Growth of lipid droplets: Insights from live cell microscopy

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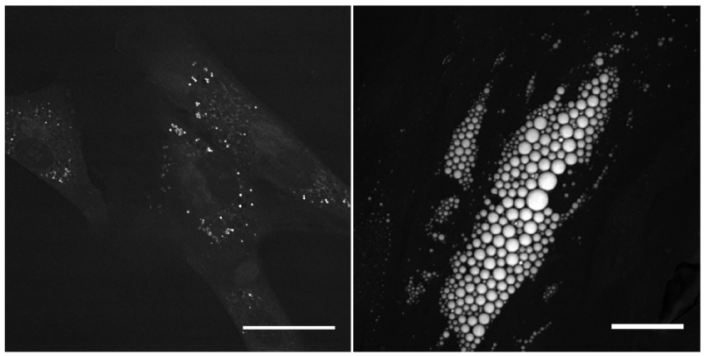
Lipid droplets (LD) are lipid rich structures which are found in many prokaryotic and eukaryotic cells. Depending on the cell type, their sizes can vary greatly, with diameters ranging from some tens of nm in most cells to several tens of µm in adipocytes. Work of the last decade has shown that LDs have to be regarded as true cellular organelles with a broad variety of functions. Despite the grown awareness of their importance, little is known so far about the growth and degradation processes of LDs. In this presentation, we will show how long-term studies of unlabeled mesenchymal stem cells based on CARS microscopy shed light on the growth of LDs during adipogenic differentiation. Our findings hint at the possibility that a protein stabilized fusion pore is involved. We analyze the lipid transfer data obtained in the microscopy studies in the framework of a Hagen-Poiseuille model. For the data analyis, the viscosity of the transferred material has to be known. We demonstrate that a viscosity dependent molecular rotor dye can be used to measure LD viscosities in live cells. On this basis, we calculate the diameter of a putative lipid transfer channel to lie in the range of 2-20 nm depending on the size of the involved LDs.



CARS image of lipid droplets in undifferentiated (left) and adipogenically differentiated (right) mesenchymal stem cells. Scale bar 30 µm.