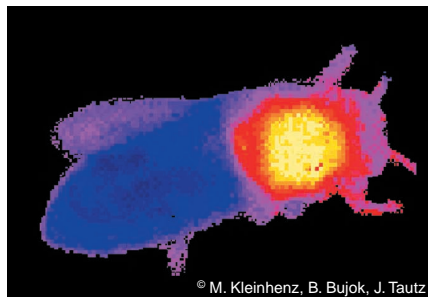


Inside JEB, formerly known as 'In this issue', is a twice monthly feature, which highlights the key developments in the *Journal of Experimental Biology*. Written by science journalists, the short reports give the inside view of the science in JEB.

# Inside JEB

## CLIMATE CONTROL, BEE STYLE



Whatever the weather, no self-respecting hive lets the temperature drop inside; the future of the next generation depends on it. If the hive's temperature falls a few degrees below 35°C, the incubating young's development is seriously threatened. Marco Kleinhenz explains that much of the hive's heat derives from general hive-keeping activity, but workers also help raise the temperature by congregating at the brood and vibrating their thoracic muscles to warm the incubating young. But how each individual worker contributes to the heating sum wasn't clear. Brigitte Bujok had noticed that some of the workers appear to position themselves over an incubating brood cell and press their thoraxes against the sealing caps 'leaving a hot spot behind' explains Kleinhenz. But not much more was known about the brood's central heating strategy until Kleinhenz and Bujok teamed up with Stefan Fuchs and Jürgen Tautz to take a closer look at the heating bee's activity (p. 4217).

Setting up a series of hives where they could monitor the bee's brood heating antics, Kleinhenz and his colleagues recorded individual's body temperatures with an infrared camera, and watched their behaviour. Some of the workers were happy to stay completely motionless on a brood cap for several minutes, pressing their thoraxes against the cap to warm the young within. But many of the bees preferred to find an empty cell amongst sealed brood cells, and take up residence, sometimes for over an hour. Kleinhenz explains that this apparently lazy behaviour had been noticed before, so he suspected that the bees were simply taking a rest; until he looked at their temperature. They were warming themselves before they vanished inside, and some bees emerged even warmer than when they went in! Were the bees really taking a nap, or were they taking up residence in an empty cell to warm the adjacent pupae?

The team built a close observation hive

where they could monitor bees' thoracic temperatures as they hunkered down in vacant cells. This time it was clear. Far from easing off and taking a rest, closeted bees were vibrating their thoracic muscles and reaching temperatures up to 41°C. Far from being idle, the workers were warming the brood.

But how effective is the bee's novel heating strategy? Fitting a small resistor inside a bee's thorax, the team placed the simulated bee heater inside a cell, and recorded the temperature in adjacent cells. After 30 minutes, the heater bee's effect could be felt three chambers away. Kleinhenz also realised that once in place, a hot worker makes the most of its heat, warming all six of the surrounding cells, while usually a single occupant is the only beneficiary from a worker perched above it on the comb. What is more, the heater bees aren't profligate with their valuable resource, staying cool when surrounded by honey or vacant brood cells that don't require warmth, or when the brood is already warm enough.

Kleinhenz also noticed that this dedicated band of bees also take great care not to over-heat their precious charges. They monitor the brood cells' temperatures and ensure a comfortable climate for all, by never letting the hive rise above 35.9°C.

10.1242/jeb.00728

**Kleinhenz, M., Bujok, B., Fuchs, S. and Tautz, J.** (2003). Hot bees in empty broodnest cells: heating from within. *J. Exp. Biol.* **206**, 4217-4231.

## IN A FLICK OF A TAIL



Picture provided by Richard Peters

Unlike their fire-breathing counterparts, Jacky dragons are rather gentle lizards. These dragons spend most of their lives perched in trees waiting to trap a passing morsel. But they don't take kindly to intruders. If a Jacky dragon invades another's personal space, the diminutive lizard begins an elaborate dance routine, warning the trespasser that it's time to move on. So how does the dragon catch an