大阪大学大学院生命機能研究科

FBS Seminar

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生命システム棟２F　セミナー室

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All-optical mapping of cell states and phenotypes

Cell imaging is fundamental to our understanding of biology. However, current imaging approaches typically involve some combination of modification (labeling), or destruction (MS, NGS) of the cell of interest. Labeling is usually needed since cells that are functionally different can appear morphologically similar. Here, we describe recent advances in using purely optical approaches to single-cell analysis, without requiring any modification of the cell of interest. Two optical measurements we use to capture cell phenotype are Raman spectroscopy and quantitative phase imaging. Raman spectroscopy provides a high-dimensional fingerprint of the molecular composition of the cell. This information can be analyzed to look for signatures of expressed molecules or to identify changes within a single cell. Alternatively, measured data can be treated as a feature vector in a supervised machine learning model to either classify cell types, such as B or T cells, or cell states, such as cell activation. Along with Raman spectroscopy, quantitative phase imaging offers complementary information on the morphology of the cell. Here, we demonstrate that both Raman spectroscopy and quantitative phase imaging could independently distinguish macrophages that have been stimulated by lipopolysaccharide (LPS). These label-free methods are also promising in other areas in biology, especially at the single-cell level, where they can be used to evaluate cellular processes such as endocytosis or apoptosis, and allow us to track cellular states over time, in contrast to more invasive analysis techniques.

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