Inside JEB 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

ARE BATS WALKING OR RUNNING?

Daniel Riskin is a self-confessed bat nut. He's mesmerised by these remarkable mammals. But it's not just their ability to fly that intrigues Riskin, 'there's so much more to these animals' he says. Out of the more than 1100 known species, only a handful have opted for a terrestrial life style, one being the common vampire bat. Riskin explains that these 30 g vampires are incredibly manoeuvrable, capable of leaping several meters from a standing start, but are they as agile on the ground? Riskin, Gerald Carter and John Hermanson headed to the island of Trinidad to test the vampires on *terra firma* (p. 1725).

Creeping along the ground, these tiny vampires feed on cattle after dark, so Riskin and his colleagues staked out ranches, successfully capturing 5 of the mammals ready for their track tests. Returning to the lab, Riskin introduced the bats to the treadmill and was amazed at how quickly they took to crawling on it. Having filmed the animals as they walked, the team found that the tiny creatures walked the same way as any other quadrupedal creature.

Once the bats were confident on the treadmill, the team turned the speed up and were amazed when the vampires burst into a strange bounding run with a top speed of over 1.1 m s^{-1}. They pushed off from the ground with their mighty forelimbs bringing the hindlimbs foreword while in the air. Returning to the ground on their hindlimbs, the bats reached forward with their forelimbs ready to give the ground another shove. 'It looks like a running push up' says Riskin.

The vampires had come up with an unusual approach to terrestrial locomotion, but were they unique? Riskin thought they might be until Bill Schutt suggested he take a look at the endangered New Zealand short tailed bat. Having evolved for millions of years free from predators, these tiny bats are equally at home on the ground and in the air. But how would their walk compare with the vampires'?

Teaming up with Stuart Parsons, Riskin and Schutt headed to a remote corner of New Zealand's South Island to put the bats through their paces. But the New Zealanders weren't as cooperative as the vampire bats. Although they were much friendlier, it took them significantly longer to get to grips with the moving treadmill. Once they had coaxed the New Zealand bats to start moving, the team could see that their walk was very similar to the vampire bat's, but even at their top speed, they never appeared to break into a run.

Knowing that walkers recover most of the energy from a pendulum-like stride, while the energetics of running are more like a bounce, the team decided to measure the forces exerted by the bats' feet as they moved across a force plate to see whether the tiny bats really were walking. Amazingly, the energetics were more like those of a bouncing run, even at the lowest speeds. The bats looked as if they were walking, but with a runner's energetics.

Riskin admits that he is surprised that the bats have solved the same problem in such different ways and adds that he hopes to continue working with these intriguing creatures. 'There's a whole lot more out there to do' he says.

10.1242/jeb.02245

Riskin, D. K., Parsons, S., Schutt, Jr, W. A., Jr, Carter, G. G. and Hermanson, J. W. (2006). Terrestrial locomotion of the New Zealand short-tailed bat *Mystacina tuberculata* and the common vampire bat *Desmodus rotundus*. *J. Exp. Biol.* **209**, 1725-1736.

DIVIDED CORALS STAY IN TOUCH

Corals have evolved the ultimate communal lifestyle. Their structures are composed of thousands of individual polyps, each of which has budded from a nearby sibling. Uri Frank explains that the polyps of most species remain connected throughout their lives, eternally linked by structures that allow communication and cooperation within the commune. However, some species lose these tissue links, leaving each polyp to a solitary existence within the colony. But how are polyp individuals affected by this loss of contact? Frank, Yossi Loya, Itzchack Brickner and Uri Oren were curious to know if polyp clones still recognise siblings after severing the link and whether siblings still cooperate despite their loss of contact. Donning their scuba diving equipment, Frank, Oren and Brickner headed to the warm waters of the Red Sea to investigate the clonal coral *Lobophyllia corymbosa* (p. 1690).

First the team tethered intact polyps together to see whether or not they formed a bond. Frank explains that if the polyps fused they must be programmed to maintain a connection, but if they didn't, then they lacked the mechanisms to remain fused. However, after binding polyps from the same colony together for several weeks there was no sign that the individuals had attempted to form a connection; they are programmed to lose their links. But having become isolated, were individual clones still able to recognise their lost twins?

Descending again to the bottom of the sea, the team carefully removed sections from polyps and grafted them to sectioned polyps from their own colony. Returning 6 weeks later to see how the corals had fared, the team were pleased to see that the sectioned polyps had fused well with polyps from their own colony, but failed to connect with foreign polyps. The clones were able to recognise their siblings and accept the grafted tissue, while rejecting unrelated polyps.

Having found that coral polyps could recognise their siblings, the team wondered whether they could still cooperate, despite their physical isolation. Knowing that connected polyps could aid injured twins, Frank, Oren and Brickner decided to test whether the isolated polyps could help injured siblings too. Collecting intact polyps from the seabed, the team returned to the lab and allowed the polyps' symbiotic algae to photosynthesize in an aquarium supplied with radioactive carbon, incorporating the radiolabel into their metabolites before returning the 'hot' polyps to their clusters. The team then caused a minor injury to one of the neighbouring polyps and then waited see if the 'hot' individual came to its aid. Two days later the team returned to the polyp cluster to see if the injured neighbour had become radioactive and were amazed that it had. Not only were the polyps able to recognise siblings and communicate, but also they behaved as if they were still united, cooperating so that the injured polyp acquired its neighbour's radioactive label.

Frank admits that it was surprising that the individuals behaved as if they were still part of a united colony, and he is now curious to know how the polyps support their siblings in times of need.

10.1242/jeb.02247

Brickner, I., Oren, U., Frank, U. and Loya, Y. (2006). Energy integration between the solitary polyps of the clonal coral *Lobophyllia corymbosa*. *J. Exp. Biol.* **209**, 1690-1695.

PROBING PROBOSCIS LEADS MOTH TO NECTAR

Picture provided by Joaqin Goyret

Humans are highly visual creatures, but other species integrate several senses to get a sense of their surroundings. When foraging for nectar, tobacco hornworm moths appear to rely on their senses of smell and vision to home in on their nectar target. But can they employ other senses to help direct them to their goal? While hovering above an attractive flower, Joaquín Goyret explains that the insect constantly probes the surface with its proboscis. Working with Robert Raguso, Goyret was curious to know whether the moth co-opts mechanosensory information from the proboscis to help locate a nectar treat. Scrutinising moths as they probed fake flowers, the team investigated how successfully the insects read the flower's terrain (p. 1585).

Working with young adult moths, Goyret offered the youngsters an array of bergamot scented paper flower shapes, each with a nectar lure at its centre. Presenting each moth with an array of 12 identical flower shapes, Goyret filmed insects as they foraged for 10 minutes and calculated the foraging success rate from the number of flowers that the moth successfully drained.

Preventing the insects from touching the flower shapes by covering them with a transparent film square, Goyret found that the moth's success rate plummeted when the surface was inaccessible. Even though the insects could see the flower shapes and smell their scent, the loss of reliable tactile information significantly reduced their ability to locate their nectar reward.

Curious to know how aspects of a flower's shape might influence the insects' success rate, Goyret tested their foraging efficiency on a range of flower shapes by varying the surface area and edge-to-centre distances, and found that the insects seemed to find it easier to locate their nectar reward on the flower shapes with the smallest surface areas. Goyret adds that the insects appear to use several probing strategies, raging from random stabs at the surface, to more directed approaches where they locate the flower's edge before tracing a radial path towards the centre.

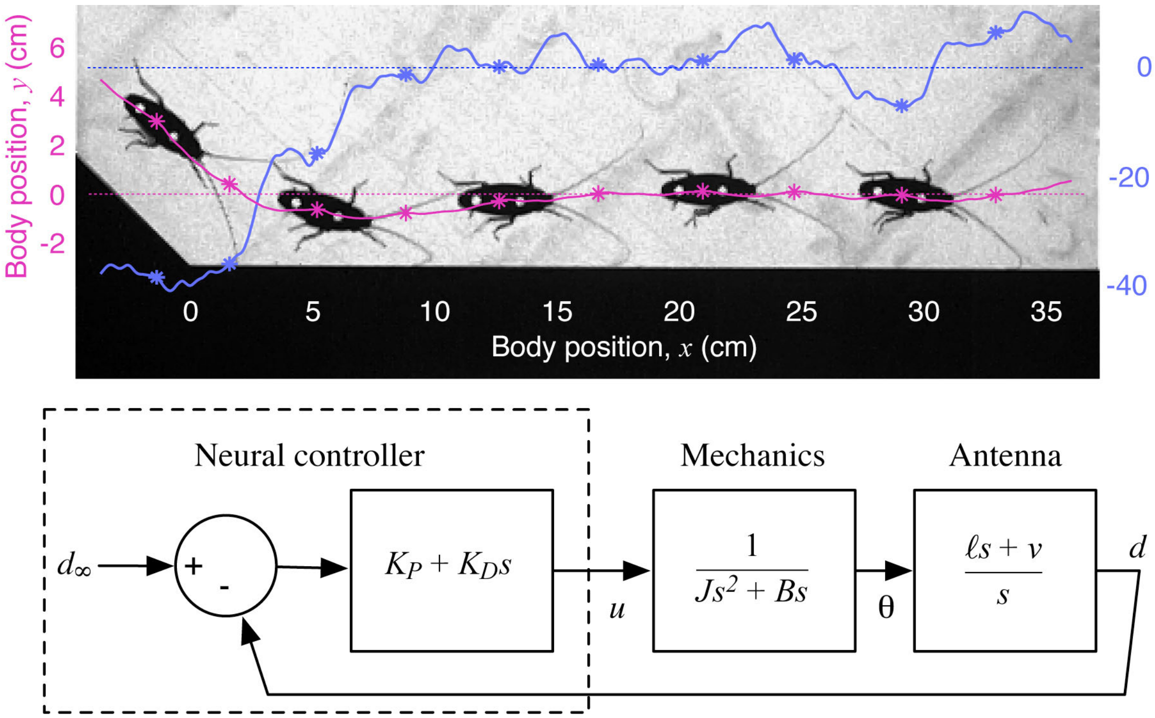
Having found that the proboscis's mechanosensory input gave the moths a significant foraging advantage, Goyret folded groves into the flower shapes to see whether the insect used three-dimensional cues to home in on the nectary. Sure enough, when the grooves converged on the nectary, the insect's proboscis tracked along them leading the insect directly to its nectar reward. But when the grooves crossed the flower, avoiding the nectar at the flower's centre, the insects rarely reached their goal. The moth seemed able to follow topographic features on the flower's surface with its proboscis.

Goyret is now keen to find out how the moths fare when presented with real flowers, and whether they choose to forage at large attractive but unwieldy model flowers, in preference to smaller model blooms that they handle more efficiently.

10.1242/jeb.02248

Goyret, J. and Raguso, R. A. (2006). The role of mechanosensory input in flower handling efficiency and learning by *Manduca sexta*. *J. Exp. Biol.* **209**, 1585-1593.

KEEPING COCKROACHES ON COURSE



Picture by Noah J. Cowan

Most cockroaches rely on information gleaned from their sensitive antennae to guide them around. But how do these insects use this information to regulate their lightning fast reactions? A cockroach can execute as many as 25 turns s^{-1} when scuttling along a wall. Noah Cowan, Jusuk Lee and Bob Full developed a mathematical model of the insect's dynamics and kinematics integrated with sensory information from the antennae to see if they could predict how the insects control their course with such precision (p. 1617). The team suspected that that the insects needed to know both their position relative to the wall, and the speed they were closing in on it, to keep themselves scuttling along. But were both pieces of information essential, or could the insect get by knowing just one; it's location? Comparing the model's behaviour with the antics of insects crawling along a wall, the team discovered that cockroaches need to know both their position and the wall approach velocity, to keep them on course.

10.1242/jeb.02246

Cowan, N. J., Lee, J. and Full, R. J. (2006). Task-level control of rapid wall following in the American cockroach. *J. Exp. Biol.* **209**, 1617-1629.

Kathryn Phillips
kathryn@biologists.com