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<http://idw-online.de/de/news847840>Forschungs- / Wissenstransfer, Forschungsergebnisse
Biologie
überregional**Insights into Evolutionary Dynamics: New Study Reveals the Evolution of Evolvability**

• Evolvability and natural selection: Study shows how natural selection optimises genetic systems for future adaptations. • Hypermutable locus: Discovery of a locus that generates mutations 10,000 times faster and enables rapid adaptation. • Adaptation with foresight: Study shows how natural selection enables organisms to anticipate and adapt to future environmental changes.

A new study by researchers at the Max Planck Institute for Evolutionary Biology (MPI-EB) sheds fresh light on one of the most debated concepts in biology: evolvability. The work provides the first experimental evidence showing how natural selection can shape genetic systems to enhance future capacity for evolution, challenging traditional perspectives on evolutionary processes.

The ability of organisms to generate adaptive genetic variation is crucial for evolutionary success, particularly in changing environments. The MPI-EB study investigates whether natural selection operates not merely as a "blind" process driven by random mutations but could actively favor mechanisms that channel mutations toward adaptive outcomes.

The researchers conducted a three-year experiment with experimental microbial populations. These populations were subjected to an intense selection regime requiring repeated transitions between two phenotypic states under fluctuating environmental conditions. Lineages unable to develop the required phenotype were eliminated and replaced by successful ones, creating conditions for selection to hone traits adaptive at the level of lineages.

Evolution of a hyper-mutable locus delivers foresight

Through the analysis of more than 500 mutations, the study uncovered the emergence of a localized hyper-mutable genetic mechanism in certain microbial lineages. This hyper-mutable locus, which arose through a multi-step evolutionary process, exhibited a mutation rate up to 10,000 times higher than that of the original lineage. It enabled rapid and reversible transitions between phenotypic states through a genetic mechanism similar to contingency loci in pathogenic bacteria.

"Experiments often lay the path to new understanding, dispelling mystery through elucidation of mechanistic detail," said Paul Rainey, the study's senior author. "Our findings show that selection at the level of lineages can drive the evolution of traits that enhance evolutionary potential, offering a fascinating glimpse into how evolution can gain what appears to be 'foresight'." Michael Barnett, the study's first author, added: "By demonstrating the evolution of a hyper-mutable locus, we show that adaptation is not just about surviving in the present but also about refining the ability to adapt in the future."

The results challenge the long-held view that evolution operates without foresight. Instead, they reveal how natural selection can embed evolutionary history into genetic architecture, enabling organisms to "anticipate" environmental

The research is detailed in the article “Experimental Evolution of Evolvability” by Michael Barnett, Lena Meister, and Paul Rainey, published in the journal *Science*.

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