INSTITUTIONEN FÖR BIOLOGI OCH MILJÖVETENSKAP

Hey ho, let's go!
Vesicle transport in chloroplasts

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Abstract

The photosynthetic reactions have been thoroughly studied, but less is known about the biogenesis of the structures harboring the photosynthetic machinery: the thylakoid membranes. Lipids, constituting both the envelopes and thylakoids, are amphipathic molecules with both hydrophobic and hydrophilic ends. Due to this, lipids are not likely to pass the stroma spontaneously, but rather arranged in a way that isolates the hydrophobic parts from the water-based surrounding. As the thylakoid lipids are produced at the envelopes, they have to pass the stroma. Hypotheses about how this is accomplished have been suggested over the years, ranging from invaginations of envelope membranes and direct contact sites between envelope and thylakoid membranes, to lipids being transferred as small spheres, i.e. vesicles. Indeed, vesicles have been identified with electron microscopy, but although repeatedly observed, not much focus has been given to how vesicles in the chloroplast could be regulated.

Vesicle transport is known from the cytosol of both animals and plants. There, vesicles with protein cargo shuttle different compartments and the process is highly regulated by different sets of proteins. In **paper I** we show that vesicles are not only present in the cytosol of plants, but also in chloroplasts and other plastids. These vesicles can be found during different conditions and temperatures, and without chemical inhibitors. This indicates that vesicles are persistent features. How chloroplastic vesicles are regulated is largely unknown, although they are strongly suggested to be of eukaryotic origin and appear to have similarities with cytosolic vesicle systems. In **paper II** and **III**, we used a bioinformatics approach to identify putative components of vesicle transport in the chloroplast. Several homologs to COPII proteins of the cytosol were identified in the chloroplast (**paper II**), but interestingly, homologs related to the cytosolic COPI and CCV systems could not be identified to the same extent (**paper III**). It was therefore suggested that the vesicle system in chloroplasts is most similar to COPII, or even unique. In **paper IV**, one of the homologs was characterized and proposed to have a role in vesicle fusion.