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Active droplets as biomimetic model swimmers[1]

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Large ensembles of biological swimmers form one of the biggest ecosystems on earth: marine phytoplankton. Investigating the dynamics of such a system is of prime ecological importance, however, as any modelling would need to include the interplay of turbulence, long-range hydrodynamics, buoyancy, as well as the self-propelled motion of the swimmers, this proves a daunting task both analytically and numerically. A scalable system of artificial swimmers with well understood and tunable interactions should help with decoupling some of these effects and studying them separately. Active emulsions of self-propelled droplets present a suitable experimental model system for the collective behaviour of biological swimmers, as they exhibit both autonomous motion and chemotaxis, move freely in three dimensions, can be produced and stored in large, monodisperse quantities and are stable over time scales comparable to biological systems. We demonstrate some of these features on a system of liquid crystal droplets driven by solubilisation into a micellar aqueous surfactant solution.

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