

In lean times, flies can't survive without their sense of smell

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It's not just bomb-sniffing dogs; animals everywhere rely on their sense of smell. Now, Howard Hughes Medical Institute and Rockefeller University researchers show just how important olfaction is, proving that fruit flies with a normal sense of smell have a survival advantage over those that don't. The findings, to appear in the July 31 advance online issue of *Current Biology*, may be useful in controlling insect populations and reducing insect-borne disease.

"You observe animals using the sense of smell to find food and you assume that this sensory modality must be important for survival, but what we wanted to do is demonstrate it scientifically and in a rigorously controlled way," says Leslie Vosshall, head of the Laboratory of Neurogenetics and Behavior. "To our knowledge, that has never been proven before."

The researchers worked with two strains of genetically modified fruit flies: one that couldn't smell and another that had a simplified olfactory system. The odor-blind fruit flies lacked Or83b, a protein in the fly nose that works in tandem with most other odorant receptors to detect a complex array of odors. So fruit flies without this protein could smell hardly anything at all. The other strain had Or83b, but only one working odorant receptor.

In previous work, Vosshall had observed that both strains survived as well as fruit flies that had a normal sense of smell. "That was the puzzle," says Vosshall, who is also a Howard Hughes Medical Institute

investigator. "If smell is so important, then why are these odor-blind animals doing as well as the animals that have a very good nose?"

To find out the answer, Vosshall and her colleagues made the fruit flies lives more difficult.

In the first experiment, the researchers placed five times the original number of fruit flies in each cage but didn't add more food. Under these conditions, the survival rate of each fruit fly strain was equally low. But when the researchers placed a second bolus of food at the opposite ends of each strain's cage, the situation changed: The fruit flies that couldn't smell continued to die while the fruit flies that had a normal sense of smell lived on. Those with the simplified olfactory system fared in between.

"When the first cup of food was exhausted, the animals with the normal sense of smell started to forage and very efficiently found that second cup - much more so than those with the simple nose," explains Vosshall. "The odor blind animals didn't have a sense of smell to guide them."

In the second experiment, the scientists went a step further: They placed odor-blind flies in the same cage as the normal fruit flies, so that the two strains had to compete for limited food. When there was only one cup of food, the survival rates of both strains were equally low. Since the flies hatch directly on a food source, neither strain carried a competitive advantage for survival. But when the researchers introduced a second cup of food into the cage, the odor-blind fruit flies were massively out-competed. The results were similar with the simple-nosed animals.

"It's a simple demonstration that in times of plenty, the sense of smell is irrelevant for survival," says Vosshall. "But in times of scarcity, when you really need to use that sensory modality to forage for food, those without it have a competitive disadvantage."

Source: Rockefeller University

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