

Three-dimensional cell imaging by cryo-soft X-ray tomography at Taiwan Photon Source

Cryo-soft X-ray tomography (SXT) with full-field transmission microscopy is a new growing synchrotron-based technique, which is developed to image 3D complete frozen cells at Taiwan Photon Source TPS 24A beamline in National Synchrotron Radiation Research Center (NSRRC)[1]. To avoid the radiation damage, bio-samples have to be frozen in liquid ethane condition and transferred to be imaged by soft X-ray irradiation. We adopted an energy at 520 eV which is an energy in water window, energies between K-edge absorption of carbon (284 eV) and oxygen (543 eV), to image the cell sample, which could produce high absorption of carbon and ignore the oxygen absorption from the water to obtain the image in natural contrast. SXT is a complementary technique with fluorescence microscopy and electron microscopy to allow quickly 3D native cell image without the requirement of dye labelling and sample slicing. In TPS 24A, an off-line cryo-fluorescence microscopy was currently employed to obtain fluorescence image which could be correlated with the image from SXT to understand the functional and structural information on region of interest (ROI) of samples. Therefore, some biomedical studies can be conducted by SXT, such as mast cell degranulation, drug development and interaction of microorganism with host cells [2-4]. We will demonstrate 3D morphology of organelles in cells clearly, including mitochondria, lipid droplet and nuclear membrane from frozen cells in this meeting.

References:

- [1] L. J. Lai, G. C. Yin, Y. J. Su et al., *Microsc. Microanal.* 24 (Suppl 2), 394 (2018).
- [2] H. Y. Chen, D. M. L. Chiang, Z. J. Lin et al., *Scientific Reports* 6, 34879 (2016).
- [3] J. J. Conesa, A. C. Carrasco, V. Rodriguez-Fanjul et al., *Angew. Chem. Int. Ed.* 59, 1270 (2020).
- [4] A. J. Pérez-Berná, M. J. Rodríguez, F. J. Chichón et al., *ACS Nano* 10, 6597 (2016).

Primary author: Dr LAI, Lee-Jene (National Synchrotron Radiation Research Center)

Co-authors: Dr LIN, Zi-Jing (National Synchrotron Radiation Research Center); Mr HSIEH, Chia-Chun (National Synchrotron Radiation Research Center); Dr LIN, Yi-Hung (National Synchrotron Radiation Research Center); Dr HUA, Mo Da-Sang (National Synchrotron Radiation Research Center)

Presenter: Dr LAI, Lee-Jene (National Synchrotron Radiation Research Center)