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Sensory systems underlying sociality in the naked mole-rat

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Social interactions rely on the integration of information across multiple sensory modalities. In many species, individuals recognize conspecifics through combinations of auditory, olfactory, tactile, and visual cues, reflecting the capacity of neural systems to integrate diverse streams of sensory input. The naked mole-rat (*Heterocephalus glaber*) provides a powerful model system for understanding how social living shapes the evolution of such communication systems, particularly under conditions where visual information is largely absent. Naked mole-rats represent a rare example of mammalian eusociality, living in large multigenerational colonies organized around a strict reproductive hierarchy and cooperative care of offspring [1]. Here, we review evidence that naked mole-rats integrate multiple sensory modalities, focusing on audition, olfaction, and somatosensation to encode social identity.

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Introduction

One of the defining features of naked mole-rat colonies is their highly cooperative and hierarchical social structure. Naked mole-rats inhabit the semi-arid regions of Eastern Africa [2], where they live underground in extensive burrow systems that can exceed 3 km in length [3]. Life underground, combined with the challenges of an arid environment has imposed strong selective pressures shaping their behavioral and physiological adaptations [4–7]. These environmental constraints have important consequences for how sensory information is acquired and used during social interactions. At the same time, the large size (up to 295 members [3]) and dynamic composition of colonies, with new individuals continually added across generations, place substantial demands on mechanisms for social recognition and communication.

Naked mole-rats are considered to be the clearest example of a eusocial mammal [1,8,9]. Like the eusocial insects (i.e., bees and ants) [1,10] within each colony reproduction is usually restricted to a single breeding female (the queen), while individuals undergoing profound reproductive suppression share cooperative tasks, including colony defense, care of pups, and foraging [1]. The naked mole-rat is just one species belonging to the diverse African mole-rat family (Bathyergidae), yet interestingly current evidence suggests that they construct particularly extensive and complex subterranean tunnel networks in terms of both length and complexity compared to other species in the family (Figure 1) [3,11–13].

Naked mole-rats engage in numerous highly cooperative behaviors that require coordination and communication among colony members. One striking example is their foraging strategy. Naked mole-rats feed primarily on underground tubers that they encounter in the course of digging tunnels. Rather than consuming these resources immediately, they often harvest only part of the tuber, transporting it back to the colony and leaving the remainder intact. Remarkably, colonies have been