Popular science summary of the PhD thesis

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Title of the PhD thesis	Physics of microbial feeding
PhD school/Department	DTU Aqua

Science summary

Life in the ocean covers many orders of magnitude of sizes. The smallest organisms can survive on photosynthesis, but larger organisms must eat other organisms in order to survive. The ocean is generally a very dilute suspension of particulate matter and organisms, and many organisms need to clear large volumes of water for prey to survive.

The smallest microbial organisms often live near surfaces where they generate feeding currents and move around to obtain enough food while foraging. In this aqueous small scale environment, organisms manage to clear huge volumes of water for prey by mechanisms that are poorly understood. Furthermore, the feeding flows are often affected by the presence of the nearby surfaces to which the organisms attach. As many microorganisms often relocate during foraging, collecting good observations are challenging. To get around this challenge, the microorganisms are sometimes tethered in rather harsh and unnatural ways.

In this thesis I examine how suspension feeding microorganisms, that are attached to surfaces, exemplified by a ciliate, manage to clear sufficiency large volumes of water for prey to sustain a living. By considering flows due to point forces near a solid surface, we quantify the effect on clearance rates and find twice the reduction in the clearance rate when the force orientation is perpendicular compared to parallel. For my example ciliate, *Euplotes vannus*, a representative model organism for upstream collection, we find that the membranelle band by its metachronal motion explains the filtration of a flow equivalent to the clearance rate and the overall structure of the prey size spectrum.

Furthermore, I demonstrate that swimming microorganisms may be non-intrusively tethered in a plane coinciding with the focal plane of the microscope by applying ultrasound to the water sample, and I construct a setup using commonly available or easily produced components.