

Was Darwin Wrong?

Christopher Booker is a contrarian English journalist who writes extensively on science-related issues. He has produced possibly the best available critical review of the [anthropogenic global warming](#) hypothesis. He has cast [justifiable doubt](#) on the alleged ill effects of low-level pollutants like airborne asbestos and [second-hand tobacco smoke](#).

Booker has also lobbed a few hand-grenades at Darwin's [theory of evolution](#). He identifies a real problem, but his criticism misses a point which is also missed even by some Darwin fans.

Is Anti-Darwin 'Politically Incorrect'?

In that 2010 article, Booker was reacting to a seminar of Darwin skeptics, many very distinguished in their own fields. These folk had faced hostility from the scientific establishment which seemed to Booker excessive or at least unfair. Their discussion provided all the ingredients for a conspiracy novel:

"[T]hey had come up against a wall of hostility from the scientific establishment. Even to raise such questions was just not permissible. One had been fired as editor of a major scientific journal because he dared publish a paper sceptical of Darwin's theory. Another, the leading expert on his subject, had only come lately to his dissenting view and had not yet worked out how to admit this to his fellow academics for fear that he too might lose his post."

The problem was raised at an earlier conference:

"[A] number of expert scientists came together in America to share their conviction that, in light of the astonishing intricacies of construction revealed by molecular biology,

Darwin's gradualism could not possibly account for them. So organizationally complex, for instance, are the structures of DNA and cell reproduction that they *could not conceivably have evolved just through minute, random variations*. Some other unknown factor must have been responsible for the appearance of these 'irreducibly complex' micromechanisms, to which they gave the name 'intelligent design'." [my emphasis]

I am a big fan of Darwin. I also have respect for Booker's skepticism. The contradiction can be resolved if we look more carefully at what we know now—and at what Darwin actually said.

The Logic of Evolution

There are three parts to the theory of evolution:

1. The fact of evolution itself. The fact that the human species shares common ancestors with the great apes. The fact that there is a phylogenetic "tree of life" which connects all species, beginning with one or a few ancestors who successively subdivided or became extinct in favor of a growing variety of descendants. Small divergences became large ones as one species gave rise to two and so on.
2. *Variation*: The fact that individual organisms vary—have different *phenotypes*, different physical bodies and behaviors—and that some of these individual differences are caused by different *genotypes*, and so are passed on to descendants.
3. *Selection*: The fact that individual variants in a population will also vary in the number of viable offspring to which they give rise. If number of offspring is correlated with some heritable characteristic—if particular genes are carried by a fitter phenotype—then the next generation may differ

phenotypically from the preceding one.

Notice that in order for selection to work, at every stage the new variant must be more successful than the old. An example: Rosemary and [Peter Grant](#) looked at birds on the Galapagos Islands. They studied populations of finches, and noticed surprisingly rapid increases in beak size from year to year. The cause was weather changes which changed the available food for a few years from easy- to hard-to-crack nuts. Birds with larger beaks were more successful in getting food and in leaving descendants. Natural selection operated amazingly quickly, leading to larger average beak size within just a few years. Bernard [Kettlewell](#) observed a similar change, over a slightly longer term, in the color of the peppered moth in England. As tree bark changed from light to dark to light again as industrial pollution waxed and waned over the years, so did the color of the moths. There are several other “natural experiments” that make this same point.

None of the serious critics of Darwinian evolution seems to question evolution itself, the fact that organisms are all related and that the living world has developed over many millions of years. The idea of evolution preceded Darwin. His contribution was to suggest a mechanism, a process—natural selection—by which evolution comes about. It is the supposed inadequacy of this process that exercises Booker and other critics.

Looked at from one point of view, Darwin’s theory is almost a tautology, like a theorem in mathematics:

1. Organisms vary (have different phenotypes).
2. Some of this variation is heritable, passed from one generation to the next (have different genotypes).
3. Some heritable variations (phenotypes) are fitter

(produce more offspring) than others because they are better adapted to their environment.

4. Ergo, each generation will be better adapted than the preceding one. Organisms will evolve.

Expressed in this way, Darwin's idea seems self-evidently true. But the simplicity is only apparent.

The Direction of Evolution

Darwinian evolution depends on not one but two forces: selection, the gradual improvement from generation to generation as better-adapted phenotypes are selected; and variation: the set of heritable characteristics that are offered up for selection in each generation. This joint process can be progressive or stabilizing, *depending on the pattern of variation*. Selection/variation does not necessarily produce progressive change. This should have been obvious, for a reason I describe in a moment.

The usual assumption is that among the heritable variants in each generation will be some that fare better than average. If these are selected, then the average must improve, the species will change—adapt better—from one generation to the next.

But what if variation only offers up individuals that fare *worse* than the modal individual? These will all be selected against and there will be no shift in the average; adaptation will remain as before. This is called *stabilizing* selection and is perhaps the usual pattern. Stabilizing selection is why many species in the geological record have remained unchanged for many hundreds of thousands, even millions, of years. Indeed, a forerunner of Darwin, the 'father of geology' James Hutton (1726-1797), came up [with the idea](#) of natural selection as an explanation for the *constancy* of species. The difference—progress or stasis—depends not just on selection but on the range and type of *variation*.

The Structure of Variation

Darwin's process has two parts: variation is just as important as selection. Indeed, without variation, there is nothing to select. But like many others Richard Dawkins, a Darwinian fundamentalist, puts all the weight on selection: "Natural selection is the force that drives evolution on," says Dawkins in one of his many [TV shows](#). Variation represents "random mistakes" and the effect of selection is like "modelling clay". Like Christopher Booker, he seems to believe that natural selection operates on small, random variations.

Critics of evolution simply find it hard to believe that the complexity of the living world can all be explained by selection from small, random variations. Darwin was very well aware of the problem: "If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down." [*Origin*] But he was being either naïve or disingenuous here. He should surely have known that outside the realm of logic, proving a negative (proving that you *can't* do something) is next to impossible. Poverty of imagination is not disproof!

Darwin was concerned about the evolution of the vertebrate eye: focusing lens, sensitive retina and so on. How could the bits of an eye evolve and be useful before the whole perfect structure has evolved? He justified his argument by pointing to the wide variety of primitive eyes in a range of species that lack many of the elements of the fully-formed vertebrate eye but are nevertheless better than the structures that preceded them.

There is [general agreement](#) that the focusing eye could have evolved in just the way that Darwin proposed. But there is some skepticism about many other extravagances of evolution:

all that useless patterning and behavior associated with sexual reproduction in bower birds and birds of paradise; the unnecessary ornamentation of the male peacock and many other examples of apparently maladaptive behavior associated with reproduction; even human super-intelligence (we seem to be much smarter than we needed to be as hunter-gatherers). The theory of [sexual selection](#) was developed to deal with cases like these, but it must be admitted that many details are still missing.

The fundamental error in Booker's criticism of Darwin as well as Dawkins' celebration of him, is the claim that evolution always occurred "*just through [selection of] minute, random variations*". Selection, natural or otherwise, is just a filter. It creates nothing. Variation proposes, selection just disposes. All the creation is supplied by the processes of variation. If variation is not totally random or always small in extent, if it is creating complex structures, not just tiny variations in existing structures, then *it* is doing the work, not selection.

Non-Random Variation

In Darwin's day, nothing was known about genetics. He saw no easy pattern in variation, but was impressed by the power of selection, which was demonstrated in artificial selection of animals and crops. It was therefore reasonable and parsimonious for him to assume as little structure in variation as possible. But he also discussed many cases where variation is neither small nor random. So-called "sporting" plants are examples of quite large changes from one generation to the next, "that is, of plants which have suddenly produced a single bud with a new and sometimes widely different character from that of the other buds on the same plant." What Darwin called *correlated variation* is an example of linked, hence non-random, characteristics. He quotes another distinguished naturalist writing that "Breeders believe that

long limbs are almost always accompanied by an elongated head” and “Colour and constitutional peculiarities go together, of which many remarkable cases could be given among animals and plants.” Darwin’s observation about correlated variation has been strikingly confirmed by a long-term [Russian experiment](#) with silver foxes selectively bred for their friendliness to humans. After several generations, the now-friendly animals began to show many of the features of domestic dogs, like floppy ears and wagging tails.

“Monster” fetuses and infants with characters much different from normal have been known for centuries. Most are mutants and they show large effects. But again, they are not random. It is well known that some inherited deformities, like extra fingers and limbs or two heads, are relatively common, but others—a partial finger or half a head—are rare to non-existent.

Most monsters die before or soon after birth. But once in a very long while such a non-random variant may turn out to succeed better than the normal organism, perhaps lighting the fuse to a huge jump in evolution like the [Cambrian explosion](#). Stephen Jay Gould publicized George Gaylord Simpson’s “[tempo and mode in evolution](#)” as *punctuated equilibrium*, to describe the sometimes sudden shift from stasis to change in the history of species evolution. Sometimes these jumps may result from a change in selection pressures. But some may be triggered by an occasional large monster-like change in phenotype with no change in the selection environment.

The kinds of phenotypic (observed form) variation that can occur depend on the way the genetic instructions in the fertilized egg are translated into the growing organism. Genetic errors (mutations) may be random, but the phenotypes to which they give rise are most certainly not. It is the phenotypes that are selected not the genes themselves. So selection operates on a pool of (phenotypic) variation that is not always “small and random”.

Even mutations themselves do not in fact occur at random. *Recurrent* mutations occur more frequently than others, so would resist any attempt to select them out. There are sometimes links between mutations so that mutation A is more likely to be accompanied by mutation B ("[hitchhiking](#)") and so on.

Is There Structure to Variation?

An underlying mystery remains: just how is the information in the genes translated during development into the adult organism? How might one or two modest mutations sometimes result in large structured changes in the phenotype? Is there any directionality to such changes? Is there a pattern? Some recent studies of the [evolution of African lake fish](#) suggests that there may be a pre-determined pattern. Genetically different cichlid fish in different lakes have evolved to look almost identical. "In other words, the 'tape' of cichlid evolution has been run twice. And both times, the outcome has been much the same." There is room, in other words, for the hypothesis that natural selection is not the sole "driving force" in evolution. Some of the process, at least, may be pre-determined.

The laws of development (ontogenesis), if laws there be, still elude discovery. But the origin of species (phylogenesis) surely depends as much on them as on selection. Perhaps these largely unknown laws are what Darwin's critics mean by 'intelligent design'? But if so, the term is deeply unfortunate because it implies that evolution is guided by intention, by an inscrutable agent, not by impersonal laws. As a hypothesis it is untestable. Darwin's critics are right to see a problem with "small, random variation" Darwinism. But they are wrong to insert an intelligent agent as a solution and still claim they are doing science. Appealing to intelligent design just begs the question of how development actually works. It is not science, but faith.

Darwin's theory is not wrong. As he knew, but many of his fans do not, it is incomplete. Instead of paying attention to the gaps, and seeking to fill them, these enthusiasts have provided a straw man for opponents to attack. Emboldened by its imperfections they have proposed as an alternative 'intelligent design': an untestable non-solution that blocks further advance. Darwin was closer to the truth than his critics—and closer than some simple-minded supporters.

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