IFPA 2017 – Speaker abstract and Photo

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Talk Title:

High-resolution optical nanoscopy of placental cells

Abstract:

The invention of fluorescence based super-resolution optical microscopy, commonly referred to as optical nanoscopy, has provided a glimpse of its future impacts on life science and medical care. Optical nanoscopy enables study of sub-cellular nanoscale biological systems in living cells, which in past was limited to electron microscopy (in fixed cells). Optical nanoscopy provide visualization of sub-cellular structures with an unprecedented optical resolution of 30-50 nm.

In this talk, I will discuss the opportunities and challenges offered by different optical nanoscopy techniques, such as structured illumination microscopy (SIM) and single molecule localization based optical nanoscopy (SML-ON). Among the existing nanoscopy techniques, SIM provides 3D super-resolution imaging with conventional fluorophores at comparatively higher temporal resolution (seconds) and is therefore suitable for live-cell applications. However, the optical resolution achieved by SIM is limited to about 100 nm. Contrary, SML-ON technique provides much better optical resolution of about 30-50 nm but at much poorer temporal resolution (10s of minutes), requires special fluorophores and is therefore typically limited to fixed cells.

Here, I will discuss the application of optical nanoscopy for clinically relevant bio-imaging. Optical nanoscopy of mitochondria and cell membrane in living trophoblast cell line using SIM technique will be presented. Optical nanoscopy is shown to detect sub-cellular morphological changes in mitochondria and cell membrane when challenged with several inflammation molecules. The preliminary results on high-resolution imaging of human spermatozoa will also be discussed.

The present limitation such as, high-cost, high-maintenance and low throughput makes it difficult for optical nanoscopy to be used as mainstream imaging tool in the clinics. To this end, I will present recent technical advancements in our lab towards the development of affordable, photonic chip-based high-throughput optical nanoscopy that enables super-resolution imaging over millimeter scale.