First 'rule' of evolution suggests that life is destined to become more complex

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Scientists have revealed what may well be the first pervasive ‘rule’ of evolution. In a study published in the *Proceedings of the National Academy of Sciences* researchers have found evidence which suggests that evolution drives animals to become increasingly more complex.

Looking back through the last 550 million years of the fossil catalogue to the present day, the team investigated the different evolutionary branches of the crustacean family tree.

They were seeking examples along the tree where animals evolved that were simpler than their ancestors.

Instead they found organisms with increasingly more complex structures and features, suggesting that there is some mechanism driving change in this direction.

“If you start with the simplest possible animal body, then there’s only one direction to evolve in – you have to become more complex,” said Dr Matthew Wills from the Department of Biology & Biochemistry at the University of Bath who worked with colleagues Sarah Adamowicz from from the University of Waterloo (Canada) and Andy Purvis from Imperial College London.

“Sooner or later, however, you reach a level of complexity where it’s possible to go backwards and become simpler again.

“What’s astonishing is that hardly any crustaceans have taken this backwards route.

“Instead, almost all branches have evolved in the same direction, becoming more complex in parallel.

“This is the nearest thing to a pervasive evolutionary rule that’s been found.

“Of course, there are exceptions within the crustacean family tree, but most of these are parasites, or animals living in remote habitats such as isolated marine caves.

“For those free-living animals in the ‘rat-race’ of evolution, it seems that competition may be the driving force behind the trend.

“What’s new about our results is that they show us how this increase in complexity has occurred.

“Strikingly, it looks far more like a disciplined march than a milling crowd.”

Dr Adamowicz said: “Previous researchers noticed increasing morphological complexity in the fossil record, but this pattern can occur due to the chance origination of a few new types of animals.

“Our study uses information about the inter-relatedness of different animal groups – the ‘Tree of Life’ – to demonstrate that complexity has evolved numerous times independently.”

Like all arthropods, crustaceans’ bodies are built up of repeating segments. In the simplest crustaceans, the segments are quite similar - one after the other. In the most complex, such as shrimps and lobsters,

almost every segment is different, bearing antennae, jaws, claws, walking legs, paddles and gills.

The American biologist Leigh Van Valen coined the phrase 'Red Queen' for the evolutionary arms race phenomenon. In Through the Looking-Glass Lewis Carroll's Red Queen advises Alice that: "It takes all the running you can do, to keep in the same place."

"Those crustacean groups going extinct tended to be less complex than the others around at the time," said Dr Wills.

"There's even a link between average complexity within a group and the number of species alive today.

"All organisms have a common ancestor, so that every living species is part of a giant family tree of life."

Dr Adamowicz added: "With a few exceptions, once branches of the tree have separated they continue to evolve independently.

"Looking at many independent branches is similar to viewing multiple repeated runs of the tape of evolution.

"Our results apply to a group of animals with bodies made of repeated units. We must not forget that bacteria – very simple organisms – are among the most successful living things. Therefore, the trend towards complexity is compelling but does not describe the history of all life."

Source: University of Bath

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