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SYNCHROTRON LIGHT APPLICATIONS IN LIFE SCIENCES

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Abstract

Complex questions such as understanding mechanisms of metal homeostasis in biological systems can be addressed through use of hybrid methods which enable studies at different length and time scales. These approaches may involve complementary use of techniques like macromolecular crystallography which yields the structure at atomic resolution together. with spectroscopic imaging which may provide spatial information. Similarly, information from time resolved solution X-ray scattering experiments may be combined with cryoEM to follow conformational changes during protein-protein or protein-ligand interactions. Advanced instrumentation at synchrotron radiation sources provide a wide spectrum tools for structural studies of biological systems at different levels. Specifically, macromolecular crystallography, small angle X-ray solution scattering (SAXS), X-ray absorption and fluorescence spectroscopy (XAS), and imaging are enabling studies of structure-function relationships at different resolutions from atomic to cellular scale. In this talk results of experiments with two metal binding proteins; a Cd-binding metallothionein isolated from durum wheat (dMT) and the periplasmic ferric binding protein from H. influenzae (FbpA) will be presented. For dMT, combined results from SAXS, circular dichroism, absorption spectroscopy and in situ dMT expression studies show that the apo protein has a flexible extended structure which stably folds in the presence of metals and that the folded and unfolded conformations are sensitive to environmental pH conditions. For FbpA, differences in conformation between apo and holo forms are shown together with differences with the allosteric mutant D52A. It is also shown that, despite its stable secondary structure the apo protein enough flexibility to accommodate different conformations in solution. These results will be discussed in the context of the current models for metal binding mechanisms for both proteins. Moreover, possible role of dMT in Cd toxicity in humans and how structural features of FbpA may be generalized to other periplasmic transport proteins will be presented.

About

Dr. Zehra Sayers is a molecular biophysicist researching mainly on synchrotron X-ray structure analysis of biological macromolecules. She holds a BSc in Physics (Bogazici University, Istanbul) and a PhD in Biophysics (University of London). She was a post-doc in the UK and Sweden and was a staff scientist at European Molecular Biology Laboratory (EMBL) Hamburg Outstation (1986-1998) before joining Sabanci University in Istanbul as a founding faculty member. Here she was the Director of Foundation Development Program (2010-2019) and served as the interim President in 2018. Currently she is on a sabbatical at the EMBL Outstation in Hamburg. Dr. Sayers has been the Chair of the Scientific Advisory Committee of the international synchrotron radiation facilityy project SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) from its early stages until 2018. Her contributions to the realization of this project have been internationally recognized with the Rammal Award in 2017 and AAAS Science Diplomacy Award in 2019. She is also an honorary member of the Science Academy of Turkey.

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