Super-Resolution Microscopy

An introduction to Super-Resolution

Resolution limits imposed by light diffraction have always been major obstacle in analysing microscopic images and obtaining insights into the fabric of living cells. To date, our best optical tools have only revealed structures measuring approximately 200 nm across and anything below that limit has been inaccessible for direct observations. Unfortunately, most cellular organelles involved in physiologically important processes involving cell-to-cell communication, growth and response to number of environmental signals are often below that limiting threshold of 200 nm. For example, synaptic vesicles, receptor proteins complexes and cellular skeletal assemblies can be as small as 50 nm yet our understanding of their function could be greatly improved if only direct optical recording was possible.

Several novel microscopic techniques made this possible and previously inaccessible nano-environments began to be mapped. PALMIRA, STORM, FIONA as well as a number of related approaches have started to yield outstanding results. For the first time direct optical recordings of sub-resolution structures allowed addressing important structural and physiological questions. Answers to these questions will dramatically improve our understanding of the nature of processes involving responses of living cells to stress, damage, proliferation and interactions in their complex physiological milieu.