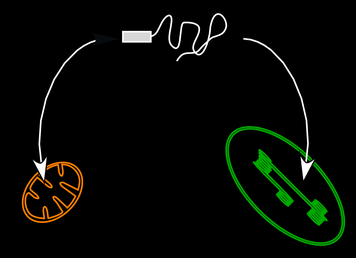
Dual targeting

Organelle specificity of nuclear encoded proteins



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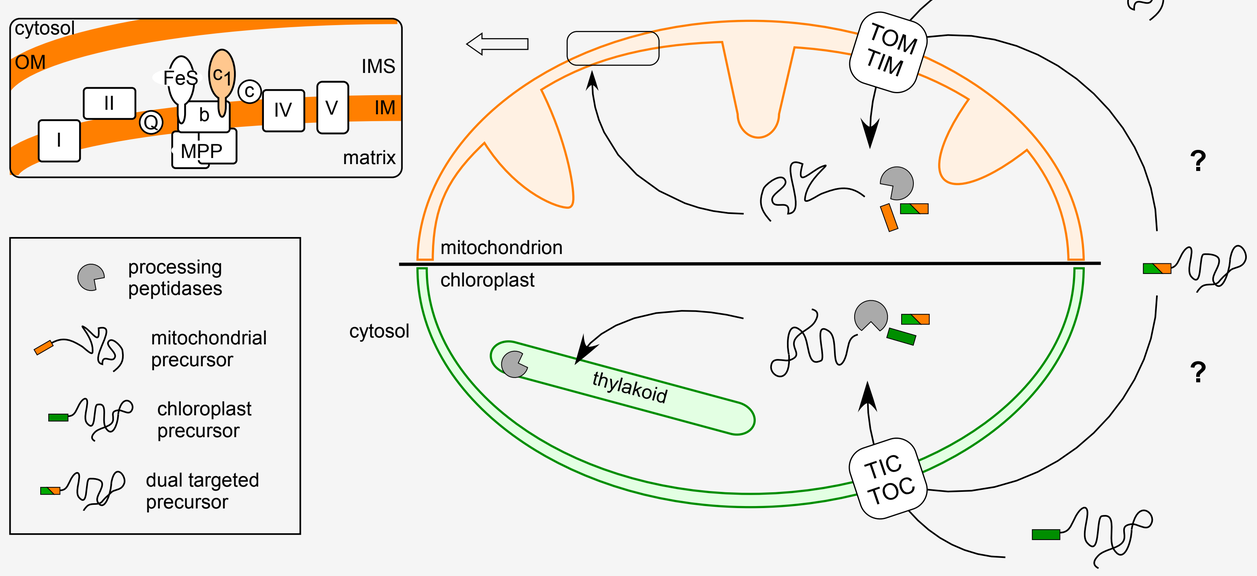
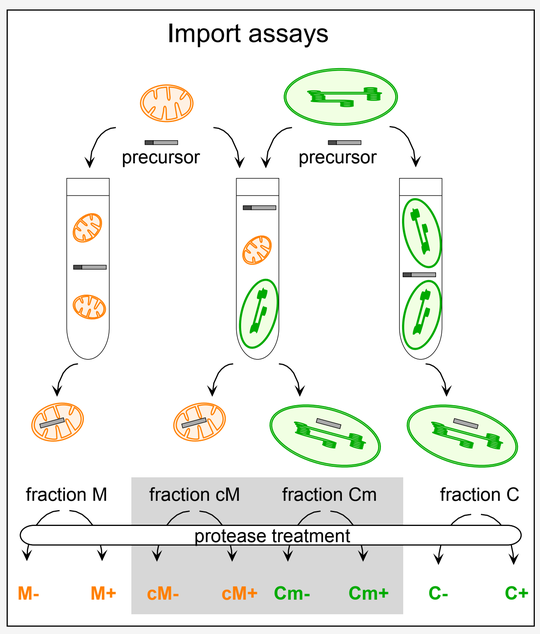
Most mitochondrial and chloroplast proteins are encoded in the nucleus and synthesized as precursors in the cytosol carrying targeting signals mediating transport into their organelle. Generally, targeting signals are specific for a single organelle only, either mitochondria or chloroplasts. But more and more proteins are identified that can be transported into both organelles - these are called **dual targeted proteins**.

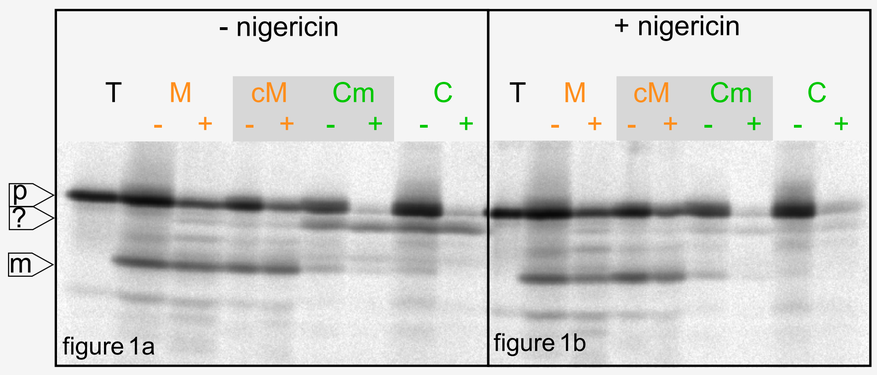
One example for such a dual targeted protein is cytochrome c1. This component of the respiratory chain must be expected to be specifically targeted only into mitochondria. However, ...

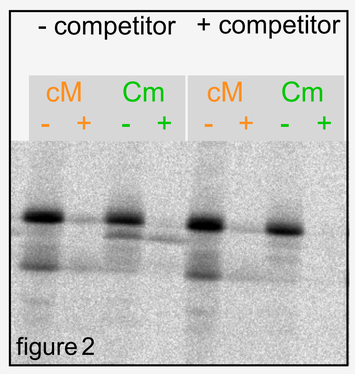


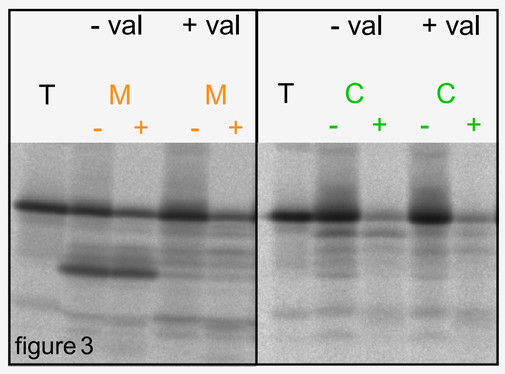


T	translation
M	singleImport mitochondria
cM	dualImport mitochondria
Cm	dualImport chloroplasts
C	singleImport chloroplasts
-/+	without/with protease

p - precursor protein
m - mature protein
? - unknown product







Cytochrome c1 is transported *in vitro* into both, mitochondria and chloroplasts.

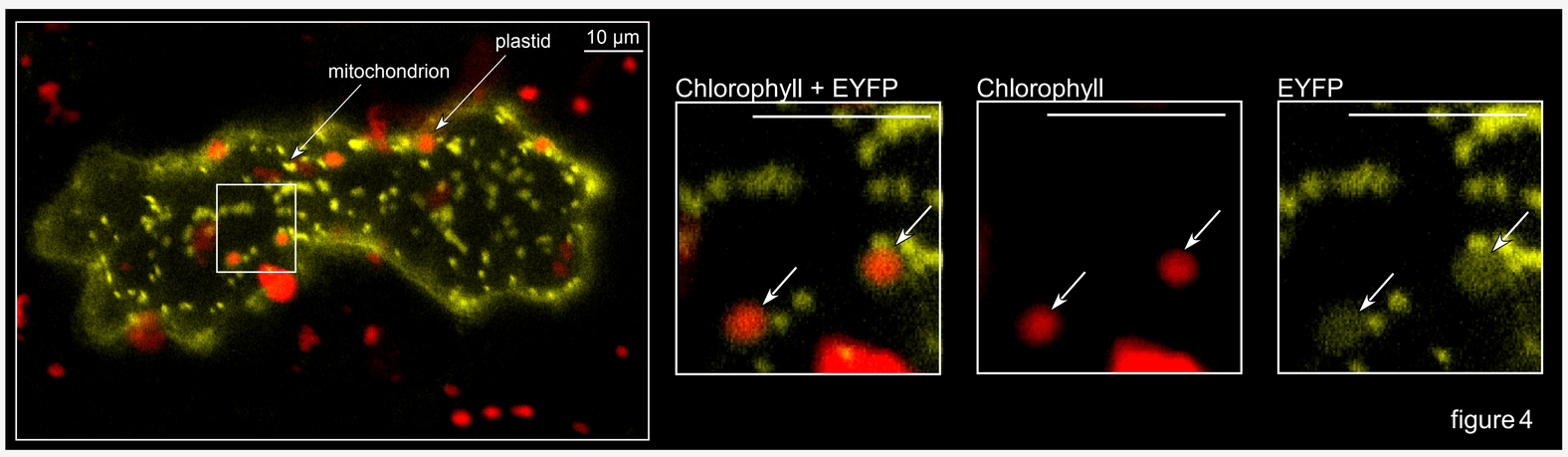
Dual targeting is observed with single organelle as well as mixed organelle assays. Within the organelles, processing occurs at different positions of the protein (figure 1a).

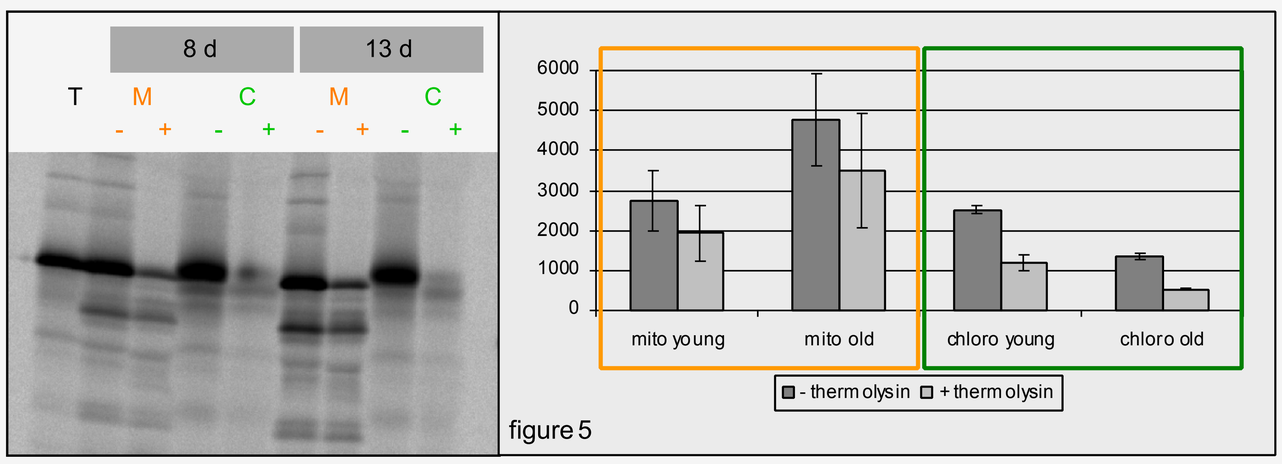
Cytochrome c1 uses the same transport machinery as authentic chloroplast substrates.

Chloroplast import is inhibited in the presence of the ionophore nigericin (figure 1b). Authentic plastid precursors like preOEC33 compete with cytochrome c1 for import into chloroplasts (figure 2). Mitochondrial import is affected by adding valinomycin (figure 3).

The cytochrome c1 presequence targets EYFP to mitochondria and plastids *in vivo*.

The cytochrome c1 presequence was fused N-terminally to EYFP and expressed transiently after particle bombardment in leaf epidermis cells of pea. EYFP and chlorophyll fluorescence are visualized by confocal microscopy (figure 4).





Organelle specificity might change with plant age.

Transport experiments were performed with organelles isolated from pea grown for 8 days or 13 days, respectively. With increasing age of the plants mitochondrial import of cytochrome c1 goes up while chloroplast import declines (figure 5).

This work is supported by the SFB 648.

References

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Rudhe, C., Chew, O., Whelan, J. and Glaser, E. (2002) A novel in vitro system for simultaneous import of precursor proteins into mitochondria and chloroplasts. Plant J. 30, 213-220.