ORGANELLE BIOGENESIS

Tethering the membranes

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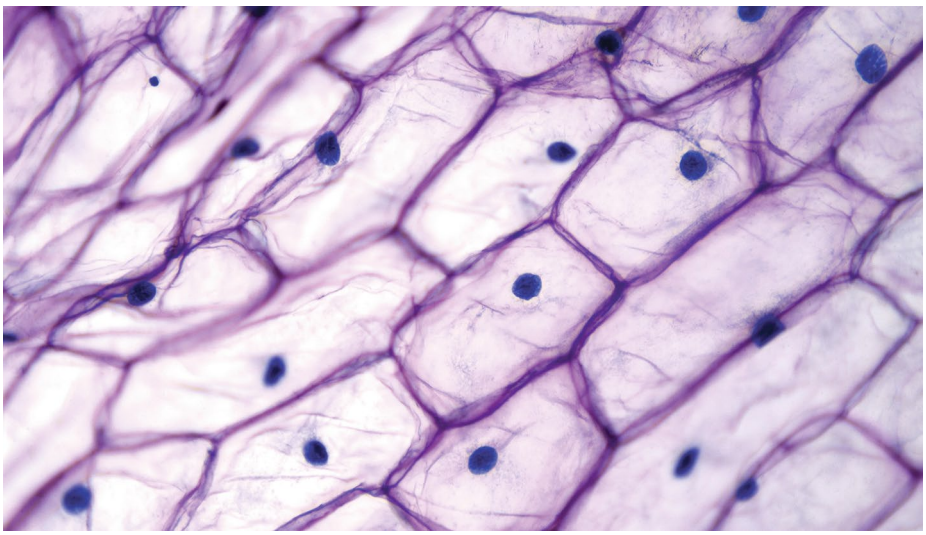

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A vacuole is a single-membrane organelle and likely the biggest one in most types of differentiated plant cells. It is also present in fungal, bacterial and some animal cells. Two multi-subunit complexes, class C core vacuole/endosome tethering (CORVET) and homotypic fusion and vacuolar protein sorting (HOPS), are reported to be required for vacuole biogenesis in yeast. However, in plants, their function has not been well characterized until recently.

The Takashi Ueda group at the National Institute for Basic Biology, Japan, published a paper earlier this year demonstrating the involvement of CORVET and HOPS in plant vacuolar/endosomal trafficking. The researchers characterized the shared core subunit VPS18, CORVET-specific subunit VPS3, and HOPS-specific subunit VPS39 in *Arabidopsis* by showing their subcellular localization and testing their interactive partners. Interestingly, CORVET subunits are colocalized in cytosolic puncta, while HOPS subunits reside in vacuole membranes. Their interaction with distinct RAB GTPases and sorting complex SNAREs also indicated their different functions in vascular/endosomal transport. Knockout mutants, *vps18*, *vps3* and *vps39* were shown to be lethal, while conditional knockdown lines displayed altered vacuole morphogenesis after induction, validating the conserved roles of CORVET and HOPS tethering complexes in vacuole transport.

In another work recently published by the Marcelar Rojas-Pierce group at North Carolina State University, USA, two tethering complex subunits are investigated in *Arabidopsis*. The core subunit VPS33 and HOPS-specific subunit VPS41 were shown to be localized in cytosol, although VPS41 is preferentially associated with vacuole membranes. In addition, both VPS33 and VPS41 were found to be associated with phosphoinositides (PIs), including PI(3)P and PI(3,5)P, which are the most abundant PIs at the membranes of vacuoles and late endosomes. Knockout mutants of VPS33 and VPS41 were shown to be male gametophyte lethal; but missense mutations and knocking down the expression of VPS33 or VPS41 caused aberrant fragmented vacuoles, confirming the roles of HOPS in tethering vacuole membranes in plants. The genetic and protein–protein interactions between VPS33/41 and vacuolar SNARE proteins, SYP22 and VTI11, were also tested.

Vacuoles are multi-functional organelles in charge of turgor maintenance, protein storage, metabolite accumulation, cellular degradation, recycling and so on. Understanding the detailed cellular mechanisms for vacuole biogenesis is important for us to understand plant growth and development.

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