Darwin's theory – no stranger to controversy?

Today, 150 years after its publication, an overwhelming body of evidence has been collected in support of Darwin's theory, but it is attracting as much, or more, controversy than ever. Discussions continue over the details of the theory and how evidence from the fossil record and (more recently) genome comparisons should be interpreted. There is debate over the extent to which the theory can be usefully applied to social and cultural subjects and the deep implications of a Darwinian view of individual and social behaviours. Finally, a fierce argument is raging between militant atheists and proponents of Creationism and Intelligent Design, over the authority of evolution versus creation accounts in sacred texts. The protagonists are adamant that their worldviews are mutually exclusive, while many people recognise that the arguments may be more subtle. What do you think?

Evolving language

Darwin's thinking on evolution may have been influenced by studies on language evolution, which pre-date his theory by at least 70 years. Darwin noted that, although languages have changed and divided at different rates, we are able to organise them in a genealogy and it should, therefore, be possible to do the same for species.

The way words are used and the meaning they are given is constantly changing. Typically, new words, variations on existing words and new meanings are created in small social groups, from which they may spread into more-or-less general use. Words and meanings also regularly fall into disuse. Increasingly, languages are intermixed, with words being shared directly, rather than translated. So words vary, reproduce and are inherited, some may not survive.

Researchers have seen startling parallels between the laws that govern evolution of language and those that govern the evolution of species. For example, the meanings of frequently used words (more critical elements in language) change more slowly than the meanings of words that are used infrequently (less critical elements).

Evolving language

*There is still debate over what is meant by 'a species'. We expect different species to look different, but contrast the following examples of species. Two 'species' of butterfly (*Heliconius himera *and* H. erato*) can mate and produce fertile hybrids, but the adults look completely different from one another. What was, until very recently, thought to be one species of earthworm actually includes four species. The comparison of genomes from different species is, in some cases, re-writing genealogies where the relationships were originally based on (mis-leading) similarities between physical characteristics.*

How can you tell when a new species emerges from an old one? The scientist's answer is that when two individuals can no longer mate and produce fertile offspring, then they are different species. Reproductive isolation of populations is essential for new species to develop. This isolation can be based on geography, behaviour, or a physical or genetic change, but it must minimise genetic mixing so that natural selection can operate on separate populations. The Galapagos Islands are home to related, but reproductively isolated, populations living in slightly different environments – hence their importance in the development of Darwin's theory.

Heliconius erato

BJANKA KADIC/SCIENCE PHOTO LIBRARY

Microraptor dinosaur

Gone extinct or moved on?

One of the main bodies of evidence that supports Darwin's theory is the fossil record. However, the fossil record itself has sometimes generated controversy, both over the interpretation of individual fossil remains and the relationships between fossils. One particular area of debate has been the evolution of the birds.

Epidexipteryx *is a recently discovered very bird-like, pigeon-sized dinosaur that may be a clue to why feathers first evolved. The feathers of this dinosaur were useless for flying, but its four long and elaborate tail feathers probably made a striking display. Fossils of feathery, but flightless, dinosaurs are quite common and it may be that feathers first evolved as an insulating layer or for ornamentation. Variations in these early feathers, acted on by natural selection, eventually led to groups of dinosaurs with feathers suited to gliding and flight. The squirrel-sized* Microraptor *may represent an important step in this story as scientists believe that it used long feathers on its arms and its legs to glide from tree to tree. So not all the dinosaurs went extinct – as some were the ancestors of birds and their descendants are still with us today.*

The development of DNA technology allows us to make detailed comparisons between the genomes of different species and this has added to the supporting evidence for evolution. The structure of the genome is an internal record of a species' evolutionary history, its 'fossil' record written in its DNA.

Read more at http://www.darwin.rcuk.ac.uk

***Darwin Today** is raising awareness of the importance of Darwin's theory of evolution by natural selection, in current research and innovation across many disciplines. **Darwin Today** is targeting general audiences around the UK. It is led by the Biotechnology and Biological Sciences Research Council on behalf of the UK Research Councils.*

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