Ion beam based analysis for medical application Hamamatsu Univ.¹, International Mass Imaging Center², [°]Mitsutoshi Setou¹² E-mail: setou@hama-med.ac.jp

Ion beam is, for the medical field, a relatively novel technology which can visualize the distributions of several biomolecules with high spatial resolution. In this symposium, I'd like to talk about biological and medical applications of "cluster ion beam based TOF-SIMS" and which is one of imaging mass spectrometry techniques and enables visualization of molecular distribution with sub-micron spatial resolution. Structural variations of DNA in nuclei are deeply related with development, aging, and diseases through transcriptional regulation. In order to bare cross sections of samples maintaining sub-micron structures, an Ar2500(+)-gas cluster ion beam (GCIB) sputter was recently engineered. By introducing GCIB sputter to time-of-flight secondary ion mass spectrometry (TOF-SIMS), we analyzed the 3D configuration and chemical composition of subnuclear structures of pyramidal cells in the CA2 region in mouse brain hippocampus. Depth profiles of chemicals were analyzed as 3D distributions by combining topographic analyses. Signals corresponding to anions such as CN(-) and PO3(-) were distributed characteristically in the shape of cell organelles. CN(-) signals overlapped DAPI fluorescence signals corresponding to nuclei. The clusters shown by PO3(-) and those of adenine ions were colocalized inside nuclei revealed by the 3D reconstruction. Taking into account their size and their number in each nucleus, those clusters could be in the cleavage bodies, which are a kind of intranuclear structure. In addition, I want to introduce collaboration on Helium ion based microscopy for medical application.

Ref:

Three-Dimensional Image of Cleavage Bodies in Nuclei Is Configured Using Gas Cluster Ion Beam with Time-of-Flight Secondary Ion Mass Spectrometry.

Masaki N, Ishizaki I, Hayasaka T, Fisher GL, Sanada N, Yokota H, Setou M.Sci Rep. 2015 May 11;5:10000.