

Center for Structural Molecular Biology



Neutrons for Biology

A Resource for Studying Biological Systems

Biomacromolecules and their Assemblies

- Protein/nucleic acid/lipid complexes

Bio-Membranes

- Membrane proteins
- Liposomes
- Nanodiscs

Complex Systems

- In-Cellulo studies
- Viruses

Biomass & Biofuels

- Plant cell wall structure & dynamics

Biomimetic/Bioinspired Systems

- Microemulsions
- Micellar systems
- Gels & fibers

Funding for the CSMB is provided by the DOE Office of Biological & Environmental Research.

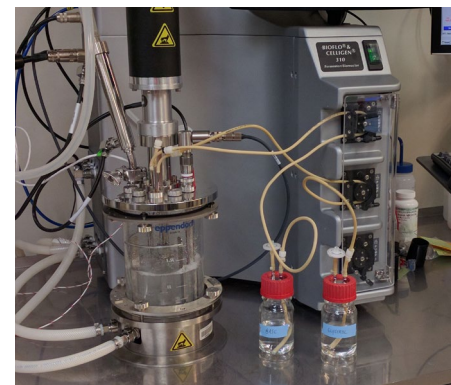
ORNL is managed by UT-Battelle for the US Department of Energy

The Center for Structural Molecular Biology (CSMB) at Oak Ridge National Laboratory (ORNL) is an open access user program dedicated to developing instrumentation and methods for determining the three-dimensional structures of proteins, nucleic acids (DNA/RNA) and their higher-order complexes. These tools help researchers understand how macromolecular systems are formed and how they interact with other systems in living cells. The focus of the CSMB is to bridge the information gap between cellular function and the molecular mechanisms that drive it.



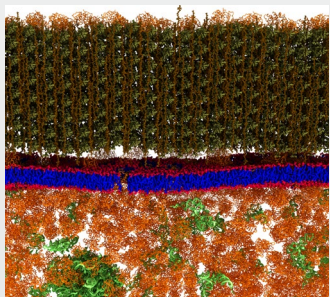
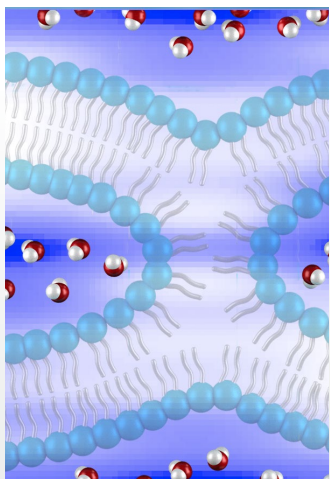
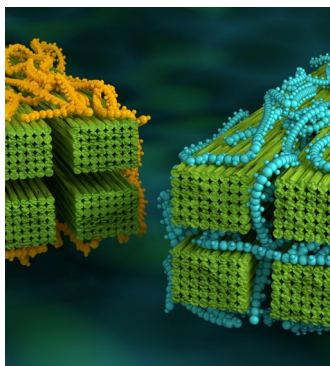
Bio-SANS

The CSMB operates a small-angle neutron scattering instrument dedicated to studying biological samples (Bio-SANS). The center is also closely allied with the Spallation Neutron Source (SNS) that provides complementary opportunities for studying a wide range of biomolecular processes on biologically relevant length and timescales.



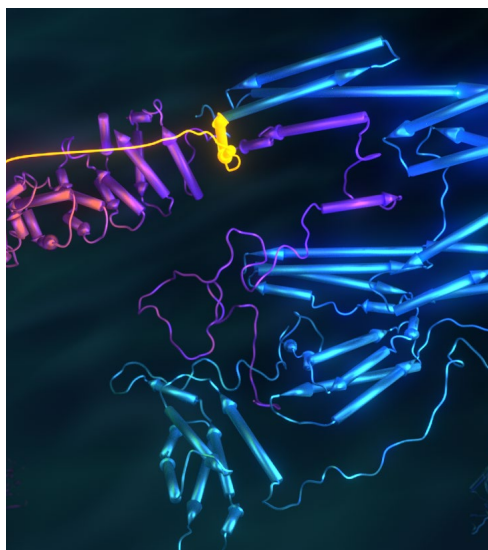
Bio-Deuteration Laboratory

The Bio-Deuteration Laboratory at the SNS is open to users for cloning, protein expression, purification, and characterization of H/D-labeled biological macromolecules.



Unique Tools for Structural Molecular Biology

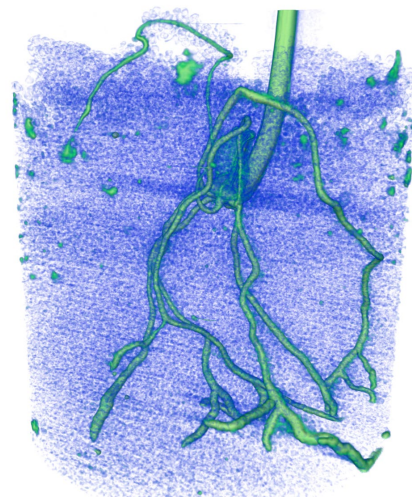
Small-Angle Neutron Scattering can be used to study biological systems under physiologically relevant conditions. Using deuterium labeling, SANS makes it possible to highlight and map components within larger complexes (e.g., viruses and ribosomes) by selective deuterium labeling and contrast variation. The dual detector configuration of Bio-SANS enables investigation of *in situ* processes using time-resolved SANS, and studies of hierarchical and complex biological systems with simultaneous access to multiple length scales.



Neutron diffraction, spectroscopy, and imaging are excellent tools for studying biological systems because neutrons interact differently with hydrogen and its isotope deuterium. As a result, it is possible to

1. pinpoint individual hydrogen positions in proteins;
2. probe the structure and dynamics of proteins, nucleic acids, and membranes; and even whole cells under near physiological conditions;
3. characterize hierarchical materials;
4. perform dynamic radiography on living systems in their native environment.

These approaches use neutrons to address questions that cannot be answered by other techniques.



Data Visualization and Analysis tools are being developed for the study of biomacromolecular complexes with SANS. When combined with deuterium labeling, it is possible to develop models of complex systems not obtainable by other techniques.

The CSMB welcomes researchers from the life sciences and environmental sciences interested in utilizing ORNL's neutron scattering facilities through the user programs.

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