



INTERNSHIP IN BIOLOGICAL FLUID DYNAMICS

HOW PLANKTON REACT TO A FLOW

LOCATION

IRPHE, 49 RUE JOLIOT-CURIE, MARSEILLE, FRANCE

GRATIFICATION

600€/MONTH

SUPERVISORS

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Among the zooplankton, copepods are model organisms. Copepods are abundant millimetric crustaceans that play a crucial role in marine ecosystems. These animals are blind, yet they are able to detect preys, predators and mates by using highly-developed hydrodynamic sensing. Copepods measure relative flow velocities with sensitive hair-like organelles on their antennae. How do they extract a meaningful signal from turbulence noise? How do they react to this information? Today, we do not know.

The objective of the project is to link the flow information sensed by copepods to their motor behavior. For this purpose, we will use 3D tracking to follow the behavior of copepods in different experimental situations. First, we will use large sinking spheres in a water tank at rest. Copepods will either perceive the Stokes flow produced by the sinking spheres as a threat or as a potential feeding source. We want to characterize the behavior of the copepods as a function of their location with respect to the sinking sphere, and as a function of the intensity of the flow signal (modulated by the size and density of the sphere, but also by the distance between the sphere and the copepod).

Second, we will evaluate how copepods respond to a turbulent flow. The flow will be produced by rotating impellers with the goal of producing homogenous isotropic turbulence (von Karman flow). We will use a light source that attracts the copepods and assess whether the presence of the flow restrict or favor the displacement towards the source. The goal will be to test experimentally the concept of "surfing on turbulence" (Monthiller et al. 2022).

The internship will be located at the 'Institut de recherche sur les phénomènes hors équilibre' (IRPHE), one of the leading French laboratories in fluid mechanics, with a strong interdisciplinary history. The intern will join the international research group of Christophe Eloy, and will contribute to the ERC-funded project COPEPOD.

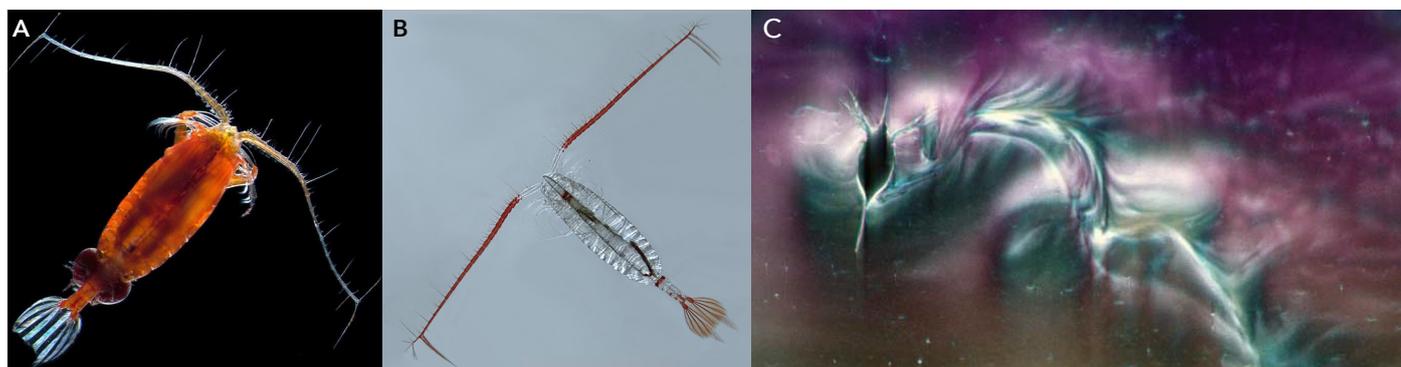


Figure. Two pictures of planktonic copepods: (A) *Valdiviella insignis*, a 9 mm long copepod living around Ireland and (B) *Calanus hyperboreus*, a 10 mm long copepod living in the Arctic. Both have long antennae covered with setae, sensing hairs that allow them to measure flow velocities (Photo credits: Russ Hopcroft/Census of Marine Life). (C) Schlieren visualisation of a swimming copepod *Daphnia lumholtzi* (from Strickler & Balazsi, 2007).