergent levels of selection have become widely accepted in evolutionary biology including the gene, the cell, organism, group, species, and even higher taxonomic categories such as class. Associations of organisms such as communities may also be considered evolutionary units. All of these emergent forms owe their legitimacy in some measure to the original proposition of group selection for altruism which Darwin used in his explanation of altruism in humans and social insects. In fact Richard Dawkins' original proposal of the selfish gene was framed as a counter to group selection. Group selection as an explanation for altruism experienced a long eclipse during the hay day of gene selection theory but has recently seen a rise in popularity and acceptance. David Sloan Wilson has long championed the cause of group selection but he has recently been joined by none other than the father of sociobiology, Edward O. Wilson. The two together recently penned a much noted article which lays down both the theoretical basis and factual evidence in support of group selection (Wilson, D.S. and E.O. Wilson 2007). The obvious

objection to group selection of altruism has been that it is easily subverted by selfish individuals arising from mutation or migration into the group. Since individual reproduction is necessarily faster than group reproduction, altruistic individuals would be swamped by selfish ones. As an alternative, altruism has been explained variously by inclusive fitness theory (Hamilton, W. D. 1964; Hamilton, W. D. 1975), reciprocal altruism (R. Trivers, R. 1972), evolutionary game theory (Maynard Smith, J), and selfish gene theory (Dawkins, R. *1976*). The arguments against group selection seemed formidable but gradually both mathematical and computer models that illustrated the feasibility of group selection emerged. Rather than a simple comparison between individual and group reproduction, these models recognise that in actuality groups form and dissolve continuously in nature. As Darwin pointed out groups with more altruist would have an advantage over groups with fewer altruists. One can easily imagine organisms dividing into groups at one stage in their life and mixing after breeding before forming into new groups. Some groups would have more altruist than other groups. The in group frequencies of the altruistic genes would decline each generation for both altruistic and selfish groups but the total number of altruistic individuals increases in the population as a whole because of the superior reproduction of the altruistic group. The other explanations of altruism are on close examination just translations of this basic fact. Not only is group selection feasible it is the only way that the disadvantages of altruism can be overcome. In reality, selection occurs at multiple levels of organisation and there is a balance between competing interests of individuals and groups.

HIERARCHY OF EXISTENCE

Emergence is also apparent in levels of organisation of matter which in some ways parallels units of selection in evolution. Hierarchy of existence is often depicted in beginning biology texts ranging upward from quarks, sub atomic particles (electron, protons, neutrons, etc.), atoms, molecules, organelles, cell associations (colonies, tissues, etc.), and organisms. Much as in evolutionary biology there has always been a certain amount of controversy as to the nature of material emergence and the relationship of lower and higher categories of existence (Bickhard, M. H. 2009; Bickhard, M. H. 2000; Campbell, D.T. 1974; Claus Emmeche, C. 2000).. The central problem of emergence is causation between levels of emergence. A classic example of this problem might involve the chair you are sitting in. The chair may seem like an entity in its own right with characteristics such as size, shape, solidity, and so on but we also are aware that it is composed of molecules and the molecules are in turn composed of atoms and the atoms of

subatomic particles, and ultimately to quarks. You might say that your chair is ultimately reducible to just a swarm of subatomic particles and that its appearance as a chair is only an epiphenomenon of its true nature. Thus what we see is just an illusion of our limited perspective much as television seems to be an image but in reality is just a pattern of flashing particles on a cathode ray tube.

Unfortunately this unidirectional causality leaves us in a rather uncomfortable paradox if we ascribe it to all emergent forms. This is especially true when it comes to the emergence of mind. Naturalism seems to trap us into a kind of philosophical Calvinism where all events follow rather mechanically from initial conditions laid down at the first moment of creation. Of course I am not referring to the Biblical account of creation but rather that alternative religion called the Big Bang. This is generally the view of physicalist philosophers such as Jaegwon Kim who limit causal power to properties of the simplest possible irreducible particles and their interactions (Kim, 1993, 1995) Each level of organisation is supervenient on the lower level and there is nothing that actually emerges from constituent parts. Any property derivable from the internal constituents and relations of a subordinate entity cannot be considered emergent (McLaughlin, 1992). Consequently there is no possibility of downward causation despite our inituitive notion that organisms and minds do have causal effects in the universe.

However this reductive view of physical reality is based on a particle and property metaphysics that is not really consistent with modern physics. The long held view of particles interacting at the micro level of fundamental physics has given way to the view everything is quantum field processes (Brown & Harré, 1988; Davies, 1984; Weinberg, 1977; Saunders & Brown, 1991). Quantum fields don't conform to the comfortable Newtonian notions of mechanical interaction but rather are relational. According to Brichard in his insightful essay on Emergence:

> Ontology is not atomised to particles on a space and time stage, and cause is not atomised to points of particle encounters.[3]

In effect there are no particles but rather fluctuations of fields more akin to the vibrations of an intrinsically oscillatory medium. What are taken as particles are better visualised as quantum vibrations of a string much like notes played on a harp. This activity is inherently relational rather than causal in the sense of particle collisions. In fact quantum fields may have effects on one

[3] Bickhard, M. H. 2000. Emergence in *Downward Causation* P. B. Andersen, C. Emmeche, N. O. Finnemann, P. V. Christiansen (Eds.) (Aarhus, Denmark: University of Aarhus) Press p.324

another that are not directly conjoined in space as witnessed by the Pauli Exclusion Principle. Thus physical reality at its very core is a product of organisation and isn't different in kind from the organisation of any emergent level of reality.

While quantum field theory is a key concept in undermining the assumption of a reductive metaphysics, science has been shifting from a substantive essentialism to a relational paradigm since the advent of relativity theory. Terrence Deacon has listed a number of examples of misplaced concreteness including: Phlogiston = fire substance, Caloric = heat substance (transferred between things), Luminiferous Ether = medium for wave & field effects, and Elan vital = essence of life. There is a natural human proclivity to envision relationships as something substantial. Transformations that occur when one form of energy becomes another form such as motion into heat into light had been viewed as passing some substance between states. Yet now we know that which is conserved despite transformation is not a substance. As Deacon points out:

> Science has progressed by systematically replacing substance essentialism with dynamical and relational accounts, but substantialism remains the tacit assumption in eliminative materialism.4

In regard to evolution there has been a shift from a mechanical reductionistic interpretation of the evolutionary process to one of nonlinear complex systems interacting with their environment through both negative and positive feedback loops (Kauffman, S.A. 1996; Kauffman S.A. 2002). This new paradigm called Complex Systems Theory is gaining a wide following in evolutionary biology but to be sure not all evolutionists embrace it. On a certain level this interactive evolution may sound rather Lamarkian and many orthodox neo Darwinians especially Richard Dawkins have resisted it. Yet Darwin himself was less averse to Lamarkian thinking than his current disciples. In what might be called the Satanic verses (a few verses embracing polytheism delivered by Mohammed but later retracted) of the Origin of the Species (6th edition) Darwin wrote:

> I think there can be no doubt that use in our domestic animals have strengthened and enlarged certain parts and disuse diminished them; and that such modifications are inherited.5

Darwin even proposed a Lamarkian form of inheritance called gemmules which gave a

[4] Deacon, T. W., Emergent dynamics (A path from matter to mattering)
CTNS-STARS, Cancun, Jan 2007

[5] Darwin, C. R. 1866. On the origin of species by means of natural selection: or the preservation of favored races in the struggle for life. (London: John Murray. 4th edition) p. 73

kind of environmental feedback into the genome of organisms (Darwin, C. 1868). Unlike Mohamed, Darwin didn't excise this heresy from the sacred texts since he had no realistic alternative to explain inheritance. Of course gemmules were discredited even within Darwin's lifetime and have become unnecessary with the advent of Mendelian genetics but Darwin's openness to a kind of genetic feedback loop was prescient to modern systems theory. As previously mentioned in regard to developmental genetics and epigenetics, organisms have developed ways of adaptively modifying their phenotype that interact with the selection of genotype (Liu, Y. S. et al 2009). Humans obviously pass information from generation to generation via learning and such information in turn shapes genetic selection in a reciprocal manner. However, it has become increasingly apparent that many organisms from bacteria on upward have similar ways of sharing information that also acts in reciprocal feedback loops. Information is not portioned off into directive bits but rather is free-flowing between the organism and the environment. The reality of life is not reducible to replicators but emergent in interactive systems.

STEPHEN J. GOULD AND BIOLOGICAL NIHILISM

The idea of direction in evolution has long provoked controversy but often the conflict is more a matter of definition than substance. One of Darwin's major contributions to science was to demystify nature and replace an anthropomorphic explanation of adaptation with a purely material one. This demystification extended to the concept of change in nature. Rather than viewing life as a ladder with progressively higher forms of life at each rung, he thought that nature's structure was more akin to a tree with branches corresponding to different body plans exploring a diversity of niches. As R. C. Lewontin (1983) has pointed out Darwin replaced a transformational view of evolutionary change embraced by Lamark and Buffon with a variational view of change. Organisms didn't so much advance during evolution as branch out. While this perspective has been both salutary for scientific research and properly deflating to teleological presumptions, it has been developed into a dogma of nihilism by some evolutionists that has little to do with observational facts and isn't really apparent in Darwin's writings. The person that most explicitly articulated this nihilistic view was the late Stephen J. Gould. Gould wrote that personal motivation always influences theoretical positions so his motivation for naturalistic nihilism seems an appropriate subject for analysis. While Gould's argument for nihilism was limited to evolutionary biology, the breadth of his writings clearly reflect a certain cultural perspective that was very much influenced by post war existentialism. Whether nihilism is a valid philosophical position is not really within

the scope of this essay but Gould's contention that life's evolution is meaningless and directionless is certainly relevant.

Gould has taken Darwin's idea of variational evolution which is really a statement about the process of evolution and derived from it a rather dubious axiom that there is no progress in form or function in evolution. For Gould the idea of progress or direction in evolution wasn't just mistaken but was downright noxious. This seems somewhat strange for a person who characterised himself as a "political progressive" but for Gould evolutionary progress represented the traditional ideas of hierarchy. This mixture of science and personal philosophy is apparent in the following quote:

> There is no progress in evolution. The fact of evolutionary change through time doesn't represent progress as we know it. Progress is not inevitable. Much of evolution is downward in terms of morphological complexity, rather than upward. We're not marching toward some greater thing." [6]

One of Gould's most popular books, *Wonderful Life*, focused directly on his central thesis that rather than progress life's history is exemplified by a random walk whose every turn was demarcated by contingent events (Gould, S. J. 1989). The title of the book draws from the classic movie "*It's a Wonderful Life*" from the 1940s with Jimmy Stewart as the leading character. In the movie Stewart's character attempts suicide thinking his life is worthless and it would be better if he had never been born but an angel rescues him and magically illustrates all of the tragic events that would have occurred if he in fact had not been born. Likewise according to Gould, if one changed a crucial event in life's history such as the asteroid that destroyed the dinosaurs, life would evolve in quite a different direction. Intelligent beings such as ourselves are quite accidental and would very likely never have arisen. The apparent increases in complexity that one sees in the fossil record Gould explains as the result of a random walk away from an initial simplicity. The reason that ever more complex organisms appear as time goes on is that you can only get minimally simple before you cease to exist but complexity is ostensibly unbounded. Thus a random variational change will tend to drift ever further from limiting simplicity. Gould uses the metaphor of a drunk staggering out of a bar. He will walk quite randomly back and forth but his journeys toward the bar are limited by the brick walls of the bar. This means his random walk will tend to

[6] Gould, S.J. 1995 The Pattern of Life's History Chapter 2 in *The Third Culture* John Brockman (Ed.) (New York: Simon & Schuster) p. 52

venture further and further away from the bar.

Gould was a palaeontologist who focused on invertebrates and undoubtedly directionless meanderings is what most characterises the lineages he observed in the fossil record. No one in evolutionary biology doubts the random paths nor the contingent aspects of the evolutionary process but Gould denies that the increase in size and complexity that is also apparent in the fossil record is actually adaptive. Gould cites the billion year reign of the bacteria as life's sole representative as evidence that there is no inexorable push toward size or multicellularity yet we know that there were constraints in the environment of early earth that favoured this minimalist approach to existence. It was a change in the environment especially the production of oxygen by bacteria that allowed life to take the next step in the upward journey. The fact that this step was taken after a change in environment and not before undermines Gould's contention that it occurred quite randomly.

LIFE IS PROGRESSIVE ON ITS OWN TERMS

Gould thought his ideas of life as a random walk were very much in the spirit of Darwin and certainly Darwin did argue that there was no transcendent law of progress in nature. He was very much aware of the unexpected turns and opportunistic innovations that characterise evolution. Yet he thought the struggle for existence forced adaptations and counter adaptations that were progressive in their own terms (Shanahan, T. 1999). Not surprisingly Gould's old nemesis Richard Dawkins pointed out the error of Gould's logic in a review of another Gould book on contingency of nature called *Full House*:

> Gould is wrong to say that the appearance of progress in evolution is a statistical illusion". If we take 'evolutionary progress' to mean 'a tendency for lineages to improve cumulatively their adaptive fit to their particular way of life, by increasing the numbers of features which combine together in adaptive complexes', then we will see that 'adaptive evolution is not just incidentally progressive, it is deeply, dyed-in-the-wool, indispensably progressive.[7]

The dynamic relationship of an organism and its environment is epitomised by what has come to be called the Red Queen effect (van Valen, L 1973).. The most salient feature of the environment for most organisms is other organisms. Organisms are constantly engaged as predator or prey, competitor or cooperator, parasite or host. These mutualistic and antagonistic relationships

[7] Dawkins, R. 1997. Human chauvinism. *Evolution* 51(3) p.1015

are constantly changing and require a move for each counter move. The result is comparable to the Red Queen in Alice in Wonderland who proclaims that she must run as fast as she can to stay in place. The most common examples of this shifting evolutionary landscape are the arms races that one often sees in the fossil record (Dawkins, R. & Krebs, J. R. 1979). For instance there is a constant increase in the cranial capacity in mammalian predators and prey during the last evolutionary epic presumably caused by a coevolutionary relationship. The Red Queen effect has also been evoked to explain the explosion of life forms at the beginning of the Cambrian Period.

LIFE IS INHERENT ON ITS OWN TERMS

The problem of purpose is ever central to the question of evolution. Darwin was convinced that the process of evolution could be explained in a strictly materialistic fashion without resorting to a transcendent goal or teleology. In fact to resort to divine purpose was tantamount to giving up on explanation in a fundamental way. Yet biology is a science whose explanations are centered around purpose and its language is riddled with references to structure and function that imply a teleology. .J.B.S. Haldane famously quipped: 'Teleology is like a mistress to a biologist: he cannot live without her but he's unwilling to be seen with her in public.' [8]This aversion to being associated with anything that implied a causality that was not based on material phenomenon resulted in the creation of the word teleonomic by C.S. Pittendrigh in 1958. The word was clarified and further defined by Ernst Mayr to mean "systems operating on the basis of a program coded information" (Mayr, E 1976). This convolution provoked the philosopher of science David Hull to complain: "Today the mistress has become a lawfully wedded wife. Biologists no longer feel obligated to apologise for their use of teleological language; they flaunt it. The only concession which they make to its disreputable past is to rename it 'teleonomy'."[9]

Yet does the change in language really change the metaphysical implication of teleology? Purpose is always derived from some purposeful entity. We have already seen that entities emerge from but are not reducible to lower order phenomena of which they are composed. If higher entities emerge from lower entities why shouldn't higher orders of purpose emerge from lower orders? It should be noted that this is a phenomenological explanation rather than a metaphysical one but it points to the question of inherency in the evolutionary process. If rather than a totally contingent

[8] Mayr, E 1976 *Evolution and the diversity of life*. (Cambridge, MA: Belknap) p. 392.
[9] Hull, D.L., 1982. Philosophy and Biology in *Contemporary Philosophy, A New Survey, vol. 2: Philosophy of Science* G. Fløistad, (Ed.) (The Hague: Martinus Nijhoff) p. 280

and random phenomenon evolution has an inherent structure then the difference between teleological and teleonomic becomes mote. If emergent entities are the inevitable products of the evolutionary process then evolutionary direction becomes a kind of destiny. Simon Conway Morris, a notable palaeontologist claims that convergence which is rampant in nature points to just such a deep structure in the evolutionary process. (Conway Morris, S. 2003; Conway Morris, S. 2005)According to Conway Morris:

> The central point is that because organisms arrive repeatedly at the same biological solution, the camera-eyes of vertebrates and cephalopods perhaps being the most famous example, this provides not only a degree of predictability but more intriguingly points to a deeper structure to life, a metaphorical landscape across which evolution must necessarily navigate.10

Rather than a random walk, the process of evolution is better described as a search for islands of stability in the adaptive landscape. The fact that organisms arrive quite independently at these same island niches gives evidence that this landscape has a definite structure that is independent of the organisms that transverse it. Like the camera eye, adaptations exist as logical structures based on the physical properties of the environment. A metaphor of the Morris Water Maze from experimental neuroscience comes to mind. A rat is dropped at one end of a pool of watercoloured white to conceal a platform placed at some point in the pool. The purpose of the experiment is to test the ability of the rat to learn from visual cues that are placed around the pool. In the initial trial, the rat's path to the platform is quite random but in later trials the rat is able to swim directly to the platform. In evolution the path toward some adaptive island resembles the inexperienced rat since there can be no foreknowledge but this does not mean that finding the island is accidental. Organisms have evolved capacities for change that search out strategies for survival. As Dawkins himself has pointed out, organisms have evolved the capacity to evolve (Dawkins, R. 1989). In systems theory these islands of stability are called attractors and complex systems are able to navigate adaptive landscapes to mount these high points of fitness.

Some points of evolutionary stability are portals that lead to a vast array of evolutionary opportunities. There are many transition points in the history of life that offer such a quantum leap. The evolution of wings is an example of such an evolutionary innovation that allowed for further diversification. According to Conway Morris flight evolved independently overtimes. Not all

[10] Conway Morris, S. 2005 The Boyle Lecture : Darwin's Compass: How Evolution Discovers the Song of Creation p. 2

major transitions are convergent but there is reason to think that certain structural necessities of life determine them. On a larger level John Maynard Smith and Eros Szathmary (1995) list eight major transitions of life: replicating molecules ==> populations of molecules in compartments; independent replicators ==> chromosomes; RNA ==> DNA and Protein; prokaryotes ==> eukaryotes; asexual clones ==> sexual populations; protists ==> animals, plants, fungi; solitary individuals ==> colonies; primate societies ==> human societies. Some of these evolutionary events probably happened just once or at least only one lead to the common lineage of life. While the path towards these portals might have been long and torturous in each case the physical structure of the environment prepared and preadapted organisms for this transition. Obviously arriving at the lower level was a prerequisite to proceeding to the next level. While there was no inevitable path from one level to another there were necessary structures that had to evolve which allowed organisms to enter the next level. Rather than a predetermined pathway, evolution might be pictured as a series of levels with portals between connected by adaptive ladders. The paths of organisms at any one level are indeterminate and contingent but the portal is structural to the environment. Convergence occurs when there is more than one portal that accesses the higher level.

Certainly the most difficult transition to explain is the first one, the origin of life from non life but equally intriguing from the perspective of this essay is the rise of human consciousness. Gould is very adamant that such a phenomenon is quite accidental and even Conway Morris seems to think that it is such an unlikely event that we may be alone in the universe. However humans are not unique in possessing intelligence and there is a general trend in evolution toward greater intelligence from the beginnings of cephalisation in invertebrates to the progressive advancement in cranial capacity of mammals. To ignore the obvious adaptive advantages of intelligence seems slavishly wed to a pretentious and false objectivism. We do not know if human like consciousness could evolve from any other evolutionary path way but certainly self consciousness has arisen at least three different times in rather disparate organisms (Conway Morris, S. 2005; Clayton, B.N. & Emery, N. 2004; Gallup, Jr., G.G et al 1995). Conway Morris cites experiments that show complex social organisation and self consciousness as exemplified by mirror self recognition has evolved in Primates (Chimpanzees and Humans), Cetaceans (Porpoises and Killer Whales), and Corvids (Crows, Jays, Magpies, etc.). The human lineage has also been shown to be much more of a branching affair than a linear progression with parallel evolution occurring in some branches.

The latest discovery of *Homo floresiensis* (nicknamed a hobbit) which lived in Indonesia up to 12,000 years ago reveals a tiny very anatomically primitive hominid which apparently possessed culture and perhaps even language (Falk, D et al 2005).

There is a smug presumption in the scientific community that any implication of specialness on the part of humans is hubris which scientific objectivity dispels. There is the usual recitation of shifts of centrality from the earth to the sun to the galaxy and onward to multiple universes but modesty is not evidence. We can't presume that evolution inexorably lead to consciousness but the very process of natural selection and the deep structures of the adaptive landscape revealed by convergences make this a not unrealistic hypothesis. Yet being an inevitable outcome is not the same as being a planned outcome. While Conway Morris doesn't go so far as offering this as proof of divine providence even his implication of circumstantial evidence is a total non sequitur. If we have learned anything from Darwin we should realise that design does not necessarily imply a designer. There may indeed be a kind of mystical aspect to evolution in the sense that Einstein used this word to describe the ordering of the universe that we can't fully grasp but this does not necessarily imply a supernatural presence.

However, evolution does offer a purpose if we wish to embrace it. Julian Huxley pointed out that evolutionary process has all but ceased to invent major new adaptations.

> Evolution is thus seen as a series of *blind alleys*….That of the echinoderms, for instance, reached its climax before the end of the Mesozoic. For the arthropods, represented by their highest group, the insects, *the full stop* seems to have come in the early Cenozoic: even the ants and bees *have made no advance* since the Oligocene. For the birds, the Miocene marked the end; for the mammals, the Pliocene.[11]

According to Huxley, humans represent the final and last source of evolutionary progress. It is both our duty and our responsibility to assume this burden of maintaining and extending this great legacy of life. Huxley coined the term transhumanism as meaning a furtherance of human evolution but I think the word today might better imply a recognition that humans are stewards of a process and a legacy that proceeded them and will go beyond them.

RELIGION AS A SEPARATE REALITY

The prospect that evolution should be considered anything other than a random contingent process is held in great disdain by many scientists who are atheists and not a few scientists who are

[11] Huxley, J. S. 1942 *Evolution: The Modern Synthesis*, (London: Allen and Unwin) p. 571

practising believers. Some like the Nobel Laureate Stephen Weinberg observe (Gantz, J 2000): "The more the universe seems comprehensible, the more it also seems pointless." This perspective is at least internally consistent in that it postulates no point other than what can be ascertained by observation of the material universe. However, a commonly held position that is more compromising if less consistent holds that even though science shows the evolution of life to be wholly random and contingent, science and religion are perfectly compatible because they are simply talking about two entirely different things. This perspective has most recently been associated with Stephen J. Gould but it dates to at least John Henry Newman and is apparent in many other writers on science and religion including Kenneth Miller (Miller, K.R. 2000), Francis Collins. It should be added that this is also essentially the policy of the National Academy of Science (National Academy of Science 1999). Gould states this view succinctly in his book Rock of Ages (Gould, S. J. 1999):

> Science tries to document the factual character of the natural world, and to develop theories that co-ordinate and explain those facts. Religion, on the other hand, operates in the equally important, but utterly different, realm of human purposes, meanings, and values—subjects that the factual domain of science might illuminate, but can never resolve. Similarly, while scientists must operate with ethical principles, some specific to their practice, the validity of these principles can never be inferred from the factual discoveries of science.[12]

But do these non-overlapping Magistra as Gould calls them actually coexist so logically? Certainly religious beliefs can be reinterpreted to avoid conflict with scientific fact and this constant giving of ground has typified religious accommodation over the last two hundred years or so. Even fundamentalists will admit that the four corners of the world referred in the Bible is metaphoric though it undoubtedly wasn't when it was written. Yet despite these appeasements most religions find it difficult or impossible to fully comply with Gould's restriction to stay out of the business of defining physical reality. Supernatural intervention into the everyday affairs of humans is a constant theme of religion and most religious people petition the Lord with prayer for just such an intervention. If a single prayer could be ascertained to be answered, it would change everything we know about causality in the universe. Even if religion is narrowly defined as human purposes, meanings, and values as Gould would have it, the world of facts is relevant beyond mere illumination. Human purpose, meaning and value cannot be divorced from the facts of how

[12]Gould, S. J. 1999. *Rocks of ages: science and religion in the fullness of life*. (New York: Ballantine Publications) p. 4

humans evolved and the nature of physical reality. Humans have theories of reality which are shaped by our social and physical environments. We experience reality as a unity and it is not subject to convenient divisions.

CONCLUSION

Constructing a rational theology consistent with naturalism is an ongoing project that has been undertaken from many quarters both in the scientific community and religious community but it is hampered by a lack of appreciation of the reality of God as experienced by religious people by scientists and the lack of commitment to rigorous standards of truth on the part of the religious. Scientists must abandon the dogma of a reductionism that is no longer even supported in the physical sciences and a morbid nihilism that may appeal to a romantic notion of heroic fatalism but is not supported by real observation. Theologians must abandon the pretence that knowledge of the universe in which we reside can come about from any other method than rational empiricism. Both scientists and theologians must put away the comfortable notion that they can somehow function in separate universes where different metaphysics apply. If God exists, God must exist in the material world because that is the only world that exists. Interestingly a material conception of God is probably closer to the Biblical view of God than the abstract theological view that has evolved from a fusion of Jewish monotheism and Platonic idealism (Murphy, N. 2006). The preponderant idea of God in both the New and Old Testament and in the Korean as well as Hinduism is one of entity. This is also how most religious people experience God in their daily lives.

From a biological perspective an entity need not be composed of a single individual. Entities emerge during the course of evolution from the amalgamation of subordinate entities. The eukaryotic cell is an amalgamation of subordinate prokaryotes. Multicellular organisms are composed of subordinate cells which are thought to have evolved from colonies of cells. Communities of organisms exist in varying degrees of integration of individuals into an entity. It has long been speculated that humans participate in a similar kind of super organism. No less an evolutionary materialist than J.B.S. Haldane proposed just such a superorganism (Haldane, J.B.S 1935).

> So the superhuman, if it existed, would be nothing external to man, or even existing apart from human co-operation. But to my mind the teaching of science is very emphatic that such a Great Being may be a fact as real as the individual human consciousness, although,

> of course, there is no positive scientific evidence for the existence of such a Being. And it seems to me that everywhere ethical experience testifies to a super-individual reality of some kind. The good life, if not necessarily self-denial, is always self-transcendence.[13]

Such a view of God is eminent and emergent rather than outside of and beyond the material world. It is a living, evolving Being rather than a supernatural abstraction. One might retort that such an entity isn't real because it must lack an individual consciousness but a tree is certainly a real organism and also lacks a consciousness as far as we know. I also think there is a great deal about consciousness and communication that we don't understand. We exist in a social matrix where our thoughts and feelings are not autonomous but are handed down to us and bubble up in us from our social surroundings. Whether we want to be or not we are components of a greater whole. In some sense the existence of God is no more in question than the existence of France. The real question is: how does God exist?

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