Plasticity-led evolution in the phenotype of a freshwater snail: from the epigenome to genetic change.

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Evolution is believed to start out from completely random mutation. This makes us unable to predict future mutations. However, researchers recently suggested that mutation may not always be random. Individual organisms can respond to their environment with a change in their physical composition. For example, snails develop sturdier shells as a defense when exposed to predators, and this is called a plastic response. The mechanism behind this phenomenon is the addition of different molecules to the DNA, and this is known as epigenetics. These molecules do not alter the DNA sequence itself, but control how many copies of each gene are produced, and this changes the composition of organisms. Now, the genetic regions where these molecules attach to the DNA might have a higher probability of mutating, which would make mutation non-random. As the plastic response might thus precede evolution, this is known as plasticity-led evolution. Our Freigeist research group aims to investigate this process in the sexually reproducing snail Physella acuta. We will first characterize the cues responsible for inducing plastic antipredator defenses. Subsequently, we will follow the evolutionary process in either the presence or the absence of these cues over up to 30 generations. Here, we will track individual variation and evolutionary change not only in behavioral, morphological and life-history traits but also in epigenomes and genomes. Any experimental proof of plasticity-induced non-random mutation would substantially shake up standard evolutionary theory. Knowing that some gene regions are more likely to mutate than others may bring us one step closer to predict prospective mutants even before they appear and to foresee evolution better.

Projektbeteiligte

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