Scientists trace gecko footprint, find clue to glue

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Geckos' ability to scamper up walls with ease has long inspired scientists who study the fine keratin hairs on these creatures' footpads, believed responsible for the adhesion. Researchers at The University of Akron have discovered that geckos' ability to adhere to surfaces is not all about keratin. Clues lie in the lipids left behind in gecko footprints.

This discovery by researchers Ping Yuan Hsu and Liehui Ge, both UA polymer science graduate students; Alyssa Stark, UA integrated bioscience graduate student; Xiaopeng Li, chemistry research scientist; Chrys Wesdemiotis, distinguished professor ofchemistry; Peter Niewiarowski, interim director, UA Integrated Bioscience, Ph.D. Program; and Ali Dhinojwala, chair of the UA Department of Polymer Science, is published in *Interface*, the Journal of the Royal Society under the title: Direct evidence of phospholipids in gecko footprints and spatula - substrate contact interface detected using surface-sensitive spectroscopy.

The researchers' analysis of the near-invisible gecko footprints reveals the presence of phospholipids, according to Dhinojwala. This material, he says, has not been considered in current models of gecko adhesion and now provides the missing link in understanding superhydrophobicity, self-cleaning and fluid-like adhesion and release of gecko feet.

Dhinojwala, a pioneer in gecko-inspired adhesive research, says the lipids in gecko footprints have significant implications for scientists working to design synthetic adhesives that could be reused thousands of times over, such as for wall-climbing robots, microelectronics, adhesive tapes and bioadhesives.

More information: Direct evidence of phospholipids in gecko footprints and spatula - substrate contact interface detected using surface-sensitive spectroscopy, *J. R. Soc. Interface*, Published online before print August 24, 2011, doi: 10.1098/?rsif.2011.0370

Abstract

Observers ranging from Aristotle to young children have long marvelled at the ability of geckos to cling to walls and ceilings. Detailed studies have revealed that geckos are 'sticky' without the use of glue or suction devices. Instead, a gecko's stickiness derives from van der Waals interactions between proteinaceous hairs called setae and substrate. Here, we present surprising evidence that although geckos do not use glue, a residue is transferred on surfaces as they walk-geckos leave footprints. Using matrix-free nano-assisted laser desorption-ionization mass spectrometry, we identified the residue as phospholipids with phosphocholine head groups. Moreover, interface-sensitive sum-frequency generation spectroscopy revealed predominantly hydrophobic methyl and methylene groups and the complete absence of water at the contact interface between a gecko toe pad and the substrate. The presence of lipids has

never been considered in current models of gecko adhesion. Our analysis of gecko footprints and the toe pad - substrate interface has significant consequences for models of gecko adhesion and by extension, the design of synthetic mimics.

Provided by University of Akron