

PHD POSITION

COPEPODS, DAREDEVILS OF THE SEAS

HOW DO THESE PLANKTONIC CRUSTACEANS TRACK TARGETS IN TURBULENT FLOW WITHOUT EYESIGHT?

LAB

IRPHE, MARSEILLE, FRANCE

FUNDING

EUROPEAN RESEARCH COUNCIL, ERC ADVANCED GRANT, PROJECT COPEP0D

PHD SALARY

GROSS ANNUAL SALARY BETWEEN 23,688€ AND 26,472€, DEPENDING ON EXPERIENCE

CONTACT

CHRISTOPHE ELOY (CHRISTOPHE.ELOY@CENTRALE-MARSEILLE.FR & WWW.IRPHE.FR/~ELOY)

Context. Copepods are millimetric crustaceans that live in all seas and oceans. Like the Marvel superhero Daredevil, copepods are blind. Yet, they are able to detect preys, predators and mates by using highly-developed hydrodynamic and chemical sensing. How do copepods process this sensing information? How do they extract a meaningful signal from turbulence noise? Today, we do not know.

Objectives. The objective of the project is to decipher how copepods exploit hydrodynamic and chemical sensing to track targets in turbulent flows. We hypothesize that reinforcement learning can reverse-engineer the algorithms used by copepods. To test this hypothesis, we will build a virtual environment, where copepods are trained: virtual copepods will sense flow velocity and chemical concentration and this sensing information will be processed by a neural network trained by reinforcement learning. This theoretical and numerical approach will be complemented by experiments on real copepods with the goal of measuring how copepods reacts in turbulent flow.

Profiles. Candidates should hold a Master degree in fluid dynamics, applied mathematics, soft matter physics, biophysics, or machine learning, and have an outstanding track-record. Candidates with a taste for interdisciplinary research will receive a particular attention.

Environment. The 'Institut de recherche sur les phénomènes hors équilibre' (IRPHE) is located in Marseille, France. IRPHE is one of the leading French laboratories in fluid mechanics, with a strong interdisciplinary history. The candidates will join the international research group of Christophe Eloy as PhD scholars. They will contribute to one aspect of the ERC-funded project COPEP0D.

Applications. Candidates are invited to contact Christophe Eloy by email before July 15th, 2019 for a starting date not before September 1st. They should provide: (1) a detailed CV, (2) contact information of at least 2 academic references, and (3) a motivation letter describing past activities and research interests.

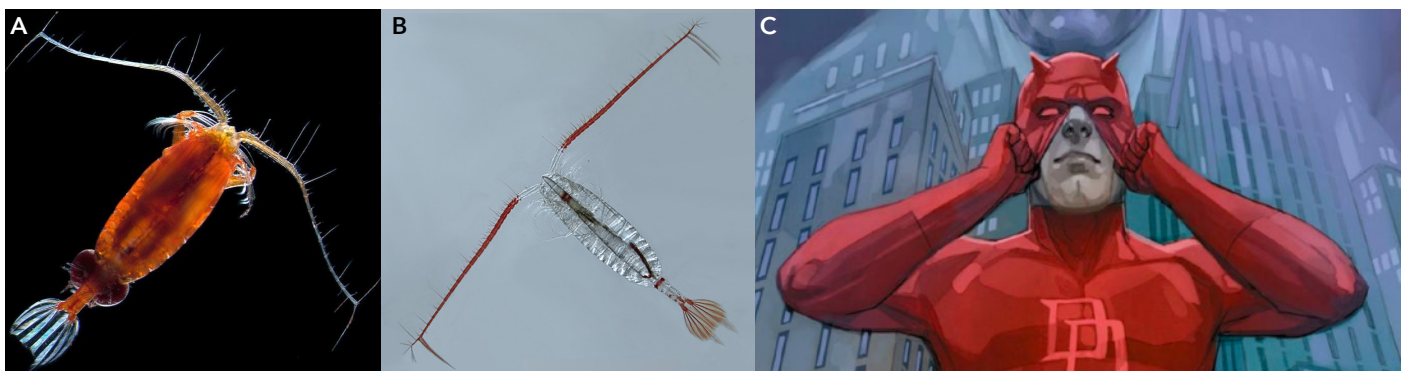


Figure. Two pictures of planktonic copepods: (A) *Valdiviella insignis*, a 9 mm long copepod living around Ireland and (B) *Calanus hyperboreus*, a 10 mm long copepod living in the Arctic. Both have long antennae covered with sensing hairs that allow them to sense flow velocities and chemical concentrations (Photo credits: Russ Hopcroft/Census of Marine Life). (C) Daredevil is a superhero created by Stan Lee (Image credits: Phil Noto/Marvel Entertainment). While he is blind, his exposure to radioactivity has developed his remaining senses, and gave him a "radar sense."