MAR05-2004-002236

Abstract for an Invited Paper
for the MAR05 Meeting of
the American Physical Society

Biological x-ray microscopy: from biochemical mapping to lensless imaging[1]

CHRIS JACOBSEN, Stony Brook University

Cell structure has been very succesfully studied using light and electron microscopy. However, x rays ofer new insights, by imaging whole cells at 20-40 nm resolution using zone plate lenses, and in particular by combining this with spectroscopic sensitivity to organic functional groups. While spectra of single compounds can provide exquisite information on electronic states, a cell is much more complex. Pattern recognition algorithms provide a way to deal with this complexity and obtain insights into biochemical organization at a fine spatial scale, as illustrated in an ongoing study of the correlation of morphology with biochemical content in sperm. Another approach to biological imaging is to abandon the use of lenses and their resolution limits. The purest form of measurement is to collect x rays scattered by a cell with no optics-imposed losses. By using iterative phasing algorithms, this diffraction data can be phased to deliver a real-space image of a complex cell (at present, 30 nm resolution in studies of freeze-dried yeast) with a possible ultimate extension to atomic resolution imaging of proteins using x-ray free electron lasers.

[1]Coauthors M. Lerotic et al.