Research shows not only the fittest survive

March 27 2011

Darwin's notion that only the fittest survive has been called into question by new research published today in *Nature*.

A collaboration between the Universities of Exeter and Bath in the UK, with a group from San Diego State University in the US, challenges our current understanding of evolution by showing that biodiversity may evolve where previously thought impossible.

The work represents a new approach to studying evolution that may eventually lead to a better understanding of the diversity of bacteria that cause human diseases.

Conventional wisdom has it that for any given niche there should be a best species, the fittest, that will eventually dominate to exclude all others.

This is the principle of survival of the fittest. Ecologists often call this idea the `competitive exclusion principle' and it predicts that complex environments are needed to support complex, diverse populations.

Professor Robert Beardmore, from the University of Exeter, said: "Microbiologists have tested this principle by constructing very simple environments in the lab to see what happens after hundreds of generations of bacterial evolution, about 3,000 years in human terms. It had been believed that the genome of only the fittest bacteria would be left, but that wasn't their finding. The experiments generated lots of unexpected genetic diversity."

This test tube biodiversity proved controversial when first observed and had been explained away with claims that insufficient time had been allowed to pass for a clear winner to emerge.

The new research shows the experiments were not anomalies.

Professor Laurence Hurst, of the University of Bath, said: "Key to the new understanding is the realisation that the amount of energy organisms squeeze out of their food depends on how much food they have. Give them abundant food and they use it inefficiently. When we combine this with the notion that organisms with different food-utilising strategies are also affected in different ways by genetic mutations, then we discover a new principle, one in which both the fit and the unfit coexist indefinitely."

Dr Ivana Gudelj, also from the University of Exeter, said: "The fit use food well but they aren't resilient to mutations, whereas the less efficient, unfit consumers are maintained by their resilience to mutation. If there's a low mutation rate, survival of the fittest rules, but if not, lots of diversity can be maintained.

"Rather nicely, the numbers needed for the principle to work accord with those enigmatic experiments on bacteria. Their mutation rate seems to be high enough for both fit and unfit to be maintained."

Dr. David Lipson of San Diego State University, concluded: "Earlier work showed that opposing food utilisation strategies could coexist in complex environments, but this is the first explanation of how trade-offs, like the one we studied between growth rate and efficiency, can lead to stable diversity in the simplest possible of environments."

Provided by University of Exeter