

LABEL-FREE QUANTITATIVE PHASE AND RAMAN IMAGING FOR DETECTION OF IMMUNOLOGICAL ACTIVATION IN LIVE CELLS

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KEY WORDS: Digital Holographic Microscopy, Raman imaging, Cellular Response, Cell Heterogeneity.

This presentation will show how we use a combination of Raman spectroscopic and quantitative phase imaging tools to study changes in molecular and morphological composition of live cells. Even though all cells possess some degree of heterogeneity, they share common features in terms of the molecules they express when exposed to danger signals, and in terms of their structural rearrangement following immune activation. Label-free optical methods provide a unique tool to measure these aspects of cell behavior, without modifying the cell in any way. Using quantitative phase imaging to measure morphology, with simultaneous measurement of the cellular composition by Raman spectroscopy [1], we can assess a number of cellular features, such as cell health, or cell type [2], as well as evaluate more subtle changes such as the onset, and inhibition of the immune response. The multimodal application of these label-free techniques allows the discrimination of changes in the cell which occur either from transcription/translation, as well as structural rearrangement.

Aside from immunological activation, the same approach can also be applied to studying unwanted changes in cell samples that may occur, for example, during fixation, where the molecular content of the cell is often assumed to be unchanging when used in fluorescence imaging. Multivariate analysis by Raman imaging reveals degradation of some components as a direct result of the fixation process [3]. Together, these tools are proving to be useful to study cellular changes that are not suitable for, or detectable by, more traditional fluorescence imaging studies.

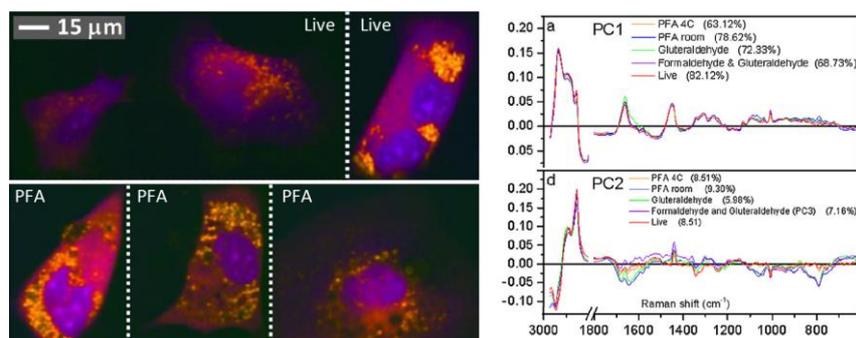


Figure: Spatio-chemical mapping of the modification of endogenous chemical components by label-free Raman imaging. The example shown here is the changes occurring during PFA fixation [3]. Both Raman (shown) and quantitative phase imaging (not shown here) are sensitive to small changes in cell morphology and composition that can be used to discern biologically important information such as immunological activation of macrophages, which is difficult to detect by other methods.

REFERENCES

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