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Optimal feeding vs. optimal swimming of model ciliates SEBASTIEN MICHELIN, Ecole Polytechnique - LadHyX, ERIC LAUGA, UCSD-MAE — To swim at low Reynolds numbers, micro-organisms create flow fields that modify the transport of nutrients around them, thereby impacting their feeding rate. When the nutrient is a passive scalar, the feeding rate of a given micro-swimmer greatly varies with the Péclet number (Pe) a relative measure of advection and diffusion in the nutrient transport, that strongly depends on the nutrient species considered. Using an axisymmetric envelope model for ciliary locomotion and adjoint-based optimization, we determine the swimming (or possibly non-swimming) strokes maximizing the nutrient uptake by the micro-swimmer for a given energy cost. We show that, unlike the feeding rate, this optimal feeding stroke is essentially independent of the Péclet number (and, therefore, of the nutrient considered) and is identical to the stroke with maximum swimming efficiency.

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