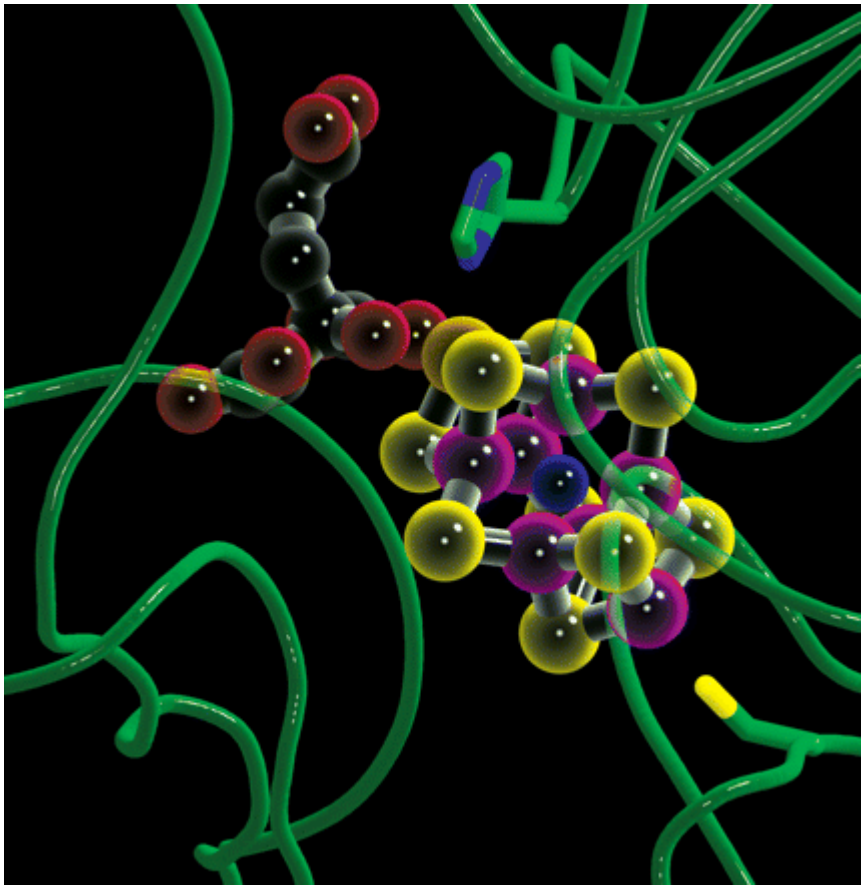
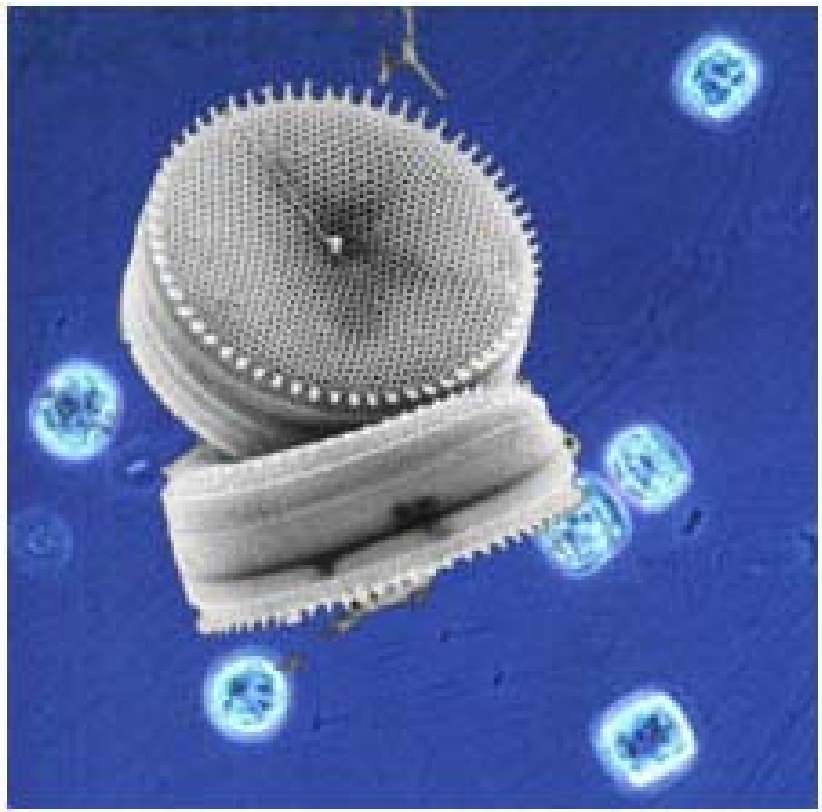
Nitrogenase Cofactor Biosynthesis



SSRL and Stanford scientists, collaborating with a team from UC Irvine, got the first look into the assembly of metal active center of nitrogenase, an enzyme which certain bacteria employ to turn nitrogen from the air into a form that plants can use for healthy growth. In contrast to the enzymatic reaction, manufacturing nitrogen fertilizer chemically requires extreme pressures and temperatures and thus huge amounts of energy.

Y. Hu, M. C. Corbett, A. W. Fay, J. A. Webber, K. O. Hodgson, B. Hedman and M. W. Ribbe *PNAS* **103**, 17119-17130

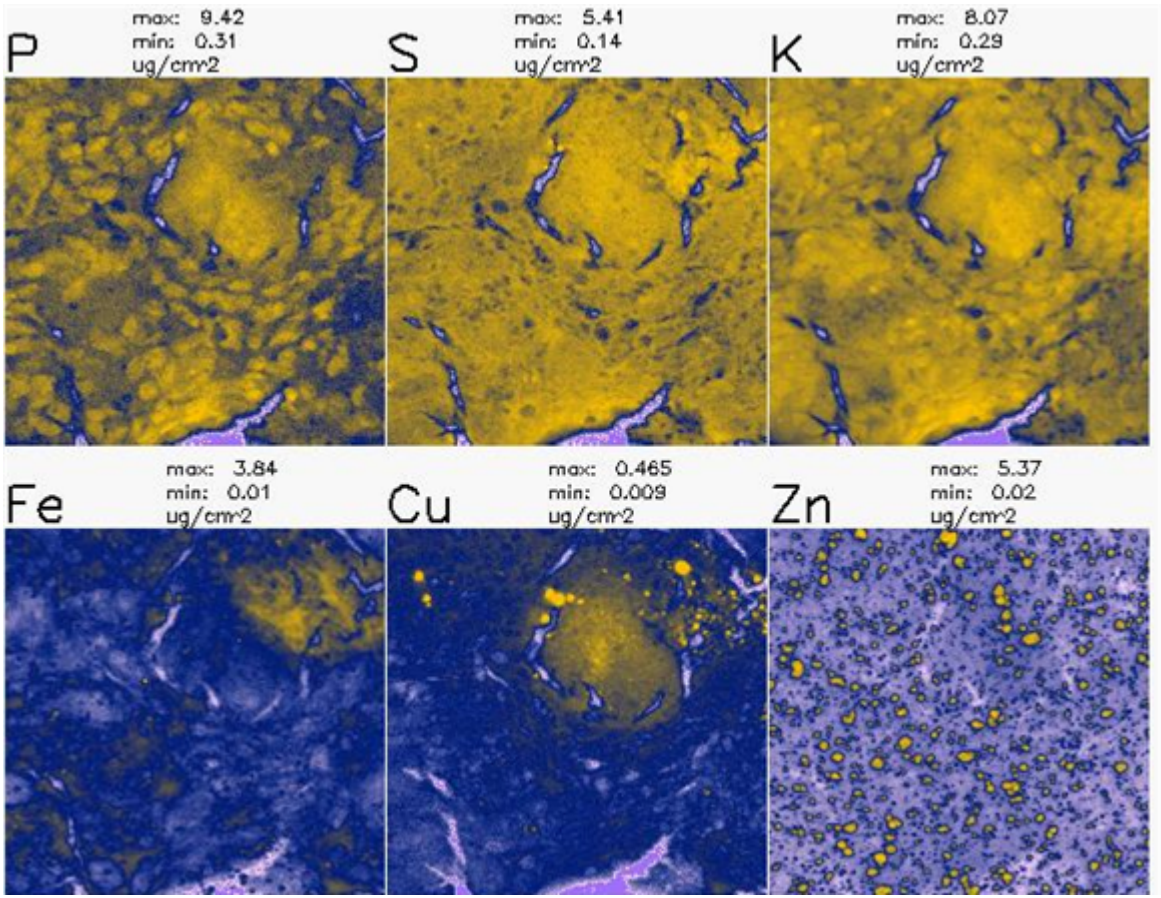
The First Cadmium Enzyme – Carbonic Anhydrase 2 from the Marine Diatom *Thalassiosira weissflogii*



Cadmium is generally thought to be toxic and was not thought to be used by nature in anyway. X-ray absorption experiments on a marine diatom showed that Cadmium is not only of biological importance, but plays an important role in the global carbon cycle.

Lane, T.; Saito, M. A.; George, G. N.; Pickering, I. J.; Prince, R. C.; Morel, F. F. M. "Isolation and Preliminary Characterization of a Cadmium Carbonic Anhydrase from a Marine Diatom" *Nature*, **2005**, 435, 42

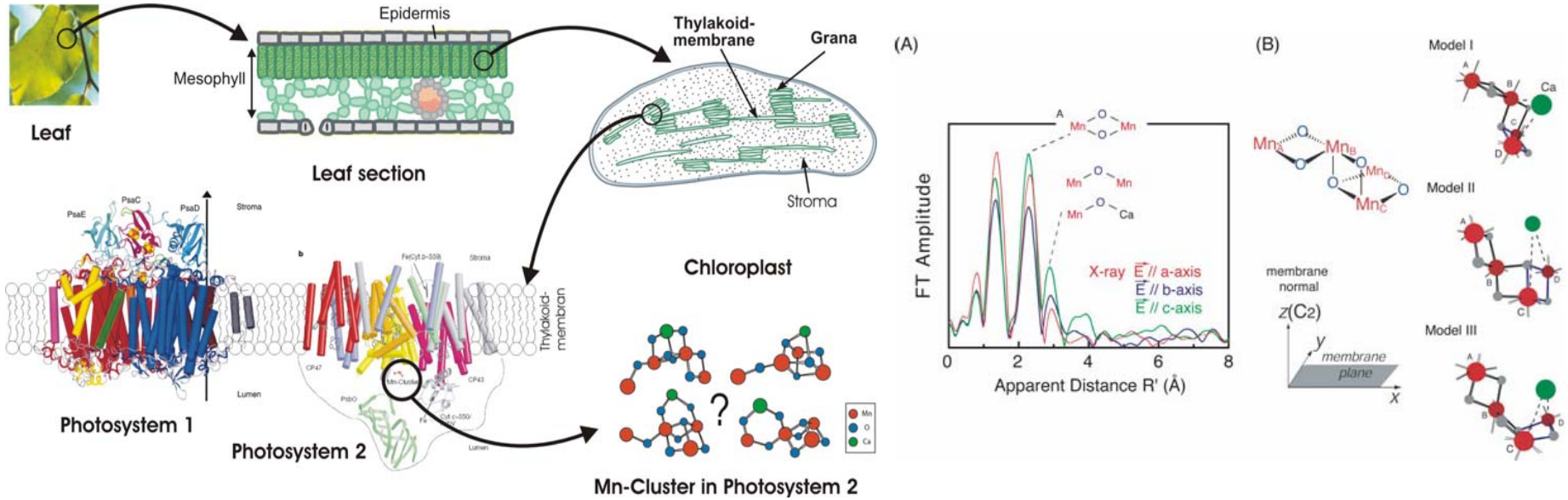
Mapping Elemental Distribution in Diseased Mammalian Tissue



Wilson's disease is a copper metabolism diseases, which results in accumulation of copper in the liver and is ultimately lethal. Synchrotron-based x-ray fluorescence mapping in a mouse model of Wilson's disease is shown. The elemental mapping shows copper accumulation in "hot spots" which are primarily localized around the bile canaliculli, where the first signs of pathology are observed. The overall cellular copper concentration is an order of magnitude greater than in the control mice livers.

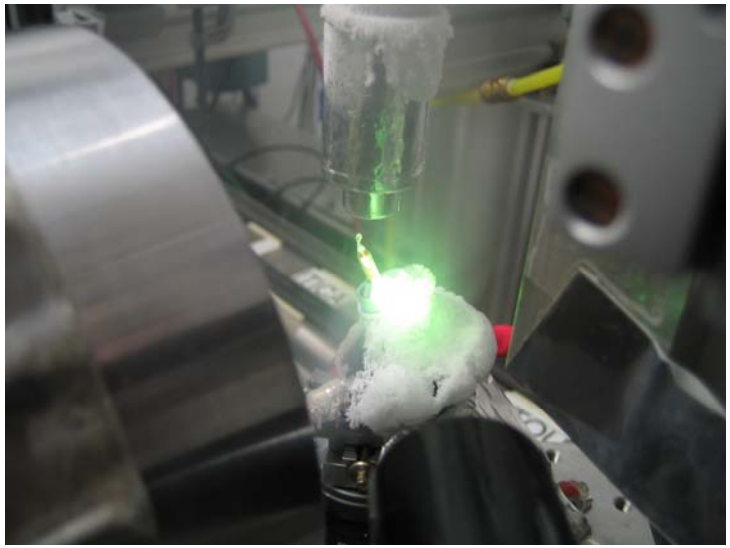
M. Ralle, *unpublished results*.

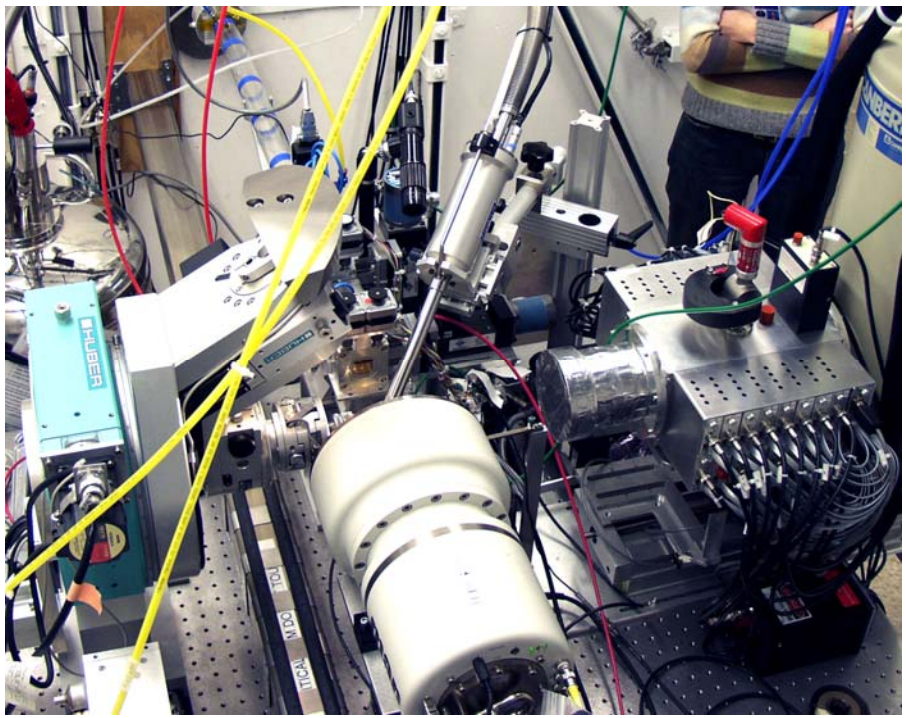
Structural Insights into Photosynthetic Water Oxidation

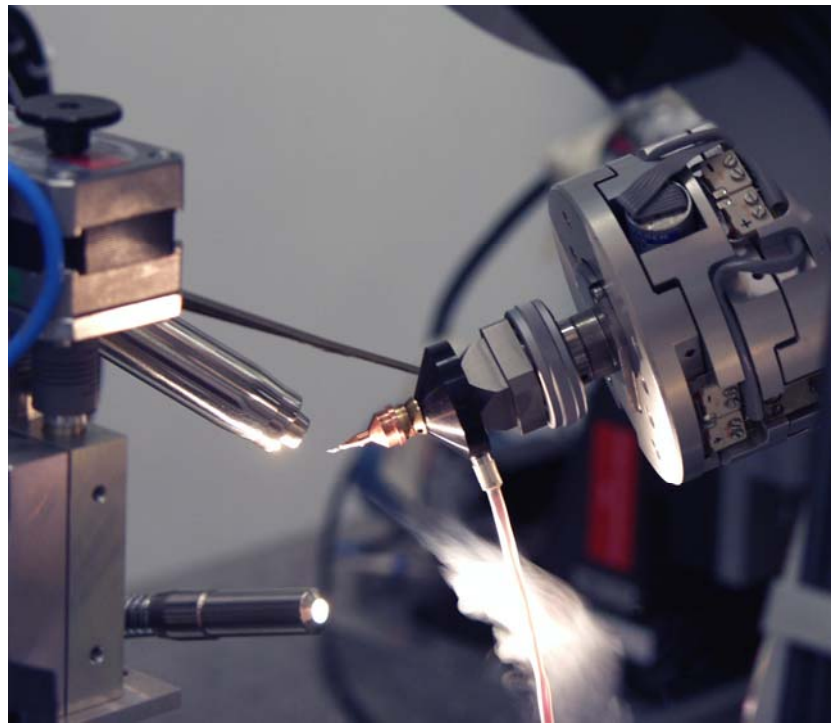


Photosynthetic water oxidation is one of the most fundamental chemical processes that occurs in nature. The process is catalyzed by the Mn_4Ca cluster of the oxygen-evolving complex, but the exact mechanism is unkown. Recent polarized single crystal x-ray absorption spectroscopic studies have helped narrow down the possible structures of this important catalytic site and have established that differences between these results and crystallographic results were an effect of radiation damage during crystallographic structure determination.

J. Yano, J. Kern, K. Sauer, M. J. Latimer, Y. Pushkar, J. Biesiadka, B. Loll, W. Saenger, J. Messinger, A. Zouni, V. K. Yachandra, *Science* **314**, 821 (2006)







Combined Single crystal diffraction and XAS instrumentation at SSRL BL9-3