Properties of Reconstitute Model Lipid Droplets in a Phospholipid Bilayer using a 3D Microfluidic Platform

Sevde Puza[1], Stefanie Caesar[2], Chetan Poojari[1], Michael Jung[1], Ralf Seemann[1], Jochen S. Hub[1], Bianca Schrul[2] and Jean-Baptiste Fleury[1]

[1]Experimental Physics and Center for Biophysics, Saarland University

[2]Medical Biochemistry and Molecular Biology, Center for Molecular Signaling (PZMS), Faculty of Medicine, Saarland University

Lipid droplets (LDs) are the main energy storage organelles in cells. The energy is stored in the form of neutral lipids such as triglycerides and sterol esters. The monolayer of LDs embedded into the cell membrane is decorated with a specific set of proteins where the targeting and removal of these proteins are being studied to understand the biology of diseases, such as obesity, diabetes and atherosclerosis. The partition mechanism of these proteins between LD and bilayer is still under investigation. Here, a 3D microfluidic platform is developed to explore the partition dynamics of these proteins in a free-standing lipid bilayer enriched with LDs. The lipid bilayer is formed by contacting two oil-water interfaces that are decorated with a phospholipid monolayer. The bilayer is characterized by electrophysiological measurements and fluorescence microscopy. Using confocal microscopy, the 3D geometry of the reconstituted bilayer-embedded LD is determined with a remarkable spatial resolution. It appears that the bilayer-embedded LDs have a radial dimension in the micrometer range and present a characteristic lens shape. Based on wetting theory, we demonstrate that this lens shape geometry corresponds to an equilibrium shape.