Preferential accumulation of gyrotactic cells in turbulence

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Many phytoplankton species are motile, propelling themselves through water with velocities ranging from 10 to 1000 microns per second. The spatial distribution of unicellular organisms in the Ocean is observed to be heterogeneous. This communication demonstrates that heterogeneity can be generated *ex novo* at the smallest scales of turbulent flows via an active coupling between motility and hydrodynamic shear, and stands in direct contrast with the aforementioned mechanism that considers phytoplankton cells to act as passive tracers.

Realistic flows are obtained by randomly forcing large-scale fluid motions and solving Navier-Stokes equations through direct numerical simulations for the resultant turbulent motion. This flow is seeded with hundreds of thousands of cells and statistical analysis reveals that the intensity, time scale, and spatial pattern of the resultant accumulations are governed by two dimensionless numbers which capture the interaction between motility and flow.