



**Oops.**

When a gecko slips or falls, its tail saves the day.

Credit: Courtesy of Thomas Libby, copyright *PNAS* 2008

## **One Tail, Many Feats**

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Despite their famous sticky toes, geckos sometimes take a tumble--and that's when a tail comes in handy. A new biomechanical study shows how geckos use their tails for extra control when they slip or fall. It even helps them glide through the air.

A flat-tailed house gecko's (*Cosymbotus platyurus*) tail accounts for about one-tenth of its body weight, a large investment that biologists previously chalked up to fat storage and defense against predators. No one thought the tail was important for climbing or steering, including biomechanical scientist Robert Full, whose lab at the University of California, Berkeley, has studied gecko locomotion for more than a decade. In his early experiments, Full noticed that geckos could run on high-traction surfaces and never use their tails. But when engineers used Full's data to design wall-climbing robots, they had to add tails to keep the

machines from falling. Full realized the real tails might deserve a closer look.

Full and his team challenged the lizards with a series of slips and falls. First, the researchers filmed nine geckos running up a vertical track that included a treacherous patch of whiteboard. When their front feet reached the slick spot, the geckos lost traction and began to tip away from the wall. That's when the tail took over, making the lizard's body act like a seesaw anchored at the hind legs: As the front of the body tipped back, the tail compensated by pressing against the wall. "It's an emergency fifth leg," Full says.

Next, the researchers parked the geckos upside down on the underside of a 2-meter-high platform that jiggled like a quaking leaf. The lizards inevitably lost their grip but always landed on all fours. In just one-tenth of a second of falling, "they sweep their tail around to rotate their body into a superman posture," says Full, who notes that other lizards might also use their tails to manage their slips and falls. That skydiver pose made the researchers wonder if the lizards could glide.

To find out, they dropped the geckos in a vertical wind tunnel. Most nonflying animals would have fallen out of control, but the geckos glided, twisting and waving their tails to steer, the team reports online today in the *Proceedings of the National Academy of Sciences*. Full's engineering collaborators will soon outfit their wall-climbing robots with more active tails inspired by the new discoveries. Learning more about how the tails work may also help improve aircraft and space-suit design, Full says.

Kellar Autumn, a biophysicist at Lewis and Clark College in Portland, Oregon, says zoologists thought they knew what gecko tails were for, so the new study is "a real shocker." And it's an interdisciplinary success story, Autumn says: "Who knew a gecko could someday help us make better robots or maneuver ourselves in outer space?"