Nether region science—What's the allure for cats of fellow feline rear ends?

Anyone who lives with more than one member of *Felis catus* knows that our beloved felines love to smell each other's anal regions. The Internet is full of helpful information on why, but what of it is accurate?

To answer that question, a research team from the Department of Evolution and Ecology and Genome Center University of California, Davis analyze the practice in felines and even compares them with anal gland emissions studies of several other mammals, including dogs, hyenas, foxes, pandas, and even humans. The findings are published in Scientific Reports.

Cats begin a potential social encounter with hesitant head sniffing, which may progress to light head bumping as pheromones waft from facial glands. Pheromones are chemicals that trigger a social response in members of the same species. Hormones, in contrast, act within an individual. So overall, the powerful sense of smell guides a feline's social life.

When two cats meet, for further intel, a cat check out another's butt odors. In *Why Cats Sniff Rear Ends*, veterinarians Ryan Llera and Lynn Buzhardt compare the feline practice to two people who meet, assess physical features and body language, and then quickly greet each other with an expression of recognition or affection – or ignore each other.

> *The aromas produced provide information to one cat what her new-found friend likes to eat and what sort of mood she is in. By simply smelling a companion, a cat can determine whether they are male or female, happy or aggressive, or healthy or ill.*

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The science behind the signature smells of animals

The distinct smell emanates from the openings of the paired anal glands tucked inside the rectum, and are emitted during defecation. When a relieved feline rockets around with the zoomies from a satisfying dump, we humans are usually too preoccupied laughing to notice the odoriferous secretions. And even if we are paying attention, the pungent poop masks the smells from the anal glands.

The key to deciphering this unique smell in all animals is found in our microbiome, the collection of microbes that live in or on an organism. In humans, the microbiome accounts for 90 percent of a person's cells, packed in because bacterial cells are so much smaller than ours. These microscopic residents live under our arms, between our toes and butt cheeks, in our guts and noses and spleens and eyebrows and, well, everywhere. It's omnipresent in the butt of cats.

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To identify the source of the smell in cats, the feline research team catalogued the microbiomes of domestic cat anal glands. The bacterial members of the microbiome, produce and release organic compounds that affect the behavior of a newly-encountered cat. The investigators identified the “volatile organic compounds” (VOCs) that the anal glands emit, thanks to those microbes.

For those who fondly remember the functional groups of organic chemistry, the volatile organic compounds, the VOCs that spew from cat rears are alcohols, aldehydes, esters, and ketones. We can’t smell these emissions, but in cats they influence mating, aggression, and marking territory, and probably some behaviors of which we humans aren’t aware.

In cats, info embedded in anal scents supplements that from mere head rubbing.. Will the pair of felines approach and touch, or one jump back and hiss? The scents are so personal that a pair of cats can tell if

they’re already acquainted, a little like recognizing someone in a gym who routinely emits a distinctive odor of dirty socks.

Not surprisingly, a dominant cat takes the lead in sniffing the other’s butt and may hiss if displeased. A shy cat may back off and even sit to squelch the emissions, like a shy human at a party retreating to a back room. Among our four felines, it’s clear who the aggressor is — Milton.

An explanation from microbiology

In the new UC Davis study, Connie Rojas and colleagues used the tools of genetics (DNA sequencing), protein chemistry (mass spectrometry), and microbiology (culturing) to identify the components of the anal secretions. They compared the DNA sequences of a gene commonly used in evolutionary investigations to identify bacterial species residing in domestic feline anal glands.

The material came from 23 domestic cats cajoled and dragged to the UC Davis Veterinary Medical Teaching Hospital for innocuous, elective procedures like cleaning teeth, for which cats are sedated. Owners gave written permission for their cats to take part in the study, but the cats were not consulted. I know that Milton would not have consented to have his anal glands interrogated.

Comparing anal gases of various species reveal, perhaps not surprisingly, that dietary differences underlie the distinctions. The domestic cat anal gland microbiome has a signature of four types (genera) of bacteria: *Corynebacterium*, *Bacteroides*, *Proteus and Lactobacillus*, with a few scant others.

What about other species?

- A dog’s anal glands share species of *Bacteroides* and *Proteus* with domestic cats, but also harbor *Enterococcus*.
- The wild spotted hyena, with its meaty diet, houses *Anaerococcus, Eubacterium, Porphyromonas* and *Proprionibacterium,* but shares *Corynebacterium* with cats.
- At the other end of the dietary spectrum from carnivores is the bamboo-loving giant panda. It’s anal gland microbiome shares *Corynebacterium* with cats, but in addition houses *Pseudomonas, Porphyromonas, Psychrobacter* and *Anaerococcus*.

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Baby giant panda. Credit: D. Chandler

The comparative contributions of the bacterial brew also vary among cats. It's a little like comparing soups that have the same components, but in differing amounts — say, a tomato-rich minestrone versus a more bean-based concoction or onion soup with a smidge of tomato.

Age and body size also influence the nature of the domestic cat anal gland microbiome. The obese cats among the group had slightly different compositions, but the sample was too small to tease any meaning from this observation. The study also didn't consider participants' health other than bad teeth, diet, and the "overall living environment."

The genetic analysis indeed showed that the bacteria living in the anal glands could be responsible for making the hundreds of released organic compounds. Presumably, the aerosol of organic compounds affects the host animal's behavior by binding to receptors on specific cell types, such as neurons, eliciting the characteristic response — like the actions of hormones and pheromones.

The researchers hope to continue and expand the study to include more domestic cats as well as other feline species. It's intriguing to think that a bunch of bacteria can control such traits as mating and mood in a large, willful, multicellular creature.

I love when chemistry explains biology.

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