Investigation of the Coral-dinoflagellate Endosymbiosis by Utilizing Synchrotron Radiation-based Technique

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Endosymbiosis in cnidaria-dinoflagellate association plays a critical role in regulating growth and productivity of corals and relates marine ecosystems. Cellular endosymbiosis with dinoflagellate Symbiodinium spp. (i.e. the symbiont or “zooxanthellae” in generic name) within corals (i.e. the host) is initiated by the internalization of symbionts via phagocytic process into host endoderm cells. However, the mechanism by which the symbiont is able to reside at inside of the host cell and establishes an obligatory and mutualistic association still remains ambiguous after four decades of investigation [1]. Thus, we tried to use varied molecular and cellular technologies for exploring the molecular mechanism of the endosymbiosis within cnidaria-dinoflagellate [2,3]. Fortunately, non-destructive synchrotron-radiation-based infrared microspectroscopy (SR-IMS) and nano-transmission X-ray microscopy (SR-nTXM) also provides a solution for investigating 2D chemical images and 3D tomography images within coral tissue, respectively. We have established the suitable protocols for employing these synchrotron-radiation-based technologies to study marine cnidarian sample. The preliminary results of SR-IMS revealed that the chemical composition within symbiotic algae (dinoflatellate) were different at symbiotic or aposymbiotic (free living) state, especially the level of glycogen, ester, phospholipids, nitride related molecules. The SR-nTXM was employed for investigating the 3D tomography for cellular localization of cytoskeleton protein within coral tissue. The fluorescent image of actin cytoskeleton protein of coral tissue was also to be acquired for comparing the protein images of using SR-nTXM. The results revealed that the SR-nTXM was able to detect the actin cytoskeleton protein at the similar location within coral tissue. These preliminary results demonstrated that synchrotron-radiation-based technologies should be applied to investigate the endosymbiosis in cnidarian-dinoflagellate successfully.

References: