Super-resolution imaging and image analysis of protein-protein interactions in membranes

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Protein-protein interactions (PPI) are important factors in determining the output of cellular processes. Co-localization analysis of fluorescence microscopy images can provide information about such interactions. However, such techniques are limited by either the diffraction-imposed resolution limit, the range of interactions they can detect (FRET), or the inability to image at single-molecule resolution in live cells. In addition, co-localization measures suffer from several disadvantages, especially in detecting indirect interactions. In this work, we aim to develop a novel method for image-based interaction inference in live cells. The approach combines quantitative dual-color super-resolution PhotoActivated Localization Microscopy (PALM) with a novel spatial statistics approach to analyze PPIs between membrane proteins in live cells. This method will be applied to infer interactions in the GPCR signaling pathway, to quantify these interactions, and to test biological hypothesis.