



Structure and Dynamics of Biological Systems

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Purpose

Integrate five emerging technologies to permit multimodal and multiscale spatial, temporal, and chemical analysis of biofilm organization, cellular nanotoxicology, and enzymatic energy transduction.

Expected Outcomes

Coherent X-ray Diffraction @ LCLS - Femtosecond diffract-and-destroy methods for atomic resolution structure determination; observe dynamics using a pump-probe regime.

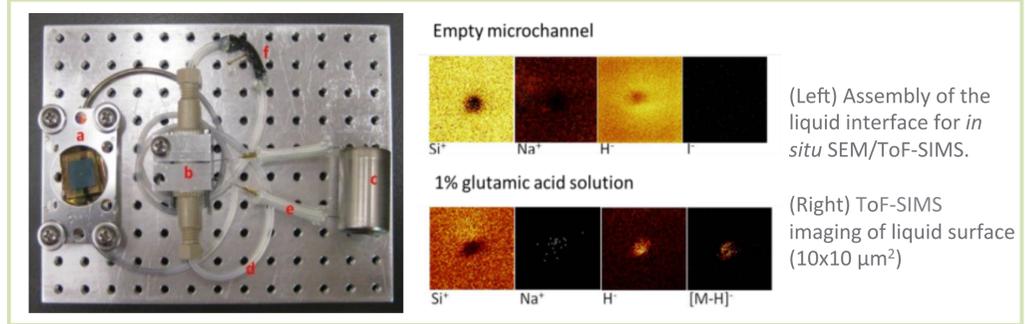
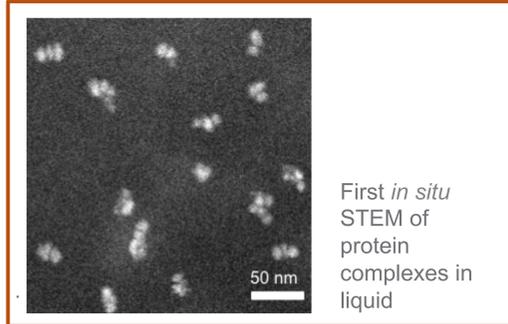
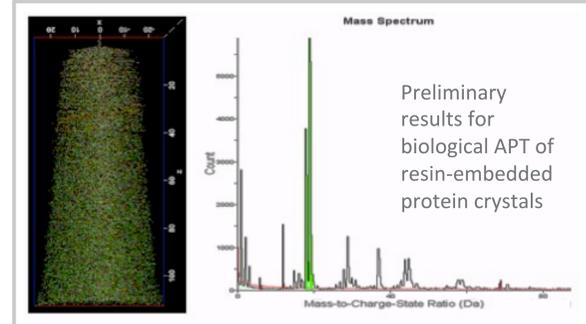
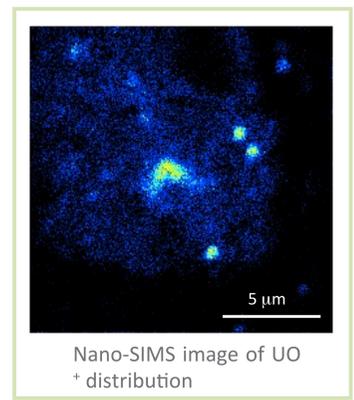
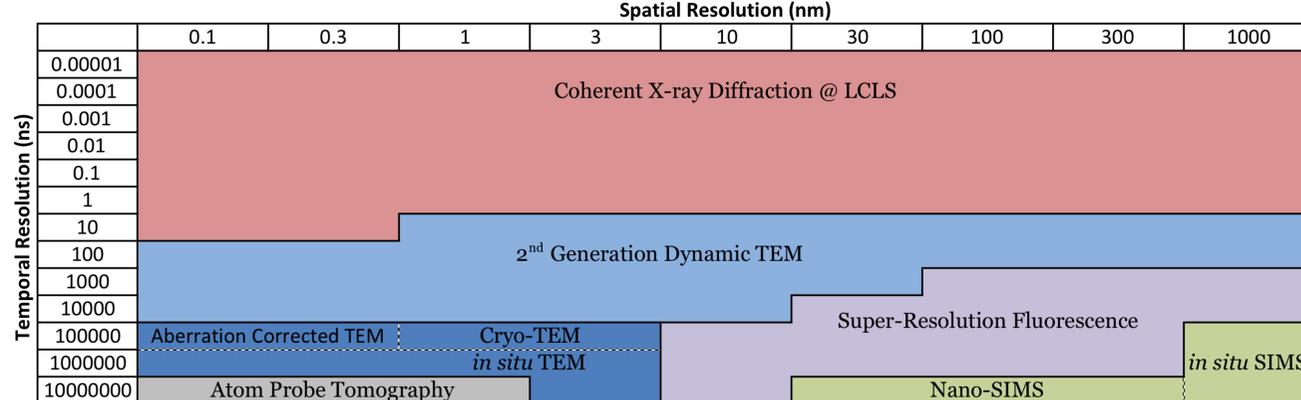
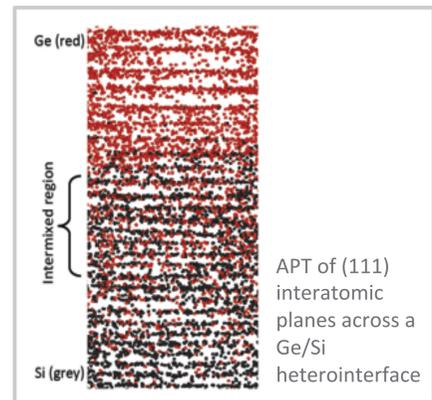
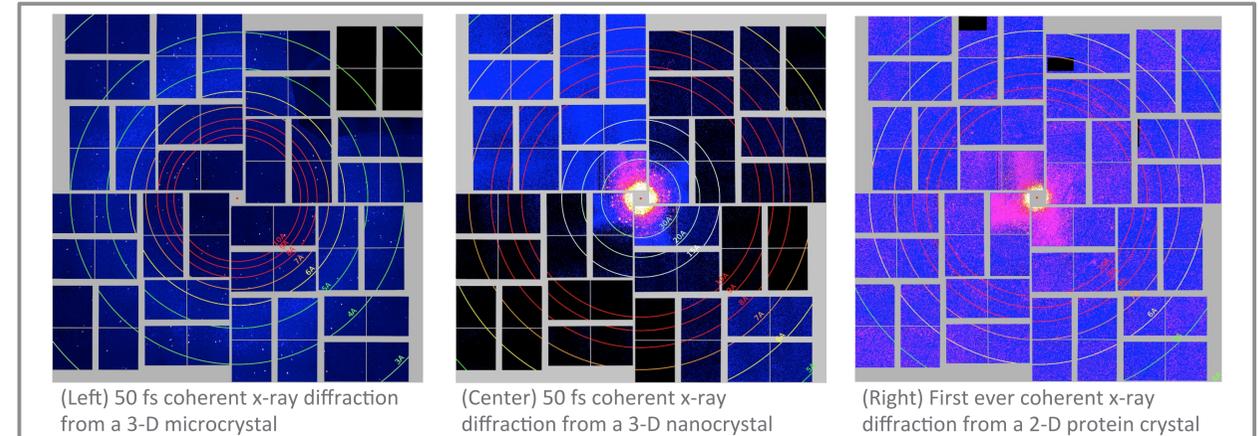
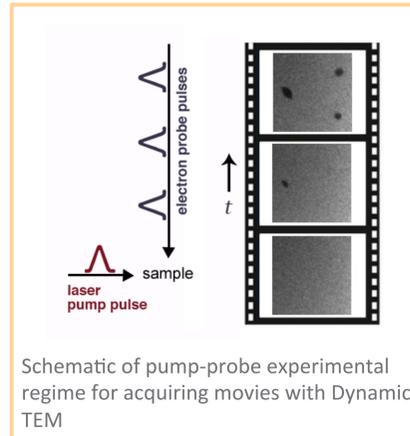
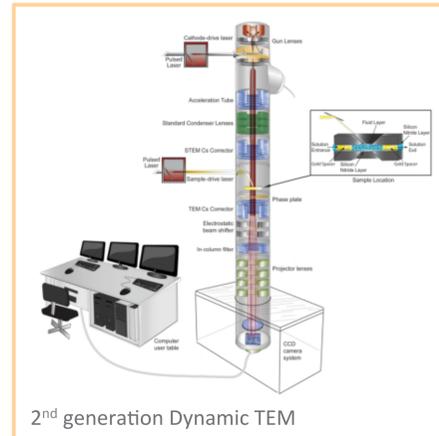
Dynamic TEM - Assess diffract-and-destroy compatibility with micro- and nanosecond single-shot electron pulses. Acquire real-time movies.

Atom Probe Tomography - Reconstruct 3-D protein crystal structure. Extend APT to more complicated biomaterials in embedded or cryo-state.

In situ TEM/SEM/ToF-SIMS – Develop flow cells for cross-platform use; Improve in situ TEM spatial resolution; probe chemical changes at biofilm/substrate interface.

Nano-SIMS - Robust analysis of biological systems; Cryogenic capability for imaging optimally preserved samples.

Research Design



Combine microsecond dynamic transmission electron microscopy with femtosecond coherent x-ray diffractive imaging, *in situ* and cryogenic secondary ion mass spectrometry and atom probe tomography to interrogate the structure and dynamics of biological systems.