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主 論 文 の 要 旨

論文題目

Auditory experience modulates song preference and sexual choice in *Drosophila*
(聴覚経験がショウジョウバエの歌への指向性と性行動を調節する)

氏名 LI Xiaodong

論 文 内 容 の 要 旨

In birds and higher mammals, auditory experience during development is critical for formation of the ability of phonetic distinction and pattern detection in the phase of auditory learning. However, it remains unclear how memory of the auditory experience is incorporated into the higher-order integration center to direct the sensorimotor output. The hearing study in *Drosophila* has attracted huge attention in recent years. Although in flies how the neural circuitry works to distinguish the species-specific courtship song in mating is intriguing, few researchers have investigated how auditory experience shapes perception of courtship song, because of the long-standing belief that most processes in courtship behavior of *Drosophila* are innate.

In this study, I discovered, for the first time, that preference of flies for their species-specific courtship song is not innately hard-wired process but is highly malleable with auditory experience. My results showed that male flies that were housed in a group with intact wings acquired the preference towards the conspecific song, while those housed in a group without wings did not, nor those housed singly with intact wings did.

To address whether the auditory experience modulated the auditory preference, I trained flies by exposing them to fly songs. The results showed that females that were raised with the

auditory experience of their species-specific song later in life rejected conspecific males presented with artificial playback of another species' song. Similarly, males raised with the experience of hearing conspecific song later in life ignored another species' song, which usually increased the mating drive of naïve males. Besides this experience-dependent tuning of song preference, it's worth noting that the song preference of both male and female flies was altered by the developmental exposure of only the conspecific song, but not another species' song. These results remind us of the selectivity in auditory learning of songbirds and humans, which prefers to learn conspecific sounds (Marler & Peters, 1977; Doupe & Kuhl, 1999).

I further identified the mechanism underlying this experience-dependent song preference. By knockdown of GABA synthesis enzyme GAD1, I identified GABA as a key modulator for the experience-dependent preference. Further I showed that GABA acts on the ionotropic GABA_A receptor, RDL, in a small group of neurons called pC1 neurons, which are thought to be command-like neurons in mating.

This study is the first analysis of a brand new behavior, how learning to listen to the precision of a courtship song as a young adult directly regulates maturation of song discrimination and mate selection as a breeding adult. This novel phenomenon in flies resembles the preference formation in auditory learning of songbirds and humans. A better understanding of how fruit flies learn and discriminate sounds may bridge knowledge gaps in research using humans and other vertebrates.