

Lizards pull a wheelie

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Why bother running on hind legs when the four you've been given work perfectly well? This is the question that puzzles Christopher Clemente. For birds and primates, there's a perfectly good answer: birds have converted their forelimbs into wings, and primates have better things to do with their hands. But why have some lizards gone bipedal? Have they evolved to trot on two feet, or is their upright posture simply a fluke of physics? Curious to find the answer, Clemente and his colleagues Philip Withers, Graham Thompson and David Lloyd decided to test how dragon lizards run on two legs.

But first Clemente had to catch his lizards. Fortunately Thompson was a lizard-tracking master. Driving all over the Australian outback, Clemente and Thompson eventually collected 16 dragon lizard species, ranging from frilled neck lizards to the incredibly rare *C. rubens*, found only on a remote Western Australian cattle station. Returning to the Perth lab, Clemente and Withers set the lizards running on a treadmill, filming the reptiles until they were all run-out.

Clemente admits that when he started, he thought that the lizards would fall into one of two groups; lizards that mostly ran on two legs, occasionally resorting to four, and lizards that never reared up. Not so. Even the lizards that he'd never seen on two legs in the wild managed an occasional few steps on their hind legs. In fact, the lizards' propensity for running on two legs seemed to be a continuum; *C. rubens* and *P. minor* spent only 5% of the time on their hind legs while *L. gilberti* spent 95% up on two.

Curious to know whether or not bipedalism has evolved, Clemente drew up the lizards' family tree and plotted on the percentage of time each species spent on their rear legs, but there was no correlation. The reptiles had not evolved to move on two feet. Something else was driving them off their front legs; but what?

According to Clemente, other teams had already

suggested reasons for the lizards rearing up; maybe running on two legs was faster or more economical than running on all four. But when Clemente analysed the lizard running footage he realised that running on hind legs was more energetically costly, and the bipedal runners were no faster than the quadrupeds. Knowing that Peter Aerts had suggested that lizards improved their manoeuvrability by moving their centre of mass back towards the hips, Clemente wondered whether the lizards' front legs were leaving the ground because of the position of their centre of mass. Maybe they were 'pulling a wheelie'.

Teaming up with David Lloyd and modelling the running lizards' movements as the lizards accelerated, they realised that there was a strong correlation between the lizards' acceleration and their front legs pulling off the ground. Clemente explains that by moving their centre of mass, a turning force acts on the lizards' torso; lifting it off the ground making them run upright.

So running on two legs is a natural consequence of the lizards' acceleration. Clemente adds that 'some dragon lizards have exploited the consequence and chosen to go bipedal because it gives them some advantage, but we have no idea what that advantage is'.

Source: The Company of Biologists

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