NSERC NEWSBUREAU BULLETIN - No. 82

Wednesday, May 14, 2003

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STICKY TOES EXCITE SCIENTISTS

What's more versatile than Velcro, doesn't have the sticky residue of duct tape, and is more re-usable than a sticky note? Geckos. "You can stick a dead gecko to a sheet of glass just as well as a live one," says Dr. Anthony (Tony) Russell. Even one that's been dead for decades. Yes. He's done it.

Now the University of Calgary professor of zoology and gecko guru is designing a new series of experiments to explore just how these lizards hang on - knowledge that could help ongoing efforts to create a synthetic Gecko glue. His NSERC-sponsored research is trying to capture the first close-up high-speed video footage of these reptiles' footfalls in order to see their unique stick-and-release dry adhesive system in action.

Dr. Russell notes that his research is part of a 200-year-old fascination with these vertically adept reptiles.

"It's sort of weird when you see one run up a pane of glass or when a lizard runs upside down on a ceiling across your hotel room. This started people contemplating the mechanism by which this occurs," he says.

Unlike tree frogs and many insects that use some form of sticky secretion to get a grip, geckos are dry danglers. Their fan-shaped, highly flexible feet enable them to get traction on a wide range of surfaces while moving or standing, either up, down, or upside down. (In contrast, cat's claws only move in one direction, thereby making it easy to climb trees and expensive for their owners to get them down.)

In 2000, U.S. researchers marked a gecko-research milestone by using minute sensors to demonstrate that geckos' gravity-defying power is due to nano-level molecular attraction, called van der Waals forces, between a surface and the tips of tens of thousands of setae, hair-like structures, on a gecko's toes.

"These little hairs on the toes are the contact point with the environment, but you've got to be able to work this system. My interest is in the entire anatomy that allows this to be done, and how it evolves," says Dr. Russell. "If you think about something like sticky tape, putting it on is the easy part; it's getting it off without damaging anything that's much harder. So, my focus is on how a gecko, once it's able to stick to a surface, is able to control all of its biological components to remove that adhesive, and re-use it over and over again without damaging it."

Dr. Russell's team is presently designing a see-through, tunnel-like apparatus that they hope will enable them to record the first good glimpses of a gecko's catch-and-release mechanism in action.

In 1878, Eadweard Muybridge demonstrated the value of photography to understanding animal motion when he made his famous freeze-action images of a galloping horse. Dr. Russell notes that prior to Muybridge a British herpetologist had used photography to study the bipedal running of Australia's frilled lizards.

However, no one's been able to accomplish this feat to date for geckos - and for good reason.

"Their ability to run on any surface makes it really tough to actually constrain where they're going to go," Dr. Russell says.

To make matters more challenging, the geckos used in the experiment are like temperamental top Hollywood actors. Tokay geckos (*Gecko gecko*) are the "Ferrari's of the gecko world" when it comes to their setae density and holding power. Unlike most geckos the adults are pugnacious players who'll "bark, lunge, jump and have a very powerful bite," says Dr. Russell, whose last gecko-chomp was several years ago. They are also one of the globe's largest geckos at 30 centimetres from snout to tail tip

The race is already on to create the first synthetic gecko glue using nano-technologies to design and manufacture materials at the level of forces involved in geckos' footholds. U.S. Defence research is leading the way with efforts to create "gecko-bots": automated machines that would be capable of scaling any surface.

"A dry adhesive doesn't leave anything behind. It will remain attached as long as you apply the loading to it, and it's removable and renewable," says Dr. Russell. "Once you conquer how it works it could be reasonably cheap to manufacture and incredibly versatile in terms of how you could apply it."

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