

Why mole rats are more flexible than we previously thought

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A mole rat. Credit: Kyle Finn

One of the most interesting facts about mole rats - that, as with ants and termites, individuals specialise in particular tasks throughout their lives - turns out to be wrong. Instead, a new study led by the University of Cambridge shows that individuals perform different roles at different ages and that age rather than caste membership accounts for contrasts in their behaviour.

Mole rats, including the [naked mole rat](#), live in underground colonies. The majority of rodents in the colonies are 'workers', with only one female (the 'queen') and one male responsible for breeding. All individuals cooperate by digging large underground tunnel systems to forage for food, and if a large food source is found, it is shared with the entire colony. 'Queens' and reproductive males remain in this role for their entire life after they have achieved this position. When a 'queen' dies, the strongest and largest helper is probably the prime candidate for inheriting the breeding position.

Early studies suggested that non-reproducing mole rats can be divided into non-workers, infrequent workers and frequent workers, and that most individuals stay members of distinct castes for their entire lives. Individual mole rats would focus on a particular task, such as digging, nest building or colony defence, throughout their lives.

Now, however, in a study published in *Proceedings of the National Academy of Sciences*, researchers from the Department of Zoology at the University of Cambridge have shown that in Damaraland mole rats, the contributions of individuals to cooperative activities change with age and

that individual differences in behaviour that appeared to be a consequence of differences in caste are, in fact, age-related changes in behaviour. Whether variation in behaviour between naked mole rats is also a consequence of similar age-related changes is not known - but this seems likely.



A mole rat. Credit: Kyle Finn

Dr Markus Zöttl, first author of the study, explains: "In some ants, aphids and termites, individuals are born into castes that fulfil certain roles, such as soldiers or workers. Initially, everyone thought that this was only found in social invertebrates, like ants and bees, but in the eighties, the discovery of the social behaviour of mole rats challenged this view. Social mole rats were thought to be unique among vertebrates, in that they also had castes. To understand this fully, what we needed was long-term data on many mole rats over extended periods of their lives."

To study mole rat development in more detail, a team at Cambridge led by Professor Tim Clutton-Brock from the Department of Zoology built a laboratory in the Kalahari Desert, where Damaraland mole rats are native, and established multiple colonies of mole rats in artificial tunnel systems. Over three years, they followed the lives of several hundred individuals to document how the behaviour of individuals changes as they age. All individuals were weighed and observed regularly to document their behavioural changes.

The researchers found that individual mole rats play different roles as they grow and get older. Rather than being specialists, mole rats are generalists that participate in more or fewer community duties at different stages of their lives. Instead of behaving like ants or termites, where [individuals](#) are members of a caste and specialise in doing certain activities, all mole rats are involved in a range of different activities, and their contributions to cooperative activities increases with age.

"As Damaraland [mole rats](#) do not have castes, this may mean that castes

are only found in social invertebrates and have not evolved in any vertebrates," adds Dr Zöttl. "Mole rat social organisation probably has more in common with the societies of other cooperative mammals, such as meerkats and wild dogs, than with those of social insects."

More information: Zöttl, M et al. Differences in cooperative behavior among Damaraland mole rats are consequences of an age-related polyethism. *PNAS*; 29 Aug 2016;

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