# Structural imaging in cells and tissues by polarized fluorescence and nonlinear optical microscopy

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Multimodal optical imaging is reaching today a mature stage, using the combination of fluorescence and nonlinear coherent optical contrasts to reveal morphological features in biological tissues from fixed samples to *in vivo* studies. While imaging can guide interpretation through morphological observation at the optical diffraction scale, providing finer structural information on bio-molecular assemblies requires challenging instrumentation developments.

Reporting molecular organization in crystals, proteins aggregates or lipid membranes down to the nano scale is made possible using polarization resolved optical microscopy, taking advantage of the orientation-sensitive coupling between optical excitation fields and transition dipole moments [1]. In this presentation, we will describe how this approach can be implemented and exploited to monitor molecular angular behavior and access sub-diffraction scale structural information.

We will illustrate the use of polarization resolved optical imaging in live cell membranes and proteins assemblies such as in amyloid fibrils and actin fibers of the cell cytoskeleton [2-6], and show how this information, when brought down to the single molecule scale, brings additional insight into the dynamic nature of orientational behaviors at the nanometric scale. We will also show how polarized nonlinear signals such as Four Wave Mixing (FWM) and Coherent Anti Stokes Raman Scattering (CARS) bring a superior level of detail in the organization of lipids in cells and tissues, without the use of fluorescent labels [7].

**References**

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