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How flies clean their eyes GUILLERMO AMADOR, FABIEN DURAND, WENBIN MAO, ALEXANDER ALEXEEV, DAVID HU, Georgia Institute of Technology — Flying insects face a barrage of foreign particles such as dust and pollen, which threaten to coat the insect’s eyes and antennae, limiting their sensing abilities. In this study, we elucidate novel aerodynamic and elastic mechanisms by which insects keep these organs clean. The compound eye of many species of insects is covered by an array of short bristles, or setae, evenly spaced between each photoreceptor unit. Among these insect species, setae length is triple their spacing. We conduct numerical simulations and wind tunnel experiments using an insect eye mimic to show this critical setae length reduces shear rate at the eye surface by 80%. Thus, the setae create a stagnant zone in front of the eye, which diverts airflow to reduce deposition of particles. Setae can also act as springboards to catapult accumulated particles. In high speed videography of insects using their legs to clean themselves, we observe deflected setae hurling micron scale particles at accelerations over 100 times earth’s gravity. The dual abilities of setae to divert airflow and catapult particles may motivate bio-inspired designs for dust-controlling lenses, sensors, and solar panels.

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