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Smaller Crystals, Larger Proteins: Deuterium Labeling for Neutron Crystallography. Dean Myles¹, Kevin Weiss¹, Dale Pelletier², ¹Center for Structural Molecular Biology, ²Life Sciences Division, ORNL, PO BOX 2008 Oak Ridge, Tn 37831, weissk1@ornl.gov, mylesda@ornl.gov.

Neutron scattering provides a unique, non-destructive probe of delicate biological materials and higher order assemblies and the design and production of H/D labeled material permits selected parts of macromolecular structures to be highlighted and analyzed *in situ*. In neutron protein crystallography, deuteration improves the signal to noise ratio of the data by an order of magnitude, allowing higher quality data to be collected from smaller crystals of larger macromolecular systems. In order to exploit this potential, we have established a Deuteration Laboratory for the *in vivo* production of H/D labeled protein, nucleic acids and other bio-macromolecules to support the user research programs at the HFIR and the SNS neutron scattering facilities at ORNL. The Deuteration Laboratory will provide the support, expertise, training and facilities required to produce specific, selective and randomly H/D labeled proteins and other macromolecules for neutron protein crystallography, small angle scattering, reflectivity and spectroscopic analysis. We will describe the development and application of deuterium labeling for neutron analysis of the structure, function and dynamics of proteins and macromolecular assemblies.