WHAT IS NATURAL SELECTION? A PLEA FOR CLARIFICATION

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This article is born out of a desire for clarification.

Any compelling theory must carry with it a clear statement of the assumptions upon which it is constructed. Many important theories or 'big ideas' have become so successfully grafted into the mainstream belief system of society that people increasingly accept them as 'received wisdom' with little appreciation of the intellectual struggle that gave birth to their formulation - rather like inherited wealth! If the concept of truth is to be valued then it is vitally important that we have an appreciation of its intellectual pilgrimage.

Modern Darwinism or neo-Darwinism is one of these big ideas that has become mainstreamed in our contemporary materialistic culture. Many view it as providing the only scientifically coherent and satisfying explanation for the living world. Let me say right at the outset that I have no wish to defend an anti-evolutionary view of life. I have no difficulty in accepting an ancient earth. I have no difficulty in accepting that organisms have increased in sophistication over many millions of years and that there is evidence for the interconnectedness of the living world. Science has inferred from a huge body of observations that life appeared as blue-green algae around 3 billion years ago, complex animals around 1 billion years, mammals 200 million years and humans perhap 1 million to 100 thousand years ago. Evolution seems to have occurred in the straightforward sense that life-forms have appeared, and mostly in bursts, over a vast time scale.

But the apparent *fact* of life's evolution must not be confused with the *cause* of evolution – this is a quite different issue. As far as I can see the question of whether life has evolved over time is very largely a scientific one that need carry no philosophical/religious implications unless one holds to the view that ancient sacred writings such as the early chapters of Genesis are specifically addressing issues of a primary scientific nature. This is probably at the heart of the creation science versus evolution controversy and it continues unabated in many parts of the Western world. I have no wish to discuss this particular issue here except to say that it is probably unwise to place the rich imagery of Genesis 1 and 2 with its obvious theological intent, in the same literary genre as that used to describe the findings of modern science.

As to *how* evolution might have occurred, modern Darwinism or neo-Darwinism is the materialist's answer to this fundamental question. Neo-Darwinism is, in essence, a synthesis of key elements that have been developed, debated and modified since the time that Charles Darwin formulated his own theory of evolution. Darwin's main thesis was the transformability of species – 'descent with modification'. Darwin in England in 1859, and almost simultaneously Alfred Russel Wallace on the opposite side of the world, proposed that this transformability of the entire living world arose from the interplay of three principles:

(1) that all forms of life varied slightly;
(2) a conserving but mysterious mechanism operated whereby similar characteristics of form are transmitted from one generation to another;
(3) the living organism is faced with a struggle as it pits itself against its immediate environment. Those variants of a given species that cope best survive and reproduce, and, as a consequence undergo organic change through subsequent generations - *i.e*. they evolve.

Thus we have the full title of Darwin's monumental work - *The Origin of Species by Means of Natural Selection*. Wallace had quite independently arrived at virtually the same idea as Darwin and outlined his theory in an essay titled *On the Law Which Has Regulated the Introduction of New Species*.

Darwin believed he had discovered in natural selection the very mechanism that would explain what previously had required a transcendent cause. He wrote:-

> It may be said that natural selection is daily and hourly scrutinising, throughout the world, the slightest variations; rejecting those that are bad, preserving and adding up all that are good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life. (p. 84)

He was acutely aware of the potential confusion conveyed by the expression 'natural selection', and sought to reassure his readers that it did not imply conscious choice or the active power of God. He went so far as to say that in a literal sense it is false:-

> Some have even imagined that natural selection induces variability, whereas it implies only the preservation of such variations as arise and are beneficial to the being under its conditions of life. . . . In the literal sense of the word, no doubt, natural selection is a false term. (p. 81)

Unknown to Darwin an obscure Augustinian priest, Gregor Mendel, had unraveled the main principles of inheritance but his remarkable experiments remained largely unnoticed until the Dutch botanist Hugo de Vries in 1900 alerted the world to their profound significance. De Vries himself had conducted a huge and painstaking series of breeding experiments with the evening primrose and established the undeniable fact of mutation—that sudden discontinuous changes may arise spontaneously to produce new, stable organic forms.

It was left to the mathematical biologists in the earlier part of the 20th century to find a way of integrating into a single unified theory Darwinian natural selection, Mendelian inheritance, the mathematics of the gene pool, and mutation as the ultimate source of new genetic material. This was the grand synthesis known today as neo-Darwinism or the modern theory of evolution.

Just as Darwin rejected any thought that natural selection was anything more than a purely impersonal mechanism by which variations in a species are systematically gathered up to produce a gradual increase or evolution in complexity, so also the neo-Darwinist asserts that natural selection is the wholly material process whereby the evolution of life has taken place.

Within mainstream neo-Darwinism there are two slightly divergent views about the mechanism of evolution. One view, one we might conveniently label as establishment neo-Darwinism, sees evolution as driven by factors involving competition for reproductive success among organisms of the same species within local populations in a given environment. Natural selection is seen as acting on genetic variation arising from largely random mutations within this population. If these mutations are beneficial, i.e. they result in advantageous modification to the organism within that environment, they are selected. If they are neutral they are tolerated and thus accumulate. And if they are negative they are selected against, or eliminated. In this view the external environment plays a somewhat subsidiary role with a slow, steady, progressive evolutionary change being brought about within lineages by the action of natural selection.

However, establishment neo-Darwinism could not resolve satisfactorily the acknowledged historical ‘pattern in the rocks’. What stands out is the lack of slow, steady, progressive evolutionary change – a quite noticeable absence of gradual morphological change over time. Instead, the rocks reveal an apparent stability of species, their largely unchanged persistence over vast periods of time and then relatively rapid periods of speciation. Further, these speciation

events appeared to occur across a large number of different lineages or genealogies and are seemingly triggered by major physical events on the earth (Eldredge, 2000, Ch. 6).

Revisionist neo-Darwinism therefore acknowledges the essential role of natural selection in evolution but asserts that it is crucially linked to major physical events external to the organism. In Eldredge's words:

> "the physical world is more than a backdrop to the evolution of life. The physical world changes in a regular, intelligible manner. And those changes have had profound effects on the evolution of life." (p. 174)

These physical events or "ecosystemic shocks" are known to have occurred through, for example, tectonic plate movements that can massively disrupt well established ecologies. Again, quoting Eldredge:

> "The stronger the shock, the more devastating the ecosystemic degradation. The more devastating the degradation, the farther up the taxonomic ladder the removal of packages of genetic information. The higher that level of removal, the more different the remaining genetic information to reshape the diversity of life once the extinction vector is dampened. And the greater the disparity in genetic information from what had once shaped the ecosystems of the world, the more different the new components, hence the new ecosystems, will be. That's the sloshing-bucket model of interactions between the two hierarchies. That to me, in a nutshell, is how life evolves." (p. 170)

What Eldredge is emphasizing is a mechanism for producing a resource of genetic material in a population which is sufficiently altered from that of the original interbreeding community and upon which natural selection can act so as to bring about major evolutionary innovation.

Whether one is an establishment or revisionist neo-Darwinist, both seem agreed that at the very heart of the process is the mechanism of natural selection. But what really is natural selection? The materialist is quick to point out, as did Darwin (see earlier quote), that despite the implied meaning of the expression 'natural selection' it is not a purposeful process. It is not directed in the sense that there is some intended plan or evolutionary agenda that is being followed. Nature, it is argued, does not *plan* in the sense that a mind might plan and the popular reasoning goes something like this: each animal varies slightly and many of these differences are controlled by genes and thus can be transmitted to their offspring. If there is competition for limited resources, and if some individuals happen to carry genes that give them even a slight degree of advantage in a local situation, then those individuals may have a slightly better chance of producing surviving offspring than others. In the next generation there will be slightly more individuals carrying these beneficial genes and so, in subsequent generations, the best genes tend to accumulate in the population's gene pool. Importantly, in neo-Darwinism the ultimate origin of this genetic variation is seen to be random. It has nothing to do with an individual's needs; it is simply that there is a change in the gene frequencies within a species population arising entirely from this 'natural' sieving process. Thus, species are said to evolve without the influence of any external guiding principle.

Darwinian natural selection as outlined above is completely different to what could be termed intelligent or 'cultural' selection. The former is seen to be a consequence of differential reproductive success of individual organisms over many generations whereas the latter arises from the creativity and selection of ideas and actions of human minds. This distinction is perhaps best illustrated by Richard Dawkins' in his book *The Blind Watchmaker* (1988) with his dismissal of William Paley's classic analogy. Paley asks his readers to imagine being out walking on a heath and stumbling upon an object - a watch - and concluding that, unlike finding a stone, this watch must have had a designer – a watchmaker. Dawkins writes thus:-

> Paley's argument is made with passionate sincerity and is informed by the very best scholarship of his day, but it is wrong, gloriously and utterly wrong. The analogy between telescope and eye, between watch and watchmaker in nature is the blind forces of physics, albeit deployed in a very special way. A true watchmaker has foresight: he designs his cogs and springs, plans their interconnections, with a

> future purpose in his mind's eye. Natural selection, the blind, unconscious, automatic process which Darwin discovered, and which we now know is the explanation for the existence and apparent purposeful form of all life, has no purpose in mind. It has no mind and no mind's eye. It does not plan for the future. It has no vision, no foresight, no sight at all. If it can be said to play the role of watchmaker in nature, it is the *blind* watchmaker. (Dawkins 1988, p. 5)

Much the same idea is articulated by the evolutionary biologist John Avise who appears to view the role of natural selection as almost sacral:-

> Only natural selection comes close to omnipotence, but even here no intelligence, foresight, ultimate purpose or morality is involved. Natural selection is merely an amoral force, as inevitable and uncaring as gravity. (quoted in Larson and Withim, 1999)

The ordinary person reading the above two quotes could hardly be blamed for feeling confused as to what these writers are really trying to say. All too often the narratives and images employed by the materialist convey impressions that appear to conflict with their declared materialism. In the interests of intellectual integrity it is surely important that the proponents of scientific materialism make absolutely clear in the language that they use to articulate their particular philosophy of life that it really is constructed from physico-material ingredients alone, untainted by any extra-material dimension.

Dawkins' explanation of how the eye could have evolved illustrates the above issue exactly. He argues that under the sieving action of natural selection there is a continuum of seamless development by tiny gradual steps from a simple light-sensing layer of pigmented skin cells right through to a sophisticated focusing eye (Dawkins 1988). We should note that this is precisely what Darwin had proposed some 130 years earlier:-

> . . . if numerous gradations from a simple and imperfect eye to one complex and perfect can be shown to exist, each grade being useful to its possessor, as is certainly the case; if, further, the eye ever varies and the variations be inherited, as is likewise certainly the case; and if such variations should be useful to any animal under changing conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, should not be considered subversive of the theory. (Darwin p. 167)

This is, of course, how many of our own technologies advance – small steps of improvement leading eventually to a better product or system.

One argument often raised against the kind of gradualism described by both Darwin and Dawkins is that a highly complex, integrated organ such as the human eye could not have evolved by a step-by-step process. Rather, it must have required the coordinated integration of all its parts, their evolving in synchrony, so as to produce the fully functioning organ. Dawkins dismisses such an objection as totally groundless:-

> Vision that is 5% as good as yours or mine is very much worth having in comparison with no vision at all. (Dawkins 1988, p. 81).

and:-

> A simple, rudimentary, half-cocked eye . . . is better than none at all. Without an eye you are totally blind. (p. 41)

The above two statements by Dawkins are, of course, correct. Few would disagree that a poor eye is better than no eye at all. But Dawkins is, I believe, confusing the real issue for he also says

> . . . part of an eye is better than no eye at all. (p. 85)

and

> An ancient animal with 5% of an eye . . . used it for 5% vision. (p. 81)

Recalling that the issue is about trying to explain how to get an improved eye, then both of the last two statements by Dawkins are clearly incorrect. He fails to distinguish between a crude eye that actually sees (however crudely) and something that represents just part of an eye that of itself is incapable of seeing anything. Even the crudest or most primitive eye is an achieving system, i.e. it *sees* to some limited degree (hence we call it an eye)**.** But part of an eye is not a going concern and therefore cannot be placed within a seamless continuum of increasing seeing function (i.e. as in both Dawkins' and Darwin's gradualism) which could be open to selection. Sight like flight is an achievement. Poor sight, just like the Wright brothers' first 12-second flight (we might call it primitive flight) is an achievement. But neither a part of an organ of sight or a component of an aeroplane can be classed as systems that achieve, respectively, either sight or flight.

However, there is a real sense in which Dawkins is correct, but at the expense of surrendering his materialistic principles. In terms of achieving sight, part of an eye *certainly is* better than no eye if one is actually *aiming* to produce an eye. But note now that a crucial, non-material goal is required to be inserted into the explanatory equation – the achievement of sight must now be *deliberately sought*.

In case I am accused of misrepresenting Richard Dawkins' real intentions it is instructive to examine his account of eye evolution in his more recent book *Climbing Mt Improbable* (1996). He exploits a computer model devised by two Swedish biologists Dan Nilsson & Susanne Pelger (1994) which 'evolves' a virtual eye object from a flat layer of virtual cells sandwiched between virtual pigmented and transparent layers. The virtual model works by producing at random small percentage changes in the degree of curvature of the sandwich, in the size of a light-restricting aperture, and in the local value of its refractive index (light-bending ability). The computer is programmed to perform a simple calculation of the sandwich's focusing or resolving power every time a random change (read virtual mutation) occurs in any of the three variables.

In a relatively small number of generations the computer model is shown to transform the flat sandwich layer through continuous minor improvements into a configuration representing a virtual, focused eye lens-shaped object. Dawkins argues that this transformation is exactly analogous to climbing the mountain of biological complexity:-

> Going upwards means mutating, one small step at a time, and only accepting mutations that improve optical performance. So, where do we get to? Pleasingly, through a smooth upward pathway, starting from no proper eye at all, we reach a familiar fish eye, complete with lens. (p. 151)

One can see that Dawkins' supposedly wholly material explanation is anything but material. He is required to impose a non-material constraint on the behaviour of the eye model - he inserts the crucial condition of "only accepting mutations that improve optical performance." Or, in terms of his mountain-climbing analogy, one must aim for the summit. Thus, in order for his model to transform into a symbolic eye object he is required to introduce a profoundly *purposeful* dimension.

In fact, intentionality is woven right through the fabric of Dawkins' Darwinism, but in various forms of disguise (ch. 4). Consider for a moment his attempt to explain the evolution of insect flight where 'proto-wings' would not have provided useful lift unless they were already of a substantial length. Dawkins does admit that a different kind of explanation may be required to avoid any reliance on large single-step mutations in order to achieve some functional advantage that may be open to selection. He argues that the first insect wings, though useless for flight, may have been pre-adapted for a completely different purpose, perhaps furnishing the animal with heat-gathering solar panels. Darwinian selection might then have acted to increase gradually the length of these `wing stubs' thus providing a smooth gradient of improvement

in solar heating performance for the insect. This increased size, he argues, would then have been exploited perhaps much later in evolutionary time for the very different purpose of flight.

Similarly Dawkins argues that feathers in birds may have evolved not initially for flight but for thermal insulation, or possibly as a kind of net for catching insects. Flapping movements might have come originally from the need for a tree-leaping animal to develop some degree of control over pitching and rolling movements, this being achieved by some kind of arm flapping, and evolving eventually into 'winged' power.

Although superficially plausible, Dawkins' attempted sideways diversions do nothing to get round the fundamental issue the materialist so desperately seeks to avoid - that all-important element of intentionality or purpose in the living world. The 'evolutionary diversion' explanation merely shifts the problem into a different biological realm: for even if it could be shown that wings did evolve originally as thermal panels Dawkins is still required to express the gradual increase in wing length in intention-laden language - they "become better solar panels". But why, we might ask, should anything in a wholly impersonal material world want to "become better" or improve?

He similarly speaks of muscular movements in 'proto-flying' animals that were used "to control glide direction, so average time to landing was postponed over evolutionary time". In discussing the flying squirrel with its special membranes of skin stretching from wrists to ankles he argues that its evolutionary ancestor possessing even a very slight flap of skin would have been able to leap that little bit further and in a critical situation "save its life". But such intention-laden language is surely a blatant contradiction of the materialistic assumption that lies at the very core of Dawkins' neo-Darwinism. All of the examples that he provides express that essential drive of the organism to achieve, to improve some aspect of its performance, to become! Dawkins' materialism does not describe a world where natural selection reigns as a "blind, unconscious, automatic process".

It is worth noting here that sideways diversions which turn out to be advantageous are not uncommon, but they all require that intensely personal element of discernment, that ability to sense whether a particular innovation might have use for something else. The space race illustrates how technologies developed originally for the exploration of space have been exploited to advantage in many earth-bound situations; and always because their usefulness has been recognized by a conscious mind.

One other example from Richard Dawkins should reinforce the point I am trying to make. He acknowledges that his computer-generated biomorph model of evolution which he developed in his book *The Blind Watchmaker* involved an artificial form of selection - the human eye (I have critiqued his biomorph analogy in some depth in my own book *How Blind is the Watchmaker?* 2001). As a way of simulating natural selection Dawkins introduces in *Climbing Mount Improbable* (1996, ch. 2) his spider web-making computer model – NetSpinner. The computer is programmed to generate (i.e. evolve) a sequence of webs using web-making rules whose details are varied according to 'genes' (numbers in the computer memory) which can mutate by altering their values slightly at random in passing from generation to generation. There will be 'genes', for example, that control the angle between radial spokes and thus their number etc. The computer then 'fires' an identical array of randomly positioned 'flies' at the sequence of 'evolved' webs and counts how many catches each web makes minus a cost function based on the length of 'silk' used in its making. Here, he claims, is a model of natural rather than artificial selection which is seen as guiding evolution in the direction of "improved efficiency" (p. 54) in which the efficient compromise is found between fly-catching ability and economic considerations.

In fact, precisely the same criticism of artificial directedness can be raised against the WebSpinner model. In a truly impersonal, material universe nothing of intent is aimed for. Things just are, boringly and unthinkingly so, full stop.

But in Dawkins' web-making analogy everything is set up to achieve certain strategic ends. Flies are to be caught. Silk is not to be wasted. These are surely deliberate and thus artificial, as opposed to natural (i.e. material), ends.

Naturalism or scientific materialism claims to have explained living complexity in wholly material terms. Natural selection is viewed as the impersonal force driving life's stupendous unfolding but at almost every point in its arguments it lapses into a kind of personified, anthropomorphized depiction of nature, giving minds to molecules, which they do not appear to have. I argue that this is not merely a stylistic convenience that can be discarded when scientific rigour is required, but is rather an implicit admission by the materialist that life transcends the laws of physics and chemistry, and thus requires a higher level of explanation.

So this is the predicament that confronts naturalism: it desperately needs something more than what the unthinking, undirected forces that an entirely material universe can provide. But it dare not admit to this in public. In private, however, barely disguised in the images, narratives and metaphors it is compelled to use, it betrays this desperate need for a non-material or transcendent guiding principle in order to provide a coherent science of life. Both Dawkins' mountain-climbing analogy of eye evolution and his web-spinning model illustrate materialism's dilemma exactly.

Many, no doubt, will rally to Dawkins' support arguing that he is simply using this personified language in a purely analogous sense to illustrate how the impersonal process of natural selection actually works. In other words Dawkins' use of such expressions as "improving optical performance", "aiming for the summit" or NS finds the "efficient compromise" is merely a convenient pictorial way of showing that an apparently purposeful end is actually achieved by an entirely material process that we call natural selection. They would argue that it was certainly never Dawkins' intention to construe NS as anything but an entirely blind, unconscious, purposeless process. But if Dawkins is simply using intention-laden language in a purely poetic, metaphorical sense then it should equally be possible for him to lay out his neo-Darwinism in straightforward language that scrupulously avoids any hint of misinterpretation. He seems reluctant or unable to do this.

Even if it really is the case that the above noted purpose-laden language is being employed merely as a convenient literary tool for getting across to the reader the way that NS works in a genuinely impersonal, material sense (and I do not believe this is the case), there remains a more fundamental criticism and it concerns the 'fine print' behind the stark impersonal descriptions of the material basis of evolution. Consider again the basic elements of the theory that I summarized a little earlier. Read any neo-Darwinist's summary of how natural selection is supposed to work and you will find Darwin's own words quoted to remind us just how straightforward the process is. For example Eldredge, in asking why it is that physicists appear to have such difficulty with the simple notion of NS, freely quotes from Darwin's *Origin*:

> As many more individuals are born than can possibly survive; and as, consequently, there is a frequently recurring Struggle for Existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected*. (quoted in Eldredge p. 89)

And as if to press home the point that of all people physicists should have the least difficulty with this central dogma, Eldredge even remarks that the concept of natural selection is hardly more complicated than the well known kinematic equation F=MA! But statements like this, while having some emotive impact, are hardy helpful in resolving the fundamental question – What is natural selection?

Even if we avoid any suggestion that NS selects in a purposeful or directed sense, and define it simply as the summation of a set of completely impersonal (mindless) processes, there remain major conceptual contradictions embodied in the very core of the theory. Firstly, the process of NS assumes factors that defy purely material description. Every orthodox

Darwinist speaks of the accumulation of *useful* characters. And if it be asked - Why are they useful? – invariably the response will be - because they give the organism a selective advantage in the "business of staying alive and making a living, procuring nutrients and food (that is, energy resources), and avoiding predation (including infection by pathogens)" (Eldredge p. 163), and thus achieving reproductive success under the pressure of competition.

But then we need to ask - Why should an organism feel the need to procure, to avoid predation, to reproduce? Why not simply 'go with the flow' of an unfeeling material universe and be that bit of aimless matter, stripped of any ambition or desire to achieve? Unfortunately for the materialist the facts of biological existence tell a very different story. The living organism is not simply a complex extrapolation of mindless matter. It demonstrates a profound sense of destiny, it wants to become, to realize its full potential, it is task-oriented, it demonstrates myriad attributes that defy explanation in wholly material terms. And it won't do for the materialist to dismiss this as merely apparent purpose. There is nothing apparent about it - it is real, observable behaviour.

In a recent article Robert Mann (2001) challenges modern evolutionary biology to take seriously the need for realistic explanations that acknowledge the primal role of *final* cause instead of clinging to a crude scientism that asserts nothing more than material causes dishonestly dressed up in goal-laden language. Neo-Darwinism when it asserts that life has evolved by NS, i.e. by wholly material means, is in my view committing a major category blunder. In effect, it is the biological equivalent of claiming that the existence of, for example, an internal combustion engine can be accounted for, or brought about by, or *caused* by the material laws that govern the formation of the iron (steel) crystals constituting the material from which the engine is made. I will return again to this analogy.

So far this paper has referred only to what I have loosely labelled establishment and revisionist Darwinism. There is, however, another strand of evolutionary thought that remains deeply rooted in the main elements of modern Darwinian theory but which also acknowledges its explanatory inadequacies. In his book *The Living Stream* Alister Hardy offers the reader a glimpse of both his Darwinian orthodoxy but also his recognition of an essential transcendent dimension. Hardy makes a number of important points that would seem to strike at the heart of an all-sufficient Darwinian materialism.

Firstly he expresses his own doubts about *natural* selection and the gene complex as being the only factors in evolution (p. 154). Secondly, he seeks to revive the role of organic selection in evolution (p. 161). The former emphasizes the selection of the animal by the environment whereas in the latter there is a much more creative interaction between the animal and its environment. Hardy suggests that organic selection is possibly of equal or even greater importance than natural selection.

Hardy dismisses as entirely unsupported by the facts of biology the inheritance of acquired characteristics, a universally discredited notion referred to as "Lamarckism". However, he is also concerned to show that history, by and large, has not dealt fairly with what he considers was Lamarck's most important contribution to evolutionary thinking - that changes in the environment can bring about changes in the habits of animals and that it is these changes in habit which can be so important in bringing about evolutionary modification, but not in the way that Lamarck envisaged (p. 155).

Hardy thus revives what he views as a crucial aspect of evolutionary theory, one hinted at by Lamarck but developed formerly nearly a century later by J. M. Baldwin and C. L. Morgan, which is that behavioural modifications arising from an organism's natural plasticity and repeated for several generations may hold that particular modification in an environment where mutations tending in the same direction will be selected and incorporated in the organism's genetic make-up. Here I quote Hardy's own summary description of this process:-

> If a population of animals should change their habits (no doubt often on account of changes in their surroundings such as food supply, breeding sites etc., but also sometimes due to their exploratory curiosity discovering new ways of life, such as new sources of food or new methods of exploitation) then, sooner or later, variations in the gene complex will turn up in the population to produce small alterations in the animal's structure which will make them more efficient in relation to their new behaviour pattern; these more efficient individuals will tend to survive rather than the less efficient, and so the composition of the population will gradually change. This evolutionary change is one caused *initially* by a change in behaviour. (p. 170)

Hardy goes on to emphasize the crucial connection between the emergence of a new habit and what he refers to as "the restless, exploring and perceiving animal that discovers new ways of living, new sources of food . . . ." and draws on the writings of W. H. Thorpe, W. E. Agar and A. N. Whitehead to argue that the living animal should be regarded as an essentially perceiving organism. This concept of perception carries with it "an actively organizing, possibly a purposive, element", a form of "generalized exploratory appetitive behaviour." (p. 172-173)

Hardy describes the behaviour of some of the simplest animals - the Protozoa. The cytoplasm of the amoeba switches to and fro from the "gel" to the "sol" state to achieve its characteristic flowing locomotion, and sends out flowing processes in order to capture and ingest prey; or the "constructional skill" of those house-building Foraminifera that build quite remarkable shelters around themselves from grains of sand. It is as if they are building to a plan, that there is some kind of memory, a psychic life that is intimately related to the mechanical functioning of the body. (p. 227-231)

Employing slightly different language E. W. F. Tomlin (1977) similarly draws attention to this same uniquely purposeful behaviour of the living organism that contrasts strongly with non-living matter or objects. He writes:-

> The organism is poised. It can take measures against the future in a manner denied to an object, which cannot take measures at all. The organism can provide for the future by reproduction or by self-repair following injury while all the time engaging in self-maintenance.

Tomlin describes organisms as "existing in themselves," as "containing their own meaning," whereas a non-living object is merely "possessed" by the external forces which have modeled it.

It needs to be reiterated that Alister Hardy declares himself to be in most respects an orthodox Darwinist. He is not doubting that random mutations of the gene and their recombinations acted on by natural selection is a creative force in evolution. He is, however, calling for a recognition of additional factors that clearly point away from the entrenched physicalism and materialism that has so dominated modern evolutionary biology.

In calling for a renewed recognition of the importance of behaviour and habit as an internal selective force in evolution, Hardy sees the operation of an actual (not apparent) purposeful drive in the living organism. Further, in addressing the issue of the origin of homologous structures (e.g. the equivalent bones in the forelimbs of human, whales, birds and bats) and especially the remarkable stability of such structures within a species, Hardy questions whether the conventional Darwinian explanation of selection by the environment, and especially with its large degree of heterogeneity (we might even add, its bland variability), is really sufficient:-

> Can the whole complicated *internal* structure of our chaffinch, for instance, really be maintained – or rather slowly evolved – entirely under the influence of its multifarious *external* surroundings and nothing else? . . . . According to modern mechanistic biology the only "plan" for the intricate homologous "machinery" – for instance, the vertebrate, the arthropod or the molluscan plan – would seem to have been laid down by the variable environment outside. I am perfectly prepared to accept the proposition that the genetic code is handing on from generation to generation the specification for the plan of development of the animal body as determined by an act of selection of one sort or another; I am doubting, however, whether the plan itself is entirely the product of the environment. To my way of thinking, and remembering the great variety of environments which a single species may encounter and the variety of different kinds of animals which may live in the same habitat, such a conclusion seems almost a *reductio ad absurdum*. (p. 214)

Drawing on a substantial body of psychic phenomena Hardy develops the idea that there might be a general subconscious sharing of a form and behaviour pattern (habit) between members of a species. (p. 257) He suggests there are two parallel streams of information, the DNA supplying the varying physical form of the organic stream which is acted on by natural selection, the other being the shared subconscious species behavioural plan of life, i.e. the species design or blueprint. This species 'plan of life' would act as an internal selecting standard in which those that did not meet it would tend to be eliminated by natural selection. Importantly, Hardy suggests that all this has the appearance of a definite mental conception or designed pattern that is outside the physical world and which serves as a template or gauge for selective action (p. 260).

There is, in Hardy's view, too much of mind in the living world to call it mindless. He calls for

> "a truer biology, one which will not sell its soul to physics and chemistry for quick results, will emerge and tackle the more important and more difficult aspects of life about whose nature we are almost as ignorant as when physics and chemistry began. I say more important because in this field lie consciousness, the nature of memory, the feeling of purpose, love, joy, sorrow, the sense of the sacred, the sense of right and wrong, the appreciation of beauty – indeed all the things that really matter in life." (p. 284)

As a scientist with an engineering background who has moved into the biological research world I have often wondered why is it that so many of those working in the biological sciences accept without apparent question wholly materialistic explanations for the living organism. If we think for a moment about the life sciences they all begin with an incredibly rich 'bank account'. Every biologist, by definition, begins with a superb, living inheritance - the fully functioning organism is there ready to greet the curiosity of the investigator. Whether it be a humble bacterium, a fruit fly or a cut finger, the biologist is presented with behaviour that is strangely different from anything seen in the non-living world. It is this innate behaviour that must surely form the essential framework within which any evolutionary process is discussed.

For the biologist the 'default setting' is a world alive. He or she is not required to *make* life, indeed cannot, but as a consequence may be tempted to think that because life cannot be made with the tools of science it has not been made at all. Rather, it has somehow sprung unaided out of the physico-material `black box'.

By contrast, the default setting for the engineer is unshaped raw materials. The engineer is required to think carefully and deliberately about how a particular piece of technology is to be created from these materials. Every act of engineering creativity is a powerful reminder that purposeful systems arise only from the expression of mind. There is no *mindless* evolutionary path from a crystalline array of iron atoms (steel) to a functioning internal combustion engine. Yes, the internal combustion engine has unquestionably evolved with many cleverly executed leaps of technological innovations along the way. But this technological evolution has been driven by the intensely purposeful activity of a conscious agent.

The engineer's creation arises from intellectual effort and deliberate design - what Michael Polanyi might have called a "profoundly informative intervention". Certainly the internal combustion engine relies on strength properties in steel arising directly from the *natural* tendency for iron atoms to arrange themselves in cubic crystalline arrays according to physical principles or laws of physics that are to some extent known and systematised. But the same internal combustion engine is not simply a *product* of these same laws; rather, the engine utilizes these material laws but only in a subservient or secondary causal sense. The primary cause of the engine is its human maker. No amount of mindless adding of individual atoms to an existing crystal of iron, even over the vast eons of time, will give rise to the combustion engine unless there is imposed on this mindless, material process a deliberate shaping strategy with the 'engine idea' clearly in view.

Unlike the engineer, the biologist is never called upon to struggle intellectually to see the living organism brought forth. We don't, indeed we cannot, make living organisms. They are there as a fundamental given. The microbes in the agar-filled petri dish oblige so generously by reproducing at a prodigious rate. We don't even *make* babies; rather, we are given the lesser task of initiating the process. But from here on the magical journey of embryonic development proceeds with exquisite orchestration independent of any significant help on our part.

We attend to a cut finger but only in a crude, ancillary sense. We apply a bandage or even inserting a stitch or two, but that truly remarkable, indeed intensely purposeful, healing response, which only the living organism possesses, is a gift of quite breathtaking generosity totally unmatched by anything we see in the world of non-living things.

Strictly speaking we cannot even talk about differences in behaviour between the living and non-living because non-living things don't actually *behave* at all. They just are. Atoms, molecules, crystals, rocks and water are all products of the material laws of nature. Some might argue that the electron orbits the nucleus of the atom and therefore displays a form of behaviour. But this is merely an imprisoned activity totally dictated or prescribed by the laws of physics.

Conversely, the living organism's behaviour is characterised by a quite remarkable degree of freedom. Yes, there are material laws which it must obey. The rules of chemical bonding are, so far as we know, fully honoured in the huge array of metabolic processes taking place within each individual cell of the living organism. But conformity to such material laws does not account for the behaviour of the organism itself. This is better likened to the performance of a majestic orchestral work. Its entire structure conforms to the rules of musical composition but the music clearly transcends these rules. The music is, vastly more, an expression of the creative imagination of the composer. And so it is in the living organism. Each of the myriad processes taking place within the living organism obeys, uncompromisingly, the laws of chemistry and physics. But the organism is `tuned' to a calling that transcends those same laws. It plays its part in the magnificent symphony of life, performing with exquisite timing and anticipation each of its individual movements which include embryonic development, growth, repair, reproduction, and all those creative responses to the innumerable challenges thrown at it by the outside world.

The orchestral metaphor of life has much that seems valid as we open our eyes to the splendor of the living world. A popular image for the materialist is a primal world where the gene – the selfish gene - rules supreme. It is said to be the innovator of that first struggling life form, and acted on by the supposedly creative power of natural selection, has produced the vast panarama of life. A currently running BBC 1 documentary *How to Build a Human* has been vigorously promoted with the persuasive line – "Everything about us is determined by the structure of this DNA." Popular, reductionist science sees the gene and nothing else as choreographing the magnificent `dance of life'.

But more cautious biologists like Richard Strohman and New Zealander John Morton think otherwise. For example, Strohman (1997) argues that "we have a complete theory of the gene that has exceeded its lawful boundary." He contends that biology has committed an epistemological error of the first order by illegitimately extending the theory of the gene from a relatively simple level of genetic structure, the relationship of this structure to information storage, replication and transmission (involving coding and decoding), to a complex level of cellular behaviour. And as if to emphasize the sheer *lack* of explanatory power residing in this entrenched theory of the gene, Strohman states what this theory does describe:-

> . . . transcription, where DNA sequences miraculously become protein forerunners in the form of messenger RNA, and translation, where the linear sequenced messages in RNA are converted to linear sequences of amino-acids in proteins. End of story.

Strohman further comments that:-

> The theory of the gene is complete and wonderfully so; it is beautiful and magnificent in its utter simplicity. A child could understand it and millions of children now do. But if you mistakenly ask them what it means in terms of function you have shamed them.

Biologist John Morton (2001) similarly argues that the gene operates merely by offering ingredients and thus functions at the lowest level of causation. He has this to say of the real limitation of the gene:-

> The first disability of the genes as an instruction-code must be their identity in almost every cell of the organism. There is no selective allocation. Every cell gets everything. It is as if there was a bare ceiling with all the pigments available at every point. To paint the pictures in the Sistine Chapel would involve information from somewhere else. So recourse was suggested to a second order of *control* genes, supposed to manage the structural or primary genes by specifying their dosage over a complex of space/time gradients. But such master genes would still in turn be part of a uniform genome - and powerless to differentiate a particular form.

This rather more sombre appraisal of the gene's power serves to illustrate just how grossly overstated is the picture offered by Richard Dawkins in his book *The Selfish Gene* (1976) - his image of living organisms as mere `survival machines' constructed by the gene for the purpose of its own perpetuation under the action of natural selection:-

> Natural selection favours genes which control their survival machines in such a way that they make the best use of their environment. This includes making the best use of other survival machines, both of the same and of other species. (p. 71)

- a statement which, by employing expressions such as "which control" and "making best use of", supports my original contention that biological materialism, despite its repeated claims to the contrary, relies on much more than the material to present its particular view of life.

I argue in this paper that any evolutionary theory of life that excludes from the living world a primary non-material or transcendent dimension or guiding presence, is no theory at all. The materialist's claim that natural selection supplies this evolutionary 'arrow' but is entirely material in its action, is a fundamentally dishonest claim. If there is no real purposive agenda that natural selection is pursuing then the expression "natural selection" is blatantly misleading and should be deleted from the evolutionary vocabulary.

Or if natural selection is nothing but the summation of a set of unguided processes then the materialist's story telling should only use language that reflects this materialism. Neo-Darwinism is riven through with words and expressions that reflect anything but a mindless materialism. Read any modern Darwinian text and the language of purpose, direction, intentionality coupled with the denial of purpose is common currency. This is, in modern parlance, a crude form of biological spin-doctoring. Here are just a few examples of this unavoidable language of intentionality:-

struggle for survival	adaptive advantage
competition	reproductive success
variants that cope best with the environment	heritable features that best suit the organism for making a living
selective advantage	selfish genes
habitat tracking	species stasis

and we could go on adding endlessly to this telling list. They all convey in different ways the operation of a life-promoting, 'a wanting to survive', principle that belongs exclusively to the living organism, a vitalism the materialist so strongly denies. This linguistic contradiction is well illustrated with Daniel Dennett's reference to Darwin's theory of natural selection as "a get-rich-slow scheme" (p. 50), or "a scheme for creating Design out of Chaos without the aid of Mind" (p. 50), but again – but we must ask Dennett - Why the need to get rich? Why the need for design?

In this paper it is therefore refreshing to be able to refer to the writings of Alister Hardy, no less a Darwinist, but also one who acknowledges that much more than purely material categories are required to describe the living world.

However, I should also want to add that even with Hardy's appeal to a transcendent, psychic dimension, major questions remain as to how such a 'mind' dimension might interact with the purely material. It is one thing to argue that the frog egg is developing in resonance with the tadpole idea, but how matter is added step-by-step, molecule-by-molecule, polymer-by-polymer, cell-by-cell, in an appropriate way to produce such a complex living system remains beyond the reach of our current science.

One thing seems certain; more plausible explanations must surely evolve in mindful rather than mindless directions.

Michael Polanyi, one of the great thinkers of the last century, a distinguished scientist and philosopher, rejects the absurd reductionist myth which attributes the emergence of life and mankind to the play of material forces alone. I can do no better than finish with a brief passage from his monumental work *Personal Knowledge* (1962):

> . . . the rise of man can be accounted for only by other principles than those known today to physics and chemistry. If this be vitalism, then vitalism is mere common sense, which can be ignored only by a truculently bigoted mechanistic outlook. (p. 390)

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