

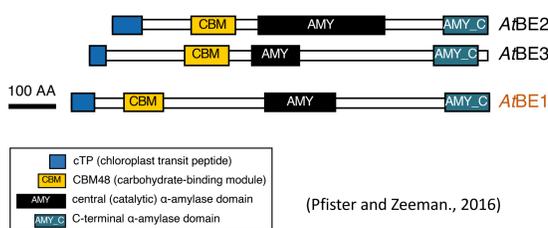
Neofunctionalization of a starch-metabolic protein to an essential factor for chloroplast development

Yuanyuan Liang, Melanie Abt, Martha Stadler, Andrea Fontana, Samuel Zeeman, and Barbara Pfister
Institute of Molecular Plant Sciences, ETH Zurich, Switzerland

Introduction

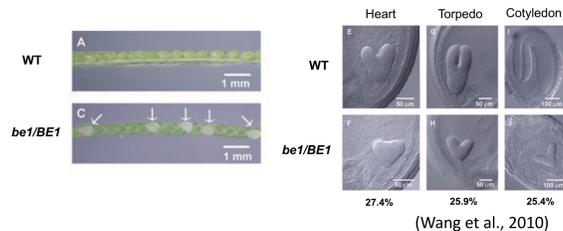
Arabidopsis BRANCHING ENZYME 1 (BE1) was predicted to be involved in starch metabolism, but functions distinctively from the canonical starch-branching enzymes.

The starch-branching enzyme family



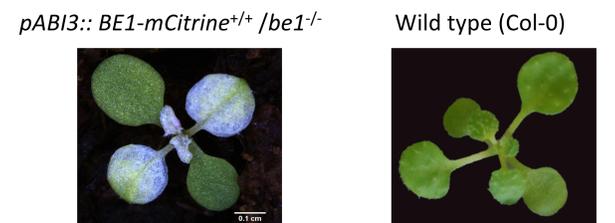
BE1 shares only 30% amino acid identity to BE2 and BE3 .

Arabidopsis *be1* mutants are embryo defective



The embryo development of the *be1* mutant arrests at the heart stage.

BE1 is essential for post-embryonic development

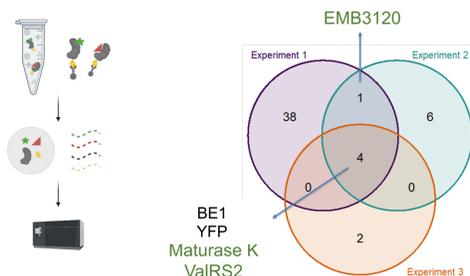


The embryo-defective phenotype of *be1* mutants can be rescued by specifically expressing *BE1* during embryogenesis (using *pABI3*), but the seedlings develop white true leaves and are inviable.

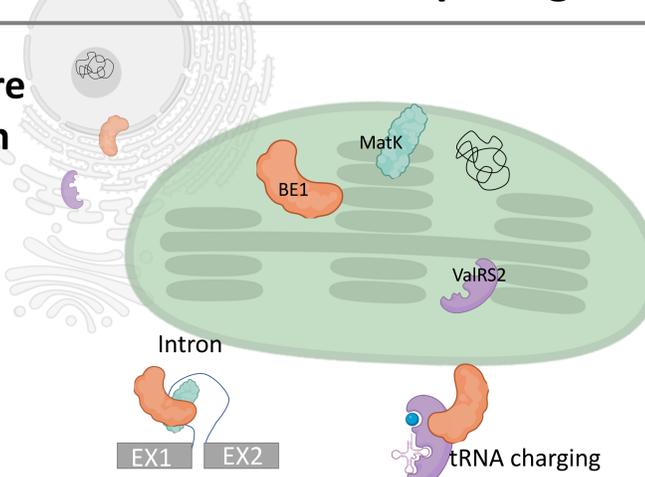
BE1 may be involved in chloroplast gene expression

BE1 interacts with proteins that are involved in plastid gene expression

Interaction partners were identified by immunoprecipitation coupled with mass spectrometry

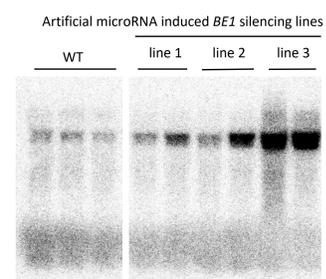
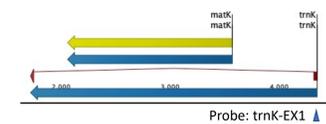


MatK: plastid-specific splicing factor
ValRS2: chloroplast-localized tRNA synthetase



Nuclearly encoded BE1 locates to plastids where it may function in gene expression by interacting with proteins like MatK and/or ValRS2.

BE1 appears to be involved in intron splicing



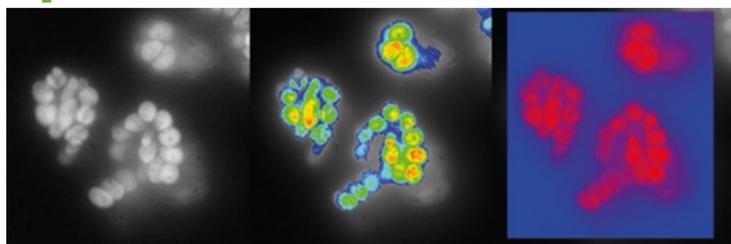
Northern blots show the accumulation of unspliced *trnK* precursors in *BE1* silencing mutants, indicating that BE1 may be required for chloroplast intron splicing.

Industrial cooperation

Improving methodologies for photosynthetic measurements



Fluorescence Kinetic Microscope

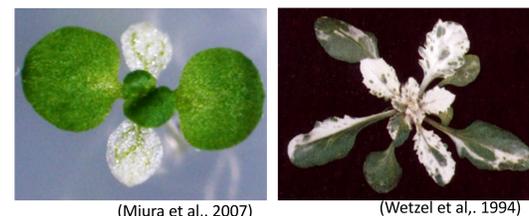


- Micrometre resolution (allows to assess individual chloroplasts)
- Non-destructive measurement of intact plants

Dynamic photosynthetic measurements at the sub-cellular level

Research
Industry

Investigate developmental transitions / response to stress treatments



Cell-to-whole plant phenotypic data

Research
Industry

Plant breeding, automatic agronomy

Summary

Arabidopsis BE1 that was predicted to be involved in starch metabolism is actually associated with components of the chloroplast gene expression machinery and essential for plastid development.