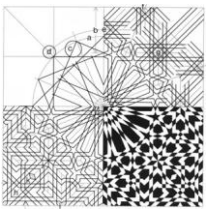
WHY IS THE SCIENCE OF LIFE SO DEAD?

Paul Carter

Life means the same as the present.
There is no life that is not present: in and of the present.
In a lifeless world we are dealing only with past and future.
- Wolfgang Schad ***Man and Mammals***



Holes in the theory of life- are genes the right plug?

Modern evolutionary biology has Darwin as its starting point and biological knowledge has since been firmly cast within the theory of evolution by process of natural selection. This knowledge has continued undisrupted despite serious criticisms that the theory's success may result from possible tautological formulation[1]. A requisite of any traditional scientific theory subjectable to empirical testing is that it specifies logically distinct elements which are *observable*. If a theory fails to make specific the observations it claims to explain, the observable criterion is ubiquitous and thus approximates tautology. Ubiquity results because the parameter of the theory remains undefined so theory and evidence remain indistinguishable.

It is common knowledge that Darwin's original theory was incomplete, but to what degree is subject to a further debate [2]. The process by which inheritance is achieved constituted the missing link in Darwin's argument, and this was fulfilled by genetics in the rediscovery in the 1900s of Mendel's work published in 1866. The synthesis of Mendelian genetics with Darwin's theory of natural selection was accomplished during the Modern Synthesis (1920s-30s). This success, however, has had the unforeseen consequence of a science of life that is focused not on living things, but on the chemical processes–specifically the formation of proteins–that give rise to living organisms. Theoretical explanations aimed at the chemical molecular level completely overlook living organisms. Furthermore, despite dramatic success in revealing the patterns of gene activity in developing organisms, our understanding of genetics remains far from comprehensive. Most importantly, it is clear that genes fail to explain anything about how physical form arises. To be clear, genes do not explain the principles governing the process of morphogenesis.

There is little doubt that the logical formulation of Darwinian evolution provides the prerequisites of an explanation for the origins of morphological diversity and adaptation. But as it stands evolutionary biology merely interprets forms and adaptations in terms of historical explanations. For example, the remarkably complex structure of an eye is said to have evolved in increments from much simpler versions that had the same basic function. Such retrospective explanations seem to say a lot about how eyes came to exist, but fail to say anything about the generative process giving rise to this organ, and thus ignore the important question of how the form came to be created.

A further problem follows if we accept historical explanations as valid. These explanations cannot be tested because past, present and future instances of eyes appear as identical in theory and evidence. The failure to specify the logically distinct elements discussed in the beginning paragraph, lead to a peculiar blending of theory and evidence. The problem is evident in the imaginative and convincing arguments that emerge from *within* the logical structure of the theory in the form of evolutionary survival strategies; to continue with the example of the eye, those individuals benefiting from random variations of eye forms will produce more offspring with the superior and therefore naturally selected eyes. On their own it is evident these explanations are at best half-full. The curious thing about such widely accepted explanations is that they exhibit the rather unscientific ability of producing their evidence by interpreting our observations instead of being tested against them. An un-testable scientific theory is tantamount to belief in a theory without recourse to empirical evidence. Belief, while necessary for the progression of knowledge, is, however, in some forms immune to

doubt, especially when the theory appears to be supported by evidence. For those concerned with the future direction of the life sciences, and science at large, I argue for an expansion of the traditional scientific methodology of quantities (primary qualities) to incorporate *qualities* (secondary qualities), which, in addition to lending an ethical basis for the study of life, will open up new areas of enquiry that have been prematurely closed due to the theory of evolution's apparent success.

Living organisms: Between a rock and a hard place

The problem of the origin of species continues to evade scientific explanation. It has been observed numerous times that, despite its title, *On The Origin of Species* (1859) had much more to say about change *within* species than about the origin of new species. More recent insights arising in response to the mass of nucleotide sequences provided by computer-assisted analysis are accepted as constituting a more rational foundation from which to address this question [3]. This school of thought is influenced by Mayr's essentialist method which ignores the subtle 'variations on a theme' observable in a single species' population and argues that forms which vary discontinuously are putatively different in kind on the basis of genetic evidence[4]. According to this modern molecular view, genes are what define an organism, they are the fundamental units upon which natural selection act, so by understanding genes we can understand how organisms are formed and how new species arise. Yet the consequence of accepting this view is that we exit the study of life and are left only with the task of performing the rational classification of forms. Mayr(1963) conceived the ordering of forms in the philosophy of neo- Platonism and thus, as with similar essentialist species concepts, attempts to assign the variability of forms to a fixed number of basic kinds, i.e. taxon placed in ideal (Platonic) phylogenies (a hypothesised sequence of ancestor-descendent relationship of groups of organisms as reflected by their evolutionary history). As a result of this fixed ontological status, species taxa–the status of an organism's classification–have replace the living organism. In other words, the identity *taxon* is now interpreted as the individual 'organism' or 'wholes' – of which living organisms are merely a part. This philosophy (essentialism) has forced those who employ it to confront empirical variation, it is the very source of the 'species problem'. The key point here is that if genes are viewed as the sole agents responsible for determining the specific morphological traits of an organism, the resulting position is the *disappearance* of organism from biology. Aside from the problems arising from a focus on genes as the answer to "What is a species?" there are other related problems resulting from the same focus on genes, these concern the *generation* of form. Darwinism as presently conceived assumes all facts of morphology are intelligible because of the genotype-phenotype causal relationship. In some cases we can claim with confidence that there is a genetic–chromosomal–difference that causes a difference in morphological properties. But this is at best only a partial explanation of the manifestation of properties for we do not know how the difference is made, nor why it is this difference rather than some other difference. The limited insights of genotype-phenotype patterns provided by the findings of Mendelian genetics are causing evolutionary biology to exhibit the character of a historical science, its purpose being confined to uncovering the genealogical–material and historical–relationships of organisms. This follows from the fact that the theory of evolution by process of natural selection and its effect on genes is taken as providing a general metaphysical foundation for explaining the origins of living beings. When this assumption is admitted it appears that there is no possibility of a scientific explanation of morphology as particular forms can only be explained by means of historical genesis. This is the case as explained above in the example of the origins of the eye. Webster and Goodwin ([2] p. 86) bring the point home:

[W]hile we do have real knowledge of some efficient causes or causal stimuli involved in the production of forms, we have, at present, little in the way of detailed knowledge of the causal mechanisms involved and, therefore, scant knowledge of how any particular form is possible, nor consequently of whether or not there are inherent constraints on the possible.

It is clear, if the above discussion is agreeable, that for biology to establish a *meaningful* understanding of life a dramatic re-orientation is necessary. To achieve this requires the development of a comprehensive theory of form which sets forth the principles governing the generation of organisms. Hitherto my enquiry has led to the recognition of two potentially complimentary candidates for such a theory. The first theory belongs to complexity science modelling, which links a theory of organism developmental dynamics to geometrical formations [2,,5]. By marked contrast, the second theory is that of *direct experience*. On the surface the latter approach appears in conflict with the former realist scientific perspective. However, this conflict only exists because the development of Western science has been one-sided. Sadly, this has caused us to neglect the rich

source of knowledge at our finger-tips (our experience) as something less than real, as an inadequate form of knowledge.

"Secondary qualities" and the case for direct experience

The demotion of direct experience in Western science has occurred because the theory (that is ourselves) relies on 'secondary qualities' (colours, sounds, tastes and smells) that do not lend themselves to quantitative abstraction. Hence our experience is seen merely as *a* way of looking at the world and not *the* way of looking at the world. This discrepancy is the root of a problem which has only recently come in to view in our science and culture and can be formulated in the question "Is it possible for a world possessing only primary qualities to appear sensible?" To rephrase the question in relation to the subject of form: Can a computer model of morphogenesis which is comprised of primary qualities appear meaningful? In order to answer this question a brief overview of the assumptions and development of Western science is necessary. The discovery of a world that could be the object of numerical measurement was made by Galileo. In his feat of abstraction, the world became inhabited only by *bodies* divested of all but 'primary qualities' (shape, velocity, size, mass, position and number). In revealing this aspect of nature the development of mathematical physics was permitted. The enormous powers secured by this mode of investigation have produced such an overwhelming impression of success that its authority is beyond question. Yet the image of reality that the sciences have since developed excludes a great amount of our experience as uninformative–that is, *less than real.* But is this divorce of the scientific and the experiential a requirement for truth? The key concern here is that the truth of a measure is not able to *specify its meaning*, and, instead of feeling in the privileged position of possessing knowledge of the world, we are left with a scientific world picture that doesn't accord with the rich reality we experience as individuals.

A couple in love walking along the banks of the river Thames are shown to be mere particles in motion or mere genes acting selfishly. The act is left devoid of agency, absent of value. In order to make *sense* of the couple in love we need to engage our secondary qualities–that is, the *language* of the senses. We can thus say that we know the world of physics only mediated-ly as this knowledge is *deduced from the world of appearances*, and that the world of appearances is known more immediately, as it appears to experience [6].

Nevertheless, it is still entertained today that lawful mathematical relations revealed through measures testify to an underlying reality. The assumption that 'lawful' is identical with 'measurable' continues to be considered by many scientists to distinguish individual subjectivity from independent reality. In general, present scientific methodologies depend upon the measurement of primary qualities, and, since those qualities are assumed to be independent of the observer, methods of measurement are used that either omit the observer entirely or attempt to escape subjective variation by generalising on the reports of multiple observers. This is despite the inescapable fact that immediate experience is *individual* (not a good candidate for what is normally termed 'scientific observation') and is far richer than its measured relations. Scientific observations, then, come to represent only a small part of the original content of our experience and hence necessitate their presentation taking the form of a "finished product" that is taken to represent something objective, static, a finished experiment.

By contrast, if we promote our senses as the method for our investigation, science becomes a living process aligned with the way we experience the world (I am not advancing this as *the* only method). The senses, just like in any scientific observation, will provide our primary data and the scrutiny of this information will be a cognitive exercise. It is important to remember that the senses do not *constitute* the observer. The conception of mind and senses as one indistinguishable process comprises what Bortoft calls the 'error of empiricism' [7]. It is now necessary to provide a brief explanation of how our experience can be an object of our attention, and how tending to this activity aids to bring for the appearance dynamic yet stable objects.

Making sense of our senses

Our knowledge of the world is based on sensory experience, but knowledge is not the same as sensory experience. Although we could not see the world without the senses, we also could not see it with the senses alone: We require cognition to make sense or to 'organise' the stimuli of the senses. This organisation is described by Hanson as not an element in the visual field, but "rather the way in which the elements are appreciated" [8].

For example, the lines, dots and dashes you perceive as the written text before you do not in themselves contain their meaning. Their meaning only exists in the way you are able to organise the words, that is, to make *sense* of them. If reading a written text is to be a meaningful act this requires more than the mere repetition of the sequence of words: A careful interpretation of the writing is necessary in order to gain its true meaning. However, a person who cannot read still perceives the same lines, dots and dashes–after all they exist on the page–but they will not be able to *organise* this perception in the way that someone who knows how to assimilate the words according to the grammatical rules governing their meaning. When the non-reader distinguishes the lines, dots and dashes as such this is also to perceive meaningful data. So when we are in the act of reading, the *meaning* that we are "seeing" is not in fact on the page, although it appears to be there. It comes in to existence in our cognition of it. Even in the case of the person who cannot read, the visual stimuli is subject to cognition. In the words of Henri Bortoft "In the act of seeing the world it *is* meaning that we see". [7]

Now we are in a position to better understand Goethe's remarks about the relationship between fact and theory:

> Let the facts themselves speak for their theory.
> *Don't look for anything behind the phenomena; they are themselves the theory.*
> *The greatest achievement would be to understand that everything factual is already theory. (Quoted from Bortoft[7])*

I will draw my concluding remarks on considering how the science of life has fallen into a one-sided approach to the study of living beings. This imbalance can only be resolved by a science which values direct experience as much as, not instead of, quantities. Only when this is fully acknowledged will the science of life be able to come *back to life*.

Wholes in the theory of life

In postulating that the parts of an organism hold the key to understanding the underlying processes, or even laws, governing an organism's creation, modern biology no longer has its focus on the living organism but on its molecular parts. This is despite the general recognition that one cannot "deduce-up" from lower, more fundamental, levels of explanations. For example, the properties of water cannot be deduced, i.e. predicted, from a detailed knowledge of the way hydrogen and oxygen molecules interact. Nonetheless, some scientists think that many, if not all, facts about organisms are explainable by gaining an understanding of molecular interactions. [9] Furthermore, this approach is grounded in chemistry, and not biology, that is to say, life. Chemical explanations in biology are inadequate, even when coupled with evolutionary narratives, because such accounts amount to little more than conveying the primitive notion of one thing "causing" another to happen. The method of explanation by mechanical models has been the way of science from Descartes onwards, until its validity was called into question in the 20th century by the development of the quantum theory. The paralleled advance of biology in the 20th century has equally brought into question the appropriateness of not just mechanistic models but of complexity models, entertained within the discipline of systems biology. Complexity modelling may be more dynamic and therefore offer a better representation of biological phenomena, but it is clear that this approach violates Goethe's remark of not looking *beyond* the phenomena for a theoretical explanation. If, however, we practice an expanded science where secondary qualities are given an equal footing to primary qualities, our senses, and therefore our experience, become our method. Phenomena, then, can be discerned as unified 'wholes' and will no longer suffer the one-sided examination as mere collections of parts–the deadening grip of pure reductionism and quantitative abstraction (only aspects of this kind of whole, such as DNA, lend themselves to the equally valuable task of quantitative analysis).

A newly conceived biology that values qualities will pursue the phenomenology of form, dynamic forms which are empirically demonstrable [10]. In order to be brought forth as stable objects, unified wholes require the scientist's careful attention. When this is undertaken with skilled judgement the scientist is able to demonstrate her using the standard means- spoken language and/or written, numerical and schematic notational representations[10]. Such schematic representations, however valuable, are not recognised as the finished product of her work. Nor is it the aim of the investigation to produce and compile such knowledge. The process is continuous, living, dynamic and aims at understanding living beings as such. Notations, in this view, do not contain the whole *meaning*, or truth, of the scientist's knowledge; this exists primarily in the

moments when the meaning is brought into being in the act of tending the appearance of the natural phenomena as it is, *in* and *of* the present. This admission means we are well on the way to rebalancing science from being theory-centered to putting the phenomenon first and supporting this with a complimentary theory.

De Profundis

The code for DNA may have been broken, but the language of the code remains distinctly foreign and incomprehensible. If we continue with our present commitment down the narrow roads of gene land, the only destination we have is the attempt to tackle the miraculous task of constructing an explanatory model capable of showing the processes of all molecular interactions in organismal generation. What I find disconcerting is the thought that this represents the path of the rational mind. For those tempted by this journey, I ask you: Will this quest be meaningful, especially in the darkening light of our present contributions to the rapid extinction of biodiversity? If we continue with this direction I doubt the outcome will be that of a triumph of science. Given the awareness we have that our science is steadily estranging our lives from the living world–the presence that Schad speaks of–we would do well to check our reasoning and *feel* the realness of the problems at hand. Countering our epistemological imbalance in this way is of great importance because it is the active neglect of our secondary qualities as a lesser form of knowing that leads us to unethical behaviour: Meaningless acts are invited in a meaningless world. Our present cultural-societal problems are the unwitting result of the one-sided development of a rational-analytical approach to knowledge. And yet at our finger-tips exists the means to escape the solitude and destruction we have found in these dead and narrowing roads.

References

1.Brady R. (1982) Dogma and Doubt *Biological Journal of the Linnaean Society* **17** 79-96
2.Webster G. and Goodwin B. 1996 *Form and Transformation* Cambridge University Press
3 Coyne J.and Orr H.A. (2004) *Speciation.* Sunderland
4. Mayr E. (1963) *Animal Species and Evolution.* London, Oxford University Press
5. Goodwin B. (1994) *How the Leopard Changed its Spots*. Touchstone, New York
6. Maier G. Brady R. And Edelglass S. (2008) *Being on Earth* Logos Verlag, Berlin
7. Bortoft H. (1996) *The Wholeness of Nature:* Bell and Bain, Glasgow
8. Hanson N.R. (1958) *Patterns of Discovery.* Cambridge University Press
9. Holdrege C. And Wirz J. (2001) Life Beyond Genes. *In Context* 5 14-19
10. Bockemuhl J. and Suchantke A. (1995) *The Metamorphosis of Plants* Novalis Press

Paul Carter *graduated from the University of Plymouth with a degree in wildlife conservation. He is a keen GO player and is a member of the British GO Association and the British GO Club. He is currently studying the Masters in Holistic Science at Schumacher College.*