



Hyenas may be using bacteria to communicate (http://io9.com/hyenas-may-be-using-bacteria-to-communicate-146111041)



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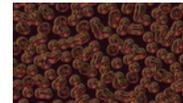
We all have bacteria that live in our bodies, helping us by breaking down food, flushing out toxins, and regulating our weight (http://io9.com/could-the-microbes-in-your-gut-be-making-you-gain-weight-1255281287). But for hyenas and other animals with specialized scent glands, bacteria may have an additional, important role: They could be allowing hyenas to communicate with each other.

Top image via Chris Eason (http://www.flickr.com/photos/mister-e)/Flickr.

The Birth of the Fermentation Hypothesis

Back in the mid-1970s, two groups of researchers were analyzing the anal scent glands of different animals (http://www.ncbi.nlm.nih.gov/pubmed/4813597), including small Asian mongooses, red foxes and lions, when they stumbled upon something interesting. They found that a prominent component of the animals' communicative scents were short-chain fatty acids (http://onlinelibrary.wiley.com/doi/10.1111/j.1469-7998.1974.tb04115.x/abstract), a type of molecule produced by fermenting bacteria.

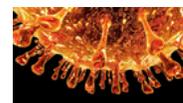
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Between fevers, congestion and diarrhea, there are numerous ways that microbes can make us feel sick. But just how do

This discovery birthed the "fermentation hypothesis," said Kevin Theis, an ecologist at Michigan State University. The hypothesis proposes that the scented components in

many mammalian chemical signals are the byproducts of the fermentation by symbiotic bacteria. It also goes on to suggest that the variation in chemical signals among mammals with specialized scent glands is due to the underlying diversity of bacterial communities (<http://io9.com/the-truth-about-why-microbes-make-you-sick-471481771>) inside the glands.

"Scent glands are always warm, moist and nutrient rich," Theis told io9. "They're good places for bacteria to grow."

On the whole, the hypothesis makes sense, but there has long been a lack of evidence to back it up. Reason being: The techniques necessary to really analyze the bacterial communities in scent glands weren't available yet. But then new DNA sequencing technology came on to the scene.

Last year, Theis and his colleagues used next-gen sequencing to survey the bacteria in the scent gland secretions of female spotted hyenas (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3431069/?report=classic>) (*Crocuta crocuta*). "We found a greater diversity of bacteria than the 15 previous surveys of scent glands combined," Theis said. "It really speaks to the power of the technology."

The research also revealed that most of the microbes were members of bacterial groups that ferment and produce odors. What's more, the bacterial communities in the secretions differed between social groups, suggesting that this variation is behind the group-specific odors that spotted hyenas are known to produce. Though the study provided some support for the fermentation hypothesis, it didn't try to tie the bacteria to the odor profiles of the scent gland secretions. So Theis conducted another study.

Pasting in Wild Hyenas

For the new research, just published in the journal *PNAS*, Theis and his colleagues focused on wild spotted hyenas and striped hyenas (*Hyaena hyaena*). These two species of hyenas live very different lifestyles.

Spotted hyenas live in very large hierarchical groups, or clans, which contain 40 to 80 individuals. Adult males and females work together to maintain and defend their territory against other clans. Striped hyenas, by contrast, live in very small groups, consisting of just a few sexually mature females and males. However, the animals don't usually have much interaction with their group members because they prefer to rest, travel and forage alone.

Despite their differences, both species engage in a conspicuous chemical signaling behavior called "pasting," which involves depositing an odorous secretion — "paste" — from anal scent glands on to grass stalks.



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A hyena sniffs the paste left by another hyena. Courtesy of Kay E. Holekamp.

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"In general, we think pasting has a territorial, communicative function," Theis said. Females may use their scents to facilitate social cohesion, whereas males may use pasting as a kind of dominance display. Even cubs rub their sacs on grass stalks, even though they don't produce paste of their own — this behavior may be a way for them to acquire their symbiotic bacteria from other hyenas' paste (if the bacteria are, in fact, behind the paste's odors).

For spotted hyenas, the paste odors provide information about the identity, age, sex, and reproductive state of the animal. And research has shown that the major smelly constituents of the paste include volatile fatty acids (VFAs), esters, hydrocarbons, alcohols and aldehydes.

Communicating With Bacteria

Theis and his team analyzed the bacterial communities and VFAs from the paste of male spotted and striped hyenas, as well as females that were pregnant, lactating or neither. They found that both spotted and striped hyenas had paste full of fermentative bacteria, though the two species had their own distinct genera of bacteria, whose metabolisms are known to yield varying concentrations of different short-chain fatty acids, including acetic, propionic, and butyric acid.

Importantly, the composition of the bacterial communities varied between species along with the profiles of the odorous VFAs in the secretions. And within a clan of spotted hyenas, the bacterial communities and VFAs in the pastes both differed between the sexes and female reproductive states.

The results add support for the fermentative hypothesis, by suggesting that symbiotic bacteria are behind the species-specific odors of striped and spotted hyenas and further underlie the paste odors that are specific to sex and reproductive states in spotted hyenas. But this is not to say that bacteria are the sole producers of the hyenas' paste odors. "I would expect that there are some synergistic effects between the hyenas and the bacteria," Theis said. "Even if the animals are not directly contributing to the scent, they could still be modulating their bacterial communities," which has an overall affect on the paste scent.

The researchers are now interested in showing that the bacteria in the paste are really the source of the secretions' VFAs, either by culturing the bacteria and measuring the VFAs they produce, or by digging into the bacteria's genome. If this holds true, the team plans to create synthetic mixtures of the VFAs — if the hyenas can discriminate between the VFAs, it would suggest that the bacteria really do play a part in the hyenas' chemical communication.

It's likely the case that bacteria are involved in the chemical communication of other mammals, too, Theis said. Or the fermentation hypothesis may be even more broadly applicable than that. "It may not even be just a mammalian thing," he said. "It could extend to animals in general."

Check out study over in the journal PNAS
(<http://www.pnas.org/cgi/doi/10.1073/pnas.1306477110>).

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duckintheaceat250knots (h...

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Hyena's are more or less closely related to weasels, which makes them giant ferrets with big teeth in my mind. In zoo's, and some rare placed in Africa, they can be fairly sociable and submissive to humans. When "domesticated" in captivity, they basically act like smart dogs. I think it would be a good experiment to breed them in captivity for reduced aggression and combativeness, like the Siberian Fox Project. If they could be made less fighty, especially the testosterone

No comment on the article, I'm just spamming the forums complaining about your broken RSS feed. As of right now, they haven't been updating since yesterday (Tuesday) which makes some of us a little sad.

Today 8:19am (<http://io9.com/no-comment-on-the-article-im-just-spammii>)



Ria Misra (<http://riamisra.ki...>)

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filled females, I think they'd make great pets. The only potential problem with this idea is their intelligence. They're considered to be about as intelligent as Chimpanzees and Dolphins. On the rare occasion some fool has kept one in captivity inside their home, they've been known to take/rip things apart, break out of enclosures, and generally create chaos.

Today 8:26am (<http://io9.com/hyenas-are-more-or-less-closely-related-to-primates-than-to-dogs-1630099>)

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It seems to me that an animal that intelligent could potentially make a better service animal than a dog. Dogs have limited ability to problem solve and come up with novel, untrained solutions to unexpected problems.

And if not, well, they are awfully damn cute and I'm sure there's a market for (descended) hyenas as pets.

Today 8:42am (<http://io9.com/it-seems-to-me-that-an-animal-that-intelligent-could-be-a-better-service-animal-than-a-dog-16303109>)

 [Remy Porter \(http://remypor...\)](http://remypor...)

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A side effect of domestication is frequently reductions in intelligence. If you tried to breed hyenas into a domestic strain (a very *long* term prospect), you'd likely be breeding their intelligence down, as well.

We've seen this in the above-mentioned Siberian fox project. In addition, those foxes started to *look* more like dogs. It seems that many of the desirable personality traits in domestic animals are tied to physical traits.

57 minutes ago (<http://io9.com/a-side-effect-of-domestication-is-frequently-reductions-1463710093>)

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You're right, I see it is working now!

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Paste this message on 20 new grass stalks to receive good luck. Breaking the chain can be very bad luck. One hyena broke the chain and was eaten by a lion. Another broke it and got kicked out of his social group. Pass it on!

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I spent some time in the 70s researching the anal scent glands of different animals, but all I got was a lifetime ban from the zoo.

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"Pasting"—critical for hyenas, inappropriate for humans. VERY inappropriate.

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