Glass eyes

The shell of the fuzzy chiton *Acanthopleura granulata* is covered with eye lenses made of aragonite crystal – the first such lenses discovered. Unlike most simple eyes, they enable chitons to see objects, not just changes in light, and work equally well in air and water.

Loggerhead travel logs

A loggerhead sea turtle *Caretta caretta* can sense its longitude using Earth's magnetic field. This was thought to be impossible because the field barely changes with east-west travel. The turtle has long been known to 'log' latitude, so it may navigate with a grid-like magnetic map.

Doug Perrine/NPL

IN BRIEF

DISCERNING DEFENCE

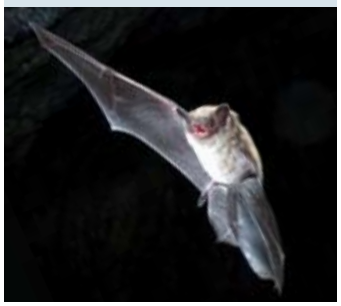
The green-lipped mussel *Perna viridis* can quickly beef up the threads it uses to cling to rocks – but does so only when vital: if mussels nearby have been eaten by a major predator (say, a crab) rather than by a general grazer (eg a mollusc). This may help to save energy for pressing issues such as growth and reproduction (J. Exp. Mar. Bio. & Eco., vol 401, pp85–8).

EGG ALARMS

Scots pine trees *Pinus sylvestris* predict insect attack – and fight back in advance. Their leaves detect sawfly *Diprion pini* eggs and undergo a deadly, but still unidentified, transformation. In tests, 75 per cent of larvae that fed on natal foliage died before adulthood. Those that survived laid fewer eggs than adults that grew up on egg-free pine after being placed there as larvae by researchers (Proc. R. Soc. B., doi:10.1098/rspb.2011.0468).

BAT MOBILES

The little brown bat *Myotis lucifugus* can aid habitat assessment. With a new genetic approach, biologists can identify the species of prey in the bat's guano, providing unprecedented detail about its diet and habitat. The absence or presence and abundance of certain prey species largely reflect ecosystem conditions (Molec. Ecol., vol 20, pp1772–80).



M Brock Fenton

Early thorn moths and their caterpillars are both master mimics – the adults resemble leaves, while their larvae look (and act) like twigs.

Andrew Darrington/Alamy

Clever caterpillars

Caterpillars are more crafty than biologists thought.

The early thorn moth caterpillar *Selenia dentaria* mimics twigs to fool birds into thinking it's an inedible object. But there's more to this tactic than meets the eye, according to new research.

A team led by John Skelhorn, from the University of Exeter, observed hungry chicks hunting caterpillars in the lab. They learned that it wasn't enough for a caterpillar to simply look like a stick: the chicks found the fakers hiding among a few twigs.

But as twig density increased, the birds began to struggle and eventually lost their motivation to look – as if they became too overwhelmed to even bother. So the effectiveness of the caterpillar's disguise depends on the density of its model.

The larvae appear to know this. When given a choice of branches with few or many twigs, during the day the caterpillars almost always inched over to the latter, even when they were devoid of leaves – in other words, when there was no food for them. This shows that they don't blindly forage and 'hope' that their masquerade works its magic, but actively seek out optimal locations for duping predators – and dine when they can.

At the same time, however, the caterpillars don't just seek out any large clump of sticks. At night – when most of their predators would be inactive – they dropped the mimicry and frequented rich feeding grounds, regardless of twig abundance. So the caterpillars have a complex strategy for selecting where to hang out – and when – that goes well beyond simply tracking down good food.

TWIGGY MIMIC

- The caterpillar truly mimics twigs – it looks and 'acts' like them, often attaching to a branch and extending the rest of its body stiffly, to appear like nearby stems.
- The moth is also a master masquerader. When clinging to a plant with its wings closed, it looks like a dried leaf with curled edges.
- Its defence is not camouflage, since the aim is not to hide per se but rather to convince predators that it is something other than itself (and that is inedible).
- Some species of twig-mimicking caterpillar change colour to match the plant on which they are feeding.
- This is the first case of a masquerading insect choosing its habitat based more on predator avoidance than on resource abundance.

SOURCE: PNAS, vol 108, pp6532–36 LINK: www.habitas.org.uk/moths/species.asp?item=6008

DAVID BRIAN BUTVILL, ZOOLOGIST
Our *Discoveries* sleuth David writes about science and nature for magazines, radio and tv. He lives in Costa Rica, where he eagerly assists his marine-biologist wife in the field.

DISCOVERIES

Living ant rafts

Scientists unveil the amazing engineering feats of fire ants.

When red imported fire ants *Solenopsis invicta* in Brazilian wetlands are caught in a flood, they don't run for their lives but instead come together and hold each other – forming a raft to literally ride out the storm. They can sail for weeks without their craft falling apart or sinking. A new study shows how they pull it off.

Nathan Mlot, Craig Tovey and David Hu, from Georgia Institute of Technology, analysed ant rafts in their lab. They discovered that about half of the colony formed the raft – and remained permanently submerged – while the other individuals rode as passengers and, curiously, never got wet.

Electron imaging and other tests revealed why. Each ant latches on to all others around it using its legs, claws and mandibles – and at a force of 400 times its body weight, the insect equivalent of a bear hug. Add to this the fact that ant cuticle is naturally water resistant: their living lifeboat is like a tightly woven disk of Gore-Tex.

But another component helps to keep it afloat. The team noticed that whenever an ant was submerged, an air bubble formed between its 'chin' and 'chest', like a tiny inflatable lifejacket. As individuals linked together, so did many of the bubbles, effectively lining the raft bottom with buoys. This increased buoyancy by a huge 75 per cent.

In the wild rafts can comprise hundreds of thousands of ants, so the extra lift is essential. But the trapped air is vital for another reason: it doubles as a sort of communal scuba tank for the ants stuck underwater, preventing them from drowning and thus their raft from breaking apart.

It's a smart craft. It's durable, elastic and impossible to tip over. If it rips – say, a fish takes a bite out of it – it immediately reseals. And it's virtually unsinkable. When the researchers pushed on any given raft with tweezers, it simply warped like a trampoline and snapped back into shape without tearing. But best of all, when it hits land, it disassembles itself in minutes and disperses – but is never more than an ant leg's length away from reconstruction.

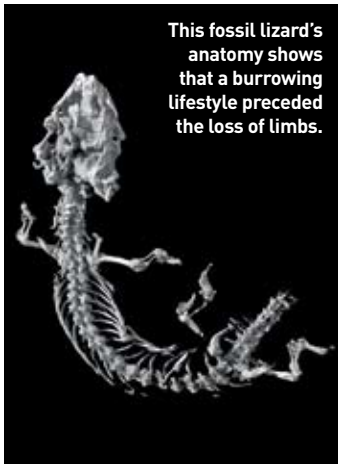
SOURCE: PNAS, doi/10.1073/pnas.1016658108

When a flood strikes, red imported fire ants transform themselves into an ingenious life raft.

Tim Nowack & Nathan Mlot

ANT CRAFTS

- To build the rafts, some ants extend onto the water from land; others then run over them and step further out, and so on, each new arrival being held by those behind it.
- A swarm of fire ants behaves almost like soft clay – you can grab a handful, shape them into a ball and toss it around without it breaking.
- The ants are expert engineers of self-assembling structures. They also build ladders, chains and walls, depending on their needs.
- This study developed a model of raft construction that may influence robotic rafts for tasks such as investigating sewer lines or underwater caves.
- Ant rafts have their kryptonite: soaps or detergents in the water will make them fall apart and sink.



This fossil lizard's anatomy shows that a burrowing lifestyle preceded the loss of limbs.

Robert Reisz

Lizard link

A fossilised clue to an old mystery.

A fossil lizard found in Germany is like no other – dead or alive – and reveals a twist in the evolution of a group of odd animals.

Amphisbaenians have long, scaly bodies and big heads adapted for burrowing into the ground, where they spend most of their lives. They lack legs (except for four species that have front stubs) and get around by slithering. To all appearances they evolved alongside snakes. Or so it would seem.

The new fossil, described by a group led by Johannes Müller, from the Museum für Naturkunde in Berlin, tells a different story. It is clearly an amphisbaenian cousin – it has the unmistakable massive skull, and 18 other shared features scattered throughout its skeleton. But the rest of its body matches the morphology of 'true lizards' (lacertids), its four legs being the most obvious. So the serpentine amphisbaenian is, in fact, more lizard than snake. The finding supports genetic studies that suggest the same origins.

The fossil's legs are small for its size and may represent the first step toward limb loss. But the fact that it has legs and a normal lizard shape shows that, in amphisbaenians, the development of a big, strong skull led the way to subterranean life.

SOURCE: Nature, doi:10.1038/nature09919 LINK: www.nature.com/nature/journal/v473/n7347/full/nature09919.html