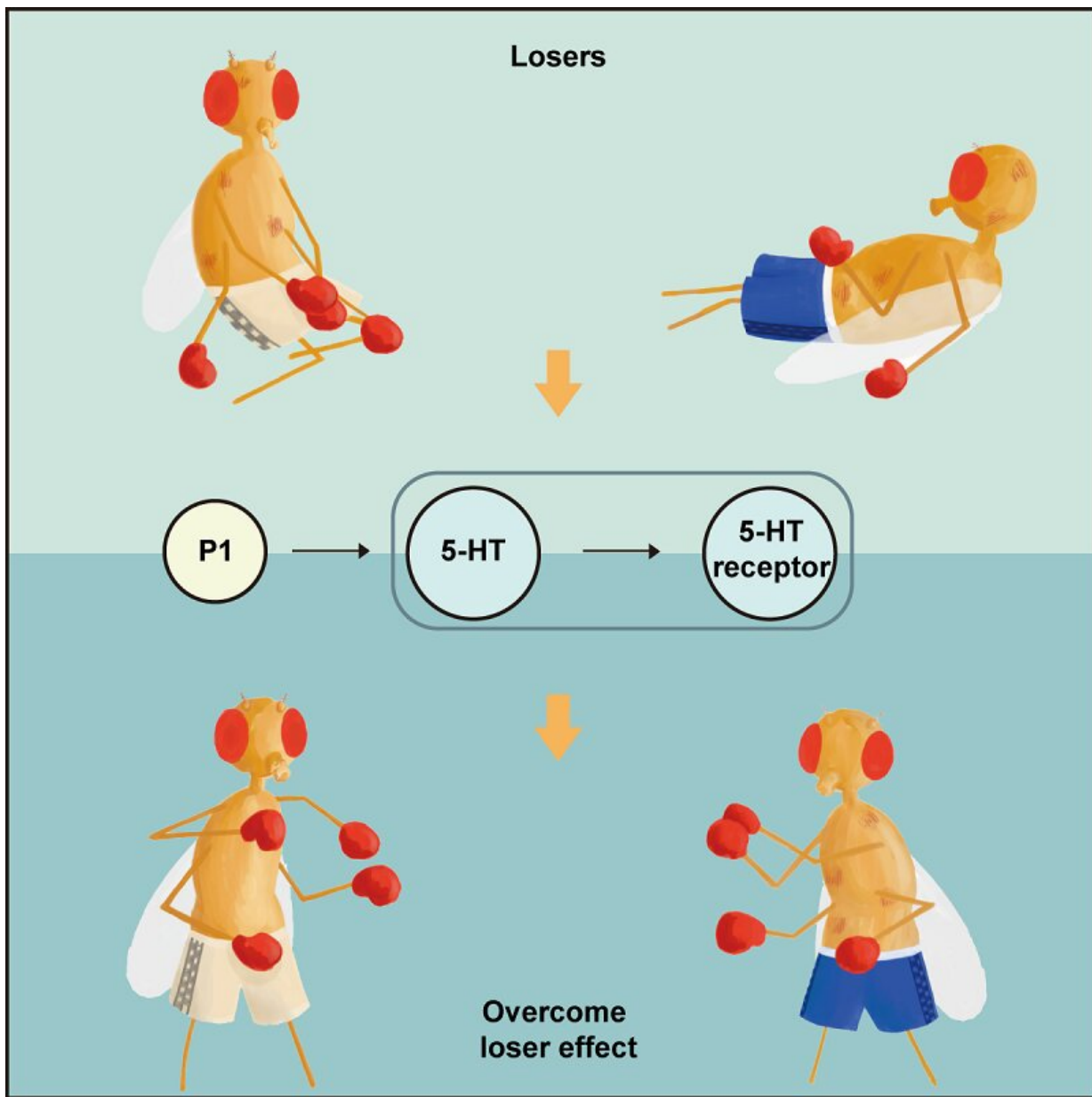


Researchers reveal serotonin signals' role in reversing 'loser effect' mechanism

November 4 2020, by Liu Jia



The P1--5-HT--5-HT1B pathway regulating the "loser effect" of *Drosophila*.
Credit: Dr. ZHU Yan's group

Past social experiences can affect the mental state of humans and the functional state of animals' brains, causing individuals to behave differently in the same situation or facing the same stimulus.

The "loser effect" is the phenomenon by which individuals with high morale run away and avoid subsequent fights after being defeated.

In a study published in *iScience*, Prof. Zhu Yan's group from the Institute of Biophysics of the Chinese Academy of Sciences (CAS) found that serotonin (5-HT), serotonin receptors and neural circuits play an important role in reversing the loser effect.

Through a large-scale optogenetics-based behavioral screening, the researchers found that activating 5-HT [neurons](#) could significantly increase [aggression](#) of *Drosophila* that were defeated in previous fights and reduce the latency of attack. By activating 5-HT neurons, around one-third of losers can reverse the fights and even defeat the previous winners. What's more interesting is that in subsequent encounters of two losers, activating 5-HT neurons once again leads to a new win-loss result. Activating serotonin neurons can also arouse aggression of losers with multiple failures.

Further research found that activating only a pair of 5-HT neurons can reverse the "loser effect" of *Drosophila* (or fruit flies). P1 neurons act upstream and 5-HT1B neurons in the ellipsoid body act downstream of 5-HT neurons to arouse losers.

The researchers were able to reconstruct aggressiveness of losing flies by

up-regulating the activity of neurons. However, other neurons known to be involved in regulating their aggression are not involved in rebuilding aggression of the loser. Serotonin and its receptor 5-HT1B molecules are also important signaling molecules to reverse the "loser effect."

More importantly, they found that a single failure may lead to individual losers' behavioral defects or abnormalities in domain, intimidation and courtship. These abnormal behaviors can be rescued by regulating the serotonin pathway.

As the "loser effect" and the [serotonin](#) pathway are common in the [animal kingdom](#), this study is expected to help understand [psychological problems](#) caused by stressful experiences, as well as provide a new perspective and experimental evidence of the mechanisms of post-traumatic stress disorder (PTSD) caused by disasters and wars.

More information: Shao Wei Hu et al. Serotonin Signals Overcome Loser Mentality in *Drosophila*, *iScience* (2020). [DOI: 10.1016/j.isci.2020.101651](#)

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