

Lab-on-a-particle technologies based on armored emulsions

Abstract

The ultimate limits of diagnostics in biology are the “quantum” units that convey information, e.g. single nucleic acids, proteins, and cells. Microfluidics has emerged as a powerful tool to compartmentalize single cells and molecules into sub-nanoliter droplets as individual bioreactors to enable sensitive detection and analysis down to this quantum limit. However, the current systems for quantum diagnostics have not been widely adopted, partly due to the requirement of specialized instruments and microfluidic chips to generate uniform droplets and perform adequate manipulations. I will discuss the platforms we are developing to fractionate volumes in simplified, instrument-free ways using 3D-shaped microparticles. Each “lab-on-a-particle” can be analyzed using widely available flow cytometers. These new lab-on-a-particle reagents eliminate the need for specialized new equipment for microfluidic compartmentalization and readout and promise to democratize single-molecule and single-cell technologies.