

# Falling lizards use tail for mid-air twist, inspiring lizard-like 'RightingBot'

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Despite its simple design, RightingBot rights itself in mid-air with a swing of its tail just like the lizards that inspired it. Credit: Tom Libby

Lizards, just like cats, have a knack for turning right side up and landing on their feet when they fall. But how do they do it? Unlike cats, which twist and bend their torsos to turn upright, lizards swing their large tails one way to rotate their body the other, according to a recent study presented at the Society for Experimental Biology meeting on 29th June in Salzburg, Austria. A lizard-inspired robot, called 'RightingBot', replicates the feat.

This work, carried out by Ardian Jusufi, Robert Full and colleagues at the University of California, Berkeley, explains how large-tailed animals can turn themselves right side up while falling through the air. It could also help engineers to design air- or land-based robots with better stability.

"It is not immediately obvious which mechanism an animal will use to accomplish aerial righting and recover from falling in an upside-down posture. Depending on body size, [morphology](#) and mass distribution there are multiple strategies for animals to execute this behavior," said Ardian Jusufi, lead author of the study.

[Lizards](#) in their natural environment encounter

various situations where they could fall. For instance, they could fall while fighting over territory, seeking food, or even mating. To avoid injuries, they must have a way to turn themselves during a fall to land safely on their feet.



To turn right-side up when falling, lizards swing their large tails one way to rotate their body the other. Credit: Ardian Jusufi

For over a century, people have been studying if and how cats and other mammals right themselves when they fall. Other animals like lizards, which have different body plans and probably use different strategies, have been largely unexplored.

The researchers used high-speed videography to dissect the motion of two common lizards - the flat-tailed house gecko and green anole - as they fall, starting upside down. Watching as the lizards righted themselves in mid-air before alighting on extended legs, the researchers discovered that both lizards swing their tails in one direction, causing their bodies to turn in the other.

The team also compared the righting movement of the two lizards, which have similar body sizes but different tail lengths and inertial properties. The gecko, with its shorter tail, has to swing its tail

further to the side to right itself, making a larger angle relative to its body. By contrast, relatively smaller movements of the anole tail, which is twice as long, are enough to reorient its body.

"A comparative approach provides useful insights in the study of aerial righting responses and could be beneficial to the design of robots that navigate complex environments," said Ardian Jusufi.

For the study, Jusufi and his colleagues developed a three-dimensional mathematical model to test their understanding of the lizards' righting movement.

To further test the mathematical model's predictions the team then built a simple [robot](#). 'RightingBot' consists of just two parts: a body joined to a tail. Despite its simple design, RightingBot rights itself in mid-air with a swing of its tail just like the lizards that inspired it, showing how useful a [tail](#) can be for that purpose.

Provided by Society for Experimental Biology

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