

## The Scientist: NewsBlog:

The scent of fear

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The nose may know more than we think: New research suggests a poorly-understood structure in the tip of the nose may regulate a vital mammalian alarm system. According to a paper published in [Science](#) tomorrow (August 22), mice detect alarm pheromones -- signals evoking behavioral reactions such as fear and anxiety -- through a bundle of cells on the roof of the nasal cavity.

This cell structure, first described by Hans Grueneberg in 1973 and called the Grueneberg ganglion (GG), is an arrow-shaped mass of about 500 cells. The system is fully developed at birth in a mouse, said Marie-Christine Broillet, lead author on the paper, and it has been found in all mammals looked at so far. Yet its function had yet to be determined.

In 2006, [researchers](#), re-discovering the structure, found that the cells express multiple olfactory marker proteins and project axons to the olfactory bulb, suggesting they have a chemosensory function. Yet under a light or confocal microscope, GG cells don't look like neurons; instead, they have round bodies lacking cilia or microvilli, and resemble a bunch of grapes.

To resolve the apparent contradiction, [Broillet](#) and a team at the University of Lausanne in Switzerland examined the cells under electron microscopes. They found thin ciliary processes on the cells and noticed triangular-shaped glial cells with long arms wrapping around the neurons, possibly protecting them -- both properties characteristic of [olfactory neurons](#)

The team then tested various chemicals to determine which would activate the GG cells. A solution of alarm pheromones, made by bubbling air collected from the cages of asphyxiating mice through artificial cerebrospinal fluid, stimulated the cells in vitro, but general pheromones, collected from un-stressed mice, induced no response. In a subsequent lesion experiment, alarm pheromones caused control mice to freeze in place while mice with severed GG axons betrayed no such reaction. Additionally, a lesioned GG did not affect the olfactory system: According to the paper, both sets of mice "were equally efficient at finding a buried cookie in the bedding."

Peter Mombaerts, director of molecular genetics at the Max Planck Institute of Biophysics in Frankfurt, believes the experiment lacked a vital control -- a sham lesion, in which mice pups undergo surgery without cutting GG axons. "It is possible that the surgery in and of itself is so dramatic that the mice do not behave properly," he wrote in an Email, "not because they no longer have a functional GG."

Also, he noted, "the term 'alarm pheromones' is just words." The group did not describe the chemical nature of the substance, he wrote, so it's unclear what exactly the animals are reacting to. Broillet said the researchers are now working to characterize the pheromones.