Artificial life: The revival of mysticism in science

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Artificial life is the subfield of complexity studies which attempts to generate insights about a wide range of biological phenomena through computer simulations. It is concerned with understanding the immense complexity in nature in naturalistic terms. By using a synthetic methodology to explore what might have happened in biological evolution, it is hoped to discover fundamental laws of biological complexity.

This essay argues that the field of artificial life is a parody of empirical science and that its emergence represents a revival of the mystical impulse which animated so much scientific speculation at the dawn of Western science. The introduction sets artificial life in its historical context and reveals its fundamental assumptions. The first section examines some of the key claims made by artificial life researchers. The second section examines the scientific credentials of artificial life. Finally, the nexus between artificial life and scientific mysticism is made explicit.

Introduction

One of the most difficult aspects of biology for modern evolution theory to explain is the immense and dazzling complexity of the various forms of life on earth. Darwin proposed that natural selection, acting upon variation within species, could explain this diversity and complexity in terms of descent with modification from a common ancestor. But he seriously addressed only the issue of diversity of life forms. The question of complexity was largely glossed over as in his treatment of the eye and complex organs in *On the Origin of Species.*[1] As Michael Behe points out in *Darwin's Black Box,* the limitations of nineteenth century microscopes meant that no one in Darwin's time comprehended the true complexity of the cell.[2] Understandably, then, Darwin did not anticipate the challenge that cellular complexity would pose for his theory. If he had initially advanced his theory in a scientific community informed by contemporary knowledge of the structural and biochemical complexity of the cell, it is highly unlikely that he would have been taken seriously, let alone have achieved his towering stature in modern science.

Ironically, discoveries which have greatly increased our understanding of the complexity of the cell have twice been used to save biological evolution theory from the doldrums. When Darwinism was at a low ebb at the beginning of this century, the rediscovery of Mendelian inheritance and advances in genetics led to the Neo-Darwinian synthesis. This synthesis makes natural selection acting upon chance mutations the creative force in biological evolution. Mutations provided a possible mechanism for introducing genetic novelty into populations at a time when doubts were increasing about the heritability of adaptive fitness. By the middle of the twentieth century, Neo-Darwinism was itself at a low ebb and the discovery of the structure of the DNA molecule was immediately jumped on by evolutionists to give biological evolution theory renewed impetus. The near universal presence of the DNA molecule in organisms was interpreted as powerful support for descent from a common ancestor.

Despite the resurgence of Neo-Darwinism following the discovery of the structure of the DNA molecule, biological evolution theory never managed to produce coercive evidence for its validity. The widespread presence of DNA in organisms can, with equal plausibility, be interpreted as support for a common designer, especially as DNA is the most efficient information storage and retrieval system known. The inability to exclude alternative explanations meant that Neo-Darwinism remained a plausible but contested theory. Meanwhile, the mounting evidence of the structural and biochemical complexity of the cell, which had been downplayed in the euphoria associated with the decoding of the DNA molecule, demanded to be addressed.

Yet, the question of complexity was not considered to be an intractable problem for biological evolution, as the work of Stanley Miller was used to suggest that chance processes may be compatible with the emergence of complexity. In 1953, when Crick and Watson announced their model of the DNA molecule, Stanley Miller reported his 'origin-of-life' experiments. These experiments seemed to indicate that amino acids, the basic building blocks of protein, could arise spontaneously under the right conditions. Thus, few seemed to be troubled by the tension between the complexity of life's structure and its supposed chance origins.[3] Most observers were confident that the explanations for origins and structure would eventually converge.[4] However, as time passed, there were dissenting voices about the adequacy of random processes to explain complexity. For example, in 1967, Murray Eden, a mathematician, cautioned that the randomness hypothesis is highly implausible from a probabilistic point of view.[5]

The early optimism about the chance origins of complexity began to fade through lack of experimental

confirmation. It seemed increasingly unlikely that something as complex as a human cell could arise spontaneously by chance. By the early 1980s, prebiotic evolution theory and the Neo-Darwinian synthesis were again stagnant. In a 1985 book, Michael Denton, a molecular biologist, revealed the extent of the crisis in both.[6] The lack of empirical support for prebiotic evolution theory posed a significant challenge to the ongoing viability of Neo-Darwinism and evolution theory generally for, without a plausible mechanism for explaining life's origin and the complexity of the cell, there is no viable evolution theory.

Meanwhile, a new field of investigation was emerging: chaos or complexity studies. The use of computers and sophisticated non-linear mathematical techniques to study chaotic, complex phenomena that were resistant to the scientific methods of the past, was coming into vogue.[7] Computer simulations were supposed to transcend the existing limitations of scientific observations by revealing orderly patterns in seemingly highly complex, chaotic phenomena, possibly leading to the discovery of general principles which governed the behaviour within these complex systems. The method which had been applied to complex systems was soon applied to the difficult problem of complexity in biological evolution. The first artificial life conference was convened in 1987.[8] Artificial life, a subfield of complexity studies, was born.

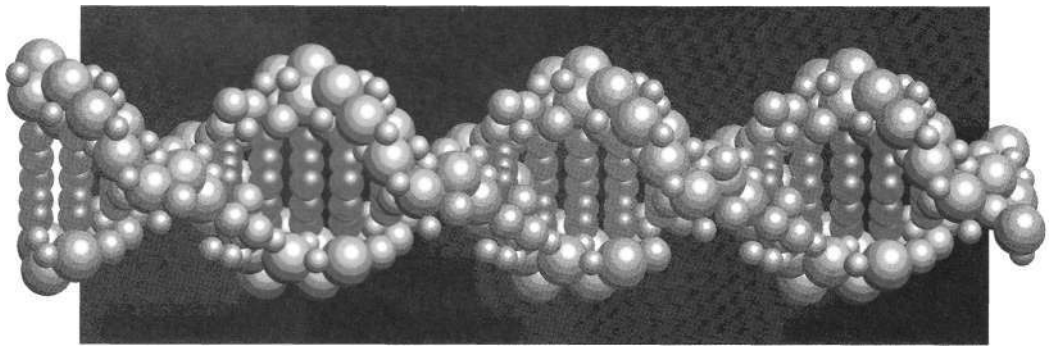
Artificial life seeks to explore, through computer simulations, possible evolutionary pathways to complexity in biology. It hopes to discover, through these explorations, fundamental laws of biological complexity. Its assumptions are implicitly naturalistic. By creating computer analogues of the conditions supposedly favourable to the evolution of life, and varying these conditions, artificial life researchers hope to develop insights into how evolution has crafted incredibly complex biochemical entities, such as the DNA and RNA molecules, enzymes and proteins, and developed them into cells and living organisms. Thus, artificial life hopes to make immense biological and biochemical complexity explicable in terms of evolution theory.

The fundamental assumption undergirding artificial life is that the improbability of biological complexity, in evolutionary terms, is only apparent. If there are multiple pathways that evolution might have taken, the remote chance that evolution could have occurred at all on earth is therefore rendered more probable. In this sense, artificial life shares one of the fundamental assumptions of the anthropic principle. This assumption asserts that there are many universes apart from our own that do not have within them the conditions necessary for life. Thus, the reason why the universe has such improbable properties and conditions for life is that there are countless other universes which lack these properties, making the conducive conditions for life on earth merely a matter of random chance.[9]

The difficulty for both artificial life and the anthropic principle is that neither can be tested within the terms of empirical science. It is impossible, therefore, for artificial life simulations to provide anything more than descriptions of what happens in computers when certain preset conditions are varied. Criticisms of artificial life have highlighted this difficulty but this has not prevented artificial life researchers from continuing their imaginative simulations. In itself, this fanciful approach to scientific explanation demands explanation.

Stuart Kauffman, an artificial life researcher at the Sante Fe Institute, has recently suggested that natural selection alone cannot explain the stunning biological complexity within the biosphere. He asserts that self-organisation is the root source of biological order.[10] It seems that Kauffman is here confusing order and complexity. In relation to information, order and complexity are not synonymous.[11] Therefore, when Kauffman refers to order, I understand that he is referring to complexity. This is the sense in which I discuss Kauffman's references to 'order'. In a move which seeks to deftly sidestep the problems that complexity creates for evolution theory, Kauffman suggests that we are not the result of an improbable accident but are actually an expected consequence of the effect of the laws of complexity upon the original soup of molecules.[12]

Kauffman's assertions are not unexpected. They are consistent with the naturalistic assumptions that undergird artificial life. It has been suggested that artificial life and the whole field of complexity studies seem to be based upon a seductive (but logically invalid) syllogism: simple mathematical rules applied by computers create extremely complicated patterns; the biological world contains many extremely complicated patterns; therefore simple rules underlie biological complexity.[13] Yet, the simplicity of Kauffman's proposed solution to the problem of biological



DNA is the most efficient information storage and retrieval system known.

complexity masks the danger that it poses to evolution theory. The danger is not that Kauffman's solution is simple and elegant but that it represents the ultimate naturalistic explanation for complexity.

Kauffman's move is therefore much more than the most recent tack taken by the evolutionary community into the winds of complexity. It represents the depletion of the evolutionary store of explanation. If Kauffman's move fails, it leaves Neo-Darwinism and other theories of biological evolution thoroughly exposed and the whole framework of naturalism in ruins. For this reason, Kauffman's assertions in relation to self-organisation and complexity will figure prominently in this article. It will be seen that Kauffman's work not only illuminates the essence of artificial life but also its place in the growing trend to mysticism in science.

Begging the question

The naturalistic assumptions which undergird the field of artificial life are nowhere better expressed than in the preface to Stuart Kauffman's book, *At Home in the Universe: The Search for Laws of Complexity.* Kauffman states:

> *'This book describes my own search for laws of complexity that govern how life arose naturally from a soup of molecules, evolving into the biosphere we see today.'* [14]

Kauffman begins by assuming the truth of that which he sets out to establish. He therefore begs the important question of the origin of complexity. While question-begging beliefs are by no means absent from science, they are not normally considered to be an acceptable part of the scientific enterprise, or rational thinking for that matter.

It might be argued that evolution is a well-established fact and that an assumption in favour of a naturalistic explanation for complexity is a perfectly appropriate assumption. But Kauffman cannot appeal to this argument, for he effectively denies that Neo-Darwinism, supposedly the proof positive for evolution, is an adequate explanation for the immense biological complexity which we see in the world. Notice how Kauffman continues in the preface:

> *'Whether we are talking about molecules cooperating to form cells or organisms cooperating to form markets and economies, we will find grounds to believe that Darwinism is not enough, that natural selection cannot be the sole source of the order [complexity] we see in the world. In crafting the living world, selection has always acted upon systems that exhibit spontaneous order [complexity]. If I am right, this underlying order [complexity], further honed by selection, augurs a new place for us — expected, rather than vastly improbable, at home in the universe in a newly understood way.'* [15]

Kauffman seems to have missed the point that if Neo-Darwinism is an inadequate theory to explain complexity, then the fact of evolution is not established and there is no good reason for him to make an assumption in its favour. In seeking to retain naturalism while divesting himself of arguably its most important conceptual pillar, Kauffman has exposed the soft underbelly of evolution and created some deep conceptual confusion.

The confusion exists because Kauffman and other artificial life researchers attempt to join two incompatible explanatory modes for complexity: chance and law. Artificial life simulations are undertaken because the origins of biological complexity are presently opaque to empirical science. The immense complexity of the simplest of organisms makes the probability of its chance origin and development effectively zero. Yet, complexity demands to be explained. If complexity cannot be explained in terms of randomness, then a viable alternative naturalistic explanation for it must make it inevitable. *Ergo* Kauffman's law of self-organisation.

The confusion emerges clearly in the simulations. By attempting to enlarge the possible set of evolutionary pathways and shed light on how evolution might have occurred, artificial life researchers acknowledge the role of chance in the emergence of complexity, but then proceed to search for patterns that supposedly result from the action of law. Even if it could be shown that chance and law are not mutually exclusive modes of explanation, simulations do not adequately mimic randomness, as they begin with carefully preselected conditions.

In postulating the law of self-organisation as the primary source of complexity, Kauffman seeks to overcome the improbability of chance origins of immensely complex organisms and systems. Yet, his explanation is incoherent because it confuses the nature of law and the nature of causation. Laws do not cause anything. As C.S. Lewis explains, laws

> *'... are the pattern to which every event must conform, provided only that it can be induced to happen ... the source of events must be sought elsewhere.'* [16]

Rather than treat the law of self-organisation as a pattern or framework, Kauffman treats it as a driving force. In fact, he must do so because he cannot admit anything beyond the law of self-organisation or he has moved beyond the boundaries of naturalism. Yet, a law is not a driving force. Laws are descriptive **not** prescriptive. Self-organisation cannot be both a pattern and a force. Therefore, self-organisation is not a law of complexity but a naturalistic formulation of causation. Ironically, the point at which Kauffman comes closest to scientific explanation is the point at which he embraces mysticism.

Kauffman is aware of how his ideas might be interpreted as mysticism for he takes pains to assure his readers that,

> *'The complex whole, in a completely nonmystical sense, can often exhibit collective properties, "emergent" features that are lawful in their own*

right.'[17]

It should not be surprising that in a universe exhibiting such complexity, matter should conform to natural law. In fact, it would be more surprising if it did not conform to law. The real issue is not the apparent existence of law-like reactions in alleged chemical soups, law-like development in organisms or even law-like patterns in computer simulations, but the source of the law to which nature conforms. In discovering the source of law, one also discovers the source of the driving force which causes matter to conform to law, for law is impotent until activated by a driving force. Kauffman's attempt to draw naturalistic conclusions about the source of complexity, without addressing the issue of the source of law and the driving force necessary to make law operative, is completely wrongheaded. It results in a mystical faith in the self-organising powers of nature.

James Crutchfield, a physicist who has attempted to design a methodology to measure the complexity of artificial universes, exhibits the same mystical faith in the self-organising powers of nature:

> *'There are some very basic principles of life that we don't understand. At some point there wasn't biological life. But nonetheless since biological life now exists we know that there's some point in time during which things had to be driven in that general direction. So that sort of lifeless, physical nature had to move forward and reorganise itself. It's at that point in a sense where I'm studying it. I can't prove that life should spontaneously arise, but given the sheer evidence around me that things do organise, we do learn, and there's so much organised matter around, I think it's actually in a sense highly probable that there does exist some basic organising force. And I see no impediments to creating something that can indisputably be called alive. If you seriously consider what science is all about, all the arrows point in that direction. Scientists try to understand things we don't yet understand. And life is one of those things. We will understand it. I don't see any limitation in principle here.'*[18]

Like Kauffman and other artificial life researchers, Crutchfield exhibits a mystical, question-begging faith in the spontaneous generation of life. He acknowledges the need for a driving force but, with an impressive dose of circular reasoning, seeks that force in spontaneous self-organisation.

One of the reasons why the Judeo-Christian view of complexity is so powerful is that it coherently explains the existence of complexity, natural law and a driving force within the universe. Note how verses from the Old Testament book of Nehemiah and the New Testament book of Romans encapsulate these elements:

> *'Thou, even thou, art LORD alone; thou hast made* [the origin of order and complexity] *heaven, the heaven of heavens, with all their host, the earth, and all things that are therein, the seas, and all that is therein, and thou preservest them all* [matter driven to conform to natural law]; *and the host of heaven worshippeth thee.'*[19]
>
> *Tor the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made* [reasonable inference from observable evidence of order and complexity leads to the conclusion that an intelligent being created the world and the laws which sustain it], *even his eternal power* [the driving power for creation and the action of natural law] *and Godhead; so that they are without excuse'* [the evidence is coercive for a rational observer].[20]

The failure of Kauffman to establish self-organisation as a valid explanation for the origin of complexity is catastrophic for naturalism. Having broken ranks and denied that the Neo-Darwinian synthesis is adequate to explain complexity, Kauffman's failure leaves naturalism with no plausible driving force for the origin of complexity. Both Neo-Darwinism and self-organisation are exposed as metaphysical formulations rather than scientific hypotheses. The demise of self-organisation leaves the evolutionary store of explanation empty.

The belief that artificial life simulations can mimic the evolution of complexity by natural selection and also reveal tendencies to self-organisation shows how plastic the methodology is, and raises serious questions about the application of numerical models to biological issues. Numerical models are only ever approximations of reality anyway, because they can never capture the true complexity of the systems which they are modelling. Biological processes and systems are staggeringly complex, so it is overreaching to suggest that 'dry' computer simulations can mimic, in any meaningful way, the operation of these incredibly complex, 'wet' processes and systems.

As Michael Behe points out, in instance after instance biochemical complexity shows itself to be enormous and irreducible.[2] Therefore, the accretion of complexity in Darwinian terms is simply not plausible, either in structural or functional terms. Complexity requires some other explanation. To his credit, Kauffman has recognised this and moved his simulations in the only logical direction left to him: searching for laws of complexity. However, Kauffman's move turns out to be equally impotent in terms of its explanatory value, not only because it is conceptually muddled, but also because he cannot realistically assemble the computing power necessary to simulate the complexity he is seeking to explain.

One artificial life researcher and biologist, Tom Ray, has recognised the limitations of conducting simulations of evolution with insufficient computing power, memory and opportunity for diversity. His solution is to link computers via the internet to provide an environment large and diverse enough for his silicon creatures to randomly mutate, reproduce, compete and die.[21] Ray's program, Tierra, attempts to create digital analogues of the drivers of evolution:

variation and competition. The human operators can vary conditions at will. They have *'Godlike control'* over their silicon creatures.[22] It is a delicious irony that the adjective *'Godlike'* should be applied to a simulation of evolution. Artificial life researchers seem to have missed the obvious point that, in their simulations, they are actually mimicking special creation. The computer or computers on which the simulations are conducted are not the result of random processes. Neither do computer programmers develop their programs randomly. Rather, they carefully establish the parameters in which their digital creations can 'evolve', driven by the power available to the computer.

Despite the evident fact that the 'evolving' creatures in computer simulations are dependent upon the programmer and the power supply for their 'existence', there are artificial life researchers who hold to the view, known as 'strong a-life', that computer simulations of living things are themselves alive.[23] Christopher Langton, the father of artificial life, is one of those who adopt this view. Horgan describes Langton's views as expressed to him during an interview:

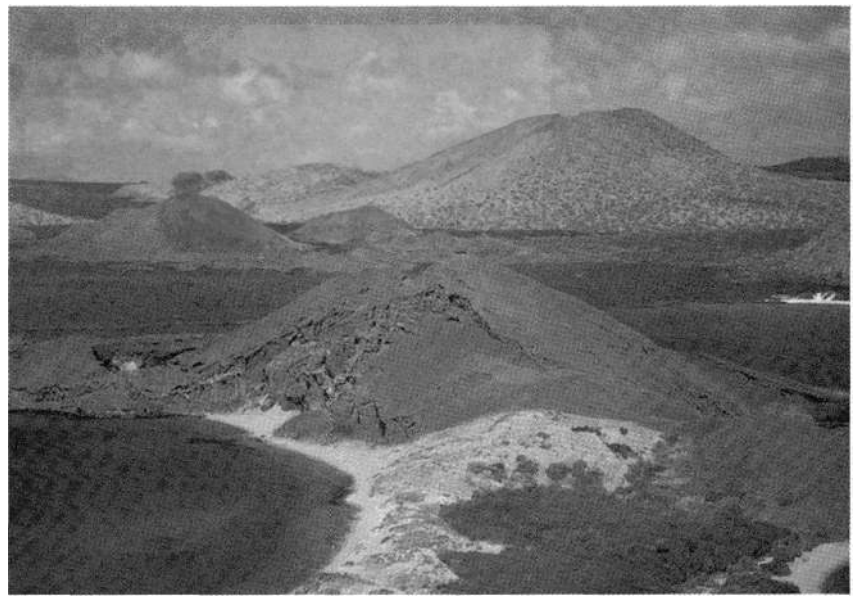
> *'He described himself as a functionalist, who believed life was characterised by what it did rather than what it was made of If a programmer created molecule-like structures that, following certain laws, spontaneously organised themselves into entities that could seemingly eat, reproduce and evolve, Langton would consider those entities to be alive — "even if they are in a computer".*
>
> *Langton said his belief had moral consequences. "I like to think that if I saw somebody sitting next to me at a computer terminal who is torturing those creatures, you know, sending them to some digital equivalent of hell, or rewarding only a select few who spelled out his name on the screen, I would try to get this guy some psychological help!".*
>
> *I told Langton that he seemed to be conflating metaphor, or analogy, with reality. "What I am trying to do, actually, is something a little more seditious than that, " Langton replied, smiling. He wanted people to realize that life might be a process that could be implemented by any number of arrangements of matter, including the ebb and flow of electrons in a computer. "At some level the actual physical realization is irrelevant to the functional properties, " he said. "Of course there are differences, " he added. "There are going to be differences if there's a different material base. But are the differences fundamental to the property of being alive or not?",*[24]

Langton concedes that the question of whether computer simulations are **'really** alive' is ultimately unresolvable.[25] Yet, his belief in 'strong a-life' discloses the mystical impulse which lurks at the centre of artificial life. The belief that digital creations are alive is contradicted in the very name of the field that Langton has helped create.

Langton's belief that life can result from multiple arrangements of matter also reveals an important assumption regarding artificial life. This assumption is that, if self-organisation is a universal principle, silicon-based life-forms are just as probable as carbon-based life-forms. It is an assumption which permits artificial life researchers to think that they are doing something meaningful for biological research when there is no real correspondence between their simulations and the biological diversity and complexity they purport to explain.

An example of this assumption in action is the commencement of Flower's article on Tom Ray's work:

> *'EVOLUTION is a wonderful theory, but so far we only have one example of it — carbon-based life forms on the third planet out from the Sun. But what if we could build another example? What if we could build a huge, empty ecosystem — let's call it Tierra — into which we then introduce creatures that could replicate themselves, compete for resources, mutate to make new forms, and travel to find niches that might be better? And what if they evolved quickly, not in aeons and epochs, but in hours, days and months, so that we could watch?*
>
> *Such a universe could show us evolution in action. We could run experiments by introducing new species, or new environments, or by varying the rate of mutation. We could look at evolution as it happens — not backwards through time, as we are forced to do in the real biological world. We might also find that the pattern of evolution observed in the organic world*



The Galapagos Islands, situated just over 1000 km off the coast of Ecuador.

is only one of a multitude of possibilities.

Last month, an evolutionary biologist working with a group of computer scientists created just such a universe ... ,'[26]

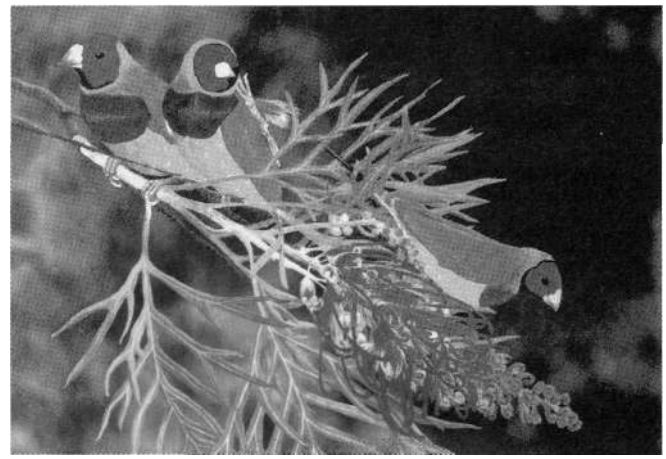
If self-organisation is a universal law, and it is possible for other life forms to evolve using a different material base, it seems somewhat curious that self-organisation has only managed to produce carbon-based life-forms on earth. It is even more curious that researchers, who have had to create a computer system to simulate these life forms, should think that their simulations are an analogue of either self-organisation or evolution.

An artificial life in science

Given the inflated claims made for artificial life, it is surprising to discover that the founding father of artificial life, Christopher Langton, seems to acknowledge that artificial life will never be a truly empirical science.[27] Similarly, artificial life has not attracted significant support from within the scientific community. In fact, the field of 'complexity studies' generally has attracted quite a deal of criticism. John Maynard Smith, a prominent Neo-Darwinist under whom Stuart Kauffman did graduate work, has complained that Kauffman's theory as articulated in his 1993 book, *The Origins of Order,* is too mathematical and unconnected to real-life chemistry.[28] He also accuses Kauffman of practising 'fact-free science.'[29] Yet, as Behe points out, *'Smith offers no solution to the problem which Kauffman identified — the origin of complex systems.'*[30]

Behe's observation is telling. The reason why complexity studies exists is simply because evolutionary science has thus far been unable to provide a plausible naturalistic explanation for the immense biochemical complexity of the cell. If there is no plausible evolutionary mechanism to explain the origin and complexity of the cell, there is no viable evolution theory. Biological entities which are simpler than the cell, such as viruses, are dependent upon the cell for replication.[31] Therefore, viruses could not have preceded cells in evolutionary development. Clearly the cell came first, so its staggering and irreducible complexity poses a massive problem for evolution theory. I believe that we find here the major reason why artificial life, with its lack of empirical methodology, is tolerated in science. To draw attention to the lack of empirical rigour in artificial life serves only to highlight the failure of evolutionary science to answer the challenge of complexity. The failure of artificial life is therefore redolent with the failure of evolutionary science.

Yet, despite the criticisms, complexity studies and artificial life have been reported in some of the world's most prestigious science journals, for example: *Science;*[32] *Scientific American]* and *New Scientist?*[3] Why is artificial life, with its conceptual fuzziness and lack of empirical rigour, legitimised by inclusion in these flagship science journals? The answer, I believe, must be found in the all-encompassing nature of evolution theory. Evolution has moved from being a biological theory to a cosmological theory, enveloping science. Therefore, there is a great deal riding on the persistence of evolution. If evolution theory loses its hold on the scientific imagination, the consequences would be immensely disruptive to naturalistic science and its special place in the popular imagination.



Life: a staggeringly complex phenomenon. 'Artificial life' resembles the real thing in only the vaguest of ways.

In *Science as Salvation: A Modern Myth and its Meaning,* Mary Midgley excoriates the curious and eccentric visions of the future proposed by scientists when they leave the legitimate realm of empirical science.[34] She reveals the high spiritual ambitions of science, or perhaps more correctly, scientism, and shows how some contemporary scientists claim scientific status for their quasi-scientific dreams and prophecies, not only because they appear in scientific books, but also because they take their start from the biological theory of evolution.[35] The purpose of complexity studies, including artificial life, is to resolve the central problem of evolution theory: the origin of complexity. Neo-Darwinists hold a theory which is in deep trouble and one that is central to the prevailing scientific world view. Therefore, they cannot afford to totally spurn a field of investigation which may just hold out some hope of saving their theory. Consequently, artificial life survives in science.

There are other reasons why artificial life is tolerated within science. A thorough cleansing of the scientific camp of all forms of conceptual fuzziness and untestable conjecture would result in some high profile casualties among Neo-Darwinists, including Richard Dawkins. Dawkins is the world's preeminent populariser of Neo-Darwinism. He also provides a bridge between Neo-Darwinism and artificial life. His 'biomorphs', computer creations that supposedly demonstrate that complexity can result from the accumulation of small changes,[36] helped spawn the field of artificial life. Richard Milton devastatingly exposes the conceptual confusion in Dawkins' simulations and highlights the fallacy which Dawkins uses to deal with the issue of improbability.[37] To insist that artificial life is not science would therefore put Dawkins outside the scientific camp and seriously weaken the Neo-Darwinian world view.

Ironically, in a previous cleansing of the scientific camp from the excesses of scientific speculation, which took place prior to the middle of the twentieth century, evolution theory was left in the cold. Midgley writes of this event:

> *'They therefore contracted science and pulled up the drawbridge. A disturbance followed when it was noticed that they had accidentally left the whole of evolutionary theory outside in the unscientific badlands as well. But special arrangements were made to pull it in without compromising the principle. That principle was to minimize the business of 'science' — to define it as narrowly as possible, confining its prestige to detailed, provable, specialized work.'*[38]

The retention of evolutionary theory within empirical science has led to the contemporary fashion for quasi-scientific speculation and created a huge dilemma for science. As we have seen, it would be no easy task for empirical science to extricate itself from all contemporary forms of speculative excess, for it would involve a severe loss of face. The fuss created by evolutionists would also be far greater than on the previous occasion that it was attempted. Yet, unless science squarely addresses the issue of speculative excess, it will continue its drift into mysticism, a point to which I will return in the final section of this article.

The issue of the scientific status of artificial life must therefore be addressed in the wider issue of the scientific status of evolution theory. The late Sir Peter Medawar and Mark Ridley, under the heading 'Evolution' in the *Fontana Dictionary of Modern Thought*, write:

> *'It is naive to suppose that the acceptance of evolution theory depends upon the evidence of a number of so-called "proofs"; it depends rather upon the fact that the evolutionary theory permeates and supports every branch of biological science, much as the notion of the roundness of the earth underlies all GEODESY and all cosmological theories on which the shape of the earth has a bearing. Thus anti-evolutionism is of the same stature as flat-earthism. Biologists therefore do not argue about whether evolution has taken place, but many details of how evolution proceeds are still matters of controversy.'*[39]

In this passage, Medawar and Ridley reveal the metaphysical assumption at the heart of evolutionary theory. If a theory depends for its acceptance upon an assumption which is not supported by relevant evidence, it can hardly be called a fact within the ambit of empirical science. It is breathtakingly presumptuous to claim that evolution is a fact when there is no agreed process as to how it occurred or even a way to test proposed evolutionary mechanisms. Yet, predictions based upon the theory can be tested, so its claims are, in fact, testable. Evolution is only therefore entitled to be considered a fact when its predictive capacity is confirmed and it is able to compellingly exclude alternative explanations.

That evolutionary theory has not managed to do this is confirmed by philosopher Max Charlesworth in a passage dealing with the late Sir Karl Popper's notion of falsification. The passage also sheds light on the persistence of evolution theory:

> *'Popper's theory of science not only suffers from internal contradictions, it also fails to account for the actual historical practice of science since falsification or refutation has not in fact been seen as essential by scientists. Quite the contrary, theories are often maintained by scientists in the face of falsificatory evidence which is simply explained away or not averted to. This is often the case when there is no clear alternative to the theory in question. For instance, there is evidence which, **prima facie,** falsifies the theory of evolution, but the explanatory value of the theory is so great and the alternatives to the theory so unthinkable, that the scientist holds on to the theory despite the apparent evidence against it. Falsification has its place in scientific enquiry, but it is certainly not the dominant place that Popper gives to it.'*[40]

Charlesworth reveals that the reason why the majority of scientists hold to the falsified theory of evolution is that they are unprepared to accept the alternative to the theory, an explanation which creationists have long accepted and highlighted. Yet, an unwillingness to consider an alternative to a theory is not a scientific attitude. Broadly applied, an unwillingness to consider alternative theories would make science impossible.

It seems that those who hold strongly to the theory of evolution have difficulty in considering an alternative to it, because the alternative explanation invokes a supernatural explanation for the origin of life. Yet, there are compelling reasons why a supernatural explanation for the origin of life provides more explanatory power than a naturalistic one. In a passage that is dealing with events not things, but which is equally relevant to things, C.S. Lewis explains why naturalistic science is inadequate to explain the ultimate source of events:

> *'Either the stream of events had a beginning or it had not. If it had, then we are faced with something like creation. If it had not (a supposition, by the way, which some physicists find difficult), then we are faced with an everlasting impulse which, by its very nature, is opaque to scientific thought. Science, when it becomes perfect, will have explained the connection between each link in the chain and the one before it. But the actual existence of the chain will remain wholly unaccountable. We learn more and more about the pattern. We learn nothing about that which "feeds" real events into the pattern. If it is not God, we must at the very least call it Destiny — the immaterial, ultimate, one-way pressure which keeps the universe on the move.*
>
> *The smallest event, then, if we face the fact that it occurs (instead of concentrating on the pattern into which, if it can be persuaded to occur, it must fit) leads*

us back to a mystery which lies outside of natural science. It is certainly a possible supposition that behind this mystery some mighty Will and Life is at work. If so, any contrast between His acts and the laws of Nature is out of the question. It is His act alone that gives the laws any events to apply to. The laws are an empty frame — not now and then on specially "providential" occasions, but at every moment.' [41]

Paraphrasing Lewis's argument in relation to things, we could say, 'The smallest thing, then, if we face the fact that it exists, leads us back to a mystery which lies outside of natural science.'

The origin of matter and life must therefore be sought in a domain which is inaccessible to science because, as C. S. Lewis put it so cogently in responding to an assertion that science has demonstrated that there is nothing beyond nature:

'But, don't you see, said I, that science never could show anything of the sort? Why on earth not? Because science studies nature. And the question is whether anything ***besides*** *nature exists - anything "outside ". How could you find that out by studying simply nature?'* [42]

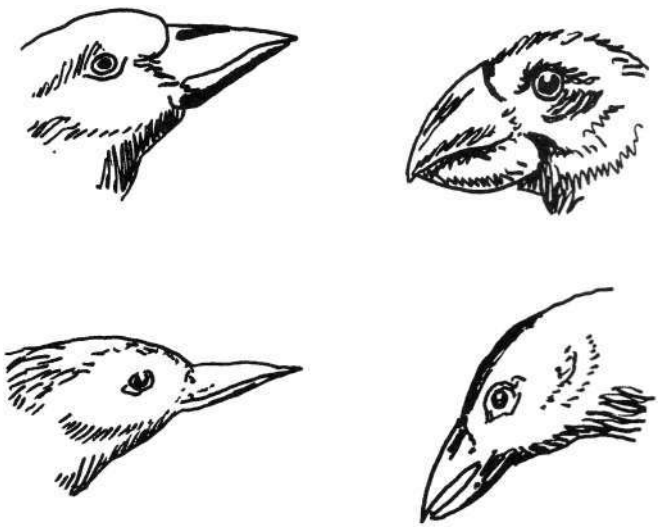
Evolutionary science, then, by attempting to explain that which is beyond its legitimate methodology, exposes itself as an oxymoron.

The extent to which evolutionists are willing to go to maintain a naturalistic explanation for the origin of life is revealed by Stuart Kauffman:

'But now the coup de grâce: to duplicate a bacterium, it would not suffice to create a single enzyme. Instead, it would be necessary to assemble about 2,000 functioning enzymes. The odds against this would be 1 in $10^{20 \times 2,000}$*, or 1 in* $10^{40,000}$*. These exponential notations are easy to state, but difficult to take to heart. The total number of hydrogen atoms in the universe is something like* 10^{60}*. So* $10^{40,000}$ *is vast beyond vast, unimaginably hyper astronomical. And 1 in* $10^{40,000}$ *is unthinkably improbable. If the total number of trials for life to get going is only* 10^{51}*, and the chances are 1 in* $10^{40,000}$*, then life just could not have occurred. We the lucky. We the very, very lucky. We the impossible. Hoyle and Wickramasinghe gave up on spontaneous generation, since the likelihood of the event was comparable to the chances that a tornado sweeping through a junkyard might assemble a Boeing 747 from the materials therein.*

Since you are reading this book, and I am writing it, something must be wrong with the argument. The problem, I believe, is that Hoyle, Wickramasinghe, and others have failed to appreciate the power of self organisation.' [43]

Kauffman's unwillingness to consider anything other than a naturalistic explanation for the origin of life leads him to this absurd position. He acknowledges the vast improbability of assembling a bacterium but refuses to move beyond the bounds of naturalism in the face of the overwhelming complexity of life on earth. The consistent experience of scientific observation is that life only arises from life, so Kauffman cannot appeal to science in maintaining his belief. When added to the compelling reasons for seeking an explanation for the origins of life beyond nature itself, the consistent experience of science highlights the total inadequacy of Kauffman's question-begging explanation of complexity. Special creation faces no such problem as plant, animal, and human life were all created by 'the living God'.



Variation within established complexity, such as in these finches' beaks, offers no explanation for the origin of complexity.

Science, mysticism and artificial life

The inability of evolution theory to establish its credentials in any meaningful scientific sense would normally mean that it would be abandoned as a theory and those fields of science which continued to function on its assumptions, such as artificial life, would go into terminal decline. The reasons for its persistence as a scientific theory, and its capacity to generate new fields of research, must therefore be found outside of the domain of science. Kauffman gives an early clue in *At Home In The Universe* about the spiritual and cultural dimensions which underlie his search for laws of complexity:

'We accept of course that the rise of science and the consequent technological explosion has driven us to our secular worldview. Yet a spiritual hunger remains. I recently met N. Scott Momaday, a Native American author, winner of the Pulitzer Prize, at a small meeting in northern New Mexico intending to try to articulate the fundamental issues of humanity. (As if a small group of thinkers could possibly succeed.) Momaday told us that the central

issue we confront is to reinvent the sacred …. Momaday's search for the sacred settled deep upon me, for I hold the hope that what some are calling the new sciences of complexity may help us find anew our place in the universe, that through this new science, we may recover our sense of worth, our sense of the sacred, just as the Kiowa recovered that sacred shield. At the same meeting, I suggested that the most important problem confronting humanity was the emergence of a world civilisation, its profound promise, and the cultural dislocations this transformation will cause. To undergird the pluralistic global community that is aborning, we shall need, I think, an expanded intellectual basis — a new way to think about origins, evolution and the profound naturalness of life and its myriad patterns of unfolding.

This book is an effort to contribute to that new view, for the emerging sciences of complexity, as we shall see, offer fresh support for the idea of a pluralistic democracy, providing evidence that it is not merely a human creation but part of the natural order of things …. But, as I hope to show, the very laws of complexity my colleagues and I are seeking suggest that democracy has evolved as perhaps the optimal mechanism to achieve the best attainable compromises among conflicting practical, political, and moral interests. Momaday must be right as well. We shall also need to reinvent the sacred—this sense of our own deep worth—and reinvest it at the core of the new civilisation.'[44]

Kauffman reveals that he considers his work to be nothing less than the conceptual underpinnings of a new global civilisation. Driven by a reinvention of human spirituality, this civilisation will celebrate the myriad patterns of evolutionary unfolding in a pluralistic world democracy. Kauffman finishes the book on these themes of global civilisation and reinventing the sacred.[45]

Mary Midgley, in *Evolution as a Religion: Strange Hopes and Stranger Fears,* takes issue with a number of bizarre scientific doctrines which cluster around the theory of evolution, especially the notion of evolution as an escalator which lifts the human race to greater and greater heights.[46] Midgley identifies evolution as the creation myth of our age and notes that

'… a surprising number of the elements which used to belong to traditional religion have regrouped themselves under the heading of science, mainly around the concept of evolution.'[47]

Apart from the fact that Midgley was writing in the mid 1980s, she might well have been referring to Kauffman's views, for they have many of the characteristics about which she writes. Kauffman's views reflect the concept of the irresistible cosmic escalator in the evolutionary unfolding of complexity. They also view evolution as a force for cultural unity in a manner reminiscent of traditional religion.

Midgley's description of the problem of scientific overstatement applies equally well to Kauffman's vision:

'The destructive message of this book is a somewhat dismal one. It concerns the sort of trouble which arises when, with writers less careful than Darwin, the dramas take over. About evolution, theory itself has again and again been distorted by biases flowing from over-simple, unbalanced world pictures. The trouble does not, of course, lie in mere wish-fulfilment of the obvious kind which paints the world as we should like it to be. It involves being obsessed by a picture so colourful and striking that it numbs thought about the evidence required to support it. Standards of proof then fall headlong. Half the trouble of course takes place out of sight, in the mere choice of problems, in taking some things for granted and being quite unpersuadable about others, in unconsciously placing the burden of proof on one's opponents, and sometimes in pure tribal feeling which confines one's attention to the fellow specialists who already share one's premises.'[48]

Kauffman's standards of proof are certainly amazingly low for such pretentious and inflated claims. His cosmic vision is clearly the source of the problem but this claim requires support because of its fundamental importance to my final conclusions.

While Midgley effectively exposes the scientific superstitions associated with evolution theory, her claim that these superstitions are not inherent in Darwin's theory is credulous. She claims that the great symbolic power of evolution is independent of its truth.[49] Yet, can it be credibly argued that all of the bizarre applications of Darwin's theory, from Social Darwinism through eugenics to self-organisation and globalism, are mere symbolic distortions? It is like saying that the symbolic power of Christianity can exist independently of the truth of the resurrection. The fact that scientific superstitions have clustered around evolution from its early acceptance, and the fact that the muddled and incautious enthusiasts who Midgley claims have distorted evolution theory are invariably the thought leaders of their generation, is a clear indication that the source of the superstition is the theory itself.

Creation and evolution are two world views, each claiming ultimate explanatory power for the existence of the Universe. Each derives its symbolic power from its supposed correspondence with truth. Midgley's misperception of this reality leads her to deny the clear implications of her own analysis:

'Why is this kind of cosmic mythology so strong and so persistent? The simplest explanation, no doubt, would be mere force of habit, the still-surviving toxic effect of Christian conditioning. But that is not a plausible story today. The days of

really confident Christian education are simply too far behind us, and the leading myth-bearers are themselves too rebellious, too critical, too consciously and resolutely anti-Christian. If they are indeed the mental prisoners of their opponent, in an age in which fashion is on their side and so much change is so easily accepted, there has to be a special reason for it. The power of these ideas still remains to be accounted for. This indeed is somewhat uneasily recognized, but the explanations given for it tend to be crude and hasty. The matter is too important for this. We need very badly to understand the influences involved.

In trying to understand them we shall, I believe, do best if we detach ourselves as far as possible from the old Voltairean notion of a ding-dong battle between science and religion.'[50]

The reason why the cosmic mythologies associated with evolution are so strong and persistent is that evolution functions as a religion; and not just any religion. The leading evolutionists are particularly opposed to Christianity, as Midgley reveals. **Evolution functions as a rallying point against Christianity.** Kauffman's acceptance of Native American spirituality, presumably on the basis that it is itself the outcome of an evolutionary process, is not extended to creationist spirituality. But on what conceptual grounds can creationism be excluded if it is also the result of evolution?

Kauffman's acceptance of Native American spirituality indicates that evolutionists are not opposed to all religions. In fact, there seems to be openness to all religions except those which embrace the detested, alternative world view: special creation. Interestingly, Bainbridge and Stark, in reporting on sociological research dealing with the effect of traditional religion on attitudes to supernatural and paranormal phenomena, report:

'Thus, those with no religion or only nominal religion are especially likely to accept deviant, exotic alternatives to Christianity, just as they are likely to accept Darwin. Apparently they are open to new ideas of many kinds, rather than accepting Darwin because they are well-informed secular rationalists.'[51]

They also report that those with no religious affiliation are the most receptive to unscientific notions and are more likely to become involved in occultism.[52] This may help to explain an emerging relationship between evolutionary science and the New Age movement. The recent work of some prominent evolutionary scientists reveals how the boundaries between evolutionary science and New Age spirituality are rapidly dissolving.[53] There is also convincing evidence that evolution is integral to the New Age and environmental movements.[54]

New Age author, Paul Roland, in his recent book, *Revelations,* states, *If we fear change, we stunt our own spiritual growth and with it our evolution.'*[55] Kauffman's message is similar. It reveals how evolution theory can be readily transformed into religious or social myth. I am using myth here in the sense of a concocted story which explains how things came to be. It is also used in the sense of a value-conferring belief which is unable to provide plausible grounds for its own general acceptance.

Kauffman's vision is illustrative of the modern trend to myth in science caused by the failure of science to rid itself of pretentious and largely conjectural claims that originate in evolution theory. It is also a mystical vision which seeks to reinvent the sacred. It seems hardly surprising, then, that Christopher Langton, the founding figure in artificial life, should mirror Kauffman's vision in his own ironic prophecy that there will be more 'poetry' in the future of science.[56] Artificial life emerges as a paradigmatic example of scientific mysticism.

Why the trend to scientific mysticism now? I cannot attempt a complete explanation here but I believe that the answer will involve at least the following elements. First, the trend to mysticism must be seen in the broader failure of the humanist enterprise. Carroll identifies two significant reasons why humanism has failed: it could not defeat death and it could not produce a satisfactory sense of community.[57] Mystical science is an attempt to soften the Baconian vision of science. It attempts to deal with the residual spiritual hunger in secular society by establishing a renewed sense of meaning while remaining within naturalism.

Second, the trend to scientific mysticism is related to the rise of the New Age movement and environmentalism. It is significant that the New Age movement and evolutionism have significant common ground and are united in their opposition to special creation. The fusion of the New Age movement with evolutionary humanism, that is well under way at present, is more than an alliance of convenience. It results from shared values and, more importantly, from shared antagonisms.

Third, I believe that the revival of myth and mysticism in science is inevitable when science embraces the mystical beliefs which animated scientific speculation at the dawn of Western science. As Aveni reminds us, the Greeks were the progenitors of evolution theory.[58] They attempted a naturalistic explanation of the world, believing that the laws which govern all parts of the world were identical.[59] The great Greek thinkers, including Plato and Aristotle, were also believers in magic.[60] It seems hardly coincidental that Darwin's theory took root during the great nineteenth century classical revival in Britain, and in a time when the Western imagination was ripe for it.[61] We should not find it surprising, then, that artificial life, based upon evolutionary assumptions, and having recovered law in a framework of naturalistic explanation of complexity, should return to the mythic and mystical dimensions of ancient speculative science.

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