Guido & Philippe Poppe /conchology.be

Spiny defence

The shells of hairy shell snails are covered in unusual spines. Flexible and lacking sharp tips, their function was a mystery. It turns out that they fend off hangers-on, such as barnacles, that weigh the snails down and cause drag.

Tree-flection

Leaves that are rich in nitrogen absorb more carbon dioxide than other foliage. New research shows that they also reflect more solar radiation back into space, revealing a hitherto overlooked role of leaf quality in climate regulation.

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.

IN BRIEF

ALTRUISTIC ANTS

Brazilian ants *Forelius pusillus* take altruism to extremes. At dusk, they seal the entrance to their underground nest with soil and sand. A few workers finish the job from the outside, shutting themselves out. They almost never survive the night, sacrificing their lives for the good of the colony (American Naturalist, vol 172, ppE239–43).

NEW BEETLE BACTERIUM

Scientists have discovered a new antibiotic-producing bacterium in the southern pine beetle *Dendroctonus frontalis* that protects its food supply. The beetle stores the bacterium in a pouch near its mouth and adds it to a fungus that it cultivates in its nest (a tunnel bored in tree bark) for its larvae (Science, vol 322, p63).

EVERY SCRAP COUNTS

Chimpanzees *Pan troglodytes* may hunt in groups not to maximise the net energy gained per hunter, but to fill nutritional voids. The small meat scraps that members often scavenge yield scant calories but they do provide a healthy dose of nutrients, such as vitamin B12 and zinc, that are scarce or absent in plants, making the hunt worthwhile (Behav. Ecol. Sociobiol., doi:10.1007/s00265-008-0676-3).

Anup Shah/naturepl.com

The ornate box turtle may be a sluggish mover, but it is exceptionally energy efficient.

Ingo Arndt/naturepl.com

Thrifty turtles are highly efficient

Meet the North American turtle that outpaces most land animals with its energy-saving stride.

Ornate box turtles *Terrapene ornata* may move slowly on terra firma, but new research shows that their stride is unusually efficient. They can outperform everything from cockroaches to kangaroos.

Despite the wild variation in body shape and size among terrestrial animals, those of similar mass expend similar amounts of energy when they travel. Or so it was thought.

Peter Zani, Rodger Kram and three undergraduates from the University of Colorado trained 18 wild-caught ornate box turtles to walk on a treadmill in their lab. They fitted the reptiles with special transparent lightweight masks that monitored oxygen use, which is a reliable measure of energy consumption, and varied the treadmill's speed and inclination.

They found that the animals' 'cost' of transportation was about half that predicted by the existing mathematical models for their size. In fact, their walking metabolic rate was often barely above their resting metabolic rate. This translates into an astounding locomotion efficiency of up to 97 per cent – five times more efficient than an internal combustion engine. Over all speeds, the turtles averaged 60 per cent efficiency, even when climbing a steep incline of 24 degrees.

The researchers hypothesise that the evolution of certain defences, whether poisonous chemicals or a protective shell, may effectively buy animals the opportunity to slow down and develop muscles geared towards saving energy rather than dodging foes.

A TURTLE'S PACE

- Ornate box turtles typically walk at speeds of about 0.25kph.
- The top sustainable speed that was clocked in this study – 0.5kph – is akin to a short sprint in turtle terms. This is roughly 75 times slower than the speed at which 2008 Olympic gold medal-winning sprinter Usain Bolt runs.
- A turtle's muscles are among the slowest-acting but most efficient in the animal kingdom.
- The shoulder blades of a turtle are attached to its carapace by a special hinge-like joint. This may reduce the work that its shoulder muscles have to perform by supporting its body weight more effectively, thus contributing to the efficiency of its strides.

SOURCE: Journal of Experimental Biology, vol 211, pp.3671–6 LINK: http://en.wikipedia.org/wiki/Terrapene_ornata

An extreme makeover

Rapid and drastic adaptation has brought an African fish back from the brink of extinction.

In response to an onslaught of environmental threats, *Haplochromis pyrrhocephalus* cichlids in Africa's Lake Victoria underwent an extreme makeover: they reconstructed their heads in order to stay alive.

In the 1980s, the Tanzanian side of the lake became plagued by regular and widespread algal blooms that were fuelled by human sewage and agricultural runoff. Water clarity and oxygen levels plummeted. At the same time, populations of predatory Nile perch boomed. So it's no surprise that by 1985 the cichlids were on the brink of extinction: it was difficult for them to see and breathe, and a voracious predator was at large.

Remarkably, however, the cichlids survived. In fact, today they are one of the most abundant fish species in the area. So how on Earth did they do it? Frans Witte and colleagues from the University of Leiden answered that question by analysing the morphology of museum specimens that were collected from the region between 1977 and 2001. And the anatomy told an amazing story.

In those oxygen-deprived waters, the species didn't suffocate towards extinction. Instead, it morphed. In just two decades, the cheek depth of the fish swelled and their eyes shrunk. The underlying muscle structure was also shuffled around. The major overhaul gave the gills some serious breathing room – their surface area became a whopping 64 per cent greater.

At the same time, however, both head length and volume actually decreased. Witte says that this is probably due to the presence of the aggressive perch. Fish species that are under intense predation, he says, often develop smaller, more streamlined heads (and other features) that enhance their ability to accelerate in sudden bursts so they can dodge striking predators.

By rebuilding their external architecture and redesigning their insides, the cichlids were able to pack bigger gills into a more predator-proof body – and thus survive into the 21st century.

The heads of cichlids (*below*) in Lake Victoria evolved over a period of 20 years to allow their gills (*right*) to expand, enabling them to survive against all the odds.

1977

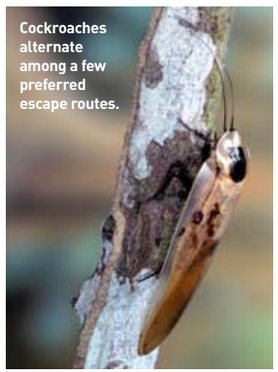
2001

Johnny Jensen/jjphoto.dk; insets: Monique Welten

EXTREME EVOLUTION

- Lake Victoria may have been dry less than 15,000 years ago. If so, all 500 cichlid species there evolved in a geological blink of an eye.
- A group of beach-spawning salmon in a US lake broke from their population and moved to a nearby river. In just 13 generations, this new community no longer interbreeds with the others – that is, they evolved into a separate subspecies. The river fish are now larger and more streamlined than their shore-nesting counterparts.
- Italian wall lizards that were introduced to an island switched from a diet of fragile insects to tough plants. Over a period of 30 years, they developed larger heads, stronger bites and longer digestive tracts complete with a new organ.

SOURCE: Bio. J. of the Linnean Society, Vol.94, pp.41–52 LINK: http://tinyurl.com/5hl2td



Cockroaches alternate among a few preferred escape routes.

Kim Taylor/naturepl.com

Cockroach compass

Scientists expose cockroach escape artistry.

The uncanny ability of American cockroaches *Periplaneta americana* to evade attack has always puzzled predators and biologists alike. A new study reveals the secret behind their unpredictable flight paths.

Researchers from the Italian National Research Council and the universities of Sussex and Puerto Rico simulated attacks on cockroaches in the laboratory. They used controlled streams of air, because cockroaches detect approaching threats by the 'wind' that is generated. The air assaults struck each insect's body at different angles, ranging from directly behind to head-on.

The cockroaches fled in seemingly random directions. However, after about 500 trials, a striking pattern emerged: the invertebrates did indeed make random choices, but only among four main escape routes – either 90, 120, 150 or 180 degrees from the direction of attack.

By alternating between these fixed angles, cockroaches can keep even the most advanced predator guessing – without ever pausing to consider the options.

SOURCE: Current Biology, vol. 18, pp.1792–6 LINK: http://en.wikipedia.org/wiki/American_cockroach