Universität Basel

Research Project

The relative importance and genetic architecture of natural versus sexual selection in the adaptive radiation of cichlid fishes

Third-party funded project

Project title The relative importance and genetic architecture of natural versus sexual selection in the adaptive radiation of cichlid fishes
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More than 150 years after the publication of Charles Darwin's *The Origin*, the identification of the processes that lead to the emergence of new species remains a fundamental question to biology. Major open questions in speciation research include (*i*) the evaluation of the relative importance of natural *versus* sexual selection in diversification; (*ii*) the identification of the factors that lead to the completion of reproductive isolation; (*iii*) the characterization of the nature of divergent selection; (*iv*) the elucidation of the molecular basis of reproductive isolation; and (*v*) the determination of the relative contribution of selection, chance and developmental biases to speciation. Since their discovery at the turn of the 19^{th} century, the species flocks of cichlid fishes in the East African Great Lakes have served as important model species in speciation research, as they fulfill all properties that such a model system should have. The cichlid species flocks in lakes Tanganyika, Malawi and Victoria represent the most diverse ('species-rich') adaptive radiations known, they are eco-morphologically disparate, their adaptive radiations happened within the confines of the different lakes, still producing some of the most fascinating cases of convergent evolution. It is hence to no surprise that the cichlid system entered the genomic era and that five species have been sequenced. Here, I propose to build upon the two sequenced Tanganyikan representatives in order to uncover the importance and the genetic architecture of natural *versus* sexual selection in explosive speciation. More specifically, I plan to make use of a unique lake-stream cichlid system that we have recently discovered in the South of Lake Tanganyika and that involves Burton's haplo (*Astatotilapia burtoni*; **subproject A**) and of the *Neolamprologus brichardi-pulcher* ('Princess of Burundi') species complex with its characteristic facial stripe patterns (**subproject B**). The *A. burtoni* populations in the South of Lake Tanganyika resemble the speciation continuum observed in lake-stream pairs of sticklebacks and are highly suited to study ecological speciation in cichlids. In the Princess of Burundi and its allies, I am interested in the genetics of the distinct facial stripes and the contribution of this characteristic pigmentation pattern to reproductive isolation. I propose starting out with the identification of naturally selected traits and a 'top-down' approach in *A. burtoni*, whereas a 'bottom-up approach' in form of genetic mapping of putatively sexually selected traits is envisaged in *Neolamprologus* using the RAD technique. The two approaches should then converge by studying mating preference in *A. burtoni* and ecological speciation in the *Neolamprologus*, which should allow us to uncover the genetic basis of reproductive isolation and the (genetic) link between natural and sexual selection. In the last part of the project (**subproject C**), I propose low coverage sequencing of additional genomes "around" the current assemblies to evaluate the role of gene evolution, genome rearrangements and hybridization in speciation.

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