

INSIDE JEB

Rebel tenrecs disregard hibernation rule book



A torpid tenrec. Photo credit: Daylin Sigler.

It's a rookie mistake; you take your pet hamster out of bed to play one late-autumn afternoon, but it looks as if the poor animal is dead. However, upon close inspection you realise that the beloved rodent is simply hibernating and all you have to do is wait for it to raise its body temperature by shivering. Hibernation expert Frank van Breukelen from the University of Nevada, Las Vegas, USA, explains that this recovery process, known as interbout arousal, is common amongst all small hibernators. So, when he heard about common tenrecs in Madagascar from Barry Lovegrove, he knew the tiny mammals were far from regular hibernators. 'They didn't do interbout arousals', he recalls. He also noticed that Lovegrove's hibernating mammals were relatively warm, ~25°C, compared with other hibernators, which can allow their body temperatures to plunge to just above freezing. Suspecting that tenrecs (*Tenrec ecaudatus*) would default to the hibernator norm and perform interbout arousals if only he could make them cool enough, van Breukelen decided to set up a captive tenrec colony in his lab.

Describing the challenges he encountered, van Breukelen says, 'It took 2 years of paperwork and a crazy amount of effort to import these animals'. But the real headache began when the hibernating animals reached the lab; virtually nothing was known about their habits and behaviour. 'Trying to figure out caging for 40 incoming tenrecs ... was an interesting experience', he recalls. And when they arrived, after being transported by road and air, it was even clearer that the animals would not conform to the regular hibernators' rule book. 'If we had done all of this movement with squirrels, they would have had an induced arousal and would have been up for a day or so, but the tenrecs were "dead to the world"', he says.

Once the tenrecs had settled in, Michael Treat and colleagues began measuring their oxygen consumption and CO₂ production over temperatures ranging from 12 to 28°C, but the animals' metabolic recordings were all over the place. While some dropped their oxygen consumption and hibernated at 12°C, others were happy rampaging around at a

similarly low body temperature. 'What's nuts is that an active tenrec at 12°C can have almost as low an oxygen consumption as a hibernating tenrec!', exclaims van Breukelen, adding that active tenrecs can have metabolic rates that vary over a 25-fold range at the same body temperature – which is unheard of.

Their ability to hibernate was also equally unorthodox. 'In ground squirrels, hibernation is essentially a binary state; they are either torpid or aroused', says van Breukelen. But tenrecs can be anything from a little bit torpid – becoming active rapidly when held on their backs – to full-blown out-cold torpid. The animals were unbelievably versatile, which made van Breukelen wonder: 'Why aren't they everywhere?'

The answer came when the team transferred some of the animals to chilly (less than 8°C) and hot conditions. The tenrecs struggled to breathe and began panting when they got too cold, while they became distressed at 34°C. van Breukelen realised that the animals' versatility is also their Achilles' heel; they simply can't survive beyond a narrow temperature range.

As tenrecs share many characteristics with our ancient mammalian ancestors, van Breukelen suspects that they haven't ripped up the hibernation rule book – it probably just got written by other creatures that evolved in more variable climates. Oh, and tenrecs definitely don't bother with interbout arousals.

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