Correlation between Cell Adhesion-associated Proteins on Patterned Surfaces using Multicolor Super-resolution Localization Imaging

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Cell adhesion-associated proteins, which include integrin family, focal adhesion kinase, paxillin, vinculin, zyxin, talin, Src, actin, and etc., are the important components in controlling the cell behavior, such as the intracellular and extracellular signal transduction, cell adhesion, motility and migration, embryonic development, tissue function, inflammation, and wound healing. Because these cell behaviors can be regulated by multiple adhesion-associated proteins, it is difficult to obtain the contribution from individual proteins using conventional optical imaging. In this report, we have investigated the formation of the cell adhesion on the nano-patterned extracellular matrix using Chinese hamster ovary (CHO) cells. When the cells attach or migrate on the extracellular matrix, such as the fibronectin and collagen, nano-patterned surfaces, the formation of focal adhesion can be manipulated by the extracellular matrix nano-patterns. However, the conventional optical imaging cannot be used to visualize the individual proteins on the fibronectin nano-patterned surface, due to the optical diffraction limit. Therefore, the multi-color super-resolution localization imaging was used to investigate the response of the cell adhesion-associated proteins on the fibronectin nano-patterned surfaces. The spatial correlation of the cell adhesion-associated proteins has been investigated by super-resolution fluorescence imaging with a few tens of nanometers spatial resolution. Combining the protein pair correlation analysis, it quantitatively provides the molecular information of the cell adhesion-associated proteins in the different types of focal adhesions.