

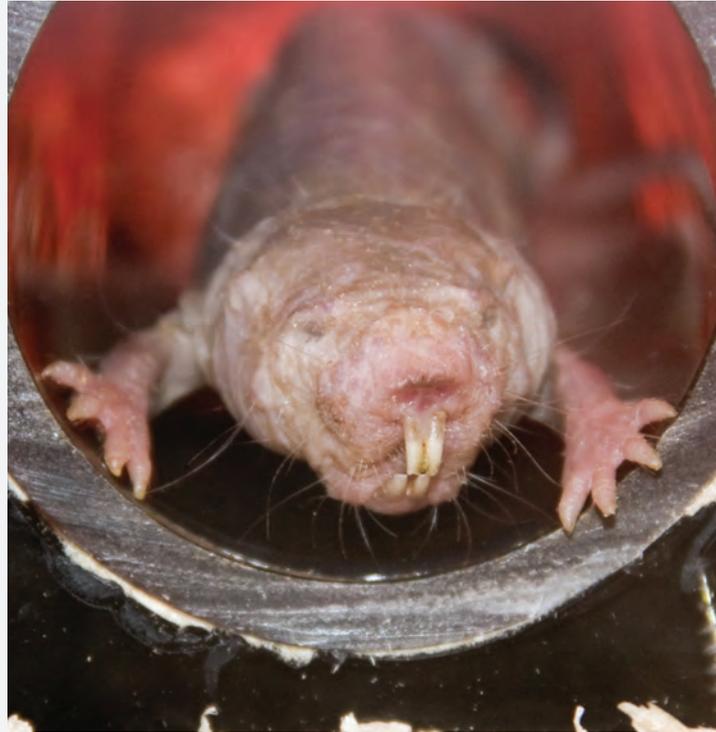


## Naked Mole Rats



As far as ugly goes, you don't get much uglier than the naked mole rat. But these hideous beasts are actually quite amazing. They have a range of special adaptations that allow them to live life deep underground in an otherwise harsh environment. They behave like bees, could help cure cancer and are superman-like in their immunity to pain.

*Heterocephalus glaber* or the naked mole rat, is a small rodent that lives in Eastern Africa, mainly in Southern Ethiopia, Kenya and Somalia. They usually grow to between 8-10 cm long and weigh 30-35 g. They have wrinkled pink or pale yellow skin that is almost completely hairless (this helps stop dirt and sand collecting on them as they dig and they stay much cleaner). They live underground in large extensive tunnel networks that can reach up to 6 km. They are usually found underneath dry grasslands but are found where the soil is sandy or loamy (mixture of sand, soil, clay) as it makes digging much easier. A typical naked mole rat colony usually has between 70-80 members but can range from 20 up to 300.



The physical appearance of a naked mole rat is quite unpleasant but they are specially adapted for their way of life. They have short thin legs that allow them to move around easily in the narrow, low-roofed tunnels and move just as fast forwards as backwards. This is very useful as there isn't enough space in their tunnels to turn around. The long hairs on their bodies are used as sensors because they have very poor eyesight. They do have eyes but these are purely for light detection, rather than for seeing. They have large protruding front teeth that are used for digging. These teeth are actually outside their mouths and the lips seal behind the teeth to stop dirt from filling up their mouths when digging. Their jaws are extremely muscular and if we compared them to a human's body, they would be equivalent to the muscles in one of our legs. They need strong muscles in order to dig and keep their mouths shut.

They don't have any insulating fat underneath their skin and rely on the environment in order to keep warm or cool. The area that they live in has extremes of temperature – scorching hot in the day and unpleasantly cool at night. To counteract the cold, they huddle together in a ball or move to areas of their tunnel network which are closer to the surface where the sun has warmed the soil. If the temperatures are too hot, they move to deeper tunnels which are cooler.

Inside the tunnel there is very little oxygen and it has poor ventilation, so carbon dioxide builds up. It is like having your head under the blankets in your bed, permanently. The naked mole rat has very small lungs and its blood has a strong affinity for oxygen (it is really good at attracting and picking up oxygen). They also have a low respiration rate because they have an extremely slow metabolism (process of breaking-down food using oxygen to release energy the body can use). In fact, their metabolic rate is two-thirds the same as a mouse of a similar size. When there is a drought or food shortage, they can reduce their metabolism even further, by another 25%. This reduces their need for food and means they use even less oxygen.

The skin of the naked mole rat is missing a type of receptor that is common in mammals. It is the neurotransmitter (signal to the brain) that feels the pain of acid and capsaicin (heat chemical in chillies). This is useful because the build-up of carbon dioxide causes acid to build up in the cells of the naked mole rat.

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The naked mole rat can live for up to 30 years which is the longest life span of any rodent. Typically rodents have short life spans and focus more on reproducing prolifically (constantly and in high numbers) in the short time they do have. Humans have looked at them as a possible hint towards slowing the aging process. They found that their long life may be due to their decreased metabolism which means they don't make as many damaging by-products from oxidation.



They also have genes that improve their mitochondria (organelles that releases energy for body cells to use) and decrease the amount of oxidation that occurs. Not only do they live longer but they are also resistant to cancer. This is thought to be due to them having two genetic-blocking mechanisms which stop cells from dividing out of control, which is what many cancers are.

They feed on large tubers that they mine from underneath the plants above them. The tubers resemble a large kumara and are often 1000 times bigger than the animal itself. These tubers can last the whole colony for months or even a year, depending on their size. Also, because the naked mole rats eat so slowly and from the inside of the tuber out, the tuber has time to regenerate and grow its tissue back so it is like a never-ending food source. The naked mole rats have a special type of bacteria living in their gut that breaks down the tough indigestible cellulose fibres into easily digestible fatty acids. They also eat their own faeces, which is called coprophagia. Animals (often rodents or rabbits) do this to gain maximum nutrition from their food. By passing through the gut a second time, they are able to extract any nutrients that have been left in the dung. The faeces also contains B and K vitamins which are produced by the bacteria in their gut and are vital to their health but are in short supply in the tubers they eat.

The naked mole rats have a unique way of reproducing. There is a single queen who is the sole reproducer in the colony. She is usually larger than the others and can weigh over 50 g. She is quite aggressive to the other females to prevent them from breeding. The non-reproducing males and females are sterile but not genetically, as they can become fertile when needed. The queen has three or four males that are the fathers to the young, these are usually strong males. The queen can live for up to 14 years and in this time have hundreds of offspring. It takes 70 days from fertilisation to birth and each litter usually has around 11 pups, however, the litters can be as big as 28. The pups are blind at birth and the queen breast feeds them until they are a month old. They are then looked after by nursery workers who feed them faeces until they are old enough to digest the tough tubers. When the queen becomes too old or unwell, other females will fight to become the new queen and some will even leave the colony to start their own elsewhere.

The naked mole rat colony has a social structure much like that of ants or bees; this is called **eusociality**. It is where there is a dominant leader, the queen, who controls the others and organises them into different functional groups. There are tunnelers who are responsible for digging new tunnels and repairing old ones. They work in teams where one naked mole rat does the digging and the others form a chain to take the soil out of the tunnel using a backwards kicking and scraping movement. There are soldiers who are usually more aggressive than the others. The soldiers search the tunnels and check for members of different colonies, whom they then attack. They also protect the young and the queen. The queen has a group of workers who look after her and the young. They feed, groom, keep them warm and stop the young getting lost. There is a final group that find food, dig out tubers and bring them back to the nests.



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