A miniscule model for research

by Melissa Berg, BS

SCIENTIFIC NAME
Suncus etruscus

TAXONOMY
PHYLUM: Chordata
CLASS: Mammalia
ORDER: Soricomorpha
FAMILY: Soricidae

General description

The Etruscan shrew, also known as the Etruscan pygmy shrew or the white-toothed pygmy shrew, is the smallest living mammal by mass. Most adults weigh 1.8–3 g with a body length of 35–48 mm, making them 20 times lighter than the average adult mouse[1]. These miniscule mammals are widespread across Southern Europe, Northern Africa and Central Asia, where they occupy abandoned olive groves and forest floors[2]. Etruscan shrews have poor vision and hearing, and rely on well-developed vibrissae for environmental information. They are adept hunters and often kill insects up to half their size. Like all mammals they are considered homeothermic; however, Etruscan shrews can enter a state of torpor to conserve energy when experiencing cold stress or food restriction[3]. Body temperature can fall as low as 6 °C, making them especially adaptive to environmental changes. The heart rate of an Etruscan shrew can reach an impressive 1,200 beats per minute with a respiratory rate of over 800 breaths per minute[4]. Its small size has promoted numerous physiologic adaptations that have made the Etruscan shrew a focus of both cardiovascular and neurophysiology studies.

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Husbandry

Etruscan shrews have a high basal metabolic rate reflective of their high surface area-to-volume ratio. They cannot survive more than a few hours without food, and they must consume as much as 6 times their body weight in crickets and other insects daily[3]. Etruscan shrews are generally housed in same-sex groups of siblings within 20-gallon glass terrariums. They are monogamous breeders[1], and breeding pairs can be set up with special burrow stones for breeding. Breeding in Etruscan shrews is temperature and light dependent, and breeding rooms are kept at light cycles between 14-h:10-h and 18-h:6-h light:dark cycles, at a temperature of 24 °C, instead of the usual 23 °C in non-breeding colony rooms. They have a fast generation time of 11 weeks, and produce 4–6 pups per litter[1].

Research résumé

Etruscan shrews are commonly used to study how small body size affects various physiologic parameters. They were first used for research in the 1930s, when a French cellular biologist compared non-neural somatic cells in Etruscan shrews with those of larger mammals and discovered that cellular size remains constant despite differences in body size[5]. Subsequently, nerves from Etruscan shrews were used to make crucial advances in understanding of how nervous impulses are conducted along axons[6]. In 1996, researchers used the Etruscan shrew to study cardiovascular adaptations for maintaining a high oxidative demand, finding that the blood of the Etruscan shrew has a larger oxygen capacity and a lower oxygen affinity than is typical for homeothermic animals[4]. They can release almost twice as much oxygen per ml of blood as humans can.

Today the most promising contribution of Etruscan shrews is in the field of neuroscience. With one of the smallest brains of all mammals, Etruscan shrews offer a unique opportunity for studies using brain imaging. The cerebral cortex of the Etruscan shrew has a measured thickness of 400–500 μm, so researchers can view and record activity from an entire cerebral column using 2-photon microscopy[3,7]. This could allow researchers to visualize every neuron in the entire somatosensory cortex at once. In this way, Etruscan shrews might help researchers finally unlock complete sections of the cerebral cortex and gain a better understanding of the relationships between structure and function[7].

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