Universität Basel

Research Project

The evolutionary and ecological context of adaptive radiation in cichlid and other fishes from Lake Tanganyika

Third-party funded project

Project title The evolutionary and ecological context of adaptive radiation in cichlid and other fishes from Lake Tanganyika
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Adaptive radiation — the rapid origination of a set of ecologically and morphologically highly distinct species within an organismal lineage resulting from their adaptation to different habitat and/or feeding niches — is arguably one of the most intriguing evolutionary processes and thought to be responsible for much of the diversity of life on Earth. In line with this, the investigation of exceptional instances of adaptive radiation, such as the 'Cambrian explosion', Darwin's finches on Galápagos, the Caribbean anole lizards, and the cichlid fishes in the African Great Lakes, has shaped our understanding of the patterns and processes of organismal diversification. However, such outbursts of diversity have typically been examined as stand-alone packages without taking into consideration other groups of organisms that co-occur with the radiating lineages in the same — in most cases insular — environments, yet have not diversified (much). Here I propose to put the massive adaptive radiation of cichlid fishes in Lake Tanganyika, which I have studied in detail over the past two decades, into the context of the ecology and evolution of the entire fish fauna of this oldest lake in Africa. More specifically, through the in-depth and comparative taxonomic, genealogical, phenotypic, and ecological investigation of all species of fishes living in Lake Tanganyika, we intend to test predictions derived from theoretical and empirical research related to the phenomenon of adaptive radiation, focusing, among others, on the 'stages-model', the 'hybrid-swarm' hypothesis, and the 'phenotype-environment correlation' criterion. In addition, I propose to intensify the genomic investigation of the cichlids in comparison to these other groups of fishes, with a particular emphasis on sensory-system
and immune-related genes. Taking advantage of the unique natural experiment going on in Lake Tanganyika, where representatives of 23 families spanning the entire phylogenetic spectrum of fishes ended up together in a single insular ecosystem, we should thus be able to identify the causal factors responsible for the various evolutionary trajectories that these different evolutionary lineages of fishes took, ultimately leading to the vastly different numbers of species and the great differences in eco-morphological disparity among these clades. This, in turn, will bring us a good deal further in answering the question what is so special about the cichlids.

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