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Propulsion by directional adhesion JOHN BUSH, MANU PRAKASH, MIT — The rough, hairy integument of water-walking arthropods is well known to be responsible for their water-repellency; we here consider its additional propulsive role. We demonstrate that the tilted flexible leg hairs of water-walking arthropods render the leg cuticle directionally anisotropic: contact lines advance most readily towards the leg tips. The dynamical role of the resulting unidirectional adhesion is explored, and yields new insight into the manner in which water-walking arthropods generate thrust, glide and leap from the free surface. We thus provide new rationale for the fundamental topological difference in the roughness on plants and insects, and suggest novel directions for biomimetic design of smart, hydrophobic surfaces.

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