

Further thoughts on the Challenges of Darwinism Neil Spurway - 1st Feb 2017

Background

To begin, let me make clear that I'm not, professionally an evolutionary scientist – I'm a physiologist. Dobzhansky's famous dictum, that "Nothing in biology makes sense except in the light of evolution", exactly characterizes my professional position: the physiologist has to assume, as an initial working policy, that any system he/she is studying either has now an advantageous function or had such a function in a precursor or precursors of the current species (or maybe has a different function now than then). Beyond this rather limited professional concern, however, I have for a long while seen the evolutionary concept as having profound significance both *philosophically*, in relation to the possibilities of human knowledge of the world (Evolutionary Epistemology), and *theologically*, in relation to the nature of God's action in the world and our comprehension of natural evil (Theodicy). The last of these is, of course, the key theme of my essay, "Taking Darwin seriously", which Chris Packard was kind enough to circulate as a primer for discussion in this Forum.

A number of issues have arisen in the first three weeks or so of this Forum, many prompted by my scene-setter paper. Key matters, particularly those raised by John Murray, can be summarized as:-

- *The contention of some philosophers of science, notably Popper in the first part of his intellectual life, that the Darwinian account of evolution wasn't science*
- *The narrowing down of Darwin's wide-ranging thought, by the Neo-Darwinists of the 1930s onward, to a few key principles*
- *Then a series of concepts supplementary to Neo-Darwinism, notably:*
 - *Epigenesis*
 - *Niche construction*
 - *Symbiogenesis*
 - *Horizontal gene transfer*
- *Finally, embodying all these, the Extended Evolutionary Synthesis*

Firstly, **Karl Popper**. This great man did indeed, as John Murray remarks, take a long time to view Darwinian thinking as anything more than an extended piece of biological history. But in later life he changed his view radically. He came to see that, contrary to his earlier claim, Darwinian theory did make predictions: the predictions are less quantitatively precise than in physics, but they are predictions nonetheless. (We need look no further for obvious instances than the present, hugely justified, concern about anti-biotic resistance in bacteria.) Popper then built up quite an edifice of work under the title "Evolutionary Epistemology", seeing the progress of intellectual endeavour – particularly, but

not solely, scientific endeavour – in terms of competition between rival concepts, and survival of the intellectually fittest ones. (Many other people – including me – use the term “Evolutionary Epistemology” in a slightly different way, but it would be a distraction to take time considering the difference here.) And in remarkable paper to the Royal Society in 1986 he proposed “A new interpretation of Darwinism”¹. All this is strictly an aside from our main debate, but as a lifelong admirer of Popper I couldn’t let a reference to him pass without comment.

Turning to the main debate, let’s grasp the nettle of the distinction between **Darwin’s** thinking and **Neo-Darwinism** (called, when it started in the 1930s, “The Modern Synthesis”). Neo-Darwinism is much the more restrictive: it pursues to exhaustion the idea that all evolutionary change starts from small, random variations, and the resulting competition between variants will see those with greater reproductive fitness gradually becoming the commonest form – perhaps ultimately the only surviving one. This mechanism was of course clearly proposed by Darwin, but he explicitly stated that it wasn’t the only evolutionary process. As many writers in the field now insist, “Darwin would not have been a Neo-Darwinist”. So I hope everyone will recognize that the paper of mine initially circulated by Chris Packard was entitled “Taking Darwin seriously”, *not* “Taking Neo-Darwinism seriously”!

That said, it’s important not to regard latter-day Neo-Darwinists as intellectual dinosaurs. There’s immense merit in pursuing an idea to its limit, and it is amazing how much of what we find in the current, biological world can be explained using the very simple assumptions of Neo-Darwinism. (One of my own favourite examples is the paper showing that, on very modest Neo-Darwinian assumptions, the vertebrate eye – so widely represented as an impossible challenge to evolutionary concepts could actually have evolved from a light-sensitive skin patch in less than a million years².) The Neo-Darwinist’s implicit question, “Why complicate the issue?”, is simply adhering to the law of parsimony, Occam’s razor – “Entities should not be multiplied without necessity” (or “Keep it simple, stupid!”). But the other side of this coin is that different mechanisms have actually been observed – or are strongly suggested by observation. If they are real, they must be included in an overall account.

The first of these was implied by the many powerful observations made by Conrad Waddington, beginning in the 1930s and extending over the best part of four decades. In Scotland we should be particularly sympathetic to these, because they were made in Edinburgh! Waddington reported an impressive number of instances where the conditions in which a first generation lived, affected the phenotypes (the body forms) of many subsequent generations. Acquired characteristics were being inherited, though not quite in the way proposed 150 years earlier by Lamarck. Waddington coined the term

¹ This lecture is briefly sketched by Denis Noble in *Dance to the Tune of Life*, CUP (2017), and fully published (for the first time!) in H.J. Niemann’s *Karl Popper and the Two New Secrets of Life*, Mohr Siebeck (2014).

² Nilsson, D.-E.; Pelger, S. (1994). "A pessimistic estimate of the time required for an eye to evolve". *Proceedings of the Royal Society B*: **256**: 53–58.

“**epigenesis**” for this phenomenon³ but, new name or not, his results were almost universally disbelieved – though one who very much *did* believe them, a generation or two later, was Popper, in that 1986 lecture. And now, of course, epigenetics is widely acknowledged, and well understood in genetic terms: the genetic heritage, the genome, has not been altered but the way those genes are expressed, in the next generation’s protein synthesis, has been. This knowledge would surely have presented no problem for Darwin, but it is an upset to the radical parsimony of Neo-Darwinism. And particularly it is an upset to the “central dogma” of molecular biology, proposed by Francis Crick in the mid 1950s, which acknowledged only the feed forward of information from gene to protein, and contemplated no possible feedback of influence from the periphery onto the gene.

Epigenesis can be seen at work in the most complex of organisms, including humans – the drive for food in second generation Dutch people, after the starvation inflicted during the World War 2, is a horribly powerful example. The same cannot be said of all the extra mechanisms which work of the last 30-40 years has shown to be involved in evolution, but one other that *is* principally found in complex organisms is **Niche Construction**. This is the process where a life-form actively alters its own environment, usually to its own advantage. Beavers, building dams, behind which to live and breed, are a classic example. We humans, building cities and creating supportive infrastructure, are an even stronger one.

The other processes now considered to be part of the overall mechanisms of evolution – the **Extended Evolutionary Synthesis (EES)** of John Odling-Smee and others⁴ – have only been observed in single-celled organisms (prokaryotes) and seem to me unlikely to occur in multi-cellular life-forms: I shall outline the arguments below. Probably next in historical sequence, after epigenesis, came Lynn Margulis’s resuscitation of a turn-of-the-century Russian proposal that mitochondria, the sites of oxidative energy-production in modern cells, were originally separate oxygen-utilising organisms, which had been phagocytosed by a larger host. Soon afterwards, the equivalent notion for chloroplasts was similarly enunciated, and soon the two phenomena became regarded as the most striking examples of a general category, “**Symbiogenesis**”. Strictly speaking, these accounts of the origins of mitochondria and chloroplasts remain theories, but they are so persuasive that I don’t know anyone who isn’t totally convinced: I’ve been teaching them myself for at least 25 years. However, no complex animal or, to my knowledge, plant feeds by phagocytosis – that process remains, in complex animals, among only among their defence mechanisms. That’s why symbiogenesis seems unlikely to be found there.

The position is essentially the same for another fascinating variation upon simplistic, Neo-Darwinian accounts of evolution, Carl Woese’s discovery⁵ of

³ Waddington, C.H.. *The Strategy of the Genes*, Allen & Unwin (1957, 2014).

⁴ Laland, K.N. *et al.*, “The extended evolutionary synthesis: its structure, assumptions and predictions.” *Proc Roy Soc B*: **282** (Aug 2015).

⁵ Woese, Carl R., ["On the evolution of cells"](#). *Proceedings of the National Academy of Sciences*, **99**: 8742–8747 (2002).

lateral transfer of genetic material between single-celled organisms. The exchange occurs between two organisms living simultaneously, not successively; regarding the latter, traditional mechanism of gene transfer as “vertical”, the newly-described process was termed “**horizontal gene transfer**” in contrast. Large amounts of genetic material have been seen to be conveyed between individuals in this way – a massive genetic transformation by comparison with anything envisaged by Neo-Darwinism, which deals always with individual genes, and predominantly there the exchange of one variant of a given gene (one “allele”) for another, not the total introduction or elimination of even a such single gene. The effect of horizontal gene transfer upon the evolutionary history of the early single-celled organisms must have been cataclysmic. But whether such a mechanism can operate in multi-cellular organisms must be extremely doubtful. Our cells are all eukaryotes, not prokaryotes: the DNA is protected behind a nuclear envelope. It is hard to see what circumstances in our reproduction and intra-uterine development could possibly allow for horizontal gene exchange. Exchange with the bacteria in our guts or lungs, perhaps, but wouldn't the result be very much more probably a new bacterium, not a new animal? And even if a new animal cell were formed that way, how could it escape the destructive attentions of our immune systems?

Implications for Theology

If anyone were previously in doubt that “we are fearfully and wonderfully made”, EES must surely provide that conviction. But my chief objective, in “Taking Darwin Seriously”, was to make the point that only Darwin's account of the frequently-horrible consequences of competition in the natural world makes it comprehensible as the work of a loving God. It does so by showing the ultimate good which accrues from what Chris Packard has termed the “package deal”. To my mind, therefore, the chief concern for theology, in the much richer, more diverse account of evolution now before us, is whether Natural Selection is still the predominant mechanism in the evolution of sentient creatures. This, according to all mainstream biological understanding, must mean creatures with nervous systems. (I won't take issue now with those people who believe that higher plants also show sentient behaviour, because these plants, too, are complex, highly multi-cellular structures.)

Looking back at the fascinating newly-recognised mechanisms which I have tried to outline here, Niche Construction modifies the environment with which the organisms concerned have to contend. The other three alter the organisms which enter the competitive world, from those which the Neo-Darwinist mechanism, left to itself, would have produced. But none of them, to my mind, alters to the least degree the fundamental Darwinian perception that the resultant, living organisms are subject to Natural Selection in that world: *competition is still the final arbiter*. So my belief that here we have the explanation for suffering in the natural world remains unaffected by the broadened understanding of evolutionary mechanisms which has grown up since the heyday of The Modern Synthesis. That's why I didn't feel it necessary to

complicate "Taking Darwin seriously" for the pure-theologian readers I was initially writing for.

Postscript: Sometimes it is useful to set out one's starting point on a topic as a way of managing the readers' expectations and interpretation. Having said so much about my scientific position, perhaps I should also briefly characterize my theological position. I am dogmatically opposed to all forms of dogmatism, particularly in theology. Instead I share Vaclav Havel's preference for seekers after truth over those who think they've found it, whether in the uncritically literal reading of any scripture, the dogmas of any church or the proclamations of any charismatic leader. The divine gift of thought should be separately deployed by everybody, to the best of his/her ability – or so I believe.