Inside JEB 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

BOA CONSTRICTORS USE TWO STRATEGIES TO CLIMB

Hunting for birds in trees, young boa constrictors sometimes have to scale the slenderest of branches to trap their prey. So what strategies do they use to move as they slither along flexible boughs that are a fraction of their girth? Greg Byrnes and Bruce Jayne decided to find out how young boa constrictors ascended slack and taut vertical ropes ranging from 3 mm to 9 mm diameter (p. 4249).

Luring the snakes to climb the ropes by placing a dark cosy refuge at the top, Byrnes and Jayne filmed the animals' ascents while measuring the tension on the rope as the animals coiled and uncoiled their grip. 'All the climbing velocities were extremely slow,' the duo says, ranging from 0.5 to 1 $cm\,s^{-1}$ and the snakes only reached their top speeds on the thickest and tensest ropes. All of the snakes gripped the rope with some parts of their bodies as they translated other parts up, but Byrnes and Jayne noticed the animals used different movement patterns depending on whether they were scaling the thinner ropes (3 mm and 6 mm) or the thicker (9 mm) rope.

When ascending the thinner ropes, the snake's entire body moved along the same path, maintaining contact with the same section of rope until the tail slid past. However, when mounting the thicker rope, the animal 'concertinaed' upward, holding on with certain parts of its body as it dragged free parts of the body up.

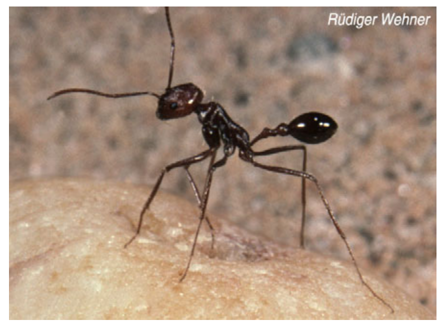
Analysing the effect that varying the rope's tension had on the boa constrictors' movements, Byrnes and Jayne saw that the snakes found it harder to climb on the slacker, thinner ropes, slipping backwards often. They also noticed that the snakes switched their grip strategy depending on the rope's flexibility and thickness.

On thinner ropes, the snakes' bodies formed a zigzag, so that the inward directed grip forces occurred at different points along the rope's length. Unopposed, the forces caused the rope to bend and kink as the snake ascended. However, as the boa constrictors mounted the thicker rope, their bodies formed C-shaped clamps, holding on like a gripping hand, so that the inward directed forces cancelled each other out leaving the rope straight and undeformed. Byrnes and Jayne suspect that although the tail may be able to form C-shaped clamps on all thicknesses of rope, thicker regions of the snakes' bodies may not be able to bend enough, forcing the animals to use the less effective zigzag strategy when scaling slender boughs.

10.1242/jeb.053611

Byrnes, G. and Jayne, B. C. (2010). Substrate diameter and compliance affect the gripping strategies and locomotor mode of climbing boa constrictors. *J. Exp. Biol.* **213**, 4249-4256.

NAMIB DESERT ANTS USE VISUAL FLOW TO FIND HOME FAST



Life in the Namib desert is harsh. With high temperatures reaching up to 71°C, venturing out of the nest can be risky. Rüdiger Wehner and Martin Müller from the University of Zürich, Switzerland, explain that foraging Namibian desert ants find their burrows quickly to avoid the lethal heat, but how do they locate their burrow homes in such a featureless landscape? According to Wehner and Müller, roaming ants keep track of their outbound route and return by taking the most direct path between their final destination and the nest. However, returning foragers don't always target the burrow as precisely as they might like: 'Because of the inevitable accumulation of path integration errors, homing accuracy rapidly decreases as foraging distance increases,' say Wehner and Müller. Instead, returning foragers have to rely on local landmarks to help them pinpoint their goal in the final approach. Curious to find out how the ants use landmarks to locate the nest, Wehner and Müller recorded the insects' homing times with and without guiding landmarks (p. 4174).

According to Wehner and Müller, ambient air temperature has a dramatic effect on the insect's running speed so an ant could take anything from 0.9 to 1.6 s to cover the last 40 cm to the nest, depending on the heat. However, when they measured the time it took returning ants to cover the distance without landmarks to refer to, the ants searched for an average of 23.5 s before finding the entrance and some took several minutes. Then, when the nest entrance was 15 cm from a granite rock landmark, the ants' accuracy improved significantly, reducing their search time to an average of 3.3 s. Having a local landmark to steer by significantly reduced the ants' homing time.

Curious to find out how the insects use local landmarks to locate home, Wehner and Müller positioned two 15 cm high cylinders 40 cm from a nest separated by an angular distance of 90 deg. Sure enough, with the benefit of the landmarks to steer by, the ants' homing time decreased significantly, but how were they using the landmarks to improve their performance?

Wehner and Müller divided the 40 cm radius area around the ants' nest into four sectors and monitored the length of time it took ants in each sector to identify the nest entrance. Ants that ran head on to the nest (with the cylinders behind the nest) had the most difficult time, with one taking over a minute to find home. However, the ants that scurried in between one of the cylinders and the nest usually found the burrow in under 10 s. Plotting the way that the images of the cylinders moved over the insects' retinas as they scampered through each of the sectors, the duo found that the amount of movement of the image across the running ant's eye – visual flow – varied dramatically from sector to sector. Instead of focusing on discrete landmarks to guide them, the ants rely on a completely panoramic view and they use visual flow across the eye as they run to locate their burrows and return home speedily.

10.1242/jeb.053637

Wehner, R. and Müller, M. (2010). Piloting in desert ants: pinpointing the goal by discrete landmarks. *J. Exp. Biol.* **213**, 4174-4179.

SMALL Hsps HELP *DROSOPHILA* RECOVER FROM CHILL COMA

Hervé Colinet

Large warm bodied animals hardly notice thermal fluctuations, but for tiny insects they can be life threatening. If temperatures drop below 7°C, *Drosophila melanogaster* slip into a coma due to malfunctions at the neuromuscular level. Hervé Colinet, Siu Fai Lee and Ary Hoffmann from the University of Melbourne, Australia, explain that stricken insects can recover from these drastic symptoms, thanks to a suite of proteins known as small heat shock proteins (sHsps). However, it wasn't clear how these proteins aided recovery. As genes first have to be transcribed into mRNA before the mRNA is translated into proteins, Colinet and his colleagues decided to knock down mRNA production (reduce transcription) of two sHsp genes, *Hsp22* and *Hsp23*, to see how losing them affected *D. melanogaster* recovering from chill coma (p. 4146).

Knocking down one gene or the other in groups of *D. melanogaster*, the team first checked that they had successfully inactived the gene. Having proved that the insects did not produce Hsp22 or Hsp23 mRNA, the team chilled the insects to 0°C for 12 h before allowing them to recover at 25°C. Tracking the flies' recovery in the short, medium and long term, the team examined how well the *Hsp23* and *Hsp22* deficient insects compared with insects that could transcribe both genes.

Insects lacking *Hsp22* and insects lacking *Hsp23* both took significantly longer to stand up during the recovery period than insects that transcribed the genes. And when the team measured the extent of the insects' injuries by testing their climbing ability 2, 4, 6 and 8 h after recovery, they found that initially, insects lacking *Hsp22* took longer to recover than insects that transcribed the gene, but by 6 h the *Hsp22* deficient flies were doing as well as flies that transcribed the gene. 'This suggests that the kinetics of the chill coma recovery process was impaired, at least during the first 4 h period immediately after the cold stress,' the team say.

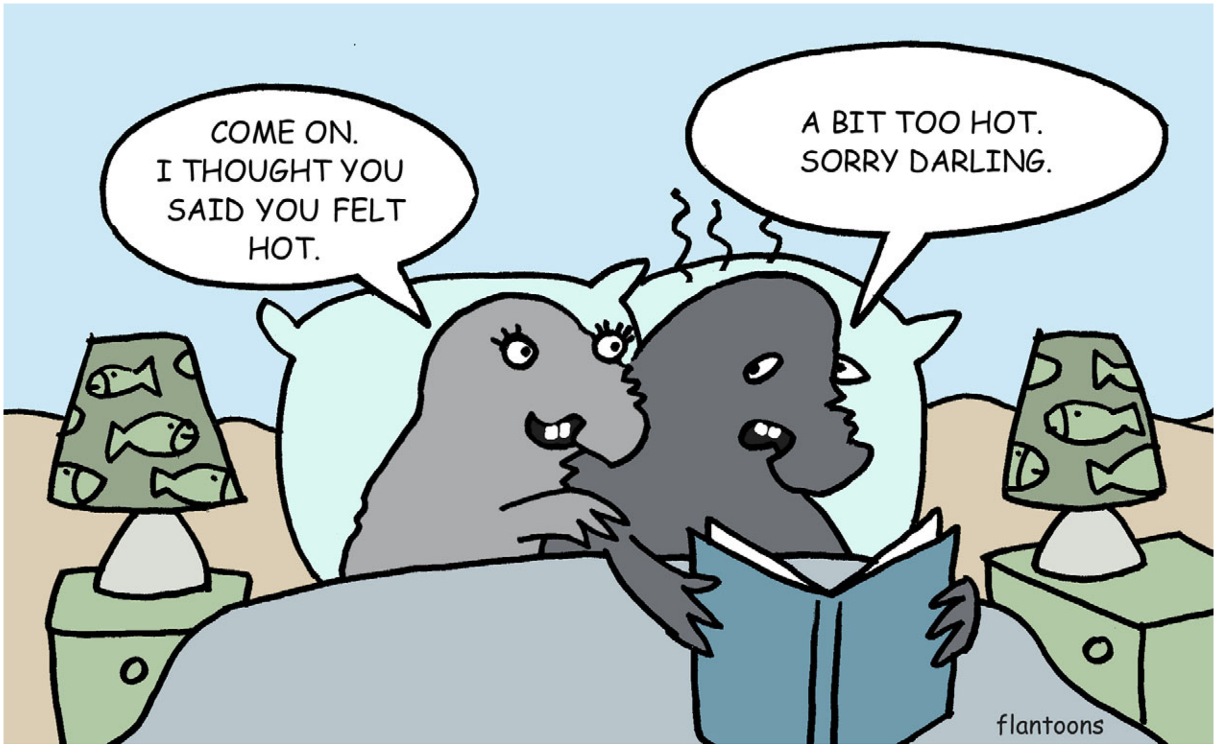
Meanwhile, insects lacking *Hsp23* seemed to be no worse off than insects that transcribed the gene during the first 2 h of recovery. However, their recovery was slower than that of the intact flies, with almost 50% of the *Hsp23* deficient insects showing injuries 8 h after recovery, compared with 10% of the insects that produced *Hsp23*. 'Our results imply that *Hsp23* might be more strongly involved in cold recovery compared to *Hsp22*,' say Colinet and his colleagues.

Outlining the potential protective roles of both genes in cold shock recovery, the team suggest that the neuroprotective effects of *Hsp22* and *Hsp23* may aid the flies' recovery from chill coma.

10.1242/jeb.053629

Colinet, H., Lee, S. F. and Hoffmann, A. (2010). Knocking down expression of *Hsp22* and *Hsp23* by RNA interference affects recovery from chill coma in *Drosophila melanogaster*. *J. Exp. Biol.* **213**, 4146-4150.

MALE ELEPHANT SEALS STAY STILL TO KEEP COOL



The mating season is a time of great exertion for male elephant seals. Defending their harem, the males fast and lose approximately 36% of their body mass during their mating marathon. Not surprisingly, the well-insulated animals generate colossal amounts of heat during their exertions, but lacking sweat glands, elephant seals can only lose excess heat by directing blood to the skin to radiate away. Knowing that elephant seals can selectively raise the temperature of patches of skin to prevent themselves from over heating, Amy Norris, with colleagues from Sonoma State University, wondered what effect environmental and behavioural factors had on the skin temperatures of elephant seal males during this extreme endurance test (p. 4205).

Travelling to the Año Nuevo Reserve, California, Norris, Dorian Houser and Dan Crocker filmed male elephant seals with a thermographic camera over the 3 month mating season. Recording thermal images of the animals during combat and other routine activities, the team collected over 2550 images from 82 males ranking from dominant alphas down to peripheral males. Analysing the animals' heat distributions, Norris and her colleagues found that solar radiation, vapour pressure and the month all significantly affected the animals' surface temperatures, with the surface temperatures of some animals rocketing to 30°C on the sunniest days while cooling to 15°C on overcast days. The team also found that battling males had the largest thermal windows, where the skin temperature is one standard deviation above the animal's mean temperature, to help them lose heat. However, the competing males were not the hottest: the most inactive males had the highest surface temperatures and largest temperature gradients between themselves and the environment. The team suspects that on warm and humid days, when it is more difficult to dump excess heat, the males limit their activity levels to prevent themselves from over heating. 'These results strongly suggest males modify behaviour relative to the potential for convective or evaporative heat loss,' the team says.

10.1242/jeb.053645

Norris, A. L., Houser, D. S. and Crocker, D. E. (2010). Environment and activity affect skin temperature in breeding adult male elephant seals (*Mirounga angustirostris*). *J. Exp. Biol.* **213**, 4205-4212.

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