

# Naked mole rats speak in dialect

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Over millions of years, naked mole-rats have cast away everything underground which uses their energy and isn't necessary to survive. This includes their fur - but also results in surprising abilities. Credit: Felix Petermann, MDC

Some people converse in Creole, while others speak Scots, but it's not only humans who can be identified by the diversity of language they speak. Naked mole-rats have their own dialects, too. Shared dialect also

strengthens cohesion within a colony, a team led by MDC researcher Gary Lewin reports in *Science*.

Naked mole-rats are very communicative creatures. If you stand outside their home and listen, you can hear the little rodents quietly chirping, squeaking, twittering or even grunting to one another. "We wanted to find out whether these vocalizations have a [social function](#) for the animals, who live together in an ordered colony with a strict division of labor," says Professor Gary Lewin, head of the Molecular Physiology of Somatic Sensation Lab at the Max Delbrueck Center for Molecular Medicine in the Helmholtz Association (MDC).

## **Foreign mole-rats unwelcome!**

Lewin worked with Dr. Alison Barker from his own team and other researchers from the MDC and the University of Pretoria in South Africa—Professor Nigel Bennett and Dr. Daniel Hart—to more closely analyze the chirps that the [naked mole-rats](#) use to greet one another. "In so doing, we established that each colony has its own dialect," reports Barker, lead author of the study published in *Science*. "The development of a shared dialect strengthens cohesion and a sense of belonging among the naked mole-rats of a specific colony."

Foreigners are not welcome in an established naked mole rat colony. "You might even say that these animals are extreme xenophobes," says Lewin, who has been studying naked mole rats for around 20 years at the MDC. "This behavior is probably a result of the permanent shortage of food in the dry plains of the naked mole rat's East African habitat. Within their own colony, however, the rodents work together harmoniously. Each one knows its rank and the tasks it has to perform—and usually accomplishes them reliably.



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### **Each mole-rat has its own voice**

In order to analyze the naked mole-rats' language, over a period of two years Lewin's team recorded a total of 36,190 chirps made by 166 individuals from seven naked mole-rat colonies held in laboratories in Berlin and Pretoria. Lewin and Barker's colleague, mathematician Grigori Vevurko, who is now at Delft University of Technology in the Netherlands, used an algorithm to analyze the acoustic properties of the individual vocalizations. "That enabled us to collect and compare eight

different factors such as the height or level of asymmetry in the sound spectrogram," explains Lewin.

Veviurko also developed a computer program that, after an initial training period, was able to very reliably detect which chirps came from which individual naked mole-rat. "So then we knew that each naked mole-rat has its own voice," says Barker. "What we didn't know, however, was whether the animals could recognize one another from their voices."

The computer program, which uses AI, didn't only identify the animals on the basis of their individual voices: "It also detected similarities in the types of sounds made within a single colony," says Lewin. The program was therefore also able to identify which colony a specific individual came from. "That meant that each colony probably had its own distinct dialect," says Barker. But at that point, the research team did not yet know whether the animals were aware of that, and whether they could recognize their own dialect and distinguish it from others.



Naked mole-rats are eusocial animals. Within their colonies there is a strict hierarchy which affects how the rodents overtake each other in their tunnels. They also chirp constantly -- for example to greet each other. Credit: Colin Lewin

### **A preference for kith and kin**

In order to find out both those things, Barker performed several experiments. In the first, she repeatedly placed one naked mole-rat in two chambers, connected via a tube. In one chamber the chirping of another naked mole-rat could be heard, while the other chamber was silent. "We observed that the animals always immediately headed for the chamber where the chirps could be heard," says Barker. If the sounds were made by an individual from the test subject's own colony, it would

give an immediate vocal response, but if they were made by an individual from a foreign colony, the mole-rat would remain silent. "That enabled us to infer that naked mole-rats can recognize their own dialect and will selectively respond to that."

To ensure that the test subjects were responding to the dialect and not to the voice of an individual known to them, the researchers deliberately created artificial sounds. These contained characteristics of each dialect but did not resemble the voice of a specific individual. "The naked mole-rats produced vocal response to the chirps developed by the computer," reports Barker. And the experiment worked even when the chamber where the familiar and trusted dialect could be heard was given the scent of a foreign colony. "That demonstrated that the naked mole-rats were responding specifically to dialect rather than scent, and that they have a positive reaction to hearing their own dialect," says Lewin.

### **Foster pups learn the dialect of their new colony**

In further experiments, the researchers placed three orphaned naked mole-rat pups in foreign colonies where the queen—the only female in naked mole-rat colonies that reproduces—had also recently had a litter. "That ensured that the new arrivals would not be attacked," explains Barker. "Six months later, our [computer program](#) showed that the foster pups had acquired the dialect of their new home."

It was rather more by chance that the team discovered another interesting fact: a naked [mole-rat](#) queen isn't only responsible for reproduction in her colony, she also plays a decisive role in controlling and preserving [dialect](#) integrity. "During the course of the study, one of our colonies lost two queens within relatively quick succession," says Lewin. "In the anarchy that ensued, we observed that the vocalizations of the other naked mole-rats in the [colony](#) began to vary much more widely than usual. Dialect cohesiveness was thus greatly reduced and didn't

return until a few months later, with the ascendance of another high-ranking female as the new queen."

## Insight into the basic workings of human culture

"Human beings and [naked mole-rats](#) seem to have much more in common than anyone might have previously thought," concludes Lewin. "Naked mole-rats have a linguistic culture that developed long before human beings even existed. The next step is to find out what mechanisms in the animals' brains support this culture, because that could give us important insight into how human culture evolved."

**More information:** A.J. Barker et al., Cultural transmission of vocal dialect in the naked mole-rat, *Science* (2021).

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