

Right angles are all wrong for tree frog adhesion



Tree frog. Credit: Julia Platter

Tree frogs have the unique ability to stick to smooth surfaces even when they are tilted well beyond the vertical - some small tree frogs can even adhere when completely upside down. Conversely when walking or jumping they can detach their toe pads easily. Researchers from the University of Glasgow will present insights into how this fascinating ability is controlled at the Society for Experimental Biology's Annual Meeting in Glasgow, UK.

“The toe pads of tree frogs are coated with a thin mucus which adhere to surfaces by wet adhesion, like wet tissue paper sticking to glass. The process by which they detach their toe pads is called peeling and is akin to us removing a sticking plaster from ourselves,” explains Dr Jon Barnes, head of the research group, “We were keen to understand why a tree frog on an overhanging surface didn't simply peel off rather than adhere.”

To investigate this, scientists measured adhesive and frictional forces simultaneously on individual toe pads of White's tree frogs (Family Hylidae), while varying the surface angle. It was found that the change from adhesion to peeling is a gradual process, with adhesive forces weakening at angles above 90° . Thus frogs maintain a grip by keeping the angle of their toes with respect to a surface at a low value, and detach when this angle increases beyond 90° . By examining the behaviour of the frogs researchers were able to correlate this observation with how the animals positioned their legs - they spread their legs out sideways to minimise the angle between their feet and the surface.

The researchers also visited Trinidad to address the problem faced by larger tree frogs, who do not adhere to surfaces very well. To partially compensate for this, larger frogs have adapted to grasp objects, and can climb in a similar manner to humans. Thus the largest species of tree frog are often found higher up in trees, while smaller species are commonly found in shrubs only a metre or so above the ground.

Source: Society for Experimental Biology

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