

Structure and Dynamics of Biological Systems: Part 1

Research Team: James Evans, Daniel Perea, Xiao-Ying Yu, Zihua Zhu, Blake Hirschi, Bingwen Liu, Jia Liu, Trevor Moser
 Key Collaborators: Nigel Browning, Matt Marshall, Galya Orr, Theva Thevuthasan



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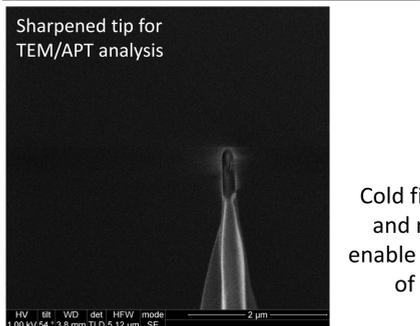
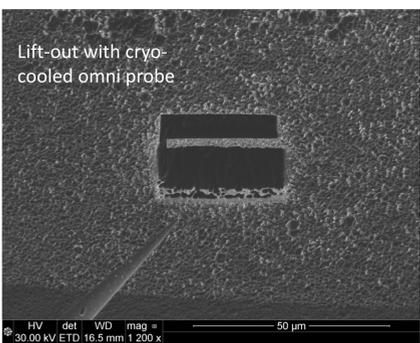
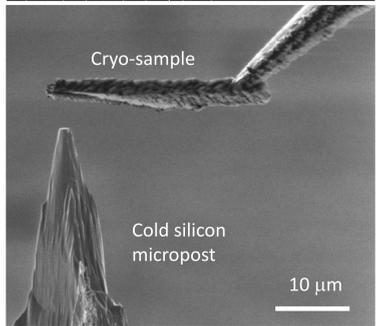
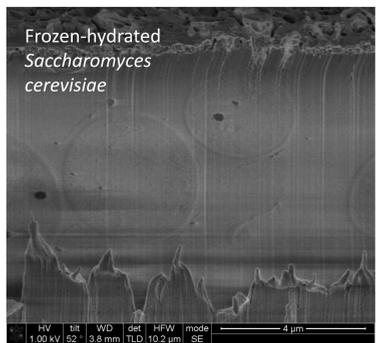
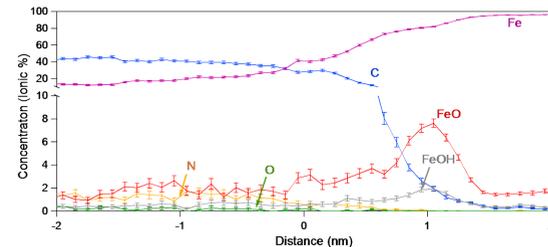
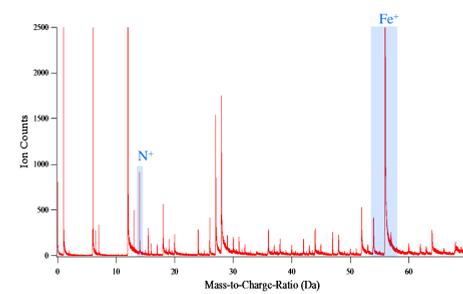
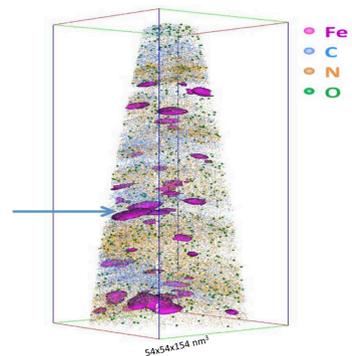
Purpose

- Biological systems are highly complex, and their dynamic processes occur over a wide range of spatial and temporal scales—from femtoseconds to hours and angstroms to meters.
- We are developing multimodal imaging capabilities that integrate structural, chemical, and dynamic information to more holistically image biological systems.

Research Accomplishments

Development of biological Atom Probe Tomography (APT)

- APT of Lowicryl resin with embedded ferritin (macromolecule containing a protein shell and iron oxide core)
- First-ever APT mapping of protein composition relative to the resin background. Perea D et al. 2014 In preparation



We can freeze and image cells with cryo-FIB/SEM but need IN_2 cooled tip with vacuum-insulated shaft to attach cryogenic samples to micro-manipulator without warming sample for lift-outs of site-selected areas for correlative TEM, SEM, SIMS, fluorescence, and APT.

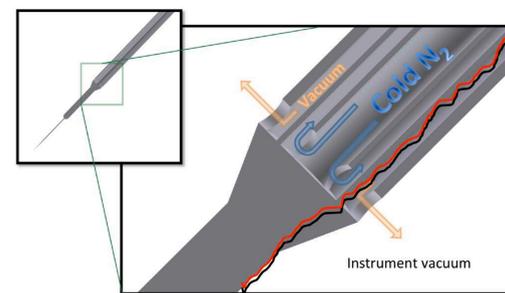
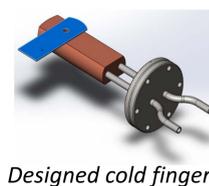


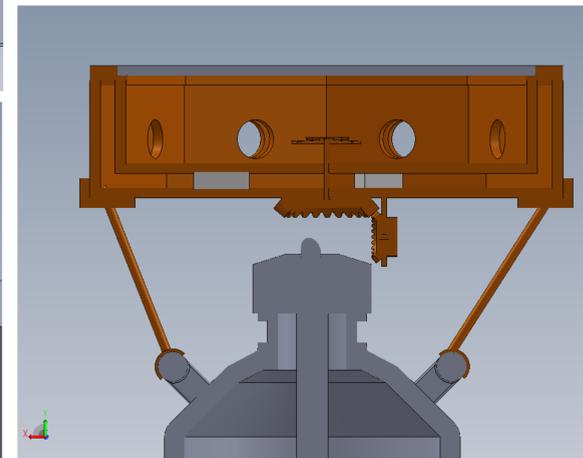
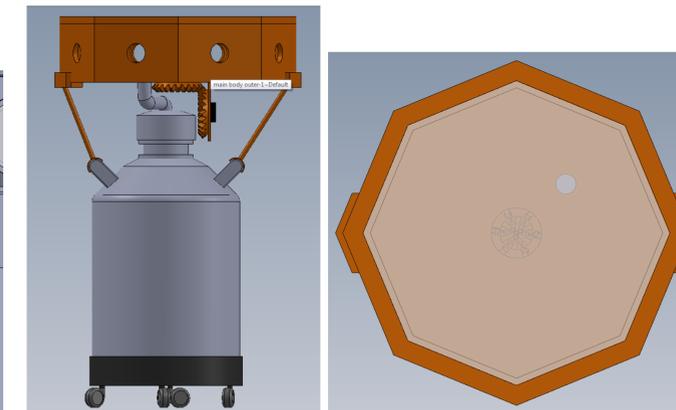
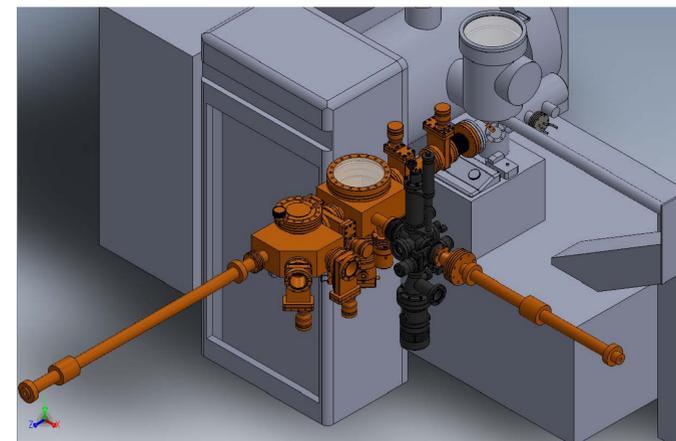
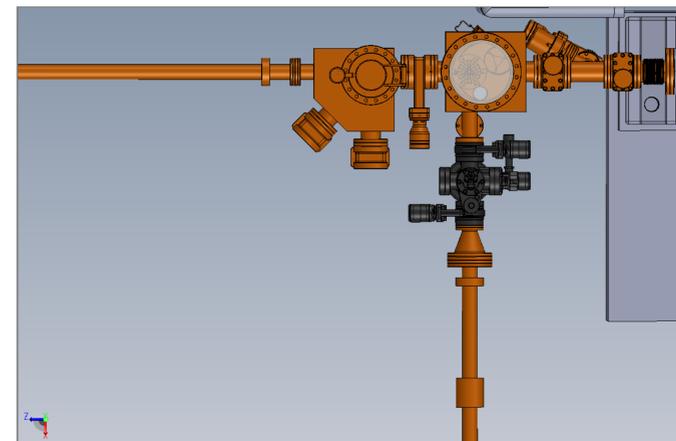
Image courtesy of Jeff Ditto (CAMCOR)

Cold finger trap for APT microscope and new sample transfer hubs will enable correlative cryogenic imaging of biological systems relevant to DOE BER.



Design and fabrication of multimodal transfer hubs

Affixed hub for direct transfer of cryogenic samples from TEM and FIB/SEM or vacuum transfer from a reactor chamber into the Atom Probe to empower unique studies of cryogenic biomaterials and in-situ catalyst reactions.



Mobile transfer hub for direct cryogenic, environmental, or vacuum sample transfer between up to 8 different imaging modalities; movable between laboratories and instruments.

FY14 Key Successes

- First imaging of molecular monolayers using transmitted X-rays
- First spectra from embedded metalloproteins using APT
- Correlative in-situ ToF-SIMS and super-resolution fluorescence microscopy
- Cryogenic FIB/SEM imaging and lift-out of frozen hydrated yeast cells.