ICFO

L4H Seminar JAMES CHAN 'Label-Free Spectroscopic and Imaging Techniques for Studying Single Living Cells"

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Cen

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Wednesday, October 8, 2014, 12:00. Seminar Room

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The analysis of single cells and its subcellular components is important in all areas of fundamental and applied biological, biomedical, and clinical research. Traditionally, single

cell analysis is largely dependent on the use of exogenous fluorescent dyes for labeling specific molecules to obtain biochemical information of the cell. Despite its prevalence, there are several drawbacks of using fluorescent labels, such as (i) photobleaching of the signal that limits the ability to study long-term cellular dynamics, (ii) the lack of defining cellular markers that can be labeled for identifying cell phenotypes, (iii) perturbation of the native biological system, and (iv) low multiplexing capabilities for assessing different chemical species simultaneously. The field of single cell analysis (i.e. cytometry) would be significantly advanced by the development of new biophotonic techniques that would enable label-free, non-invasive analysis of living cells. These techniques all have a common theme: they directly acquire biochemical information from the cell without requiring any exogenous labeling or genetic modification of the sample. These methods would allow new ways of detecting cells and analyzing their biochemical and dynamic properties, which would ultimately lead to new biomedical and biological discoveries. In this talk, I present the development of two label-free techniques based on Raman scattering and second harmonic generation (SHG) in which Raman scattering and SHG signals acquired directly from intrinsic biomolecules comprising the cell can be used to assess its cellular properties. Raman scattering is based on the inelastic scattering of photons by molecular bond vibrations. In SHG, photons interacting with a nonlinear material result in frequency conversion and the generation of new photons. Applications that highlight the unique capabilities of these techniques, including the analysis of human blood cells, the detection of bacterial dynamics, and the monitoring of cardiomyocyte development and function, will be presented.

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Hosted by Dr. Pablo Loza-Alvarez