

Lizard body language

Most lizards rely heavily on their finely tuned visual system to avoid predators and competitors, to find prey and to attract mates. Cognitive neuroscience research student Max Drakeley describes some of the ways in which lizards use their body language to communicate with each other and to avoid becoming a tasty meal

Key words

Ectotherm
 Courtship
 Signalling
 Display behaviour
 Predator-prey interaction

Lizards — like snakes, crocodiles and turtles — are reptiles. They are found primarily in warm climates across the world. Lizards are **ectotherms**, meaning that they use energy from the sun to warm their bodies. They are active during the day and rest in the canopy at night (see *BIOLOGICAL SCIENCES REVIEW* Vol. 25, No. 1, pp. 2–6). More than 5600 species of lizards are found across the world. They

inhabit every continent except Antarctica, as well as most oceanic island chains.

Anoles

One of the most studied groups of lizards are the *Anolis* lizards, commonly referred to as anoles. Anoles come in all shapes and sizes, ranging from tiny twig anoles such as the dwarf anole (*Anolis occultus*) to huge anoles that live in the uppermost canopies of trees such as the knight anole (*Anolis equestris*) (see Figure 1).

The main predators of these lizards are snakes and birds. Although anoles can move fast, their primary form of defence is camouflage. Like chameleons, crested anoles (*Anolis cristatellus*) can change colour, and in so doing blend themselves into their natural environment. Unlike chameleons, this colour changing ability is restricted to a range between dark brown and light grey. But even limited colour change can be valuable for remaining undetected while perched in seemingly obvious places. This makes it difficult to spot individuals while conducting field research! Anoles have little trouble spotting each other, however, and they communicate via movement in a variety of ways.

Head-bobbing and dewlapping

There is one part of the anole's anatomy that contrasts completely with its camouflaged appearance — the **dewlap** (see Figure 2). The dewlap is a brightly coloured flap of skin that hangs between the jaw and the neck on males and

some females, although little is known about how these females use it. The dewlap can be extended and retracted in a display behaviour called 'dewlapping'. Dewlapping is used in conjunction with head-bobs to convey signals to potential mates.

Anoles of the same species usually share a characteristic head-bob and dewlapping pattern and this helps identify them to members of the same species. This is very much like bird song. Birds vary the intensity and pitch of their voices, singing **stereotypical** songs that can be recognised as one species or another. In the same way, crested anoles move their heads up and down for different amounts of time to produce bobbing patterns with varying amplitude and intensity. Looking at these display patterns helps identify these anoles to one another and so is the primary behaviour in courtship.

Attraction and danger

Crested anoles are usually surrounded by green or brown vegetation that sways in the wind, making the detection of head-bob movements rather difficult. However, the incorporation of dewlapping into the display greatly increases the chances of males being spotted, thanks to the dewlap's bright yellow-orange colours against a dull background. In addition, the head-bob displays are jerky, and this contrasts with the slow-moving foliage around them. When wind

Terms explained

Dewlap A flap of brightly coloured adjustable skin that hangs beneath the head of some lizards.

Ectotherm An animal that uses its environment to regulate its body temperature.

Push-ups Extension of an anole's front or hind limbs, or both, raising its body from the surface on which it is perched.

Stereotypical Conforming to a set pattern.

speed increases, so does the rapidity of the anoles' head-bobs. In addition, if a male is targeting his displays towards one female, he changes his display depending on the distance the female is away from him. The initial head-bob in the pattern will have the highest intensity, as it is critical in attracting an onlooker's attention, especially since this is less stereotypical than the rest of the pattern.

Using these methods to attract attention is an effective way to find a mate. During the mating season, male anoles spend up to 10% of their day displaying in this way. However, it poses a new problem — blowing cover. It is not only attractive females that see these display patterns — potential predators and competing males may also be watching, and both pose a threat to survival.

Honest signalling

If you are a small lizard, energy conservation is important. The last thing you want is to get into a fight for your life, or to fight over your dominance. Anoles can struggle out of the mouth of a snake once captured, but certainly not reliably — and usually at a cost of some sort, such as losing a tail or a limb. Similarly, males will defend their territory from one another, sometimes locking jaws in wrestling matches that determine the best spots for foraging or mating. These encounters can end in injury or be energetically expensive.

Avoiding these situations is a primary concern for most anoles, and they have developed interesting and effective display behaviour to help lower the chances of finding themselves in such circumstances. Male anoles perform **push-ups** — lifting their bodies from their perch up and down with either their front two limbs, or all four, for a couple of reasons.

Predator deterrence

The probability of a snake catching an anole is drastically reduced once the anole has seen the snake. Snakes rely primarily on camouflage and stealth to sneak up on their targets. If they have been spotted, the prey is more likely to escape. When an anole sees a snake approaching, it may start

Further reading



For all things *Anolis*, check out *Anole Annals*. This is a fascinating, if advanced, website where budding lizard enthusiasts can pick and choose articles to investigate their interests further: www.anoleannals.org/

Anolis lizards have been an important group of animals for evolutionary biologists owing to their convergent evolution. For an interactive learning experience, find a friend and complete this activity created by the University of California Museum of Paleontology: <http://tinyurl.com/pgygj6y>

For keen Anolists, check out this application for an *Anolis* ecomorph visualisation app: <http://tinyurl.com/qavg9ow>

For the best display of lizard body language see: <http://tinyurl.com/phdjmyj>

For more displays see: <http://tinyurl.com/pkfdp3v> and <http://tinyurl.com/q744dug>

Watch displays of assertion at: <http://tinyurl.com/q86ctor>

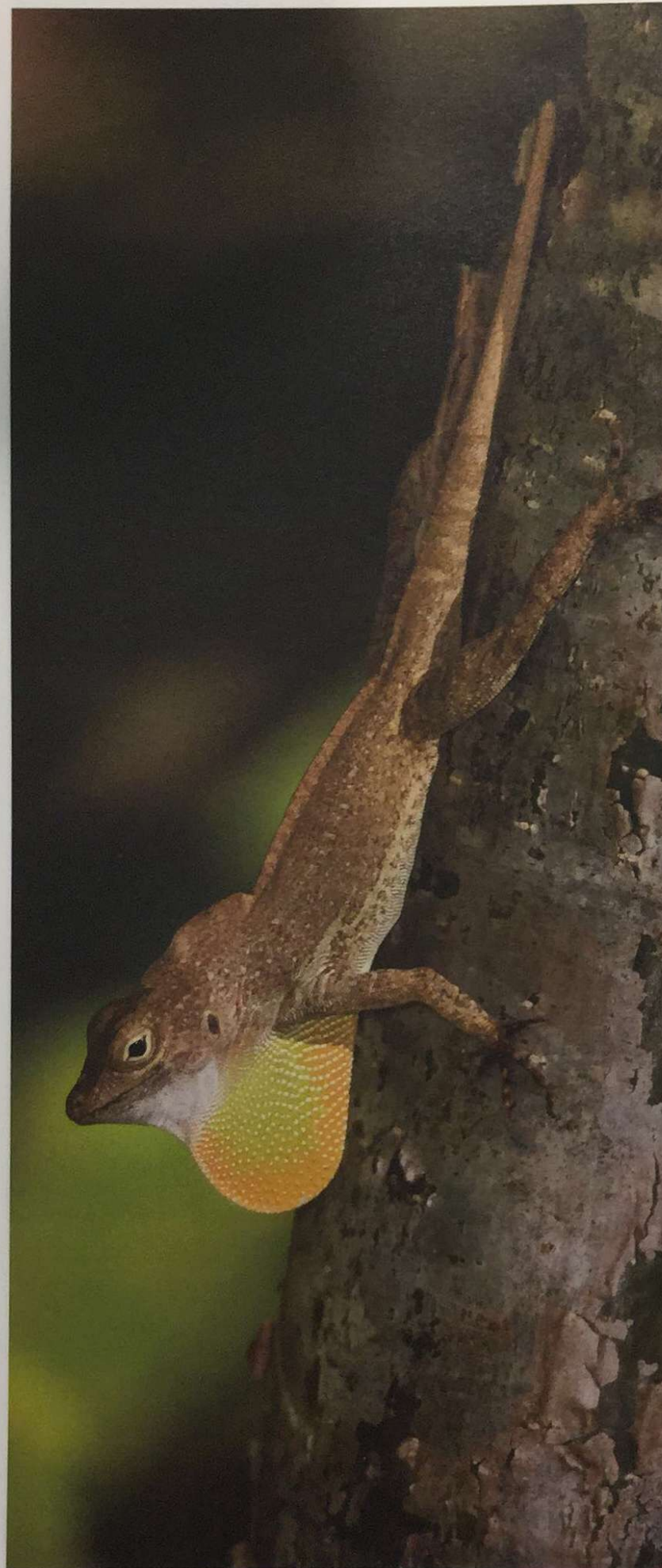


Figure 2 Male *Anolis cristatellus* (crested anole) displaying bright dewlap

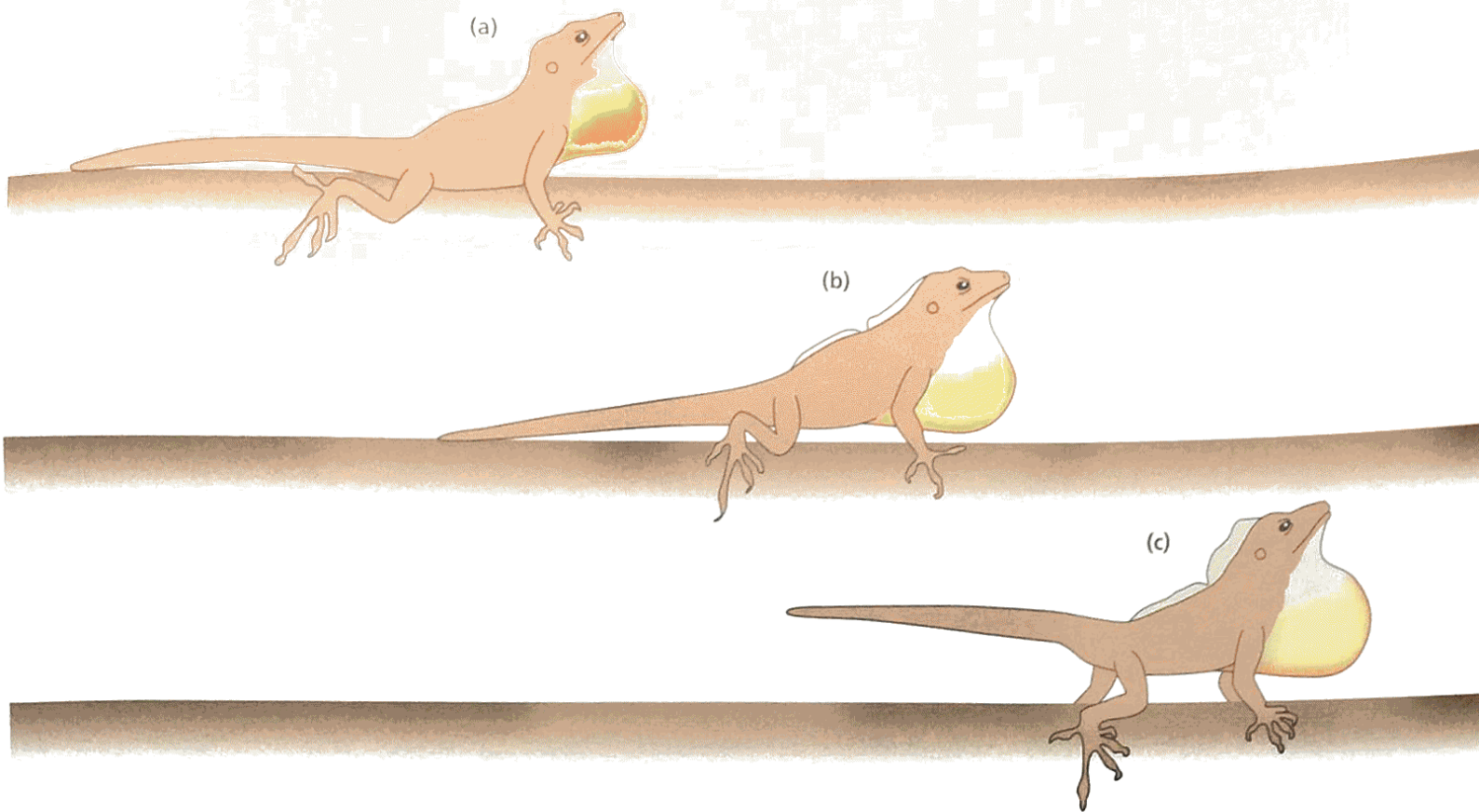


Figure 3 Progression of display behaviours for antagonistic encounters between anole lizards (a) extending dewlap (b) head-bob and two-footed push-up (c) whole body push-up and dewlap display

performing push-ups. These movements signal to the snake that it has been detected. This behaviour may deter the snake from launching an attack, because expending energy on a failed attack would be unwise.

Signalling detection is not the only thing anoles are trying to convey when they push-up. Performing push-ups is energy demanding and is a good indicator of physiological fitness. This means that the stronger, fitter anoles will be able to push-up more times and more intensely than weaker, less fit anoles. This information might be important to signal to a predator, because the stronger you are, the higher your chances of escaping an attack. In laboratory trials, anoles that pushed-up more prior to a snake attack were better at struggling away from the snake than those that pushed-up less. So, when pushing-up to deter attacks, anoles are telling potential predators 'don't mess with me' as well as saying 'I can see you'. This is called honest signalling.

Courtship and confrontation

Signalling in this way is not reserved for predators. Push-ups are also used to convey fitness to other competing males and for attracting females. As push-ups are honest ways of displaying physiological strength, they are used in conjunction with head-bob and dewlapping patterns to attract females in the area.

For males, signalling will most likely be toward other males during 'assertion displays'. Assertion displays are analogous to a lion's roar — they serve as advertisements of the territory's ownership by the displaying male and are performed even in the absence of a competing male. If there does happen to be another male near to a territorial male,

the defending male progresses through a sequence of display behaviours before engaging the approaching male or fleeing.

The initial behaviour in a confrontation is the display of a dewlap, followed by or with a head-bob pattern or raising of the head. As the head-bobbing pattern increases in intensity the anole may perform two-footed push-ups, or raise the top front of its body away from its perch (see Figure 3). This will progress to whole body push-ups and the anole raising itself completely off its perch appearing as large as possible. The anole's final position will include being raised from its perch like this with its dewlap extended, head and tail raised from the perch (see Figure 3). It will lean towards the opponent, again increasing its apparent size and attempting to deter an impending attack. If after all this 'showing off' the two males have not settled their differences, they may line up with each other, biting hindlimbs, forelimbs or locking jaws to wrestle each other for position and dominance of their territory.

Body and motion display behaviours are fundamental for the survival of the crested anole, and indeed any anoles. While initially signals were probably selected for courtship display, the application of honest signalling in predator-prey interactions and male-male competitions helped to drive evolutionary development for more complex patterns and behaviours.

Max Drakeley is studying for a BSc (Hons) in cognitive neuroscience and psychology with industrial/professional experience at the University of Manchester. He wrote this article while undertaking a placement year at the University of Rhode Island, USA, under the supervision of Dr Jason Kolbe.