

The Bio-Deuteration Lab at Oak Ridge National Laboratory

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The Bio-Deuteration Laboratory (BDL) is being developed at Oak Ridge National Laboratory (ORNL) for production of $^1\text{H}/^2\text{H}$ -labeled biological macromolecules to support development of the neutron structural biology research and user programs at ORNL's neutron scattering facilities. The upgrade and development of the High Flux Isotope Reactor (HFIR) and Spallation Neutron Source (SNS) facilities at ORNL offer unprecedented opportunities to develop a world-leading program of neutron structural biology research in the life sciences. Studies at these facilities are enhanced by the design and production of specific, random, and uniform $^1\text{H}/^2\text{H}$ -labeled biological macromolecules. Deuterium labeling provides contrast and permits labeled parts of macromolecular structures to be highlighted and analyzed in situ. The BDL will serve as a central training/user facility that will be accessible to the broader scientific community.

BDL Objectives

- Develop a laboratory dedicated to specific $^1\text{H}/^2\text{H}$ -labeling of cells, proteins, nucleic acids, and other biological macromolecules
- Develop efficient systems and methods to produce deuterium-labeled biological macromolecules for the biology community
- Improve downstream technologies to exploit these reagents (including data collection and interpretation for neutron scattering)
- Train research students and staff in the application of these powerful techniques

Key BDL Resources

Fermentation

With precise control and monitoring of dissolved oxygen, pH, agitation, and feed solutions, BDL users will be able to produce high-density cell cultures in 1.5- and 5-L vessels with the BioFlo 3000[®] fermentor. Also equipped with software control capability, this bioreactor will be instrumental in the efficient production of $^1\text{H}/^2\text{H}$ -labeled samples by BDL users.



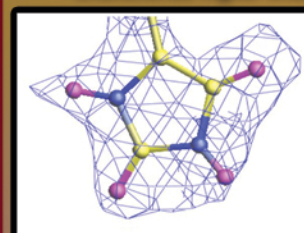
Sample Purification

For those BDL users with the need to purify samples on site, an AKTA FPLC[®] workstation is available for medium-pressure column chromatography at preparative scales on a wide selection of columns.

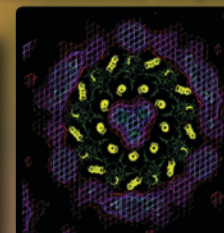


Deuterium labeling will help

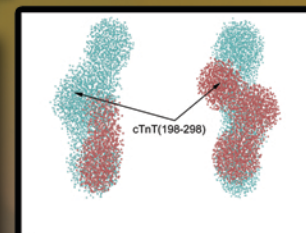
- Pinpoint positions of individual hydrogen atoms
- Probe the structure and dynamics of biological macromolecules
- Characterize higher-order macromolecular complexes



Enzymes - Catalysis



Membrane Proteins



Protein Complexes

The Center for Structural Molecular Biology (CSMB)

The CSMB at ORNL seeks to study complex biological systems using a multidisciplinary approach combining X-ray and neutron scattering methods and molecular biology approaches for isotopic labeling of biological macromolecules. Our goal is to develop and refine experimental techniques, data analysis and modeling methods, and protein production and labeling methodologies in support of the neutron scattering facilities at the SNS and HFIR. We also seek to build the biological neutron scattering community through outreach and collaboration.

For Access to the BDL, please contact

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http://www.ornl.gov/sci/csd/Research_areas/msg_group.html

OAK RIDGE NATIONAL LABORATORY

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