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Analysis of an Osmo-Sensing System That is Involved in Salt- and Osmo-Tolerance in Yeast

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Summary

Adaptation to high salt and high osmolarity conditions is a fundamentally important biological response of all types of cells, ranging from bacteria, fungi, plants, and animals. In yeast, for example, external high salt and high osmolarity conditions activate the HOG (High Osmolarity Glycerol) MAP kinase (MAPK) pathway, which is essential for yeast to adapt to and survive on those conditions. MAP kinase cascades are conserved signaling modules composed of three sequentially activated kinases (MAPKKK, MAPKK, and MAPK). The HOG pathway can be activated by either of two upstream pathways, termed the SHO1 or SLN1 branches. However, the osmosensing mechanism in the SHO1 branch has not been clearly defined.

In this study, we showed that Sho1 formed a homomultimer via its tarnsmembrane regions. Sho1 is a tetra-membrane-spanning protein to play a crucial role in osmosensing in concert with osmosensors Hkr1/Msb2. Intermolecular thiol cross-linking experiments revealed that Sho1 molecules were associated at two distinct interphases of TM1/4 and TM2/3 to form a homomultimer. Three Sho1 molecules bound at the TM2/3 interphase, while two bind at the TM1/4 one. These interactions of Sho1 result in formation of a lateral polymer structure on the plasma membrane, in which other membrane proteins such as Hkr1, Msb2 and Opy2 may interact and coordinately work with Sho1 for osmosensing.