

Super-resolution light microscopy: Recent developments and remaining challenges.

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In its elegant simplicity, the diffraction limit as postulated by Ernst Abbe more than one-hundred years ago has until very recently been an unsurmountable obstacle for imaging very small details using light microscopy methods. Only in the last years imaging techniques have become available that allow to circumvent this impediment and to visualize structures at unprecedented levels of detail beyond the limit given by traditional wave optics. Based on three different approaches, Stimulated Emission Depletion (STED) microscopy, localization accuracy based microscopy and structured illumination, a range of new instruments and imaging methods now offer the possibility to perform super-resolution imaging. In this talk, an overview of the currently available super-resolution methods and their underlying principles will be given. Differences and common aspects of these technologies will be highlighted to illustrate the specific strengths and weaknesses of the approaches. New labeling requirements resulting from the increased image resolution will be highlighted and the importance of fluorophore properties for super-resolution imaging will be covered. The existing limitations and remaining challenges for this exciting new field will be discussed.