Popular science summary of the PhD thesis

PhD student	Federica Miano
Title of the PhD thesis	**Fluid dynamics, ecology, and evolution of marine flagellates.** Motility, foraging mechanisms, and defense strategies
PhD school/Department	DTU Aqua – Centre for Ocean Life

Science summary

Life in the ocean can be very challenging for microorganisms. Imagine being one cell of a few microns (2-20 µm) in that immense volume of water. To survive in the marine jungle, you will have to face the biggest challenge of life: to eat without being eaten.

Looking for food in the ocean is not easy. Resources are extremely diluted, and you would have to clear every day a huge amount of water – approximately 106 times your body volume - to fulfill your energetic requirements. Luckily, you might be equipped with flagella, beating appendages that function like a motor – converting “fuel” provided by the metabolic activity of the cell into movement. The beating of the flagella is advantageous for foraging, as it enables the flagellate to swim faster through the water or produce a feeding current to direct food particles towards the cell body. However, this advantage comes with a cost. The swimming or foraging activity itself puts the flagellates at a higher risk of predation, as their predators can sense them through the noise generated by their beating flagella in the surrounding water. Therefore, flagellates have evolved extraordinary functional traits and behaviors, such as feeding strategies or defense mechanisms, to overcome these challenges and find an equilibrium between resource acquisition and predation risk.

Even though flagellates play a key role in marine food webs, the fundamental resource acquisition-predation risk trade-off remains largely unexplored. This PhD thesis aims to reduce this knowledge gap by investigating, from a fluid dynamic point of view, the functional traits and behaviors of several flagellates belonging to different branches of the eukaryote Tree of Life. Combining experimental observations, theoretical modelling and computational fluid dynamic, my research provides insights on escape strategies, foraging mechanisms, and complex 3-dimensional beat patterns showed by species belonging to three different taxonomic groups, namely the Haptophyta, Excavata, and Stramenopila.