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Self-righting behavior of cockroaches CHEN LI, University of California, Berkeley, TONI WOHRL, University of Jena, HAN LAM, ROBERT FULL, University of California, Berkeley — Small insects must be able to right themselves from an upside-down orientation to survive. Previous studies described diverse self-righting strategies in insects. Here, we compare the self-righting behaviors in three cockroach species on a flat, rigid ground to begin to reveal what governs the choice of dominant behaviors. All species self-righted successfully (75 +/- 11 % probability) and quickly (as low as 140 ms and typically within 2 s). The smallest winged American cockroach, which has the most elongate, least flattened body, and longest legs, primarily pushed legs against the ground to roll its body to the side to self-right (relative frequency = 93%). The largest wingless Madagascar hissing cockroach with the shortest legs primarily (84%) hyperextended body to roll to the side and then rubbed its legs on the ground to self-right. The intermediate winged discoid cockroach, which has the least elongate, most flattened body, more often (57%) abducted wings and flexed body to raise center of mass and reduce ground contact and rotated about the wing edges to self-right. We hypothesize that, given morphological and physiological constraints, the gravitational potential energy landscape resulting from the animals' body/appendage-ground interaction governs their dominant behaviors. Our study provides inspiration for robotics, as many current terrestrial robots have rigid, cuboidal bodies which hinder self-righting.

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