Optical lenses cannot bend light over a certain angle to achieve resolution beyond the diffraction limit. This is currently defined by Raleigh or Sparrows resolution limits. This limitation exists in all modern microscopes and is a fundamental limitation of optical physics. Whilst we cannot break these laws, we can creatively utilize some characteristics of fluorescence imaging to circumvent this problem.

There are basically two approaches to optical super-resolution imaging. 1) Localization Microscopy which seeks to determine the spatial localization of a fluorophore in the specimen, and 2) Illumination Manipulation that modifies the illumination system of the microscope to achieve higher resolution. Both of these are typically associated with different applications in cell biology; Localization Microscopy is normally performed in TIRF (Total Internal Reflection Fluorescence Microscopy) based applications whilst Illumination Manipulation (3D-Structure Illumination Microscopy) allows one to image relatively thick samples which are not directly in contact with the cover slip. We will discuss the methodologies and the advances in Super Resolution Imaging to enable one to see biology in higher definition.