Snakes use friction and redistribution of their weight to slither on flat terrain

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Snakes use both friction generated by their scales and redistribution of their weight to slither along flat surfaces, researchers at New York University and the Georgia Institute of Technology have found. Their findings, which appear in the latest issue of the *Proceedings of the National Academy of Sciences,* run counter to previous studies that have shown snakes move by pushing laterally against rocks and branches.

"We found that snakes' belly scales are oriented so that snakes resist sliding toward their tails and flanks," said the paper's lead author, David Hu, a former post-doctoral researcher at NYU's Courant Institute of Mathematical Sciences and now an assistant professor of mechanical engineering at Georgia Tech's George W. Woodruff School of

Mechanical Engineering. "These scales give the snakes a preferred direction of motion, which makes snake movement a lot like that of wheels, cross-country skis, or ice skates. In all these examples, sliding forward takes less work than does sliding sideways."

The study's other co-authors were Jasmine Nirody and Terri Scott, both undergraduate researchers at NYU, Michael Shelley, a professor of mathematics and neural science and the Lilian and George Lyttle Professor of Applied Mathematics at Courant.

The study centered on the frictional anisotropy—or resistance to sliding in certain directions—of a snake's belly scales. While previous investigators had suggested that the frictional anisotropy of these scales might play a role in locomotion over flat surfaces, the details of this process had not been understood.

To explore this matter, the researchers first developed a theoretical model of a snake's movement. The model determined the speed of a snake's center of mass as a function of the speed and size of its body waves, taking into account the laws of friction and the scales' frictional anisotropy. The model suggested that a snake's motion arises by the interaction of surface friction and its internal body forces.

To confirm movement as predicted by the model, the researchers then measured the sliding resistance of snake scales and monitored the movement of snakes through a series of experiments on flat and inclined surfaces. They employed video and time-lapse photography to gauge their movements.

The results showed a close relationship between what the model predicted and the snakes' actual movements. The theoretical predictions of the model were generally consistent with the snakes' actual body speeds on both flat and inclined surfaces.

Source: New York University (news : web)