Table-Top X-Ray Microscope for Biomedical Imaging

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Recent advancement in nanofabrication technology and high power x-ray sources may enable x-ray microscopy to realize *in vivo* functional cellular imaging at nanometer scale. The x-ray wavelengths (from 2.5 nm to 0.3 A) not only provides the nanometer scale resolution, but also enables metal-protein/metal-organic labeling by exploiting the spectroscopic properties of various metal K-edges. Less multiple scattering of x-rays in biological entities provides the additional benefit of larger penetration depth that is critical for 3-Dimentional imaging. However, challenges exist in that while shorter wavelength (i.e. higher photon energy) indeed provides resolution at nanometer scale, the radiation damage on the living cell becomes the limiting factor.

It is widely agreed that *in vivo* functional cellular imaging at nanometer scale, if realized, will have a huge impact on the effort of understanding the complexity of biological systems. A table-top x-ray microscope that has nanometer resolving power (<50nm), large field of view and depth of focus (~15 μm), and thus 3-Dimensional imaging capability of biological samples is proposed. Extension to x-ray functional imaging is straightforward with the various K and L absorption edges at these wavelengths. While soft x-ray imaging holds the potential of *in vivo* cellular imaging at nanometer scale, challenges in radiation damage prevents the immediate realization of this dream.