

Automated 3D Imaging of Macromolecules in their Native Hydrated State

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Cellular functions are orchestrated by a series of macromolecules acting in concert, many of which are held together by weak forces and hence are not amenable to standard biochemical isolation and characterization procedures. Studying these macromolecules in their native state gives rise to an understanding of the macromolecule's conformation as well as the cell's supramolecular architecture.

Two new techniques for the 3D imaging of macromolecules show great promise to study these complexes in their native state: single particle analysis (SPA) and electron tomography. These electron microscopy (EM) techniques bridge the gap between the atomic resolution structures of protein molecules and cellular structures obtained by light microscopy.

FEI's Titan Krios transmission electron microscope (TEM) enables the investigation of the biological world at the nanometer scale. Designed specifically to address the needs of structural and cellular biologists, Titan Krios provides visualization of the interactive mechanisms of individual proteins and molecular machines and to localize that activity within the three dimensional architecture of the cell. It has been designed for automated data acquisition and processing and optimized for the single particle analysis and electron tomography applications.

Of paramount importance in this context is specimen integrity. Life scientists face a fundamental dilemma: longer exposures improve the signal-to-noise ratio, but also risk damaging the sample. Titan Krios optimizes imaging performance on delicate biological samples. It is specifically designed to obtain the maximum information with minimum exposure, preserving sample integrity and ultimately enabling investigation of increasingly smaller macromolecular detail. Together these capabilities allow images to be recorded at higher doses or the number of images to be increased for better resolution or higher signal-to-noise ratios.

Titan Krios is the tool for obtaining fast, fully automated, high content three dimensional information about biological cells down to the scale resolving individual molecular complexes. Advanced automation makes analysis fast and easy, increasing experimental productivity and enabling the high volume analysis needed for complex biological systems. This presentation will focus on the main concepts of the Titan Krios and automated data acquisition and processing of results for the single particle analysis and electron tomography applications.