Evolution—a short guide for the perplexed

Bruce Craven

Reader in Mathematics at Melbourne University until retirement. Still active in mathematical research and writing.

Introduction

Some people 'believe in' evolution, as if it were a religion. Some conclude from it that predatory human behaviour ('winner takes all') is justified. Some say that, because mutations are random, there can be no purpose or meaning in the world, or ourselves. Some strongly disbelieve in evolution because it conflicts with an interpretation of a sacred text. All these are serious distortions of a scientific theory.

Note that 'theory' means a coherent set of ideas, with substantial evidence to support them. It does NOT mean a dodgy conjecture, with little to back it.

It is a big misunderstanding to put evolution in that dodgy class. Nonetheless, evolution includes a whole package of ideas, and they are not all equally supported by evidence. No one need swallow a whole package without considering its various ingredients.

The sacred text mentioned (Genesis) is worthy of respect. But it has been interpreted quite differently, in ancient times (long before our current disputes) as well as now. A literal six-day creation of a 'young earth' is not the only tenable interpretation. For an outline of this issue, see What does Genesis tell us?[1]

What do observations tell?

There is strong evidence from observations that:

(a) the earth is much older than a few thousand years,

(b) many biological species have become extinct, and that others have arisen,

(c) there are common biological ancestries (see especially the DNA evidence).

(d) neo-Darwinian natural selection operates locally (for closely related species.)

[1] http://iscast.org.au/pdf/CravenWhatGenesisTells.pdf

How old is the earth?

In the last two centuries, geologists have observed rock strata that must have been laid down in sequence and fossils of many animals and plants that are no longer with us. These things only make sense with a much longer time scale than a few thousand years. When a river winds in and out of mountains several times, a slow rising of the land explains it; no flood can do so (The details don't fit.) Also radioactive dating methods indicate an old earth.

Changes in plant and animal species

Fossil evidence shows that many biological species, including many groups of similar-appearing species, have come and gone over a long period of time. This strongly suggests a process of development from some species to other species. Recent studies of DNA have supported this, by showing that the genetic material from various species, including human, has a great deal in common.

Mechanism of change

Experiments within a species, or with closely similar species, indicate that such development can happen by a combination of mutations of genetic material, with some 'natural selection'.

Large changes?

Large changes, as from one species to a very different species, are more difficult. If one assumes that 'natural selection' was the main process operating, for large changes as well as for small changes, then the fossil evidence can be interpreted (with Darwin) in terms of many small changes produced by 'natural selection'. This is the explanation usually given. But how sure are we that it happened just this way?

Implications

'Evolution' is a difficult idea to discuss. Does a statement that 'evolution has been established' refer to items (a), (b) and (c), or also to (d), or also to claim that 'natural selection' is the complete explanation for the 'large changes'? But the evidence for the last is of a different character to the previous items and sometimes involves long chains of conjecture, and an assumption that only one process was operating.

Could there be an evolutionary interpretation of anything that possibly might be observed? (Popper has questioned whether evolution could be falsified by any possible observation.) A 'unifying principle' that fits everything also predicts nothing. We cannot travel to distant past time, to experiment and observe.

Randomness

This is a slippery concept. In popular language, 'random' may mean haphazard and unstructured; but that can mislead. Consider a 'purely random' sequence of coin tosses, supposing heads and tails are equally

likely. Will this sequence contain some structure, say Shakespeare's 'Hamlet' (in teleprinter code)? Yes, but you must wait very long, likely longer than the age of the universe! Moreover, garbled versions of 'Hamlet' are equally likely, and how can you tell which is the right one, without some principle of selection that is external to the random process. The popular idea that life came out of pure randomness offers neither sense nor explanation.

Structure

Structure is present from the beginning, as well as randomness. As an illustration, Conway's computer game 'Life' indeed builds up interesting patterns on the screen, from what looks like randomness. But the essential structure, the 'rules of the game', are there from the start. If they seem few, it is because they are mathematical, and mathematics is a concise language.

So, the universe did not start by a random event in the vacuum. The 'vacuum' is not empty, but is highly structured, containing all the laws of physics.

Mutations plus natural selection do not make a purely random process. At the least, they include a great deal of non-random biological and chemical structure. It is misleading to stress the random and forget the structure.

Design and purpose

A scientific study of mechanism does not consider design and purpose, but equally it does not refute them. For a discussion of this issue, see: Must evolution exclude purpose?[2]

Some eminent scientists, both religious believers and those opposed to religion, have stated that evolutionary biology is compatible with a belief in a creator God with purposes, and also compatible with atheism. A choice between these positions does not depend on science.

Supporters of 'intelligent design' (a different view from 'young earth') assert that some developments, such as the eye, were too complicated to have happened by natural selection. While this is not a scientific hypothesis, it suggests hypotheses that might be tested. Was there enough geological time available, and enough isolation from external random disturbances, for such a complex development to happen?

Where are we?

It is well to acknowledge that we do not have all the answers. Aside from passing exams, one might well accept items (a) through (d) above as strongly supported, but consider the explanation of the large changes by natural selection only as more conjectural, awaiting more evidence.

---

[2] http://iscast.org.au/pdf/CravenonID.pdf

In any case, evolution cannot be a complete and unique explanation for the development of life. A century ago, the poet Flecker[3] wrote, about a possible world of the future:

> But have you wine and music still,
> And statues and a bright-eyed love,
> And foolish thoughts of good and ill,
> And prayers to them who sit above?

[3] Flecker, JE, 1884–1915, http://en.wikiquote.org/wiki/James_Elroy_Flecker, viewed October 23 2008.