

# Research uncovers why urine sprayed by cats emits a pungent odor

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Cats communicate with others through their scents. One of their scent-marking behaviors is spraying urine on vertical surfaces such as walls and furniture. Although spraying plays an essential role in the feline

world, it often poses challenges for pet owners because of its strong and pungent odor. Consequently, the website is overflowing with posts discussing the issue of cat spraying.

Notably, sprayed urine has a more pungent odor on the human nose than normal urine in their litter boxes. While it is believed that sprayed urine contains additional chemicals possibly derived from anal sac secretions, scientific evidence supporting this remains unclear. Japanese researchers examined why the sprayed urine had distinctive smell compared to the normal urine.

The researchers initially compared the chemical profiles of volatile organic compounds emitted from sprayed urine, normal urine, and bladder urine collected using ureteral catheters. Chemical analyses revealed a high degree of similarity in these profiles within the same individuals. The study has been published in the *Journal of Chemical Ecology*.

Behavioral analyses further demonstrated that cats perceived the sprayed urine and urine remaining in the bladder after spraying as similar odors, whereas the odors of another cat's urine were perceived as different. According to Prof. Masao Miyazaki, a leader of the research project, the data indicate that the sprayed urine originates from bladder urine without supplementation with chemicals from other secretory glands.

Given the high degree of similarity of volatile [chemical](#) profiles between sprayed urine and naturally normal urine, researchers examined why sprayed urine emits a pungent odor from another perspective.

They observed that cat urine samples easily adhered to the inner surface of plastic syringes when they transferred the samples into glass vials for urinary volatile analyses.

"This observation prompted us to explore the underlying mechanisms," said Reiko Uenoyama, the paper's first author.

Twenty years ago, Prof. Miyazaki discovered that healthy [cats](#) excrete a substantial amount of a urinary [protein](#) named cauxin (curiosity in Japanese), which contributes to the production of sulfur-containing odorants responsible for the distinct catty smell.

"Generally, the wettability of a liquid on [solid surface](#) increases as the surface tension decreases. Based on this knowledge, we hypothesized that the high protein concentration in cat urine might reduce the surface tension of cat urine, enhancing the emission of urinary volatile compounds from the large vertical surface area that was spread over the urine," said Uenoyama.

As anticipated, the surface tension was reduced with increasing concentrations of the urinary protein cauxin. At the same protein concentration, the wettability was higher in the cauxin solution than in the control solution containing albumin, a major protein contained in mammalian blood.

When comparing the surface tension of cat urine with and without proteins, they confirmed that urine with proteins exhibited significantly lower surface tension than deproteinized urine. Interestingly, the urine with proteins also demonstrated greater adhesion to vertically positioned glass plates than the deproteinized urine.

In their observations, odorants responsible for the distinctive catty smell were detectable in an artificial miniature garden designed to mimic natural environments in which a block sprayed with tomcat urine was placed. In contrast, no such odorant was below the detection limit in another garden where the same urine was poured directly into sandy soil and then covered.

"The difference in environmental odors between the two gardens, despite using the same urine sample, can be explained by most of the urinary volatile chemicals being trapped in the porous structure of the sandy soil. This phenomenon did not occur in the urine adhering to the surface of the block. Additionally, liquid droplets of sprayed urine can easily dry on the surface of the block, resulting in greater emissions of volatile chemicals from the scent mark rapidly as compared to from normal urine," explained Miyazaki.

In conclusion, feline sprayed urine originates solely from the bladder, without any contribution from other secretions. However, despite this exclusive source, sprayed urine emits a strong and pungent odor owing to enhanced adhesion on vertical surfaces.

The specific urinary protein, cauxin, plays a crucial role in scent marking by not only producing cat-specific odorants but also by enhancing the emission of urinary volatile chemicals by increasing the wettability of the sprayed urine.

This study may provide insights into addressing the distinct smell associated with sprayed [urine](#).

**More information:** Sprayed urine emits a pungent odor due to its increased adhesion to vertical objects via urinary proteins rather than to changes in its volatile chemical profile in domestic cats, *Journal of Chemical Ecology* (2024). [DOI: 10.1007/s10886-024-01490-1](https://doi.org/10.1007/s10886-024-01490-1)

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