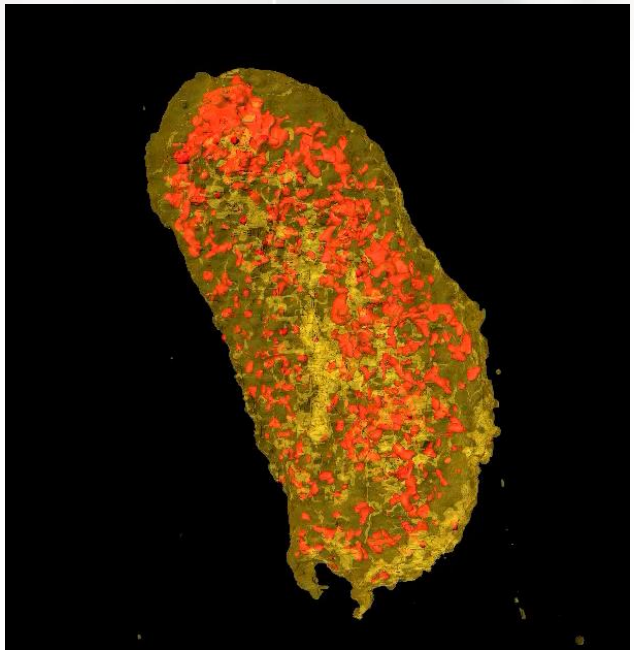
3-D Nanoscale Imaging of Membrane Proteins in Cells



3-D X-ray movie of a single E.coli bacteria where yellow represents the erbium bound to the LBT, which is co-expressed with a membrane protein. Red represents zinc in the cell. At NSLS-II, the cell was imaged with a sub-15 nm X-ray beam, which is the highest resolution X-ray fluorescence tomogram of a biological cell ever collected.

Scientific Achievement

Lanthanide binding tags (LBTs) were used to image an individual membrane protein in bacteria in 3-D with a sub 15-nm X-ray beam.

Significance and Impact

The combination of LBTs and X-ray microscopy has the potential to become a widespread tool for imaging individual proteins in whole cells and tissues at the resolution of the cell membrane and subcellular organelles.

Research Details

- Lanthanide binding tags (LBTs) are short peptides with a high-affinity lanthanide-binding domain.
- They can be genetically "fused" with any protein of interest to generate an X-ray-sensitive protein tag.
- X-ray fluorescence nanotomography was used at the HXN beamline at NSLS-II and the APS Bionanoprobe to simultaneously image the protein of interest along with the trace element composition in the cell.

T. W. Victor, K. H. O'Toole, L. M. Easthon, M. Ge, R. J. Smith, X. Huang, H. Yan, Y. S. Chu, S. Chen, D. Gursoy, M. Ralle, B. Imperiali, K. N. Allen, and L. M. Miller. *Journal of the American Chemical Society* ***142*** (5), 2145-2149 (2020).

Work was performed in part at Brookhaven National Laboratory