

One missing gene leads to fruitless mating rituals

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Male fruit flies missing a gene for one particular odor receptor become clueless in matters of love, scientists at Duke University Medical Center have discovered.

Because they lack the ability to read important chemical cues, these flies will indiscriminately attempt to have sex with other males, and with females who have already mated. The signals they're missing are pheromones wafting from mated females and male flies. The work appears online in *Nature Neuroscience*.

The researchers found that the signals from this pheromone receptor are so important to the flies that they are wired directly into the higher-order processing center of the fly's brain, which governs behavior. This direct connection surprised the scientists, who have studied other fruit fly courtship genes.

"It goes against the dogma that was established for the olfactory and taste systems," said Hubert Amrein, Ph.D., of the Duke Department of Molecular Genetics and Microbiology. "Our finding implies that signals from the outside don't have to go through processing stations in the chemosensory system before being connected to the higher-order brain structures."

Males without a gene called Gr32a, the gustatory receptor gene, showed normal levels of courtship with virgin females. But in competition with normal (or wild-type) male fruit flies, they were outperformed by 4 to 1.

In fact, the Gr32a-lacking flies courted the male competitors in addition to the females.

To further investigate the role of the gene, researchers used decapitated, passive flies of both genders, because these do not provide any behavioral feedback that could confound the precise measurement of the sex appeal they held for the male flies being studied. Both types of males courted the decapitated virgin females equally. However, courtship attempts toward decapitated males increased only in the males lacking the Gr32a gene, and these flies attempted copulation, behavior not seen in the wild-type males.

The scientists also found that the males lacking the Gr32a gene courted females who had already mated. Wild-type males, however, were significantly less attracted by mated females, because mated females have received male pheromones during the first mating.

The hapless Gr32a-negative males tried to mate with virgin females even when they had been covered with male pheromones, behavior that the wild-type flies avoided.

"This gene was very powerful for distinguishing between genders and for determining mating status," said co-author Tetsuya Miyamoto, Ph.D., also of the Department of Molecular Genetics and Microbiology. "Male pheromone is so effective that Gr32a mutants court males with almost the same intensity as they do females."

The GR32a gene is not found in humans. "In general, the development of pheromones in human sexual behavior is not as clear-cut as one would hope," Amrein said. "We know that males and females have preferences for certain olfactory cues. The mouse has an olfactory organ, and humans have a remnant of this in the nose, but it doesn't function in people. So I think it is very difficult to make any direct connections

between these gene findings in fruit flies and what happens in people."

Source: Duke University

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