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Hyenas send smelly signals on sex and species with microbes' help

By Amina Khan

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When hyenas leave sour-smelling notes for friends and enemies alike, it's actually tiny microbes that are printing each letter. So say a group of scientists from Michigan State University, who have analyzed the bacteria in the animals' scent pouches and found that they help relay key information about species, sex and reproductive state.

The findings, published in the Proceedings of the National Academy of Sciences, provide fresh evidence about the complex, cooperative relationship between mammals and the microbes that reside in them. Bacteria don't just affect aspects of biology like digestion and the immune system -- they can play a role in higher functions, such as communication and behavior.

Hyenas are far from the only ones to have such microbial communities on their bodies -- it's a common relationship across the animal kingdom. Humans have thriving communities in the armpits, between the toes, in the mouth and nose -- not to mention in our guts, where they help us process our food.

"All animals are populated by microbes, and, contrary to popular belief, most microbes appear highly beneficial to their hosts," the scientists wrote.

Hyenas regularly communicate by smell: They mark territory by rubbing a rancid substance called "paste" from a large scent gland beneath their tail on stalks of grass that they walk over, the scientists said.

Such glands, the team said, "are typically warm, moist, nutrient-rich and largely anaerobic," the researchers said -- making them perfect breeding grounds for bacteria, particularly fermentative ones.

These microbes eat and break down whatever gooey deliciousness they find in the gland, leaving behind odorous compounds that can be potentially used by their hosts to leave messages for other hyenas.

So the microbes were contributing to the sour smell -- just as they often do on human feet. But the scientists wanted to see if, for the hyenas, the microbes were helping produce specific information. Were the microbial demographics linked to the message the animal was sending -- say, about what clan they were from, or how manly they were, or whether they were pregnant?

Studying both wild hyenas in their natural environment and analyzing paste samples back in the lab, the researchers discovered that there were clear differences in the bacterial communities between spotted hyenas and striped hyenas, which typically live in the same area. Out of 461 bacterial groups identified, only 11 were shared between the two species.

Among one clan of spotted hyenas, they found that the microbial communities were very diverse for males, pregnant females and lactating females, and each of these groups seemed to have a subset of microbe types that were unique to them: Out of 343 types identified, 120 were exclusive to males, 54 to lactating females

and 46 to pregnant females.

They couldn't establish a clear difference between males and females among the striped hyenas, which are less social and travel in far smaller groups than spotted hyenas.

Hyenas also seemed to make their odoriferous marks on the same shared spots -- which would mean they were sharing bacteria, too. This could help explain why the bacteria were relatively similar within a given group, the researchers said.

The hyenas could be visiting the same grass stalks for a reason: If they shared the same bacterial communities, they'd produce similar smells that would allow hyenas in the same clan to quickly identify each other -- thus reducing potential fights within the group. It could also allow them to more effectively mark their territory, given that everyone would be depositing the same odor at specific sites.

The scientists think hyenas aren't the only ones benefiting from microbial messengers -- that "the fermentation hypothesis for chemical communication will prove broadly applicable among scent-marking mammals."

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