BOOKS & ARTS

Evolution's highest branches

An intriguing tour around and, especially, up the tree of life.

Creatures of Accident: The Rise of the Animal Kingdom

by Wallace Arthur

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Matthew A. Wills

All life on Earth, no matter how complex, shares a common, very simple, ancestor. You and the bacteria in your gut have been evolving away from this starting point for precisely the same length of time. So how is it that you are capable of perusing a magazine, whereas your gut bacteria look little different from the most ancient prokaryote fossils we know? The answer, in a nutshell, is development.

From a starting point of maximum simplicity, there are only two directions you can take. One, to borrow an analogy provided by Wallace Arthur in his book *Creatures of Accident*, is 'sideways' — to diversify without increasing in complexity, an endless fugue on the bacterial theme. Undeniably, this strategy has worked very well: there are more prokaryotes on the planet today than anything else. The other direction is 'up', towards more complex and elaborate forms. But this is risky and difficult, witnessed by the gap of perhaps three billion years between the first prokaryotes and the first

animals. Assembling a complex body means you have to glue cells together, organize and differentiate them. Dividing one adult into two simply won't do; you need to develop.

Evolution seems to have produced developmental complexity very differently from the way an engineer would have designed it. Components, from genes to legs, are duplicated, and sister copies freed up and recruited elsewhere. Biologists in the 1990s were astonished to discover that flies and humans share the same underlying *Hox* gene mechanism to pattern their bodies from head to tail. But they were even more astonished to find that part of the same mechanism is cannibalized to regulate the development of vertebrate limbs.

So, how should we visualize the tree of life at the broadest scale? Arthur considers all the popular devices: the ladder (a one-dimensional, anthropocentric model, with its connotations of progress); the cladist's dendrogram (in some respects the opposite, egalitarian view, which places all species at the tips and ignores time); and the geologist's fossil-range chart (which considers time alone). Only by combining elements of all these can we get something approaching a meaningful picture.

But the story of increasing complexity —

the 'up' — has been downplayed to an absurd degree, and Arthur's book seeks to remedy this. The complexity of any given lineage can decrease as well as increase, but the 'average' and 'maximum' complexity (in a statistical sense, mass extinctions aside) have increased right up to recent times. The human brain enables behaviours vastly more elaborate than those of even our closest relatives. But is this an inevitable corollary of evolution? Arthur — like Simon Conway Morris in his excellent book *Life's Solution* (Cambridge University Press, 2003) — thinks it probably is.

The subtext and closing chapters are an attack on fundamentalism of every stripe. Pleasingly, there is little explicit tilting at the straw men of creationism and intelligent design: atheism and theism are equally irrational in Arthur's view. Richard Dawkins, famously, has no truck with this stance "because the same could be said of Father Christmas and tooth fairies". But to lump these with the 'God hypothesis' is facile: the latter has at least been entertained by some celebrated evolutionary thinkers (George Gaylord Simpson, Theodosius Dobzhansky, Stephen Jay Gould and even Charles Darwin from time to time). Dawkins is glib on this: if only we would look at the evidence, God would disappear in a puff of logic. Arthur gives the lie to this, finding nothing to evaluate: "I see no more reason for a rational scientist to be a committed atheist than to be a committed theist."

Arthur's science, although beautifully simplified and readable, is never simplistic. Unfortunately, theological arguments lose out: a liberal, humanist world-view doesn't inevitably flow from the story in the preceding chapters (or, if it does, I needed to hear the arguments hammered out), and I hit the glossary with a bump. But this is a small criticism. Readers whose interest is piqued should check out *Dawkins' God* by Alister McGrath (Blackwell, 2004) and *Pascal's Fire* by Keith Ward (Oneworld, 2006).

Creatures of Accident richly deserves to be read widely. With biology teaching becoming increasingly reductionist, it offers the (gloriously coined) "megaevolutionary" perspective. Lay readers will find plenty of surprises, and those with a more scientific background will find Arthur's straightforward and non-posturing style hugely enjoyable.

Matthew A. Wills is a lecturer in evolutionary biology at the University of Bath, Claverton Down, Bath BA2 7AY, UK.