Visualization of Accumulation of Galectins Around Damaged Organelles: Cytosolically Exposed Glycans as Novel Mediators of Cellular Response

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Abstract

Galectins are β-galactoside-binding lectins containing one or two conserved carbohydrate-recognition domains (CRD). They do not contain a classical leader sequence and are found mostly inside the cells, although they can also be released by cells. Recently, a picture has emerged that galectins can bind to cytosolic glycans that become exposed when intracellular vesicles or organelles are damaged. We found galectin-3 accumulated around *Listeria monocytogenes* escaping from phagosomes, through binding to host N-glycans on the membrane of damaged phagosomes that contained the bacteria. Moreover, through this mechanism, galectin-3 suppressed autophagic activation induced by the bacterial infection. We also found in the gastric epithelial line AGS cocultured with *Helicobacter (H). pylori*, galectin-8 accumulated around damaged lysosomes in a host O-glycan-dependent manner. We employed a model system in which Chinese hamster ovary (CHO) cells are allowed to endocytose a photosensitizer, aluminum phthalocyanine disulfonate (AlPcS2a), and then be illuminated to induce damage of the endosomes containing the photosensitizers. We found that galectin-3 and -8 accumulated around the damaged endosomes in a carbohydrate-dependent manner and became colocalized with autophagic adapters and markers. Studies with super-resolution fluorescence microscopy revealed that these two galectins accumulated in different microdomains on damaged endosomes. Importantly, alterations in cell surface glycosylation induced by extracellular factors can be “sensed” by cytosolic galectins and transmitted as altered cellular responses, through the above-described mechanism.

Keywords: galectins, glycans, intracellular organelle, autophagy

References

[1] Weng, I.-C., Chen, H.-L., Lo, T.-H., Lin, W.-H., Chen, H.-Y., Hsu, D.K., and Liu, F.-T. Cytosolic galectin-3 and -8 regulate antibacterial autophagy through differential recognition of host glycans on damaged phagosomes. Glycobiol 23:392-405, 2018 (Editor’s Choice).

[2] Li, F.-Y., Weng, I.-C., Lin, C.-H., Kao, M.-C., Wu, M.-S., Chen, H.-Y., Liu, F.-T. Helicobacter pylori induces intracellular galectin-8 aggregation around damaged lysosomes within gastric epithelial cells in a host O-glycan-dependent manner. Glycobiol 29:151-162, 2019 (Editor’s Choice).

2019.

[4] Hong, M.-H., Lin, W.-H., Weng, I.-C., Hung, Y.-H., Chen, H.-L., Chen, H.-Y., Chen, P., Lin, C.-H., Yang, W.-Y. Liu, F.-T. Intracellular galectins control cellular responses commensurate with cell surface carbohydrate composition. Glycobiol 30:49-57, 2019 (Editor’s Choice).