MS2-P5 LB Nanotemplate as optimal nanotechnology for Synchrotron Radiation (SR), Cryo Electron Microscopy (Cryo-EM) and X-ray Free Electron Lasers (XFELs).

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The methods of 3D protein structure resolution had significant progress in the recent years. However, many protein structures of high industrial, pharmaceutical and fundamental life science interest are still unsolved. The production of the protein crystal as well as its quality (order, intensity of diffraction, radiation stability) remains the major problem in the protein crystallography. Serial femtosecond crystallography with use of XFELs allows data collection from nm to micrometer-sized crystals, but the problems such as low hit rate and high quantity protein nanocrystals needed have to be solved. In Cryo-EM image recording by direct detectors as well as processing software make possible to obtain 3D macromolecular reconstructions at near-atomic resolution. Radiation damage and conformational heterogeneity of the sample make high resolution a major challenge. Therefore, common problems to all these advanced techniques is both radiation damage and difficult sample preparation. Langmuir-Blodgett (LB) protein nanotechnology is a novel approach for highly ordered, radiation stable protein sample preparation for all above methods of analysis. The numerous nanocrystallographic studies confirm exceptional radiation stability and quality of the crystals grown by homologous protein LB nanotemplate, including those failed to be obtain by classical methods. Moreover, highly ordered LB protein multilayer can bypass the bottleneck of protein crystallization. Further, homogeneously oriented LB film with the natural protein conformation offer the elegant solution to Cryo-EM problem. The property of the LB nanocrystals and LB multilayers can be used in all three frontier methods of analysis aiming to optimal protein 3D atomic structure resolution.

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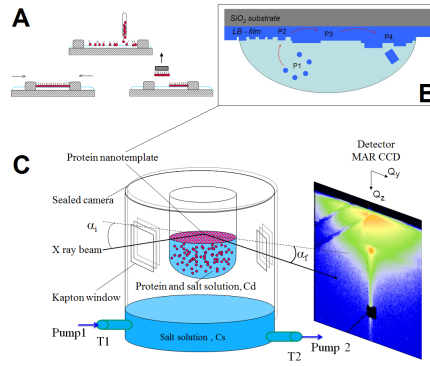

Figure 1. A. Formation of LB nanotemplate. B. The temporal model of LB nanotemplate method. Protein solution, P1, leads to protein association on the LB film states, P2 and P3, and to the crystal formation P4 detaching from the film in the drop. C. In situ submicron GISAXS of LB nanotemplate flow cell.

Keywords: Langmuir-Blodgett Nanotemplate, Protein Nanocrystallography, Synchrotron Radiation, XFELs, Cryo-EM.