

Male scent stimulates female goats' fertility

Single pheromone found to induce ovulation.

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The distinctive aroma of goats does more than just make barnyards extra fragrant. Male goats can use their heady scent to make female goats ovulate simply by being near them.

Researchers had ascribed this 'male effect' to chemicals known as primer pheromones — a chemical signal that can cause long-lasting physiological responses in the recipient. Examples of primer pheromones are rare in mammals; the male effect in goats and sheep, and a similar effect in mice and rats, where the presence of males can speed up puberty in females, are the only known cases. But exactly what substances are at work and how has remained a mystery.

Now, reproductive biologist Yukari Takeuchi from the University of Tokyo and her colleagues have identified a single molecule, known as 4-ethyloctanal, in the cocktail of male goat pheromones that activates the neural pathway that regulates reproduction in females¹. "It has long been thought that pheromones have pivotal roles in reproductive success in mammals, but the mechanisms are scarcely known," says Takeuchi.



Current Biology, Murata et al.



Murata et al.

The researchers fitted the goats with hats that absorbed their neck odours for a week.

The researchers found that male goat pheromones are generally synthesized in the animal's head skin, so they designed a hat containing a material that captured their odorous molecules and placed them on the goats for a week to collect the scent. Analysis of the gases collected identified a range of compounds, many of which were unknown and were not present in castrated males. When exposed to a cocktail of 18 of these chemicals, the brains of female goats showed a sudden increase in the activity of the gonadotropin-releasing hormone (GnRH) pulse generator — the neural regulator of reproduction.

Citrus overtones

But one molecule stood out: 4-ethyloctanal, a chemical not previously found in nature and that has an orangy, floral odour. When presented to the female goats on its own, the chemical elicited a similar, albeit weaker, response, and the cocktail showed less of an effect when that ingredient was removed. None of the other chemicals

appeared to have a statistically significant effect. The work is published today in *Current Biology*¹.

Peter Brennan, a physiologist at the University of Bristol, UK, says that the work will be useful in husbandry in goats and other ruminants, such as sheep, but he is not sure that the whole effect can be ascribed to the pheromones alone. "How much of this effect is innate and how much is learned?" he asks. Takeuchi admits that she cannot be sure, but she thinks it is an innate reaction, because it was seen irrespective of the mating experience of the female goats.

The main benefit of the work, says Takeuchi, is that it could be used to develop new, more-natural technologies that improve the efficiency of breeding and to treat reproductive disorders. "To control reproductive problems, it is important to regulate not only inhibitory factors such as infection or stress, but also accelerative factors such as pheromones," she says. The group is now looking to find similar pheromones and pathways in other economically important livestock animals, such as sheep and cows.

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References

1. Murata, K. *et al.* *Curr. Biol.* <http://dx.doi.org/10.1016/j.cub.2014.01.073> (2014).