

Copper + love chemical = big sulfur stink

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Research by Duke University and UAlbany has shown that copper ions allow the female mouse to detect sulfur-containing chemicals in the urine of a male mouse suitor. (Graphic by Ann Thomson)

When Hiroaki Matsunami, Ph.D., at Duke set out to study a chemical in male mouse urine called MTMT that attracts female mice, he didn't think he would stumble into a new field of study.

But the research has led scientists at Duke University Medical Center and the University of Albany to the discovery that it's the copper in our bodies that makes mammals recoil from sulfur chemical smells.

Working with Eric Block, Ph.D., the Carla Rizzo Delray Distinguished Professor of Chemistry at the University of Albany, the team looked at reasons why mammals, including people, can detect even trace amounts of sulfur-containing substances, like MTMT.

"While we were doing our experiments, on even very dilute specimens of MTMT, our neighbors on the lab hallway complained," Matsunami said with a laugh. He is an associate professor of [molecular genetics](#) and microbiology and of neurobiology at Duke. The Duke laboratory ran a high-throughput test of several hundred mammalian odor receptors, and found that one receptor that bound [copper ions](#) resulted in superior detection of even trace amounts of sulfur.

Rotten egg smell, skunk spray, [volcanic gases](#) and odorized natural gas (for leak detection) are examples of sulfur-containing substances.

The work was published in the [Proceedings of the National Academy of Sciences](#) online the week of Feb. 6.

"We learned that copper was the metal that allowed for detection of all the sulfur-containing compounds we tested, and it was Eric Block's idea that metal ions must be involved," Matsunami said. "I see no reason why the mouse receptor activity would be different from human receptors, because we have the same kind of [olfactory receptors](#)."

Block and colleagues created several dozen sulfur-containing compounds for testing.

The odor impact of the sulfur-containing molecule MTMT can be attenuated by manipulating the copper concentration in the nasal mucus. The team also did experiments using a chemical that binds to copper in the mouse nose, so that copper wasn't available to the receptors, and the mice didn't detect the MTMT, Matsunami said.

"This study establishes for the first time the key role of a metal, namely copper, in the activity of an olfactory receptor," Eric Block said. "What's also exciting is that, because olfactory receptors are transmembrane G protein-coupled receptors (GPCRs) of the same type as receptors for

drugs, our discovery suggests a possibility that some drug receptor responses may also be enhanced in the presence of copper or other [metal ions](#)."

Provided by Duke University Medical Center

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