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MULTI-MESSENGER OPTICAL MICROSCOPY, A NEW PARADIGM IN OPTICAL MICROSCOPY

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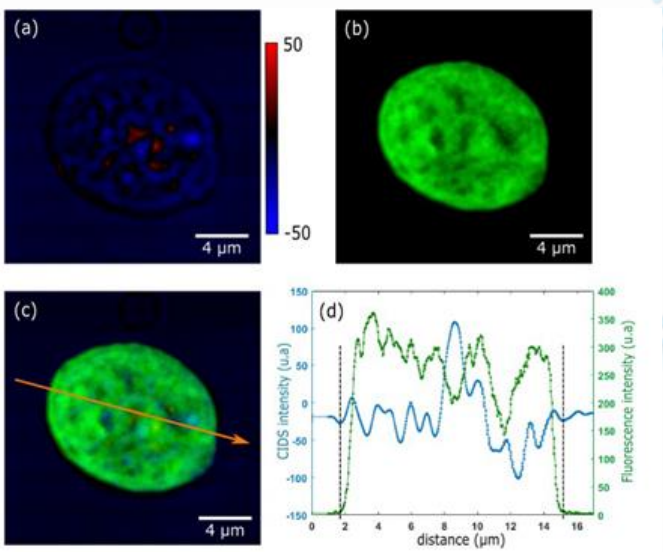
The possibility of integrating different light-matter interactions to form images and to correlate image data in optical microscopy is the starting point for the design and implementation of a brand new multi-messenger optical microscope. The multi-messenger microscope could represent a new paradigm in data collection and image formation with a potential high impact in biophysics exploiting the possibility to "tune" the microscope across a large, almost unlimited, range of spatial and temporal resolution. Fluorescence, including FLIM, FRET, FRAP, FCS and super resolved, and label free approaches, including multiphoton, SHG, Mueller matrix microscopy, fluorescence. For this reason, we will discuss from basic to advanced aspects of confocal and multiphoton microscopy, single molecule localisation methods, nanoscopy and label-free approaches.. We aim to bring a contribution for answering an open universal question in cellular and molecular biology: what are the local and global four-dimensional (x,y,z,t) chromatin structures in the nucleus that rule the compaction and function of the human genome in the interphase of cells and mitotic chromosomes? Expansion and light sheet microscopy will be considered as part of the multi-messenger approach. Deep learning approaches and brand new oriented detectors are key components for the development. The final "destination" of the multimodal collection of data is oriented to a "liquitopy" (liquid tunable microscopy) development [1].

[1] R. Won, "The super-resolution debate," Nature Photonics, vol. 12, no. 5, pp. 259–260, Apr. 2018.



(Image credit: Aymeric Le Gratiet, Luca Pesce, Michele Oneto, Riccardo Marongiu, Giulia Zanini, Paolo Bianchini, Alberto Diaspro, "Circular intensity differential scattering (CIDS) scanning microscopy to image chromatin-DNA nuclear organization," OSA Continuum 1, 1068-1078 (2018))