

Adaptation to parasites drive African fishes along different evolutionary paths

An international team of scientists from Canada (Université Laval), the U.K. (University of Hull, Cardiff University) and Spain (Doñana Biological Station), have discovered that a pair of closely related species of East African cichlid fishes – a group of fish whose diversity comprising hundreds of species has puzzled evolutionary biologists for decades – evolved divergent immune gene adaptations which might explain why they do not interbreed, despite living side by side.

The two species (*Pseudotropheus emmiltos* and *Pseudotropheus fainzilberi*) are found in the north western part of Lake Malawi. Until now, the only known difference between them was the color of their dorsal fin. Many researchers believe that African cichlids recognize conspecifics from these kinds of colour differences, which are thought to result from sexual selection. However, recent mate choice experiments have shown that female *P. emmiltos* recognize males of their own species from *P. fainzilberi* males based on olfactory communication rather than color.

Some of the genes known to influence mating behavior through olfaction in other vertebrate species are genes of the major histocompatibility complex (MHC). These genes code for receptor that bound molecules produced by infectious agents and present them to specialized cells of the immune system which then launch an immune attack on the microbes. They are the most diverse genes found in vertebrate genomes and individuals of some species, including humans, are able to "smell" other individuals' variability at these genes and adjust their mate choice in order to optimize the effectiveness of their offspring's immune system.

Analysis of MHC genes between *P. emmiltos* and *P. fainzilberi* revealed that the two species were genetically more different at these sites involved in contacting and presenting molecules to immune cells than at other sites of the gene's DNA sequence that do not play functional roles.

These results show that natural selection has driven the evolution of these genes in different direction between the two species. Furthermore, the researchers showed that infecting parasites found on the two species were significantly different, as predicted based on the known immune function of MHC genes. "The mechanisms having produced the hundreds of species of East African cichlid fishes in a relatively short period of time are unclear", says Jonatan Blais, the senior author of the paper. " This is one of the first genetic adaptive differences between closely related East African cichlid species identified. As such, it improves our understanding of the recent evolution of this incredibly diverse group of fish by pointing to a trait that not only diverged for adaptive reasons but may also be involved in mating behavior."

"The precise role that this divergence played in the evolution of reproductive isolation has yet to be studied", comments Louis Bernatchez, co-author of the study. " But it offers an exciting new perspective in the study of African cichlids speciation ".

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