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Survival of the fastest: Evolving wings for flapping flight SOPHIE RAMANANARIVO, New York University, Courant Institute, THOMAS MITCHEL, New York University, Department of Mathematics, LEIF RISTROPH, New York University, Courant Institute — To optimize flapping flight with regard to wing shape, we use an evolutionary or genetic algorithm to improve the forward speed of 3d-printed wings or hydrofoils that heave up-and-down and self-propel within water. In this scheme, "genes" are mathematical parameters specifying wing shape, and "breeding" involves the merging and mutation of genes from two parent wings to form a child. A wing's swimming speed is its "fitness", which dictates the likelihood of breeding and thus passing on its genes to the next generation. We find that this iterative process leads to marked improvements in relatively few generations, and several distinct shape features are shared among the fastest wings. We also investigate the favorable flow structures produced by these elite swimmers and compare their shape and performance to biologically evolved wings, fins, tails, and flippers.

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