***Are scientists in part to blame for the lack of stricter regulations on some of these chemicals?*** Hmm, scientist as villain…what a novel plot. But I guess you could blame us. If we all agreed on *exactly* what effects these types of chemicals cause and at what doses, perhaps stricter regulations would be in place. Scientists all see the world a little differently and emphasize different things, don't we? It's part of our charm but it drives the media, the public, legislators and regulatory agencies crazy. They want simple answers like what's safe and what isn't. We feel the need to qualify everything and love to dispute the details (let's face it, 'I'll show you' gets us motivated and sends us back to our lab benches). But we can disagree on the details and still agree that a chemical with the properties of BPA isn't good for our bodies.

The manufacturers of BPA, however, have been very effective at using us against ourselves. The effect on the growing oocyte that we stumbled on was examined subsequently by several groups. All reported adverse effects, but there was variability among the findings, and one group concluded that BPA didn't give rise to chromosomally abnormal eggs because the defects it induced caused the arrest and death of the cell. The manufacturers spun this into: 'no one can repeat that Hunt study'. But really, does the difference in interpretation between studies matter? A dead oocyte or an abnormal egg — no healthy baby either way.

As long as BPA manufacturers can continue to convince people that 'it's controversial', many will think, 'Why worry? I'll wait until they *know*'. In the case of BPA, a few scientists have been willing to stand up and admit that, while we still have a lot to learn, what we know scares the daylights out of us, and that's making a difference. Speaking like that is stepping away from how we were trained to talk about our work. But saying, 'I'm a scientist and what I know worries me', puts things in a context that the man on the street and the elected official can understand.

***What are the consequences if scientists fail to participate in a dialogue with the public?*** Scientific ignorance hurts science. I get so frustrated when I hear some misguided politician riffing on a fruit fly study, making it sound like a colossal waste of time and money. In part, it's our fault. We don't think about explaining to nonscientists what we do and why it's important, even though taxpayers fund most of our work. It's not that people are too stupid to understand; it's that we don't know how to make it comprehensible. But we can learn. After 10 years of talking to parent groups, legislators, and reporters, I can explain meiosis to anyone. And, when it comes to chemicals like BPA that have become so complexly interwoven into our daily lives (did you know that eating greasy french fries or applying hand lotion and then handling a paper receipt is a terrific way to get a good dose of BPA?), failure to voice our concerns, to explain our findings to the general public, and to work for change in the regulatory process may jeopardize human health.

***And how can we get scientists to communicate better?*** Our best hope is the next generation. Scientists like me who have stumbled into the world of reporters and legislators provide evidence that old labs can learn a few new tricks, but it's so much easier for young pups. New students effortlessly get it when you break the principles of giving a good talk down for them. Imagine what would happen if we taught them how to talk to reporters, legislators, and the man on the street? Although they can certainly text and email, our students are coming to us with a woefully inadequate appreciation of the power of direct, face-to-face communication. We have to impress this upon them and help them develop and hone their skills.

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**Quick guide**

# *Mus spicilegus*

**Wenfei Tong[1,3,*] and Hopi Hoekstra[1,2,3]**

***What or who is* Mus spicilegus*?*** *Mus spicilegus*, aka 'the mound-building mouse', is a rather nondescript, brown mouse that looks just like its close relative, the commensal house mouse (*Mus musculus*). In fact, they look so much like house mice that the first individuals described in 1840 from a garden in Odessa probably were house mice. Its epithet '*spicilegus*' is derived from the Latin, *spica* meaning a spike of grain, and *legere*, to collect, which makes sense, since these mice do in fact gather grains.

***So why should we care?*** Because its architectural skills and social behaviours are truly unique — none of the other *Mus* species in Europe build mounds. Unlike typical house mice, groups of mound-building mice construct their own overwintering structures. They pile up soil and up to 50 litres of vegetation, which when completed are about 40,000 times the volume of a single mouse (Figure 1). These conical mounds can be up to 4 metres in diameter and are typically 0.5 metres high when freshly built. Deep below the mounds, the mice dig a network of tunnels that either exit above ground, or connect the mound of vegetation with an underground nest chamber. Mounds are typically found in fields, often at the edges, and there can be up to 100 mounds per hectare. Construction begins in early autumn, and a mound can be built in just a few days or weeks, so if mounds are destroyed by ploughs, which often happens in crop fields, it is quite common for mice to rebuild a mound before winter.

***What are the mounds for?*** We don't know exactly. One obvious hypothesis is that the vegetation stored in mounds, which can vary greatly and contain crop grains, serves as a winter food supply. However, a recent study of mice in Hungary showed no overlap between the plants stored in mounds and those eaten. It is also not clear whether there are tunnels linking vegetation in mounds to nest chambers. Another idea is that

mounds help to keep mice warm and dry, possibly by fermenting vegetation generating heat during winter. While there is no direct evidence of fermentation, the soil under a mound is indeed warmer and drier than unprotected soil. *Mus spicilegus* winter coats are also less insulating than the coats of house mice, so the mounds may alleviate the need for thick fur.

***Do the mounds perhaps offer protection from predators?*** Again, we don't know, but it's equally possible that they actually draw the attention of predators.

***Who builds the mounds?*** This is also still largely a mystery, but it has been suggested that rather like in social insect and human societies, some work harder than others. One study showed that in a group of six mice only two individuals did the majority of the excavation. Most mounds contain 10–20 mice from more than one litter. The inhabitants of a mound tend to be relatives, suggesting that shared genes may help to offset the costs of helping others. The age and sex of mound builders has yet to be established, but by the end of winter, very few adults are found in mounds, suggesting that only juveniles survive.

***How do they reproduce?*** Unlike many other cooperative mammals, *Mus spicilegus* is not a cooperative breeder. Whereas female house mice tend to nurse communally, female mound-building mice are highly aggressive towards each other, and tend to produce fewer offspring when experimentally forced to share a mate. *Mus spicilegus* is socially monogamous, with strong mating pair-bonds and significant paternal care. Curiously, *Mus spicilegus* also have the largest testes relative to body mass of any *Mus* species. As large testes size often is an indicator of high sperm competition, these mice are probably not strictly monogamous.

***Where do mound-building mice live?*** *Mus spicilegus* is distributed across eastern and central European grasslands, hence they're also known as 'steppe mice'. Recently, a morphologically and genetically distinct population was discovered along the Adriatic coast. Like all members of the species, these populations build mounds, but the mounds might be smaller in the warmer southern climate.

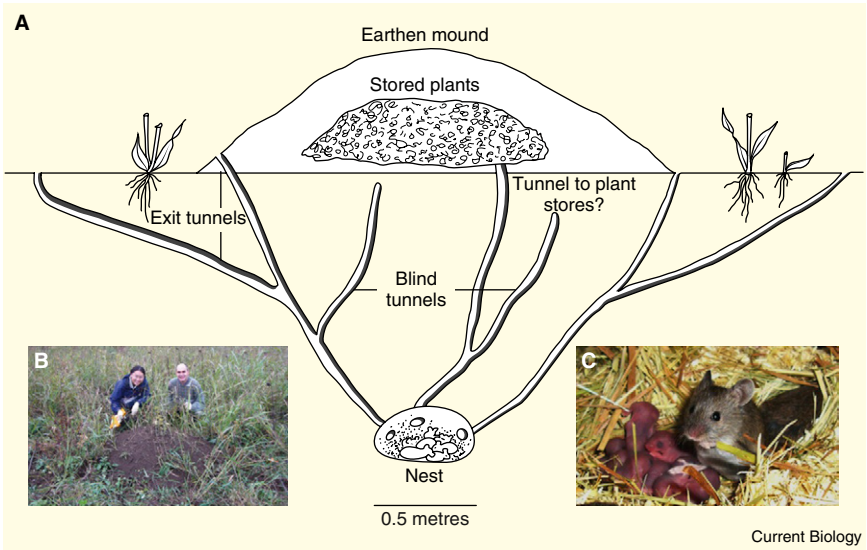


Figure 1. The mound and its builder, *Mus spicilegus*.
(A) Diagram of a typical mound composed of vegetation and soil that is above ground, with a network of tunnels leading to a nest chamber underground. (B) A freshly built mound with biologists for scale. Photograph by Daniela Simeonovska-Nikolova. (C) A *M. spicilegus* dam with her pups.

***Are mound-building mice pests?*** Throughout much of their range, farmers consider these mice to be pests, particularly because their large mounds make fields difficult to plough. *Mus spicilegus* populations are decreasing in many areas with the loss of steppe grassland and an intensification of agricultural practices that minimises unploughed field edges where the mice can retreat. Indeed, *Mus spicilegus* is highly endangered in Austria, one of the most economically and agriculturally developed parts of its range.

***Why study yet another mouse?*** Well, as you've seen, we don't know an awful lot about them! And as the house mouse is such a well-established model in genetics, development and neurobiology, it provides the perfect toolkit for investigating the evolutionary and molecular causes of the unique behaviours — from mound-building to social monogamy — in closely related wild species like *Mus spicilegus*. Surprisingly little is known about wild *Mus* species, with six of the 14 currently known species discovered only after 2003. Given their unique behaviour and their genetic similarity to a laboratory workhorse, mound-building mice should provide interesting insights into the evolution of cooperation, complex architecture, and mating system variation.

## *Where can I find more about* Mus spicilegus*?*

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