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The mechanics of slithering DAVID HU, Courant Institute, JOHN BUSH, MIT, MICHAEL SHELLEY, Courant Institute — Snakes propel themselves over land using a variety of techniques, including a unidirectional accordion-like mode, lateral sinuous slithering and sidewinding. We explore these friction-based propulsion mechanisms through a combined experimental and theoretical investigation. Particular attention is given to classifying the gaits of snakes according to Froude number and the relative magnitudes of the frictional forces in the tangential and normal directions. While the term "gait" is usually used to describe a sequence of foot movements, here it refers to a sequence of undulations made by the limbless snake. In a simple mass-spring model, we prescribe the muscle activity of the snake and then calculate its motion as required by the torque and force balances on its body. A key feature of our model is that it allows us to rationalize the mode of locomotion of the snake on the basis of propulsive efficiency.

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