replacing DFD16-2016-000963.

Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Hydrodynamics of freely swimming flagellates[1] JULIA DOLGER, Department of Physics and Centre for Ocean Life, Technical University of Denmark, LASSE TOR NIELSEN, THOMAS KIORBOE, National Institute of Aquatic Resources and Centre for Ocean Life, Technical University of Denmark, TOMAS BOHR, ANDERS ANDERSEN, Department of Physics and Centre for Ocean Life, Technical University of Denmark — Flagellates are a diverse group of unicellular organisms forming an important part of the marine ecosystem. The arrangement of flagella around the cell serves as a key trait optimizing and compromising essential functions. With micro-particle image velocimetry we observed time-resolved near-cell flows around freely swimming flagellates, and we developed an analytical model based on the Stokes flow around a solid sphere propelled by a variable number of differently placed, temporally varying point forces, each representing one flagellum. The model allows us to reproduce the observed flow patterns and swimming dynamics, and to extract quantities such as swimming velocities and prey clearance rates as well as flow disturbances revealing the organism to flow-sensing predators. Our results point to optimal flagellar arrangements and beat patterns, and essential trade-offs. For biflagellates with two symmetrically arranged flagella we contrasted two species using undulatory and ciliary beat patterns, respectively, and found breast-stroke type beat patterns with equatorial power strokes to be favorable for fast as well as quiet swimming.

[1]The Centre for Ocean Life is a VKR Centre of Excellence supported by the Villum Foundation.

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Date submitted: 01 Aug 2016 Electronic form version 1.4