

# Naked Mole Rats

(*Heterocephalus glaber*)

## housing specifics in laboratory conditions



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GLP Planet 2022



# Naked mole-rats maintain cardiac function and body composition well into their fourth decade of life

[Emine Can](#), [Megan Smith](#), [Bastiaan J. Boukens](#), [Ruben Coronel](#), [Rochelle Buffenstein](#)

& [Johannes Riegler](#)

*GeroScience* **44**, 731–746 (2022) | [Cite this article](#)

> *Comp Biochem Physiol A Mol Integr Physiol.* 2022 Apr;266:111139. doi: 10.1016/j.cbpa.2021.111139. Epub 2022 Jan 3.

## Supermole-rat to the rescue: Does the naked mole-rat offer a panacea for all that ails us?

[Matthew E Pamerter](#)<sup>1</sup>, [Hang Cheng](#)<sup>2</sup>

### Naked mole-rat brown fat thermogenesis is diminished during hypoxia through a rapid decrease in UCP1

[Hang Cheng](#), [Rajaa Sebaa](#), [Nikita Malholtra](#), [Baptiste Lacoste](#), [Ziyad El Hankouri](#), [Alexia Kirby](#), [Nigel C. Bennett](#), [Barry van Jaarsveld](#), [Daniel W. Hart](#), [Glenn J. Tattersall](#), [Mary-Ellen Harper](#) & [Matthew E. Pamerter](#)

*Nature Communications* **12**, Article number: 6801 (2021) | [Cite this article](#)

> *Anat Anz.* 1974;136(4):372-7.

### [Rudimentary prehallux in heterocephalus glaber]

[Article in German]  
D Hetkamp

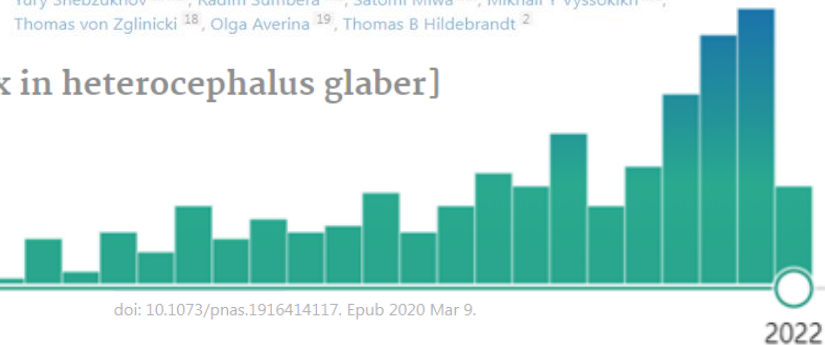
### НЕОБЫЧНАЯ КОРРЕЛЯЦИЯ МЕЖДУ РИТМАМИ АКТИВНОСТИ-ПОКОЯ И ТЕМПЕРАТУРЫ ТЕЛА У ГОЛОГО ЗЕМЛЕКОПА (*Heterocephalus glaber*) В СРАВНЕНИИ С ПЯТЬЮ ДРУГИМИ ВИДАМИ МЛЕКОПИТАЮЩИХ

© 2020 г. В. М. Ковальзон<sup>1,\*</sup>, О. А. Аверина<sup>2</sup>, В. А. Минков<sup>3</sup>, А. А. Петрин<sup>1</sup>, М. Ю. Высоких<sup>2</sup>

Review > *Biol Rev Camb Philos Soc.* 2021 Apr;96(2):376-393. doi: 10.1111/brv.12660. Epub 2020 Oct 30.

### Surprisingly long survival of premature conclusions about naked mole-rat biology

[Stan Braude](#)<sup>1</sup>, [Susanne Holtze](#)<sup>2</sup>, [Sabine Begall](#)<sup>3</sup>, [Julia Brenmoehl](#)<sup>4</sup>, [Hynek Burda](#)<sup>5</sup>, [Philip Dammann](#)<sup>3,6</sup>, [Delphine Del Marmol](#)<sup>7</sup>, [Ekaterina Gorshkova](#)<sup>8,9</sup>, [Yoshiyuki Henning](#)<sup>6,10</sup>, [Andreas Hoefflich](#)<sup>11</sup>, [Annika Höhn](#)<sup>12,13</sup>, [Tobias Jung](#)<sup>12</sup>, [Dania Hamo](#)<sup>14,15</sup>, [Arne Sahm](#)<sup>16</sup>, [Yury Shebzukhov](#)<sup>8,14</sup>, [Radim Šumbera](#)<sup>17</sup>, [Satomi Miwa](#)<sup>18</sup>, [Mikhail Y Vyssokikh](#)<sup>19</sup>, [Thomas von Zglinicki](#)<sup>18</sup>, [Olga Averina](#)<sup>19</sup>, [Thomas B Hildebrandt](#)<sup>2</sup>



### Neoteny, Prolongation of Youth: From Naked Mole Rats to "Naked Apes" (Humans)

[Vladimir P Skulachev](#)<sup>1</sup>, [Susanne Holtze](#)<sup>1</sup>, [Mikhail Y Vyssokikh](#)<sup>1</sup>, [Lora E Bakeeva](#)<sup>1</sup>, [Maxim V Skulachev](#)<sup>1</sup>, [Alexander V Markov](#)<sup>1</sup>, [Thomas B Hildebrandt](#)<sup>1</sup>, [Viktor A Sadovnichii](#)<sup>1</sup>

Review > *Biochemistry (Mosc).* 2017 Dec;82(12):1504-1512. doi: 10.1134/S00066297917120094.

Anecdotal observation of a sexual encounter between male naked mole-rats

In: *Behaviour*

Authors: [James D. Gilbert](#)<sup>1</sup>, [Matilda Brindle](#)<sup>2</sup>, and [Christopher G. Faulkes](#)<sup>3</sup>

Online Publication Date: 05 Apr 2022

### Spontaneous and Experimentally Induced Pathologies in the Naked Mole Rat (*Heterocephalus glaber*)

[V N Manskikh](#)<sup>1</sup>, [O A Averina](#), [A I Nikiforova](#)

Comparative Study > *Respir Physiol.* 1976 Dec;28(3):303-14. doi: 10.1016/0034-5687(76)90025-6.

### Blood respiratory properties in the naked mole rat *Heterocephalus glaber*, a mammal of low body temperature

[K Johansen](#), [G Lykkeboe](#), [R E Weber](#), [G M Maloij](#)

### Mild depolarization of the inner mitochondrial membrane is a crucial component of an anti-aging program

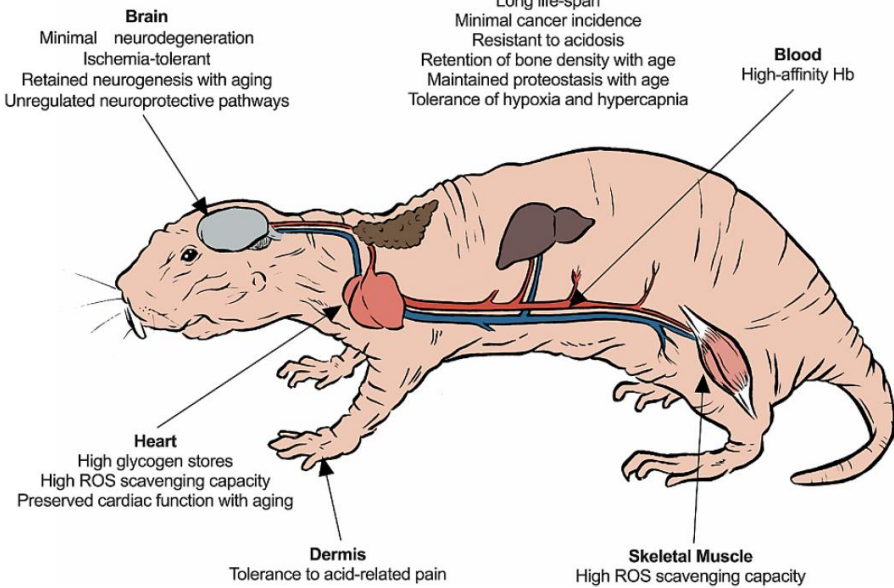
[Mikhail Y Vyssokikh](#)<sup>1</sup>, [Susanne Holtze](#)<sup>2</sup>, [Olga A Averina](#)<sup>1,3</sup>, [Konstantin G Lyamzaev](#)<sup>1,3</sup>, [Alisa A Panteleeva](#)<sup>1</sup>, [Maria V Marey](#)<sup>4</sup>, [Roman A Zinovkin](#)<sup>1,3,5</sup>, [Fedor F Severin](#)<sup>1</sup>, [Maxim V Skulachev](#)<sup>1,3</sup>, [Nicolas Fasel](#)<sup>6</sup>, [Thomas B Hildebrandt](#)<sup>2</sup>, [Vladimir P Skulachev](#)<sup>7</sup>

> *Open Biol.* 2022 Apr;12(4):210292. doi: 10.1098/rsob.210292. Epub 2022 Apr 6.

### Immune competence and spleen size scale with colony status in the naked mole-rat

[Valérie Bégay](#)<sup>1</sup>, [Branko Cirovic](#)<sup>2</sup>, [Alison J Barker](#)<sup>1</sup>, [Robert Klopffleisch](#)<sup>3</sup>, [Daniel W Hart](#)<sup>4</sup>, [Nigel C Bennett](#)<sup>4</sup>, [Gary R Lewin](#)<sup>1</sup>





- ✓ Long life and good health
- ✓ Resistance to cancer
- ✓ Tolerance to systemic hypoxemia
- ✓ Resistance to pain and hypercapnia
- ✓ Tolerance to Ischemic damage to heart and brain
- ✓ The neoteny



**Adaptations of biomedical interest in naked mole-rats.**

*Pamenter ME, Cheng H. Supermole-rat to the rescue: Does the naked mole-rat offer a panacea for all that ails us? Comp Biochem Physiol A Mol Integr Physiol. 2022 Apr;266:111139.*

**Biology and environmental requirements of naked mole rats.**

Characteristic	Description	References
Behaviour	Eusocial rodent that lives in colonies of up to 300 animals of mixed generations	Kress et al. 2017; Schuhmacher et al. 2015
Breeding	Colony composed of a single breeding female, one to three breeding males and other hormonally suppressed colony members	Clarke and Faulkes 1998; Kim et al. 2011
Gestation	66-74 days	Abiyelassie 2018
Litter size	Mean litter size of 12 pups	Buffenstein 2005
Body	Cylindrical body measuring 8-10 cm long and a tail 3-5cm long	Jarvis and Sherman 2002; Abiyelassie 2018
Adult weight	30-50 grams	Jarvis and Sherman 2002
Body temperature	32°C and poikilothermic	Schuhmacher et al. 2015
Longevity	Up to 32 years	Kim et al. 2011
Diet	Roots and tubers	Abiyelassie 2018
Drinking	They solely obtain water requirements from succulent food they consume	Jarvis and Sherman 2002
Habitat	Subterranean in underground tunnels that extend up to 3 kilometres depending on food availability and colony size	Schuhmacher et al. 2015
Tunnel humidity	Up to 90%	Schuhmacher et al. 2015
Tunnel temperature	28-32°C	Abiyelassie 2018



*Mwobobia R, et al. Housing behaviour of the naked mole rat (Heterocephalus glaber) under laboratory conditions. Scandinavian Journal of Laboratory Animal Science. 2020;46(1):16-24. 2.*



In Animals, Science & Nature / 27 August 2018



By Micaela Jemison

*Heterocephalus glaber*

Order: Rodentia

## Husbandry Information

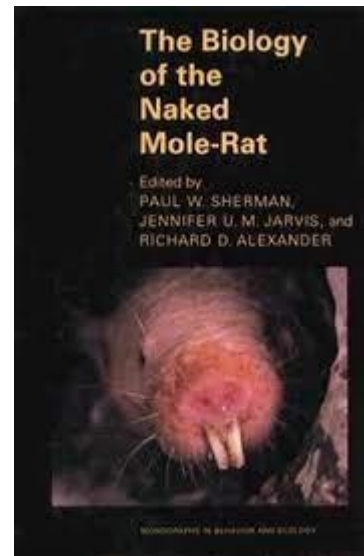
### Housing Requirements



## The Laboratory Rabbit, Guinea Pig, Hamster, and Other Rodents

American College of Laboratory Animal Medicine

2012, Pages 1055-1074



## Chapter 45 - Naked Mole Rat

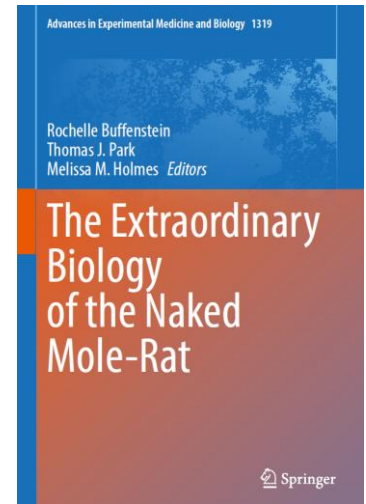
Rochelle Buffenstein<sup>1</sup>, Thomas Park<sup>2</sup>, Martha Hanes<sup>1</sup>, James E. Artwohl<sup>2</sup>

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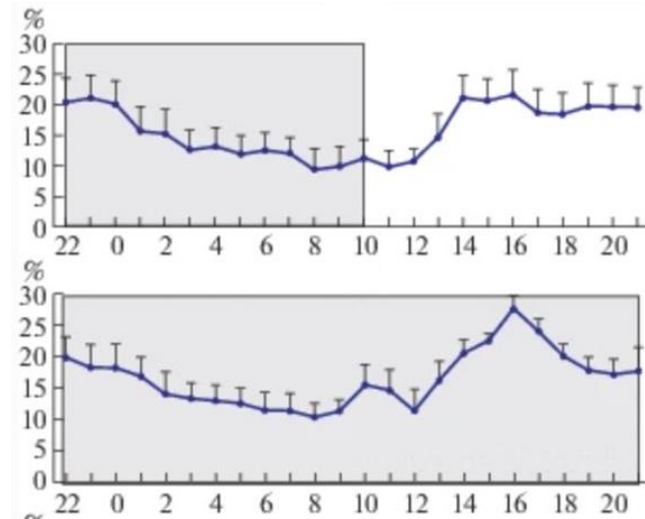
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## Housing behaviour of the naked mole rat (*Heterocephalus glaber*) under laboratory conditions

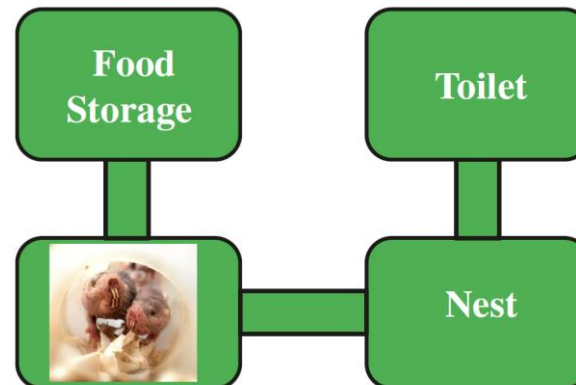




Number of Chambers (18.4 cm in width, 29.2 cm length and 12.7 cm height)	Number of Animals
3	1–15
4	15–25
5	26–35
6	36–49
9	50–99
13	100–149
25	150–200



- ✓ Temperatures, between 27–30 °C
- ✓ Humidity, between 40–50 %
- ✓ The animals are extremely sensitive to vibrations and noises
- ✓ **Light/Dark or Dark/ Dark Cycle**



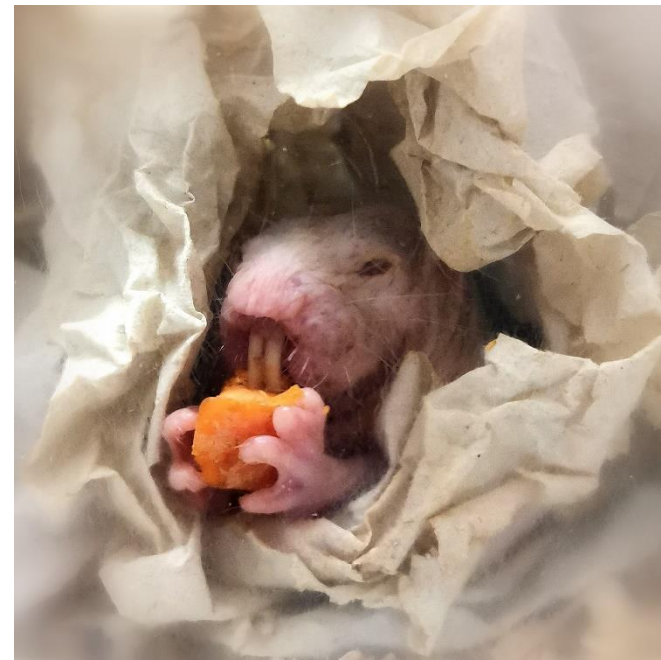
- ✓ The high temperature and humidity within the vivarium have a tendency to spoil the food rather quickly - food should be removed and replaced daily.
- ✓ When feeding the animals, a large section of sweet potato is given and that allows the animals to perform their instinctual behavior of gnawing on a tuber that is in place
- ✓ NMR evolved in an ecosystem with little to no access to free water, and can maintain water balance using preformed water in foods and metabolic water produced during the oxidation of foods
- ✓ Only the queen and brood are involved in coprophagy



### Diet:

Carrot, celery heads, kohlrabi, batata, apple, rolled oats

Feed compound – blocking a malocclusion





## Social Phenotypes

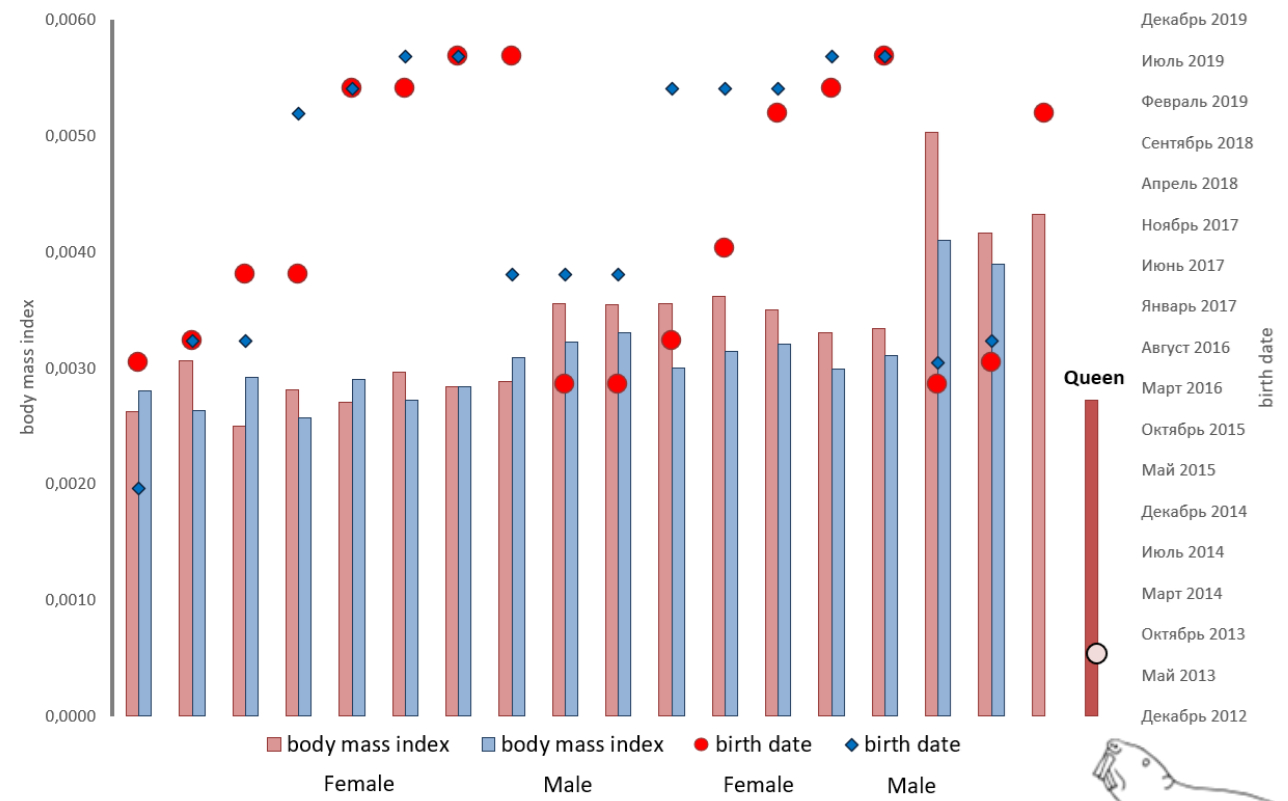




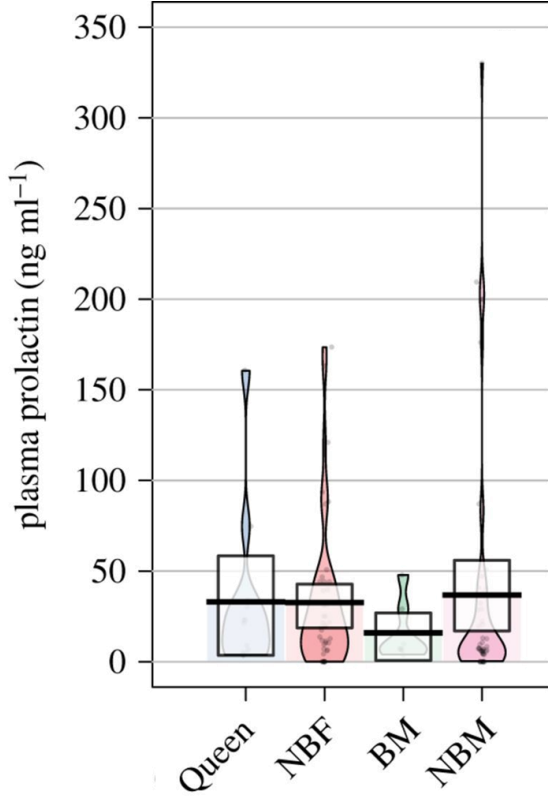
• Forager • Nurse • Digger

• Queen

• Father • Soldier • Founder/Scout

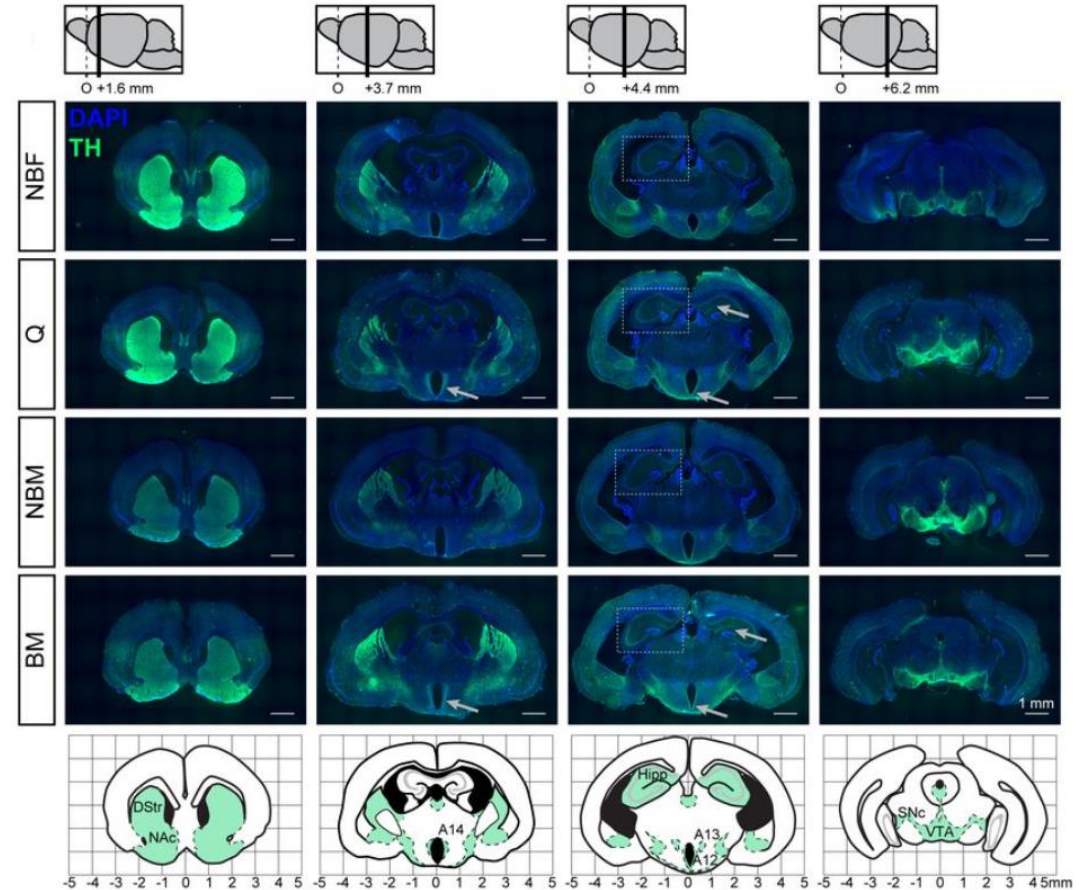
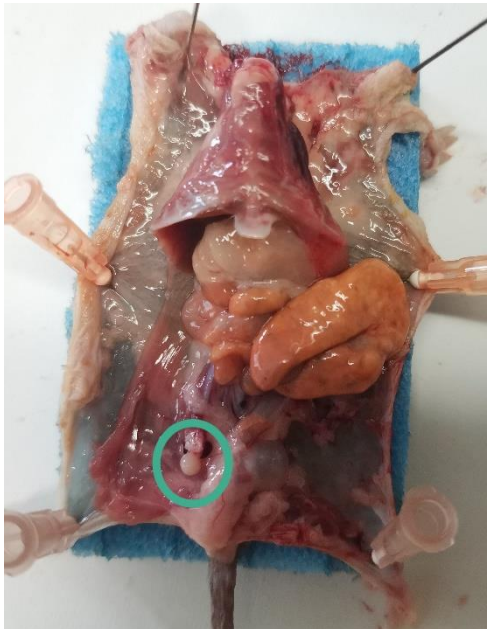






# The hyperprolactinaemia as a component in socially induced reproductive suppression

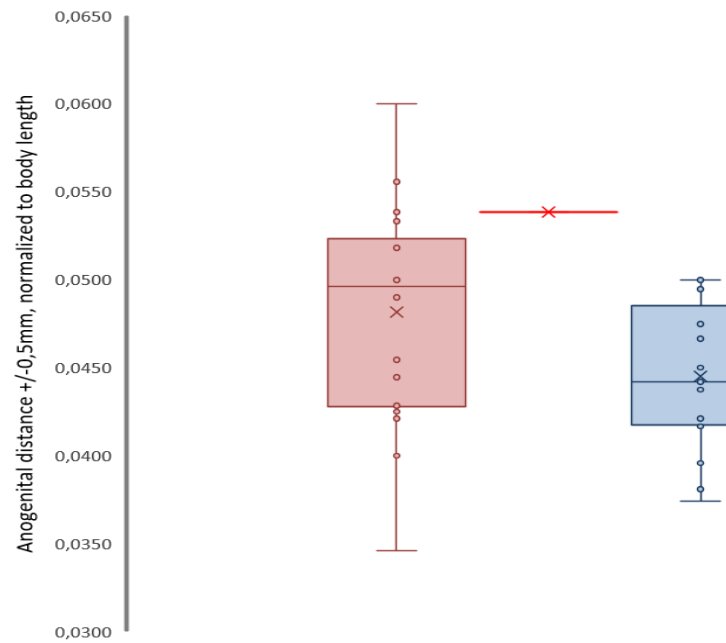
- DOI: 10.1098/rsbl.2018.0150
- DOI: 10.1016/j.yhbeh.2022.105196



doi: <https://doi.org/10.1101/209932>



### Anogenital distance



Working females Queen Males



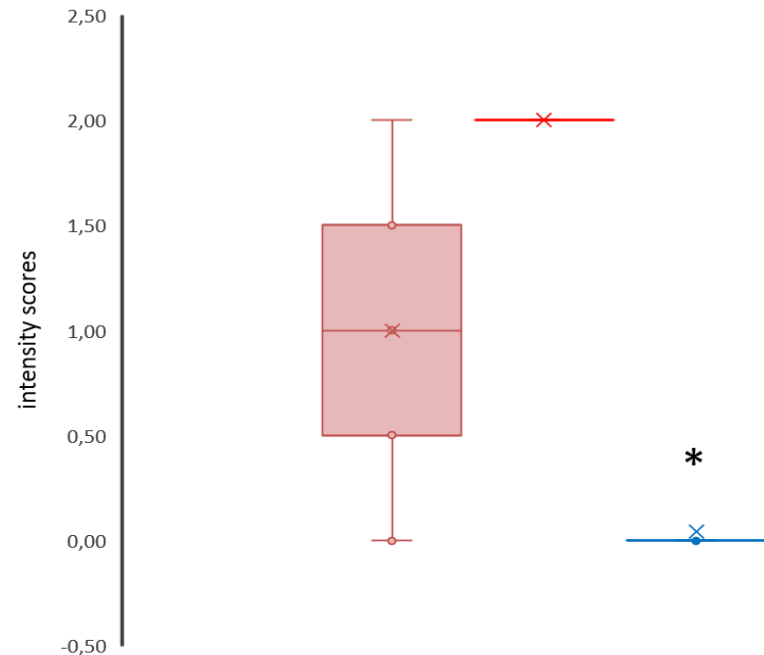
**Queen**



**Male**

**Female**

### Availability of red membrane

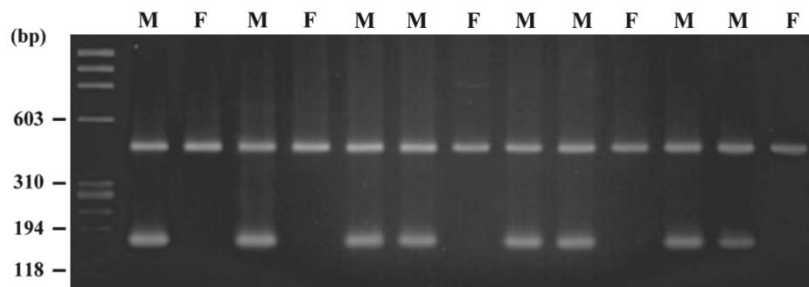


Working females Queen Males



**Male**

**Female**





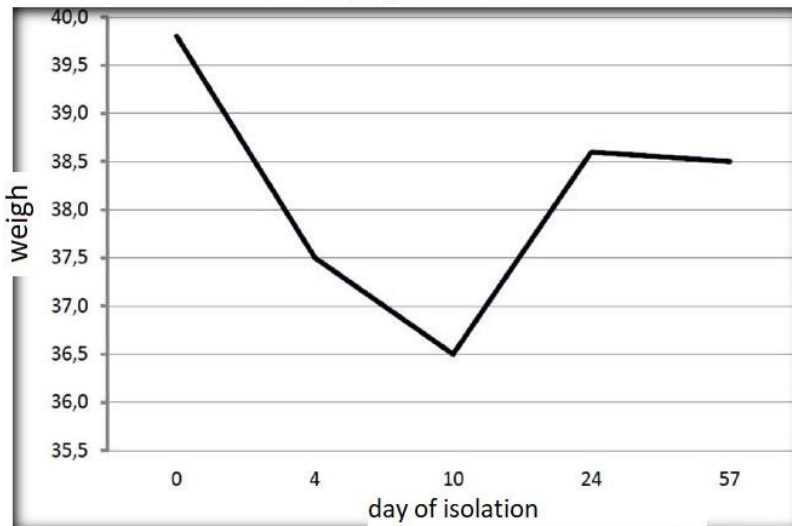
3 day of isolation

37 day of isolation

Working female NMR isolation in order to get rid of suppression by Queen

- This operation is necessary for transformation of the working female to Queen
- Weight loss
- Increase of the cortisol level

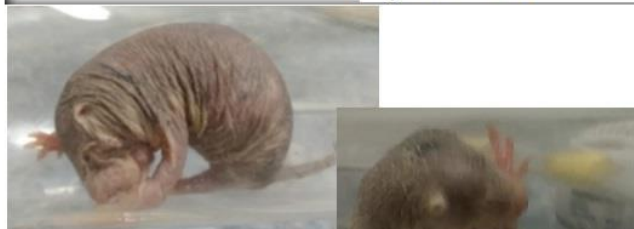
Result of breeding attempt without female isolation period is death



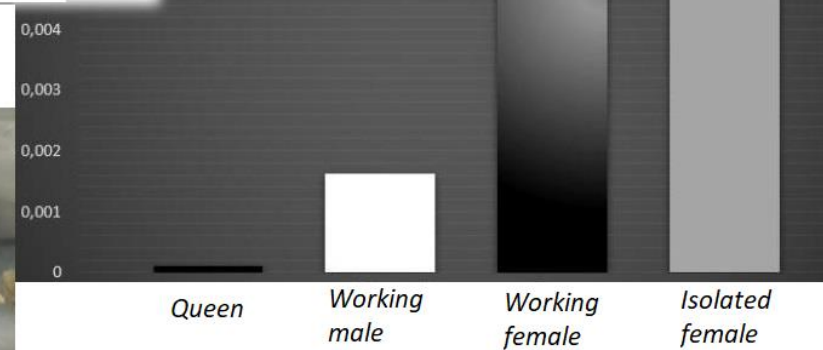
Stress due to isolation

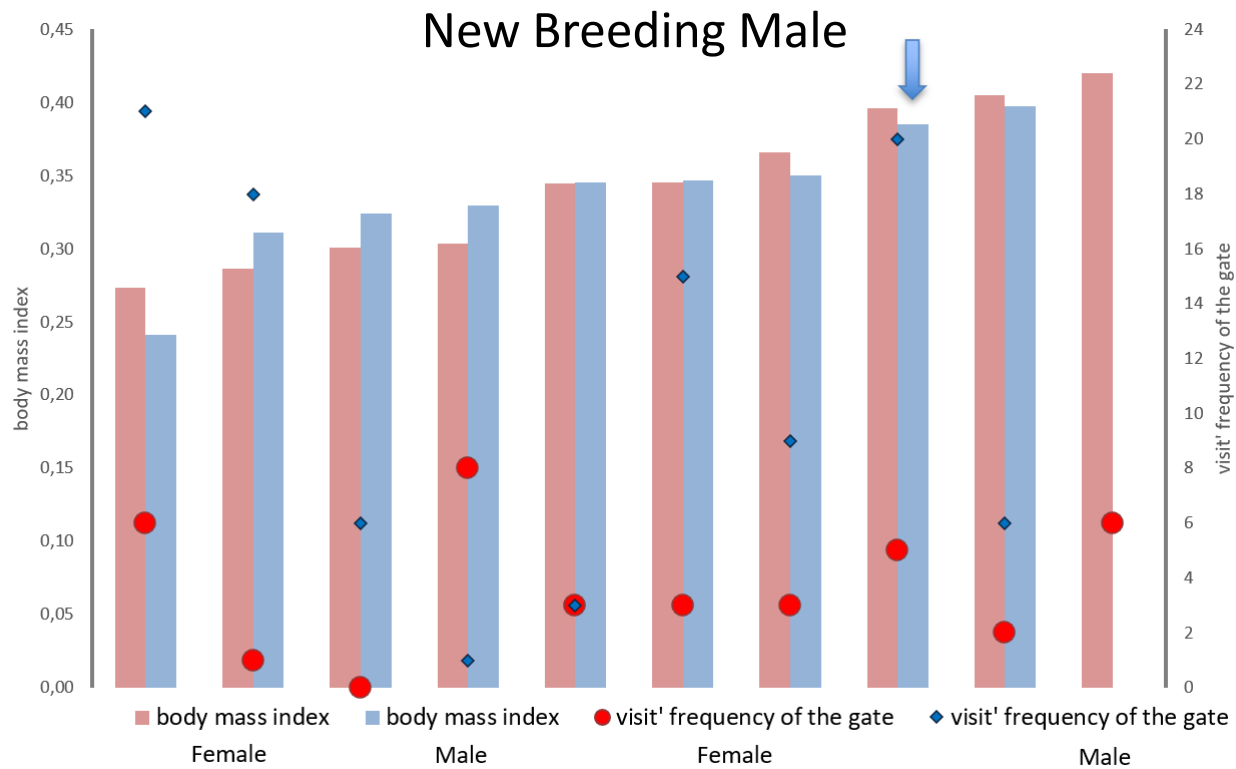
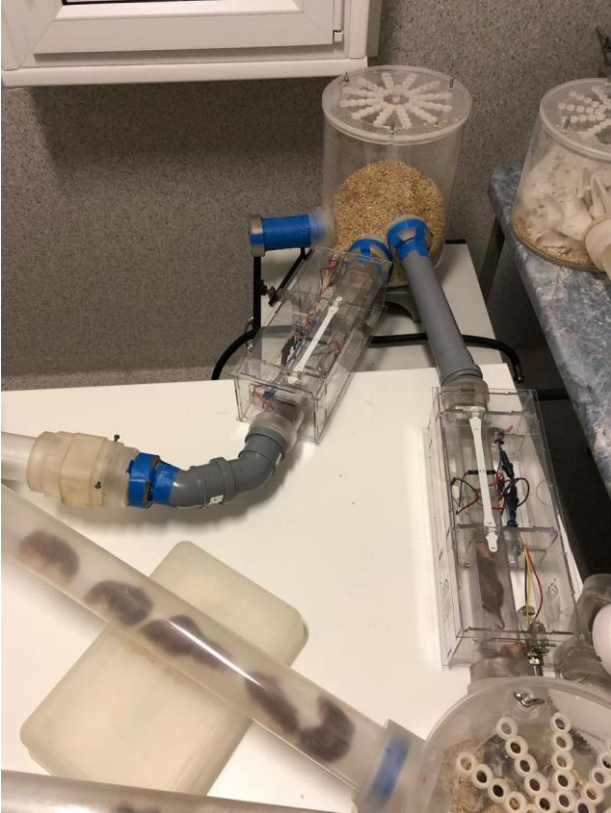


Level of the glutathione peroxidase



abnormal grooming intensity





**New Female**



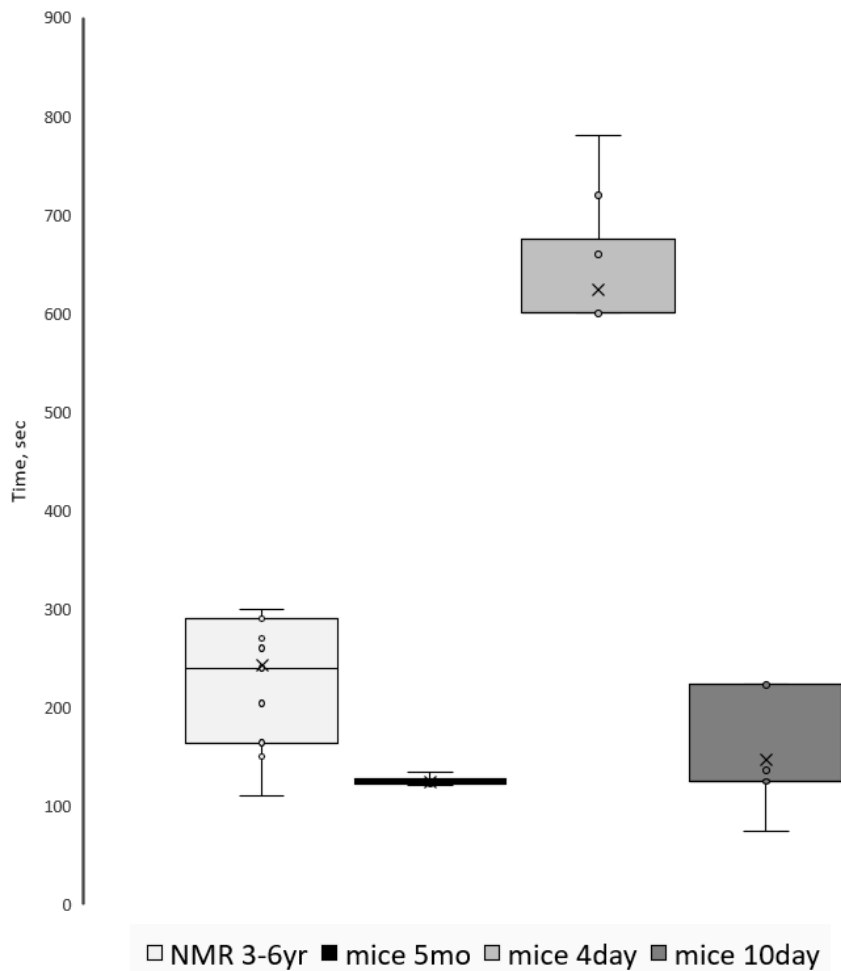


- ✓ Naked mole-rats are spontaneous ovulators, with an ovarian cycle length of approximately 27-38 days;
- ✓ Mating usually occurs 7 to 10 days after birth of previous litter;
- ✓ Estrus period: 24 h or less.

	MICE puppy	NMR puppy
gestation period	21 days	~ 70 days
pelage formation	2 – 4 days	7 – 14 days
eye opening	12 – 14 days	~ 30 days
lactation period	3 – 4 weeks	4 – 6 weeks
pubescence	1 – 1,5 months	From 7,5 months to >16 years



### Immersion anesthesia



**Blood sample**



**Surgical procedure**

### Chip implantment

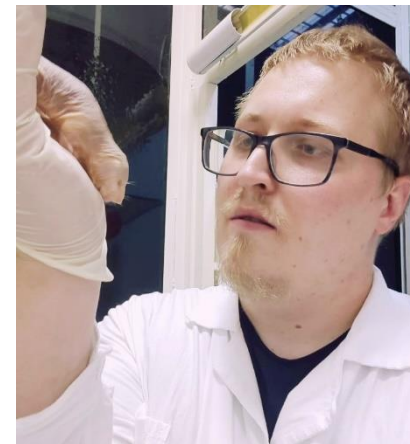




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