# Neutrons for Biology

A Resource for Studying Biomolecular Complexes

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

For further information, please contact the Center for Structural Molecular Biology:


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## Bio-macromolecules and their assemblies

PROTEIN COMPLEXES

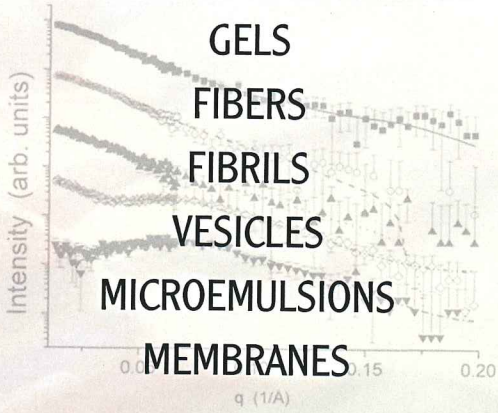
LIPIDS

VIRUSES

CARBOHYDRATES

PROTEIN/DNA COMPLEXES

## Hierarchical biological structures




GELS

FIBERS

FIBRILS

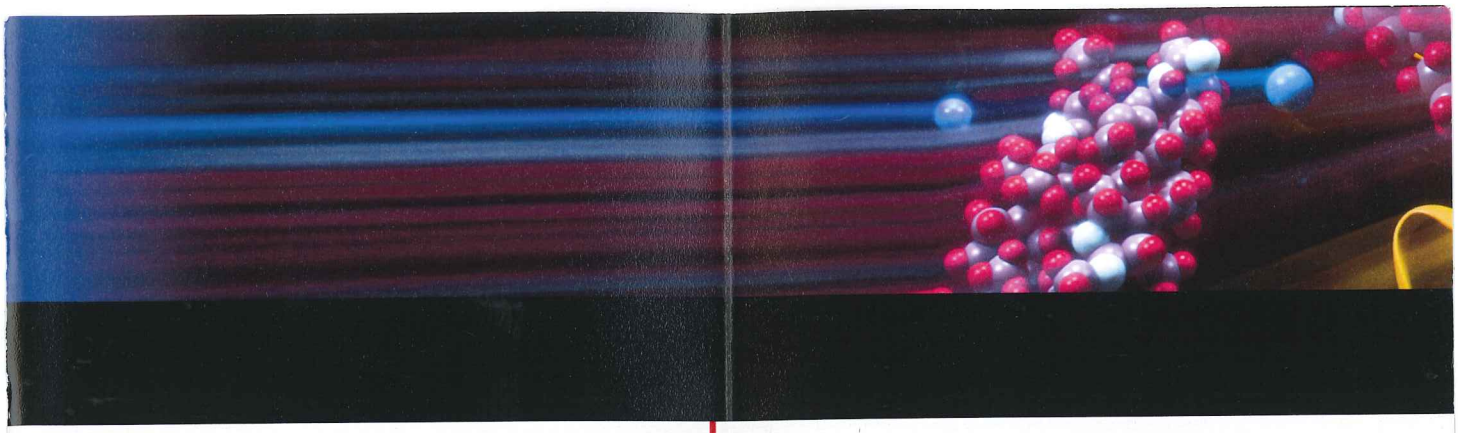
VESICLES

MICROEMULSIONS

MEMBRANES

## Biomimetic and bio-inspired systems

2010-G00100/es



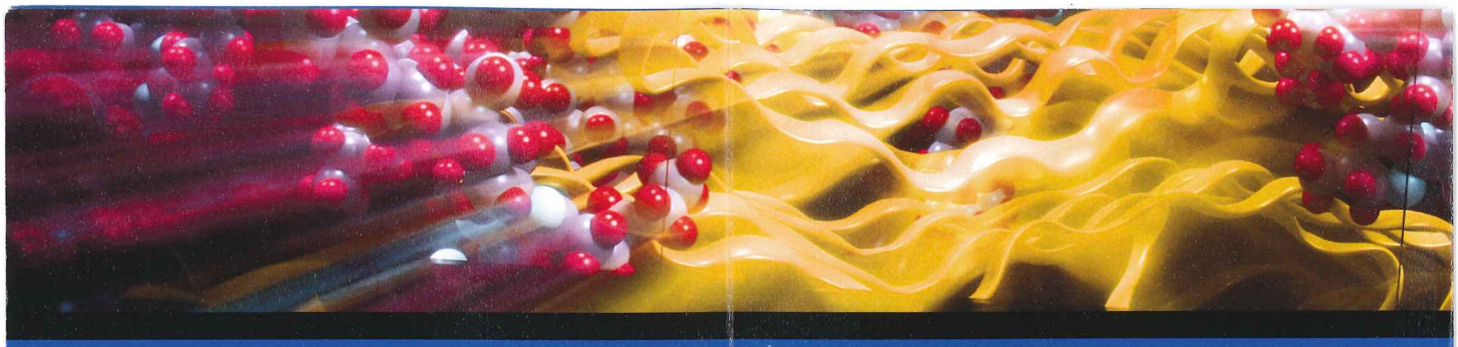
The Center for Structural Molecular Biology (CSMB) at Oak Ridge National Laboratory (ORNL) is dedicated to developing instrumentation and methods for determining the three-dimensional structures of proteins, nucleic acids (DNA/RNA), and their higher-order complexes. The tools of the CSMB will help researchers understand how these 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.

## SANS Facility

A small-angle, neutron-scattering (SANS) facility for biological samples has been constructed at the ORNL High-Flux Isotope Reactor (HFIR). The CSMB is also closely aligned with researchers at the Spallation Neutron Source (SNS).

## Bio-Deuteration Laboratory

The CSMB has established the Bio-Deuteration Laboratory for cloning, protein expression, purification, and characterization of H/D-labeled biological macromolecules.



**SANS** can be used to study biological systems under near-physiological conditions, providing insight into interactions within complexes and conformational changes in response to stimuli. Through the use of deuterium labeling, SANS makes it possible to highlight and map components within larger complexes (e.g., viruses and ribosomes). The SANS instruments at ORNL's HFIR and SNS facilities will open new opportunities for studying conformational changes and molecular processes on biologically relevant timescales.

**Computational Techniques** are being developed for the study of biomacromolecular complexes by SANS. Combined with **deuterium labeling**, they will make it possible to develop detailed structural models that will enable the understanding of function.

**Neutron diffraction, spectroscopy, and scattering** 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
3. characterize higher-order complexes.

These studies use neutrons to address questions that have not been–or cannot be–answered by other techniques.

## Unique Tools for Structural Molecular Biology