Revealing the Contribution of Glycan Structures to Galectin-dependent Glycoprotein Dynamics

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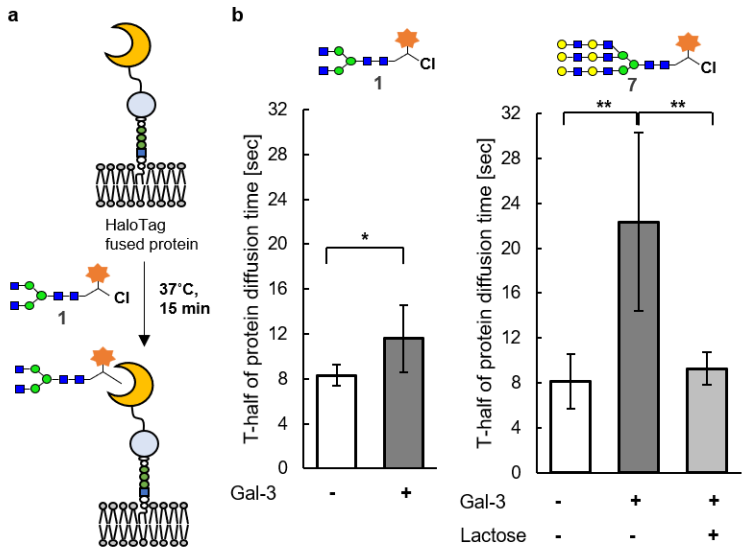
Glycans regulate the function of membrane molecules via interaction networks with various molecules. The temporal and spatial structural diversity of glycans makes it extremely difficult to correlate the glycan structures with the function of membrane molecules. Therefore, we have developed a method to display synthetic homogeneous glycans to membrane proteins on the cell surface via HaloTag protein. Furthermore, we applied this system to analyze the regulation of protein dynamics by the interaction between glycans and Galectin-3 (Gal-3).

Gal-3 forms a network structure called galectin lattice on the membrane via glycoprotein recognition.[1)] Although the galectin lattice has been thought to suppress the dynamics of membrane proteins and regulate their function, precise verification of galectin lattice functions dependent on glycan structures has been difficult. Therefore, we measured the lateral diffusion rate of the protein with the homogeneous synthetic glycans by several live cell imaging methods. These analyses showed that the lateral diffusion of target protein with Gal-3 high-affinity glycan ligands (Ligand 7) was significantly suppressed by Gal-3. Furthermore, the Gal-3 was able to divide the lateral diffusion of the target proteins into two major groups according to the degree of the inhibition. This result suggested that the percentage of proteins which were trapped by the galectin lattice depends on the Gal-3 affinity of glycans.

In conclusion, we have succeeded in analyzing the function of galectin lattice for each glycan structure.



The method to display synthetic homogeneous glycans to membrane proteins via HaloTag (a). The lateral diffusion analysis of HaloTag fused protein (b).

Bibliographic references:
I. R. Nabi, J. Shankar, J. W. Dennis (2015), J. Cell. Sci. (128) 2213-2219.