

Fighting fish synchronize their combat moves and their gene expression

June 17 2020



A Siamese fighting fish, *Betta splendens*. Credit: ivabalk, Pixabay

When two betta fish are fighting for dominance, not only do their attacks mirror each other, but the gene expression in their brain cells also starts to align. The new findings, published June 17th in *PLOS Genetics* by

Norihiro Okada of Kitasato University, Japan, may explain how the fish synchronize their fighting behavior.

The fighting fish *Betta splendens* is famous for its aggression, but opponents typically stop fighting after assessing the other's abilities to avoid any serious injuries. The small freshwater fish is commonly used to study aggression in the lab, and it employs a handful of standard tactics like mouth-locking, bites, strikes and swimming to the surface to gulp air. In the new study, researchers observed that during a fight, two male opponents modify their actions to match the aggressive behavior of the other, leading to tightly synchronized battles. Furthermore, when the researchers analyzed the brains of both opponents, they observed that the fish also synchronized which genes were turned on or off in [brain cells](#). The fighting pair had similar changes in gene activity related to learning, memory, synapse function and ion transport across cell membranes. The synchronization was specific to a fighting pair and became stronger after fighting for an hour compared to a 20-minute fight, suggesting that the degree of synchronization was driven by fighting interactions.

The new study takes a neurogenomic approach to the old question of how animals synchronize their behavior. Similar mirrored behaviors also occur during mating, foraging and cooperative hunting, and these behaviors may also trigger synchronized [brain](#) changes in the pairs of animals. "One of my future plans is to elucidate what happens in the male-female interaction of fish on the molecular level," said author Norihiro Okada.

The findings suggest that even though the betta [fish](#) are fighting each other, sometimes to the death, their brains may be cooperating at the [molecular level](#).

More information: Vu T-D, Iwasaki Y, Shigenobu S, Maruko A, Oshima K, Iioka E, et al. (2020) Behavioral and brain- transcriptomic

synchronization between the two opponents of a fighting pair of the fish *Betta splendens*. *PLoS Genet* 16(6): e1008831.
doi.org/10.1371/journal.pgen.1008831

Provided by Public Library of Science

Citation: Fighting fish synchronize their combat moves and their gene expression (2020, June 17)
retrieved 26 April 2024 from <https://phys.org/news/2020-06-fish-synchronize-combat-gene.html>

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