Label-free imaging quantification of lipids inside individual live cells or organisms using optical diffraction tomography

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Lipids reserved and metabolism in live cells or microorganisms are important for the study of cell biology, hepatocyte, as well as biotechnology. To quantify the lipid contents inside the cells or microorganisms, chemical extraction of the lipid using organic solvents or labelling methods have been conventionally used. However, the chemical method requires time-consuming drying and extraction processes and consumes a large amount of the sample volumes. Also, the labelling method causes the modification to physiology of cells and also surfer from time-consuming and qualitative measurements.

To overcome this limitation, we suggest optical imaging quantification of the lipids in individual microalgae using optical diffraction tomography (ODT) [1-3]. By measuring three-dimensional (3D) refractive index (RI) distribution of individual hapatocytes or microalgae, we could quantify the lipid contents inside the cell via high RI values of the lipids. By comparing to the fluorescence images of the cells, we confirmed the high RI values shown in 3D RI tomograms are the lipid droplets reserved in the cells [4-5]. The results measured using ODT show good agreements with the value measured using conventional techniques.

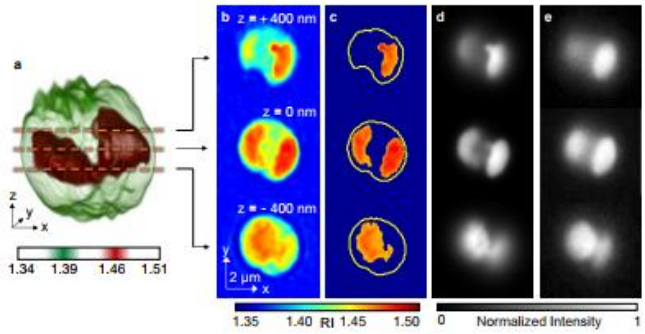

Figure 1: Identification of the lipid droplets inside an *N. oculata* cell: (a) A 3D rendered iso-surface of RI distribution of the cell. (b) Cross-sectional images of different axial planes. (c) The identified lipid regions based on the RI threshold n > 1.46. (d) The emulated images generated from the RI. (e) The fluorescence images of the same cell stained with Nile red dye.

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