Study reveals why African mole-rats have a nose for 'social distancing'

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Credit: Kyle Finn

A new study has revealed how one of the world's most enigmatic creatures uses smell to maintain a crucial form of "social distancing."

The Damaraland mole-rat is a burrowing rodent found across southern Africa, in places like Botswana, Namibia, South Africa, Zambia, and Zimbabwe.

Closely related to the hairless naked mole-rat, it lives in a labyrinthine network of subterranean tunnels.

Now a first-of-its-kind study, led by Liverpool Hope University's Dr. Amy Leedale, has shed intriguing new light on how the mole-rat's olfactory senses are vital to breeding and survival in its sandy, pitch-black home.

Like African Meerkats, the Damaraland mole-rat is what's known as a cooperative breeder.

They live in groups of up to 41 individuals comprising a dominant breeding pair and their non-breeding offspring, who perform vital duties like burrow excavation and maintenance, group defense and pup care while forgoing their own chance to mate.

The problem comes, however, when the group fragments and disperses, through events like wet weather or the death of one of the breeding individuals.

In such circumstances, individuals disperse up to a kilometer away from where they started, in search of new mating opportunities.

The prospect of a dispersing mole-rat joining an actively breeding group is highly unlikely—because group members often attack intruders. Instead, dispersing females tend to establish a new group, while males go off in search of these single females.

But how do visually challenged mole-rats navigate their way towards these potential new partners? And, equally, how do they sniff-out the threat from competing individuals from other breeding groups, who might not take kindly to a new intruder into their underground family?

According to Dr. Leedale, Lecturer in Environmental Science at Hope and a specialist in evolutionary animal behavior, it's largely down to odor cues in the extruded sand of a particular burrow system.

In new research published in the journal *Animal Behaviour*, Dr. Leedale writes that "using a series of behavioral experiments, we reveal that mole-rats can discriminate between breeding groups and solitary, non-breeders of the opposite sex by using odor cues."

"Our experiments showed that subjects spent more time investigating sand taken from other mole-rat groups than control sand, indicating an ability to recognize substrate-borne conspecific (other mole-rats) odors."

"Mole-rats also spent more time digging and sweeping in sand taken from the tunnels of unfamiliar, solitary animals of the opposite sex than sand taken from unfamiliar breeding groups and removed a higher volume of this sand during the experiments."

"Together, these results suggest an olfactory preference in both sexes for solitary, opposite-sex animals over breeding groups."

"Our results are supported by observations from the field that immigration into breeding groups is rare, with dispersing females typically establishing new groups, where they are subsequently joined by unfamiliar males. This study supports olfaction as a potential recognition cue which may facilitate adaptive dispersal."

She adds that "the implication of the research is really important—because if we can understand how animals are adapted to, and interact with, their environment then we can predict how they're going to be able to respond to environmental changes, protecting them in the future."

Dr. Leedale and her team tested 25 mole-rats from a captive population of over 500 animals at the Kalahari Research Centre, Kuruman River Reserve, South Africa, housed in artificial burrows made from transparent plastic which allows their behaviors to be properly observed.

The sharp-toothed test subjects were presented with four types of aroma—sand collected from the tunnel systems of solitary, nonbreeding males, sand collected from the tunnel systems of solitary, nonbreeding females, sand collected from the tunnel systems of active breeding groups, or control sand simply lifted from a nearby dune.

One by one, the mole-rats were placed in a T-shaped maze, where they were presented with two tunnels at either side packed with a 30cm 'plug' of experimental sand.

Dr. Leedale says the more a mole-rat interacted with a certain type of sand, the more they were 'engaged' with that specific odor.

She adds that "in our study, subjects were considered to exhibit a preference for the experimental stimulus if they spent proportionally more time moving sand from the arm containing the experimental stimulus compared to the control and, or, removed more experimental sand."

And what the researchers found was that mole-rats of both sexes could very easily identify conspecifics—i.e., other mole-rats—through their odors—even though they'd never come into contact with each other before.

Mole-rats spent more time moving the sand taken from the tunnels of solitary opposite-sex individuals, or moved more of this sand during the experiments, compared with sand taken from breeding groups.

And the report, described by the authors as "an important step in guiding future studies on social recognition in mole-rats," concludes that "Damaraland mole-rats are able to discriminate between sand taken from the tunnel systems of other mole-rat groups and control sand, suggesting they have the capacity to identify conspecifics using olfactory cues."

"Odor cues in sand could be used by dispersers to locate mates, and even avoid encounters with active breeding groups, which comes with the risk of attack, via olfactory cues."

"This study provides timely insight into the role of olfactory cues in discriminatory behavior and reveals a putative mechanism by which mole-rats are able to make adaptive dispersal decisions."

More information: Amy E. Leedale et al, Odour-based social recognition in Damaraland mole-rats, Fukomys damarensis, *Animal Behaviour* (2021). DOI: 10.1016/j.anbehav.2021.06.019

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