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Moving microdroplets in 3D using photochemopropulsion

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The ability to selectively transport chemical species in a controlled fashion, typically against chemical and electrochemical gradients, has been the cornerstone of the development of complex natural systems. In 2013, the Nobel Prize in Physiology or Medicine was awarded to Rothman, Schekman and SUdhof "for their discoveries of machinery regulating vesicle traffic, a major transport system in our cells". Vesicles are closed cellular structures formed from lipid bilayers that are used to actively transport macromolecules from inside cells to the outside fluid by a process known as exocytosis or between cells by a variety of mechanisms. In exocytosis, the macromolecules are contained in the vesicle that isolates them from the rest of the cell and which eventually fuses with the cell membrane to release the macromolecular cargo to the outside of the cell. Emulating such structures and processes in the fluid environment is considered one of the grand challenges confronting nanoscience today and has the potential to add revolutionary capabilities to fluidic platforms that could be used to transport medicine in the human body, act as chemical messengers for signal transduction in sensing or other systems, move cargo around microfluidic devices, or even be utilized for transport in artificial cellular systems. We have developed lipophilic droplets whose movement and direction can be controlled on or in an aqueous medium solely by photo-driven "chemopropulsion" (photochemopropulsion). In this presentation, we will demonstrate how the droplets can be "pushed" or "pulled" by light in 3D, are able to carry "cargo", and undertake sequential chemical reactions through the interaction of two or more droplets.

Biography

David Officer is Professor of Organic Chemistry in the Intelligent Polymer Research Institute and the Australian Research Council Centre of Excellence for Electromaterials Science at the University of Wollongong, Wollongong, Australia. He joined the lecturing staff at Massey University, New Zealand in 1986 and during the following 20 years, he became founding Director of the Nanomaterials Research Centre and Professor in Chemistry in the Institute of Fundamental Sciences. In 2007, he moved to the University of Wollongong. He has published more than 200 papers in the areas of graphene and porphyrin chemistry, conducting polymers, nanomaterials and solar cells.

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