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INSIDE JEB

Serotonin key for trap-jaw ant aggression

A trap-jaw ant, *Odontomachus kuroiwae*, with jaws open. Photo credit: Hitoshi Aonuma.

Any creature with the term 'trap-jaw' in its name is bound to be fairly ferocious, and trap-jaw ants make the most of their ballistic mandibles, turning them on foes and prey, in addition to using the structures to catapult themselves to safety when confronted by larger adversaries. While some trap-jaw ant nest residents are particularly aggressive, other inhabitants of the same nest simply turn and walk away when attacked. Wondering what lay at the heart of the insect's decision to withdraw or confront an opponent, Hitoshi Aonuma, from Hokkaido University, Japan, started prodding *Odontomachus kuroiwae* ants with a paintbrush to find out which members of the nest were most aggressive and which preferred simply to wander off.

Surprisingly, only 10% of the 580 goaded insects took any interest in the intrusion: 14 of the ants turned around to confront the brush with their jaws disarmed (closed), while 29 wheeled about with mandibles cocked aggressively, ready to take on the intruder. The remaining nest-mates (90%) simply scurried away from the encounter. Curious to discover the difference between the aggressive ants and their docile companions, Aonuma compared the insects' brains and found that the antagonistic ants had higher levels of octopamine, dopamine and serotonin, vital chemical messengers – neurotransmitters – that transmit signals between nerves. But which of these essential nervous system chemicals held the key to the insects' hostility?

This time, Aonuma collected meek nest-mates and fed one of the three neurotransmitters to the ants, to see whether any of the compounds could transform a placid ant into a belligerent aggressor. Impressively, the ants that had been fed serotonin became more confrontational, taking on the paintbrush instead of sauntering away, while the ants that consumed dopamine became slightly more combative. Aonuma was also able to amplify the ants' aggressive tendencies by feeding them compounds that their bodies could convert into serotonin or dopamine. And when he fed drugs that counteract the effects of the essential neurotransmitters to naturally aggressive ants, the insects became more accommodating, preferring to walk away from an irritating tap on the rear instead of turning to confront the intrusion.

'This study demonstrates that the serotonergic system contributes to the initiation of defensive responses to unexpected tactile stimuli and that dopamine can weakly contribute to the initiation of defensive responses in the trap-jaw ant', says Aonuma, who is keen to learn more about the mechanisms that make some ants docile and others more easily provoked.

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