INTRACELLULAR DYNAMIC STUDIES WITH HIGH DEFINITION QUANTITATIVE PHASE IMAGING

Sherazade Aknoun[1], Anaïs Saintoyant[1], Julien Savatier[2], Serge Monneret[2] and Benoit Wattellier[1]
[1]Phasics S.A., Espace technologique de Saint Aubin, Route de l'Orme des Merisiers, 91190 Saint Aubin, France
[2]Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, Faculté des Sciences Saint Jérôme, 13013 Marseille, France
E-mail : julien.savatier@fresnel.fr

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It is now known that interaction between cells and their environment or between intracellular compartments is based on complex vesicular transport processes. This transport consists in material internalization from the external environment and compartment exchanges inside the cell itself. Understanding the mechanisms and regulation of this intracellular trafficking is an intense object of study in the field of cell biology. The goal is to understand how vesicles transporting proteins and lipids are targeted to specific cellular compartments and fused with the membrane. Progress about intracellular trafficking is currently essentially made by constant innovation in fluorescence based techniques. They now reach single molecule resolution in living cells. It is possible to follow molecules all along their travel inside the cell. In this case, the main limitation is that fluorescent probes could bias the vesicle behaviors and alter their transport inside the cell.

Quantitative phase imaging techniques are conventionally used in microscopy, enhancing the contrast for imaging semi-transparent samples with a non-invasive (i.e. label free) and fast approach [1]. For instance, phase correlation imaging introduced by [2] showed that global statistics on the whole cell or a population can give insight of motions and dynamics. We propose to study in details the behavior of vesicles at the intracellular scale and their interaction with the cytoskeleton.

The resolution, big field of view and high sensitivity brought by a High Definition wavefront sensor (5.5 Mpx phase image) allows following individual vesicles through time, while imaging the whole cell at high magnification. We can study their interaction with the surrounding environment, their motion (Brownian or guided along microtubules). We will show how we can extract information from quantitative phase images about the intracellular transport and the influence of the external modifications (temperature, specific inhibitors of molecular motors and actin polymerization) on motion.

References:

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