



CORTICAL ER – PM CONTACT SITES IN PLANTS

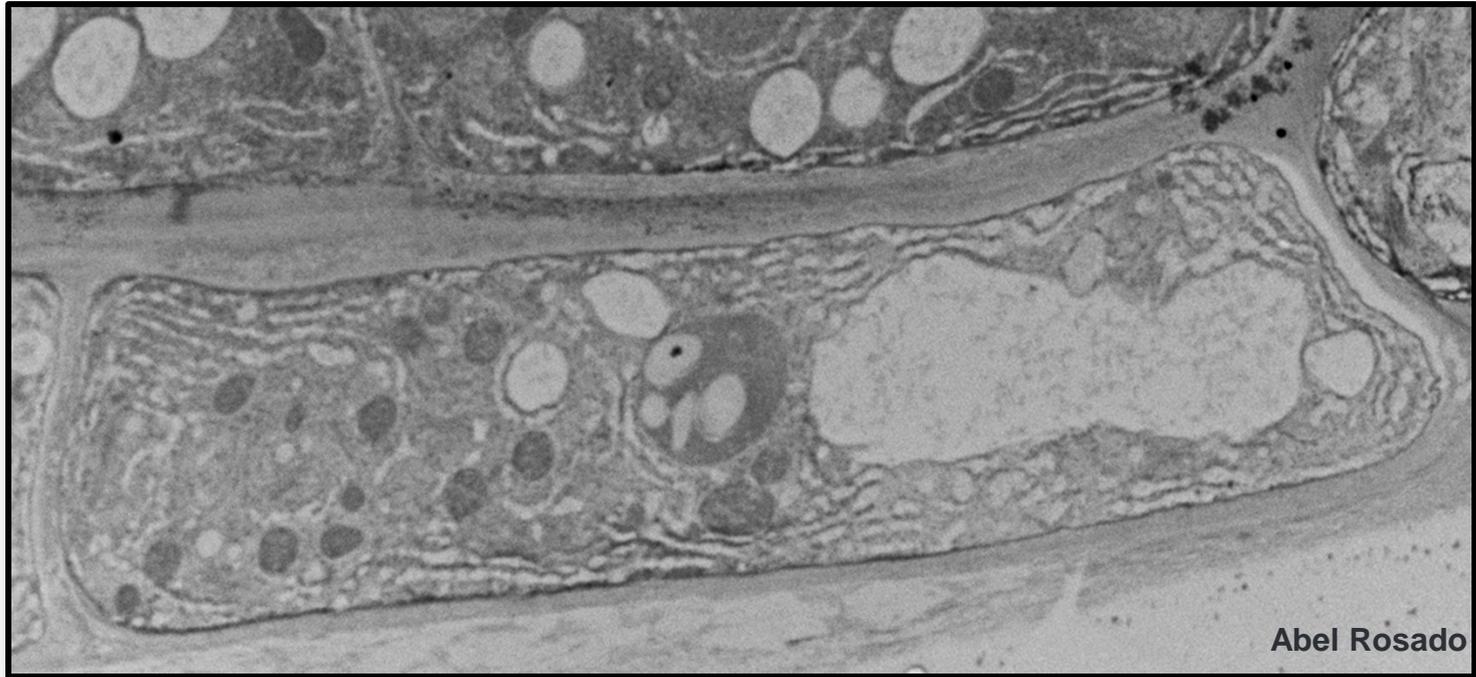
**Where Cell Biology meets abiotic
stress tolerance**



**EUROPEAN NETWORK FOR PLANT
ENDOMEMBRANE RESEARCH**

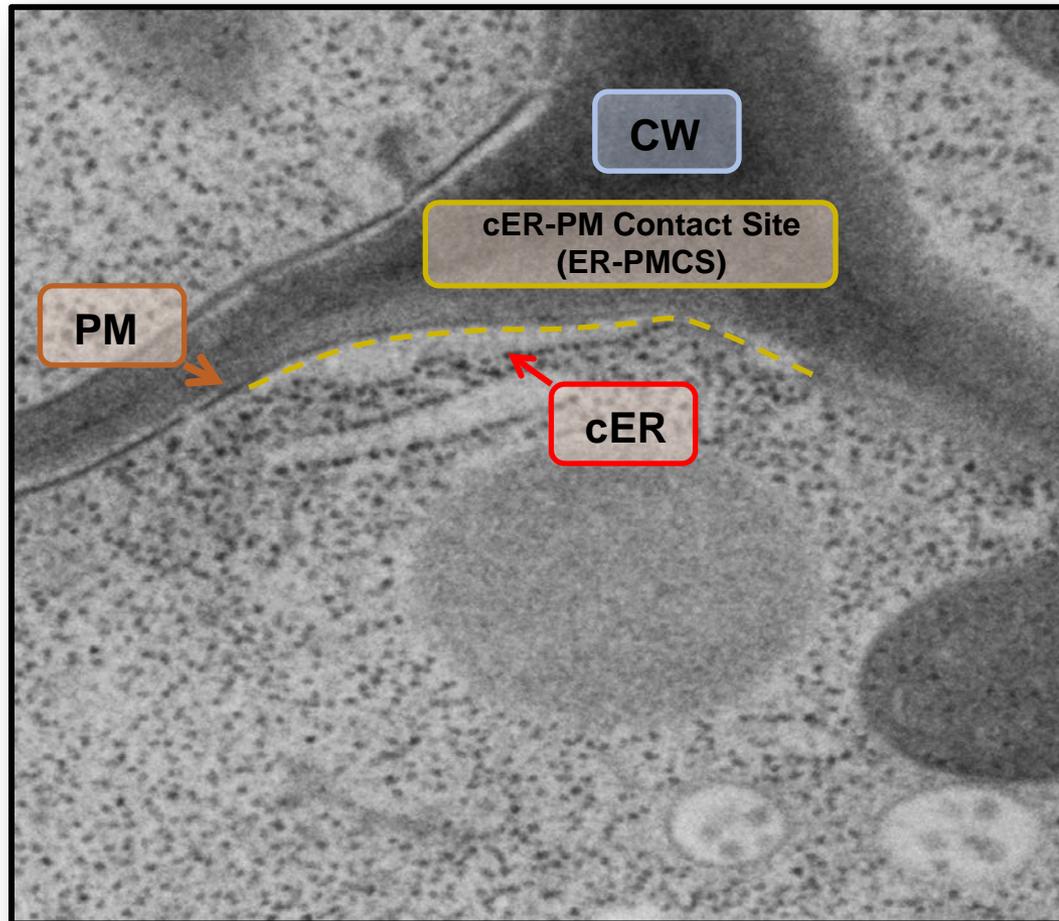
**Jessica Pérez-Sancho
August 27-30, 2013
Ghent, Belgium.**

ER function requires membrane contact sites (MCS)



- The ER requires physical interactions with different organelles to be fully functional.
- cER interacts with PM through membrane contact sites: ER-PMCS.
- The establishment and the functions of this ER-PMCS are unknown in plants.

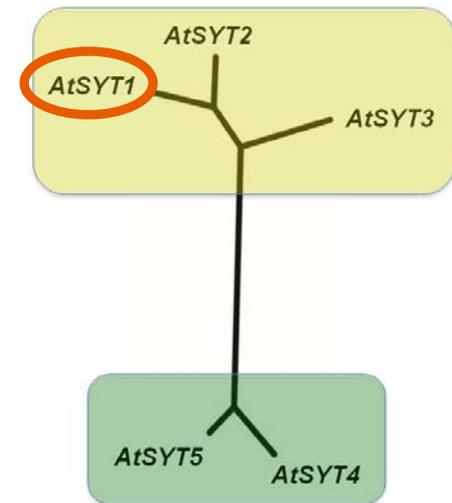
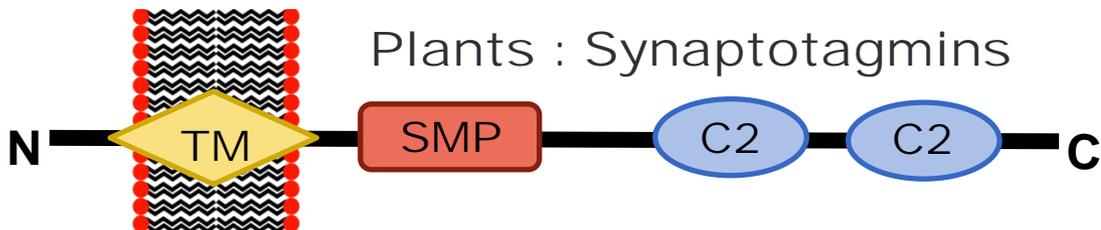
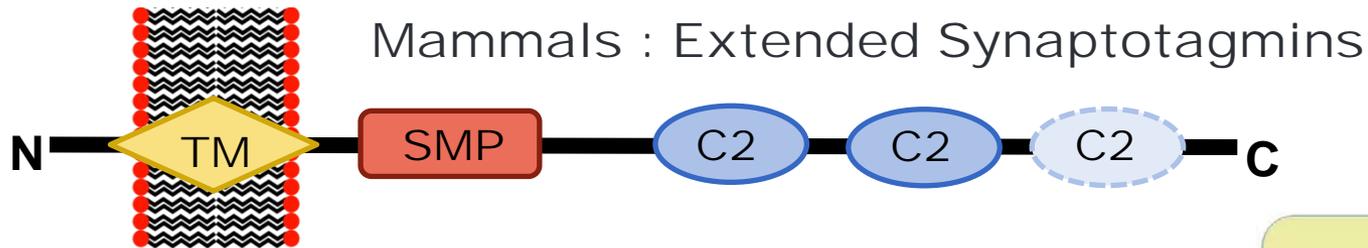
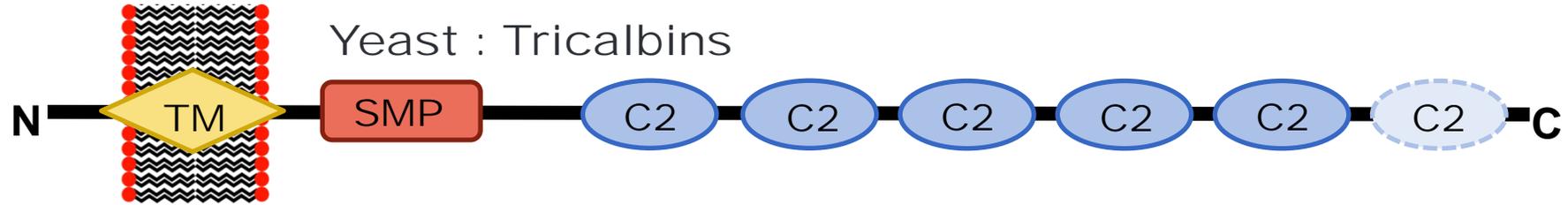
cER – PM Contact Sites (ER-PMCS)



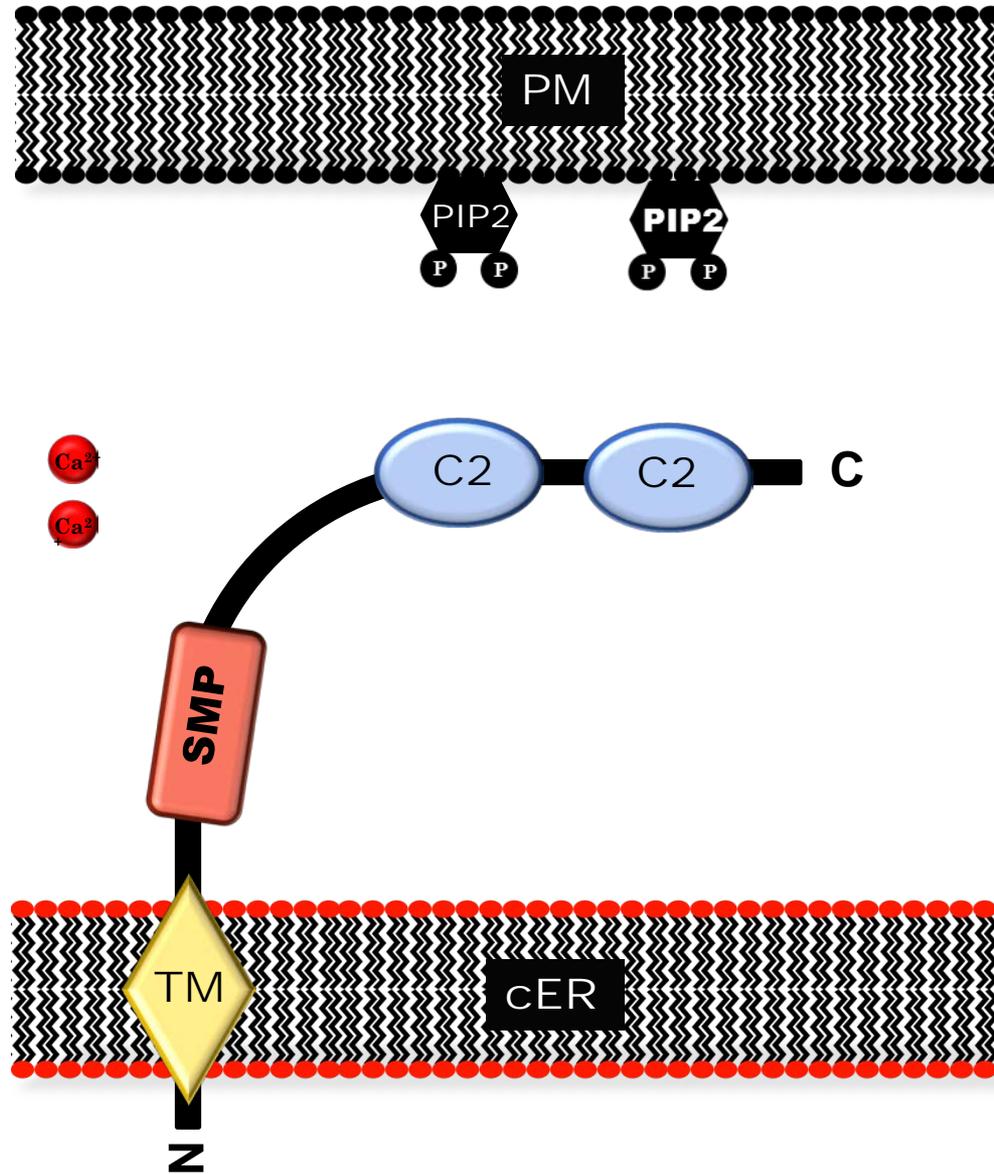
Pérez-Sancho et al., Unpublished

- Close apposition between cER and PM
- 10-30 nm distance between membranes
- Ribosomal exclusion

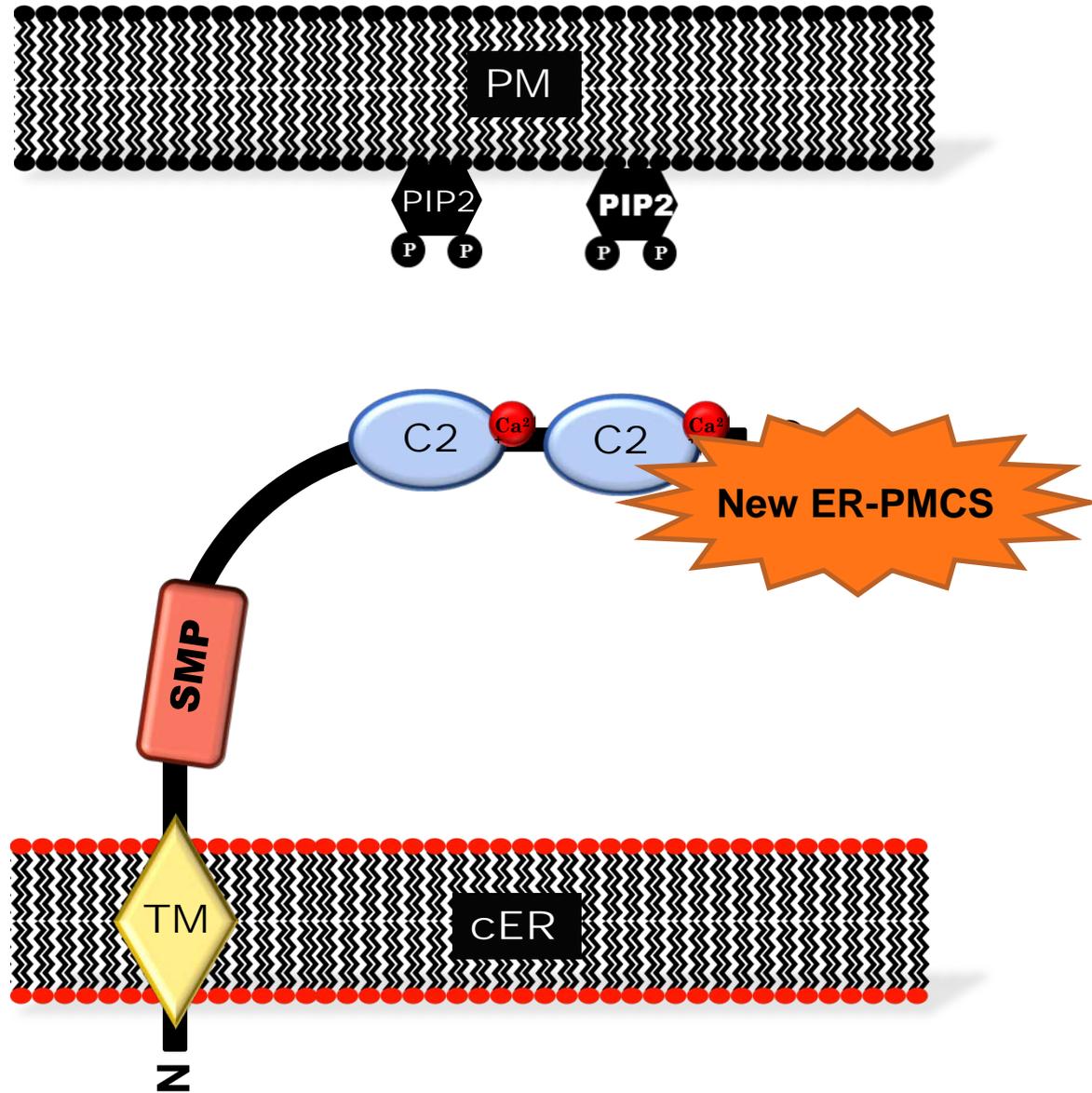
ER-PMCS establishment relies on Ca²⁺-dependent phospholipid binding proteins



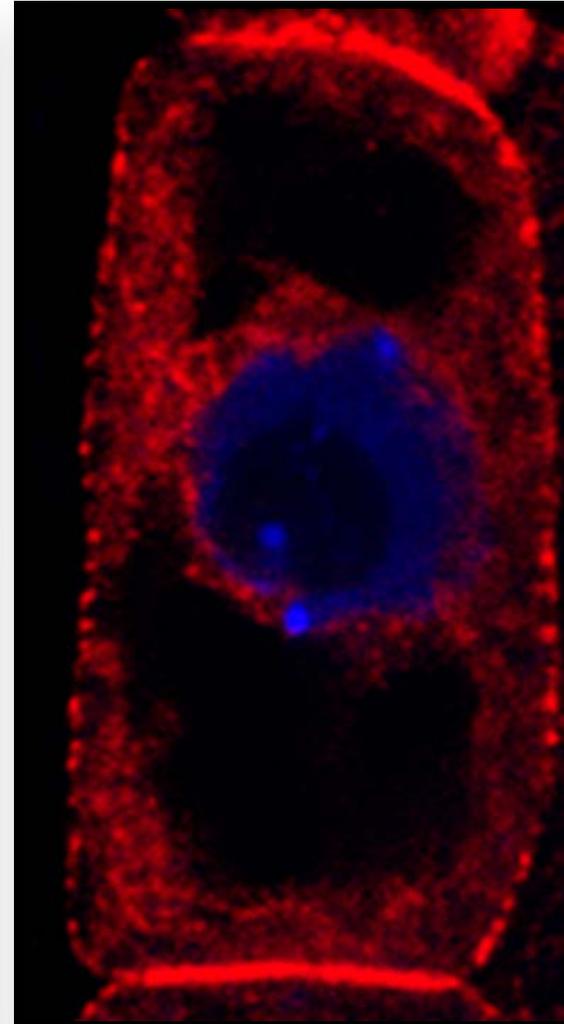
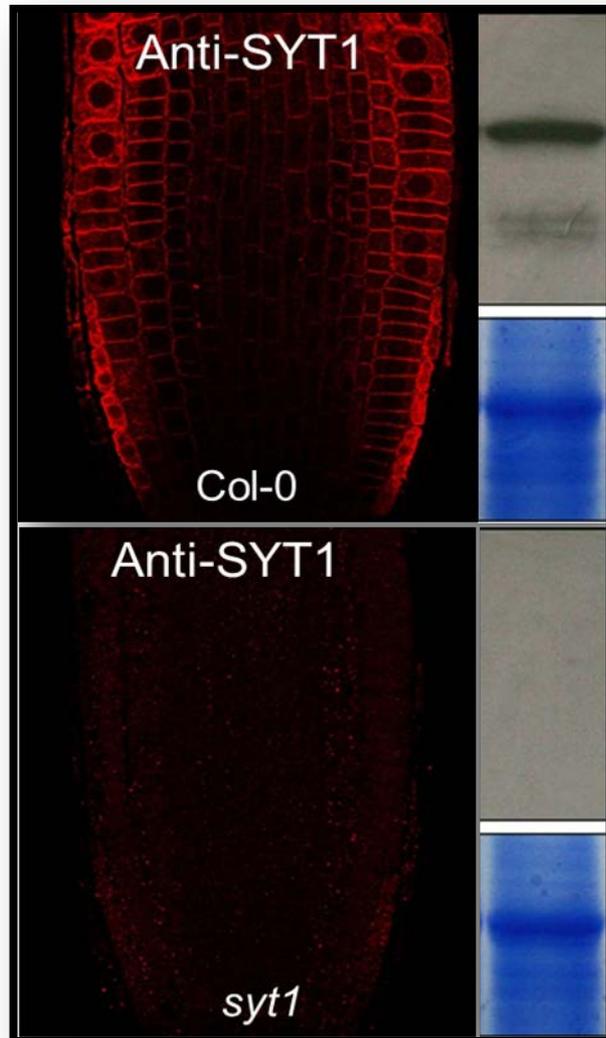
ER-PMCS establishment mechanism in yeast and mammals



ER-PMCS establishment mechanism in yeast and mammals

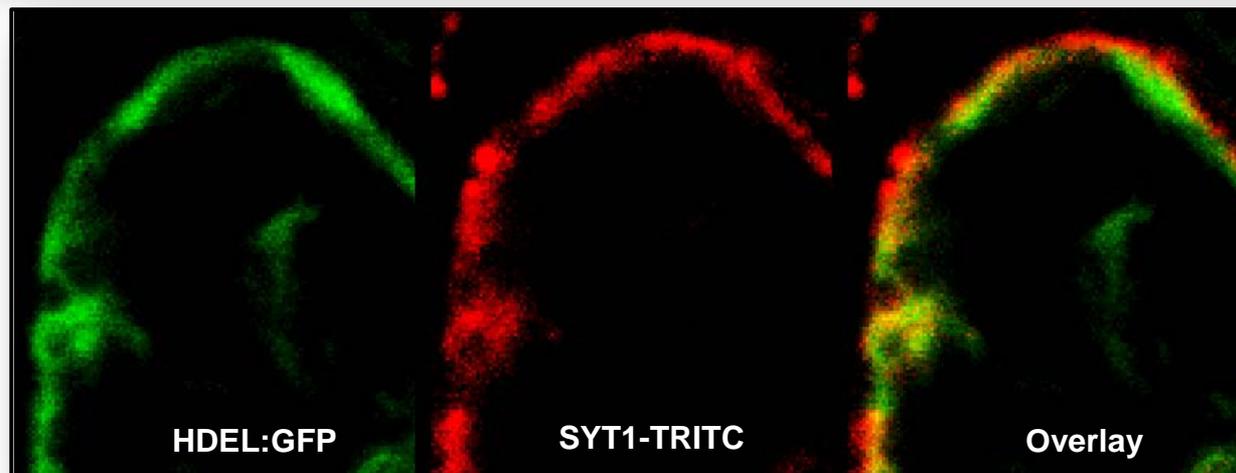
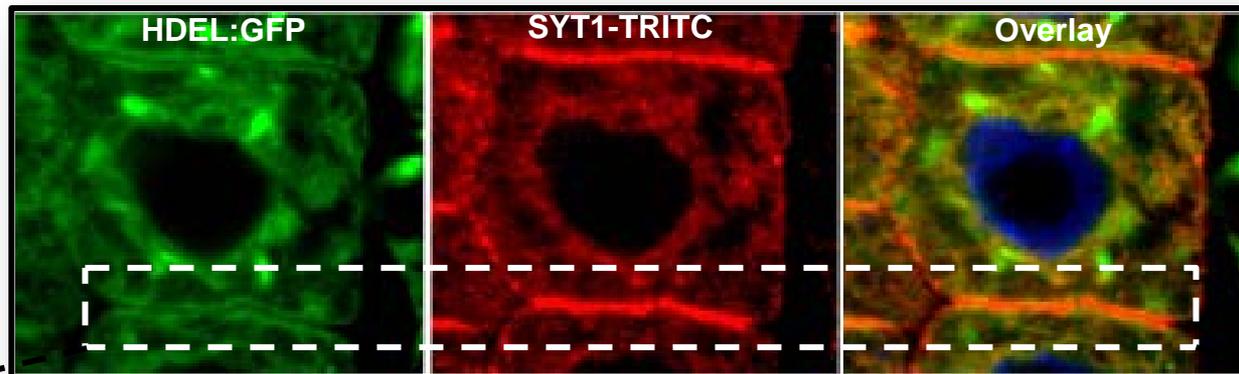


Are Arabidopsis SYTs localized in ER-PMCS?



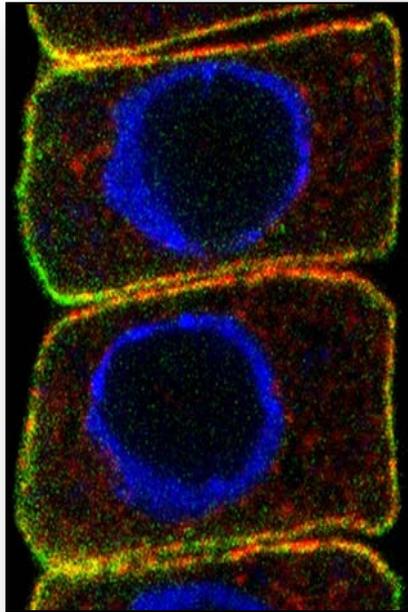
Pérez-Sancho et al., Unpublished

SYT1 is closely associated to the cortical ER

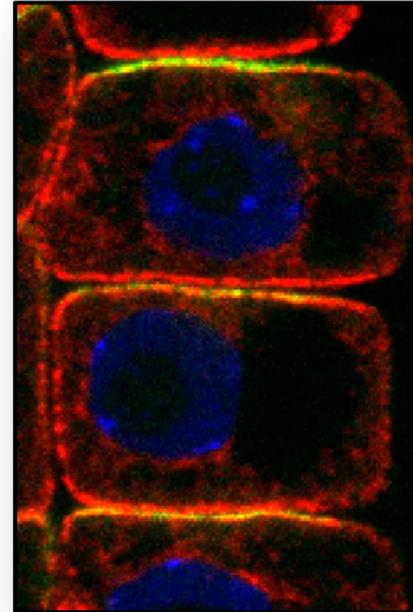


SYT1 partially colocalizes with PM markers

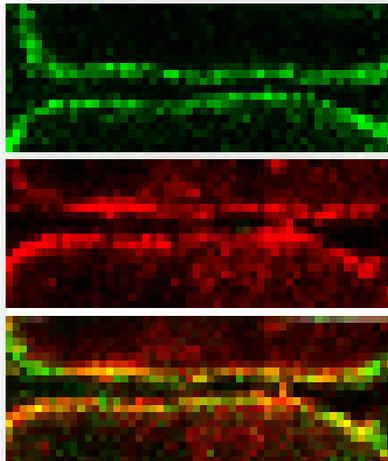
PIP1-GFP
SYT1-TRITC
DAPI
Overlay



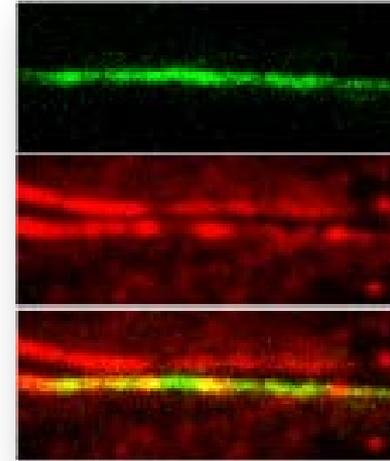
PIN2-GFP
SYT1-TRITC
DAPI
Overlay



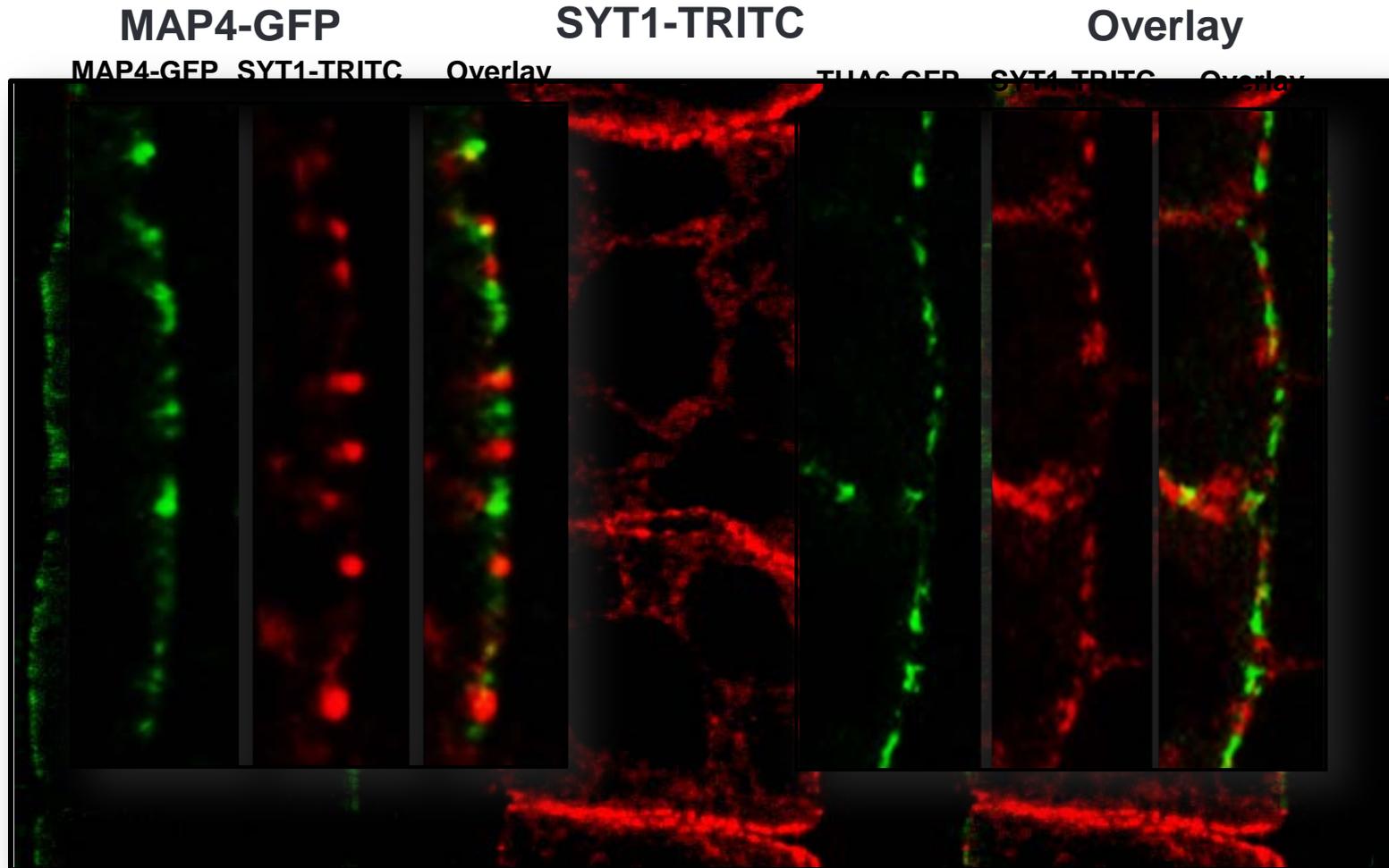
PIP1-GFP
SYT1-TRITC
Overlay



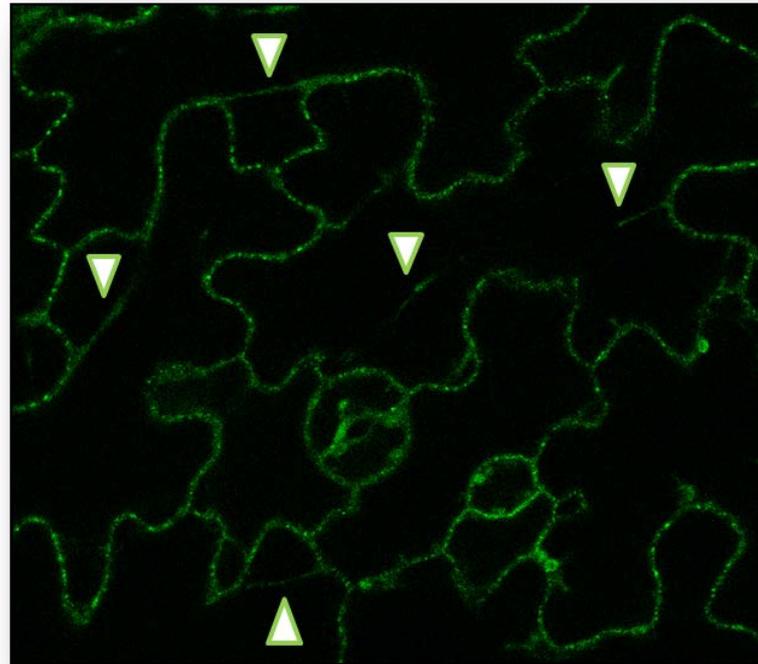
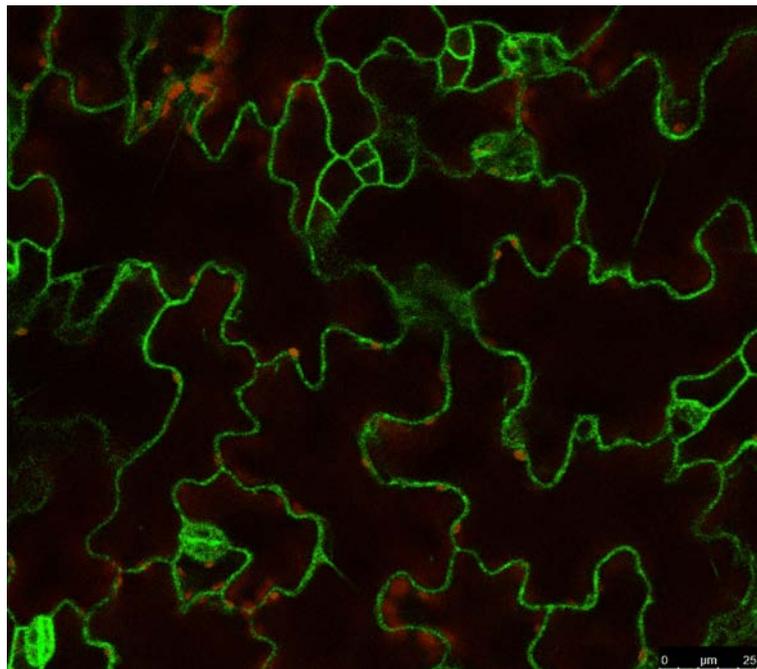
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SYT1-TRITC
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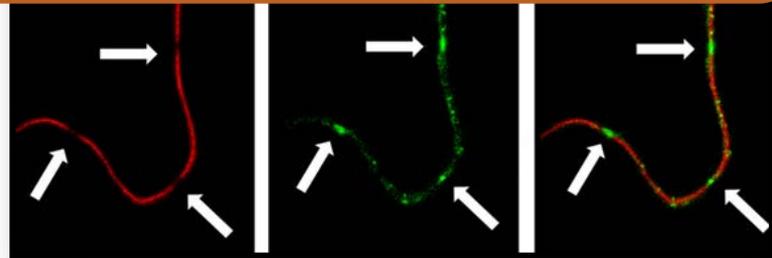
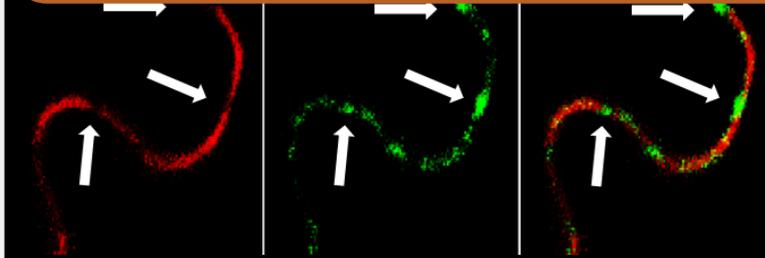
SYT1 and cortical microtubules signals are mutually exclusive



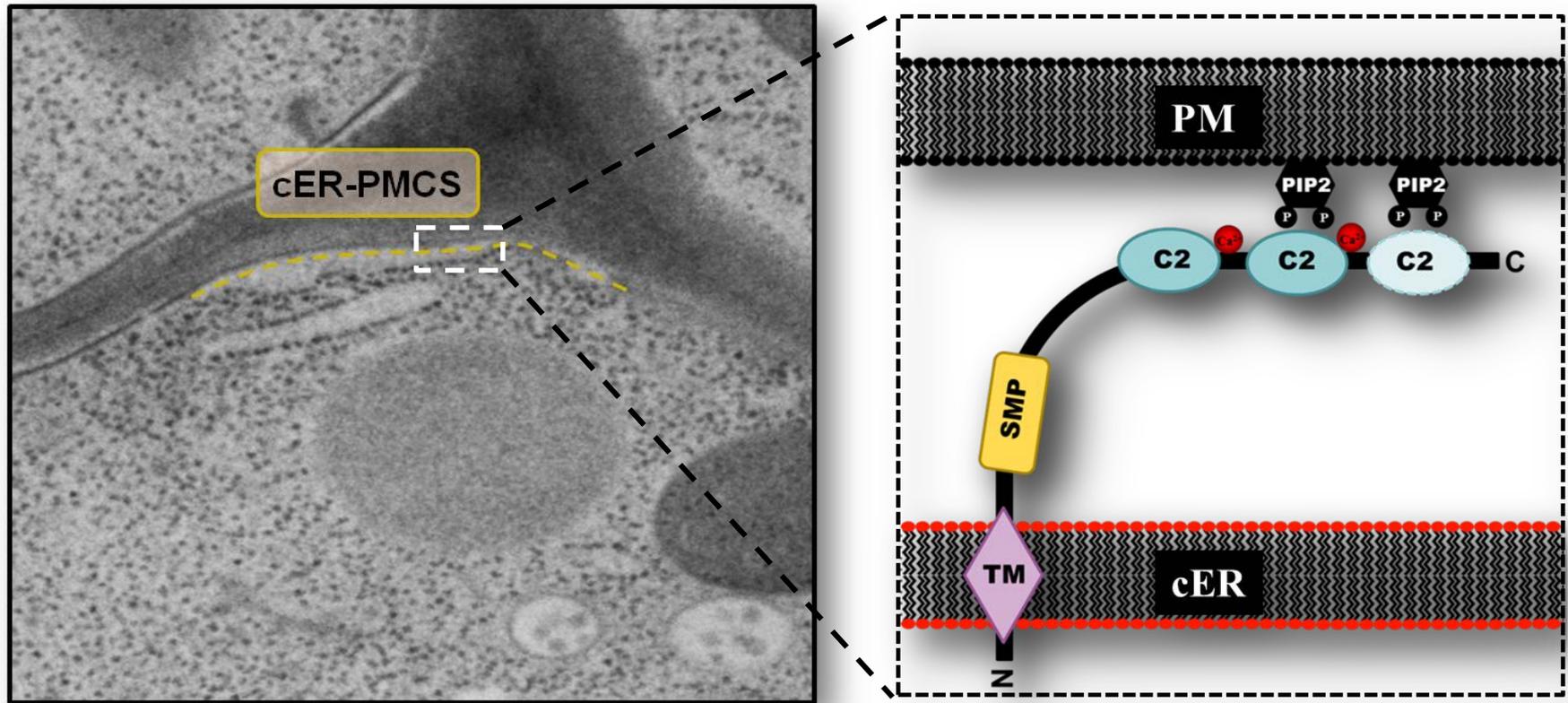
Different SYTs are located in plasmodesmata



SYTs localization in plants is compatible with function in ER-PMCS

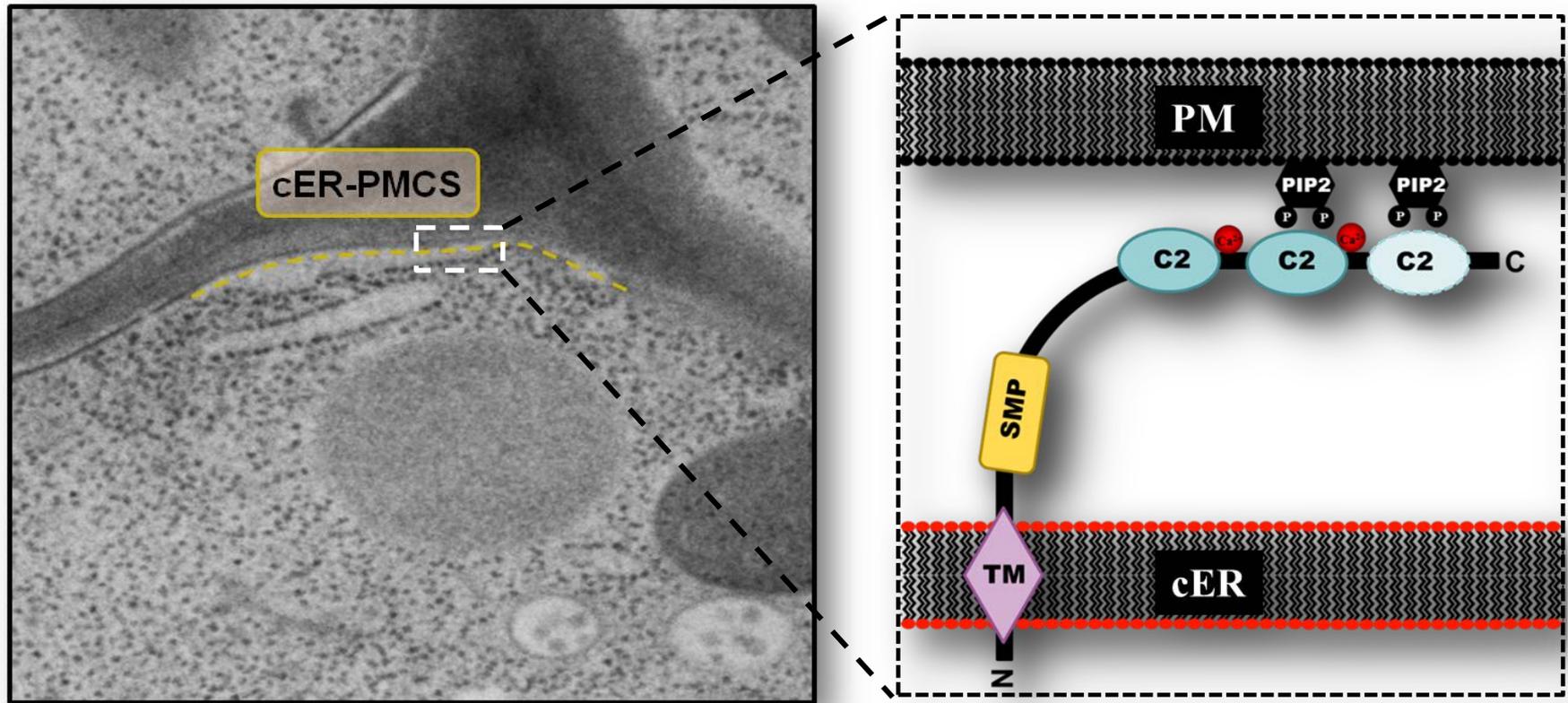


Known functions of ER-PMCS in yeast and mammals



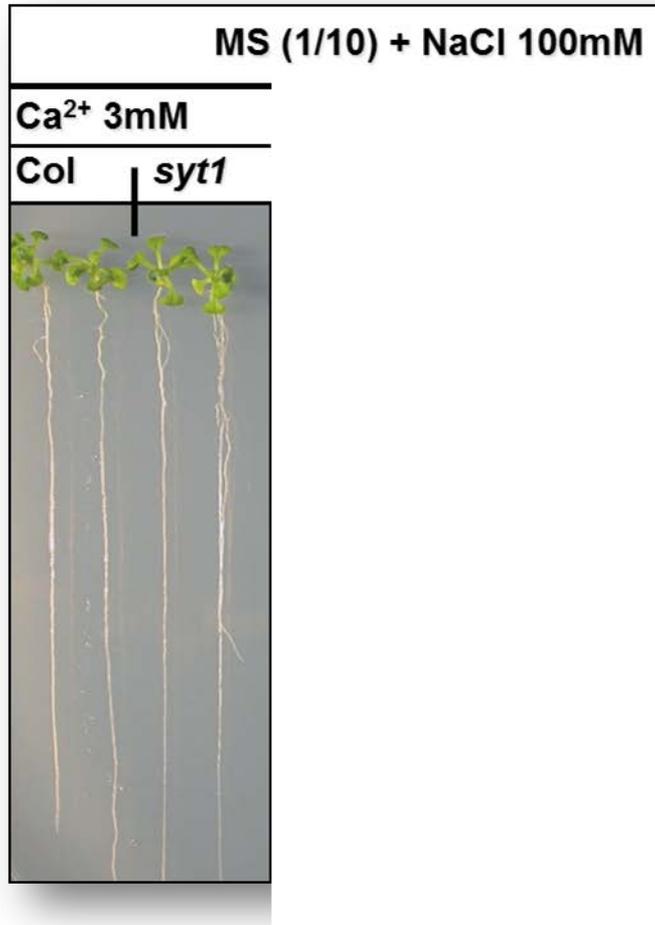
1. Ca²⁺ homeostasis
2. Lipid homeostasis
3. Stress response

Known functions of ER-PMCS in yeast and mammals



1. Ca^{2+} homeostasis
2. Lipid homeostasis
3. Stress response

syt1 has altered Ca^{2+} sensitivity under stress conditions



Schapiro et al., 2008 Plant Cell

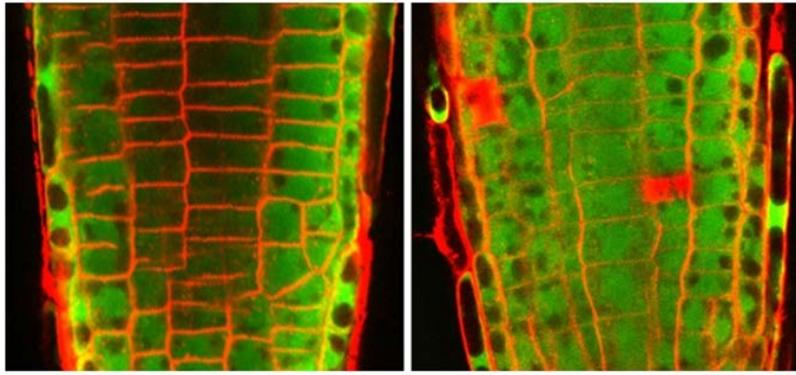
syt1 has altered Ca^{2+} sensitivity under stress conditions

FM4-64

FDA

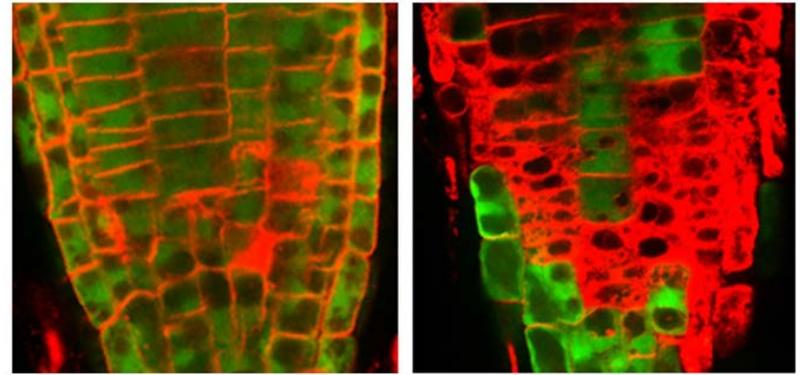
Col-0

syt1



Col-0

syt1



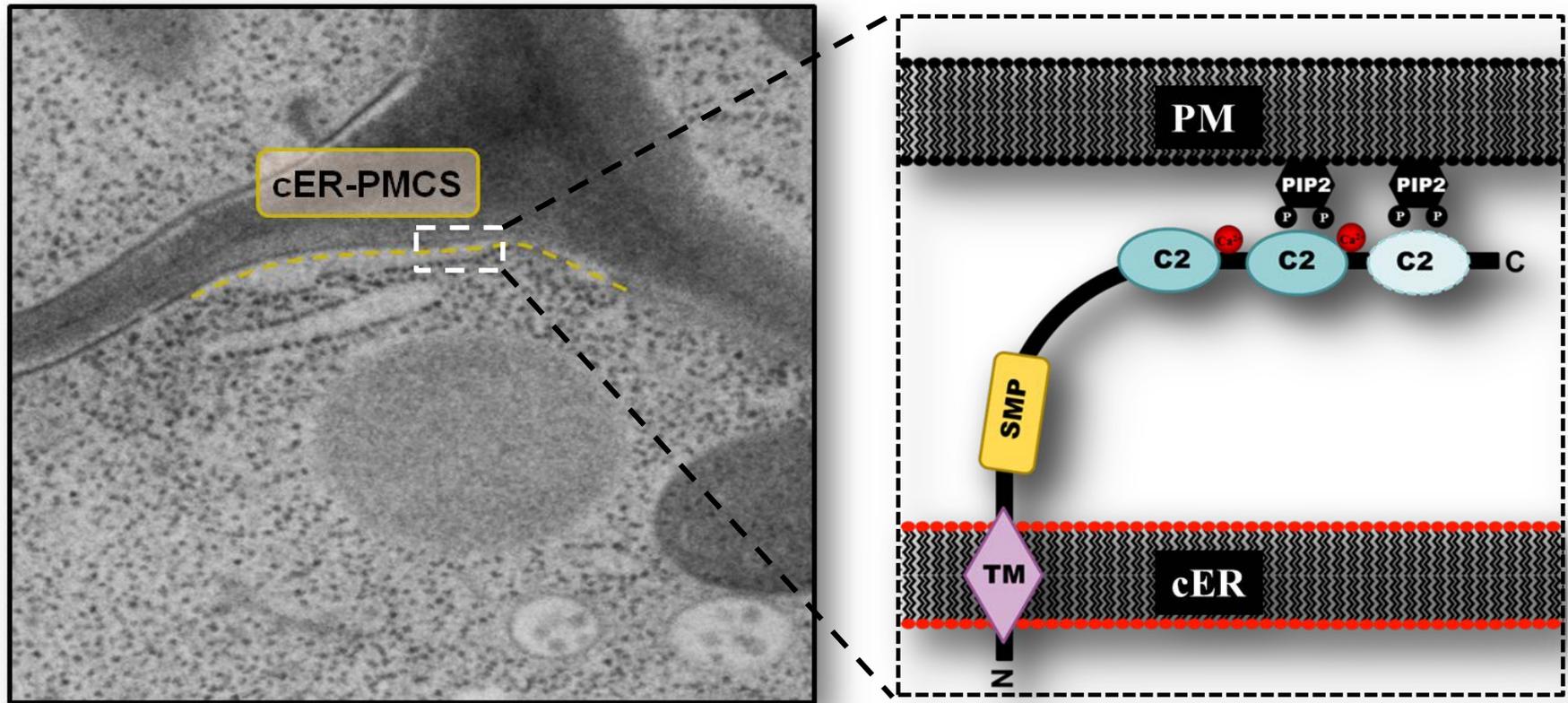
MS 100mM NaCl
3mM Ca^{2+}

MS 100mM NaCl
0.3mM Ca^{2+}

Schapire et al., 2008 Plant Cell

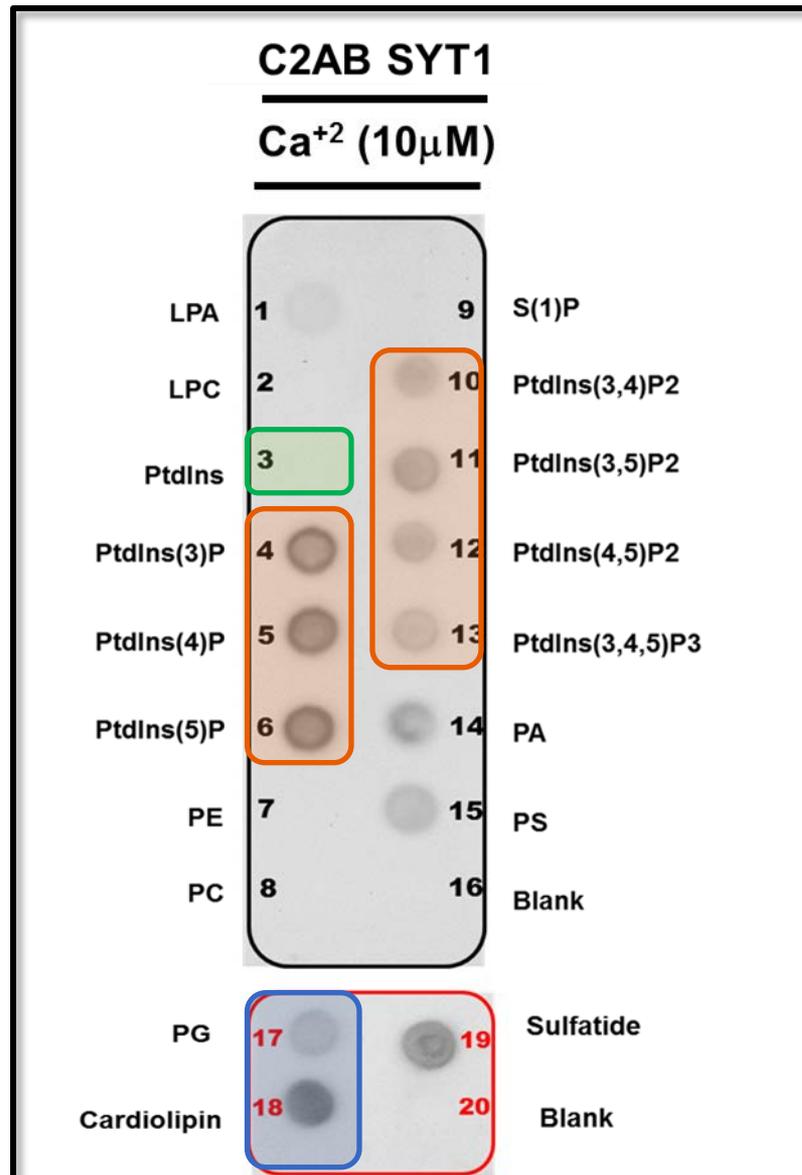
SYT1 might be involved Ca^{2+} homeostasis during stress episodes.

Known functions of ER-PMCS in yeast and mammals



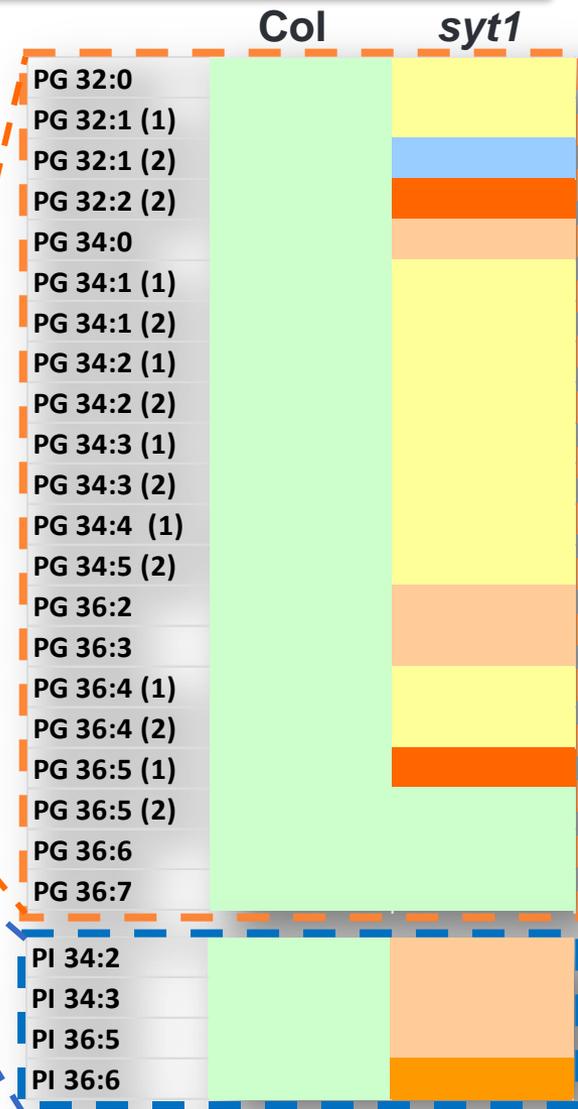
1. Ca^{2+} homeostasis
2. Lipid homeostasis
3. Stress response

SYT1 binds PtdIns(P)s and PGs



Lipid profile is altered in *syt1*

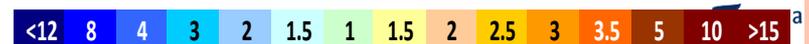
	Col	<i>syt1</i>
LIPIDS		
DGDG	1495.1 ± 67.1	1567.6 ± 104.3
MGDG	3206.4 ± 226.5	3218.0 ± 209.8
PC	3726.3 ± 264.6	3687.0 ± 243.7
PE	337.7 ± 19.2	346.5 ± 19.3
TAG	326.4 ± 36	326.5 ± 17.4
DAG	19.6 ± 1.4	21.1 ± 1.2
SQDG	194.2 ± 9.8	171.5 ± 13.0
PG	79.5 ± 18.4	132.7 ± 22.9
PS	474 ± 41.3	459.7 ± 30.0
PI	1 ± 0.2	2.2 ± 0.4



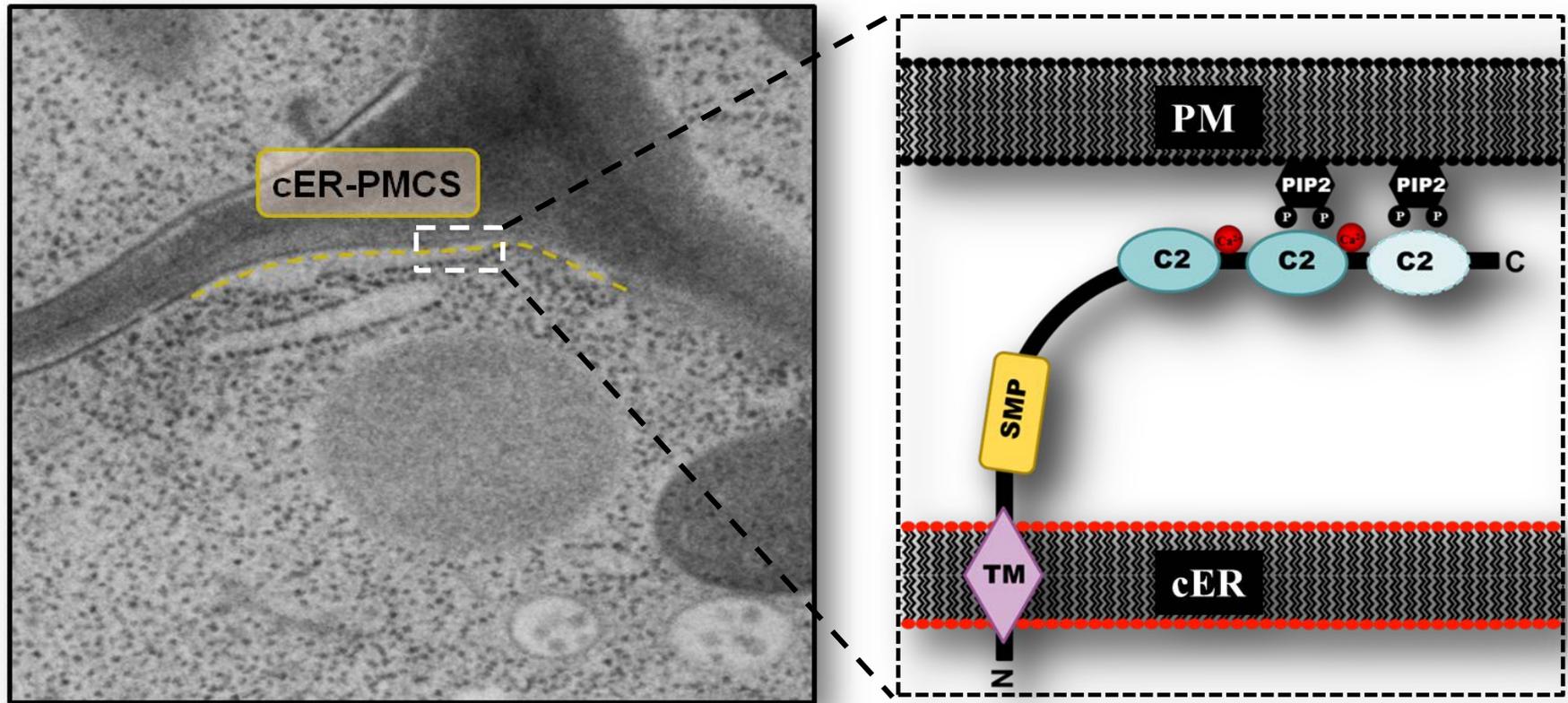
SYT1 might be involved in lipid homeostasis maintenance

Fold Reduction

Fold accumulation

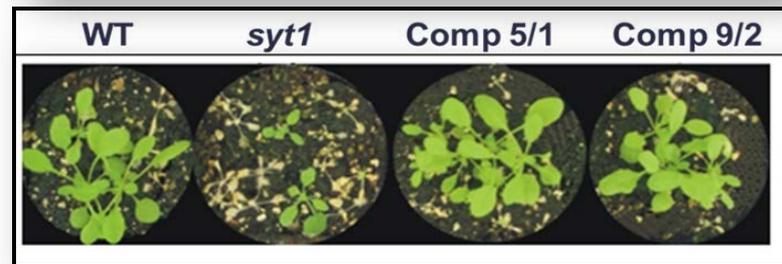
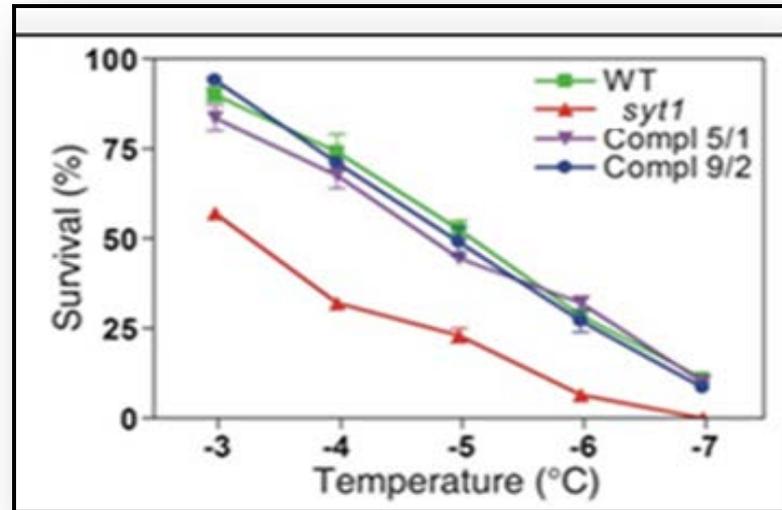
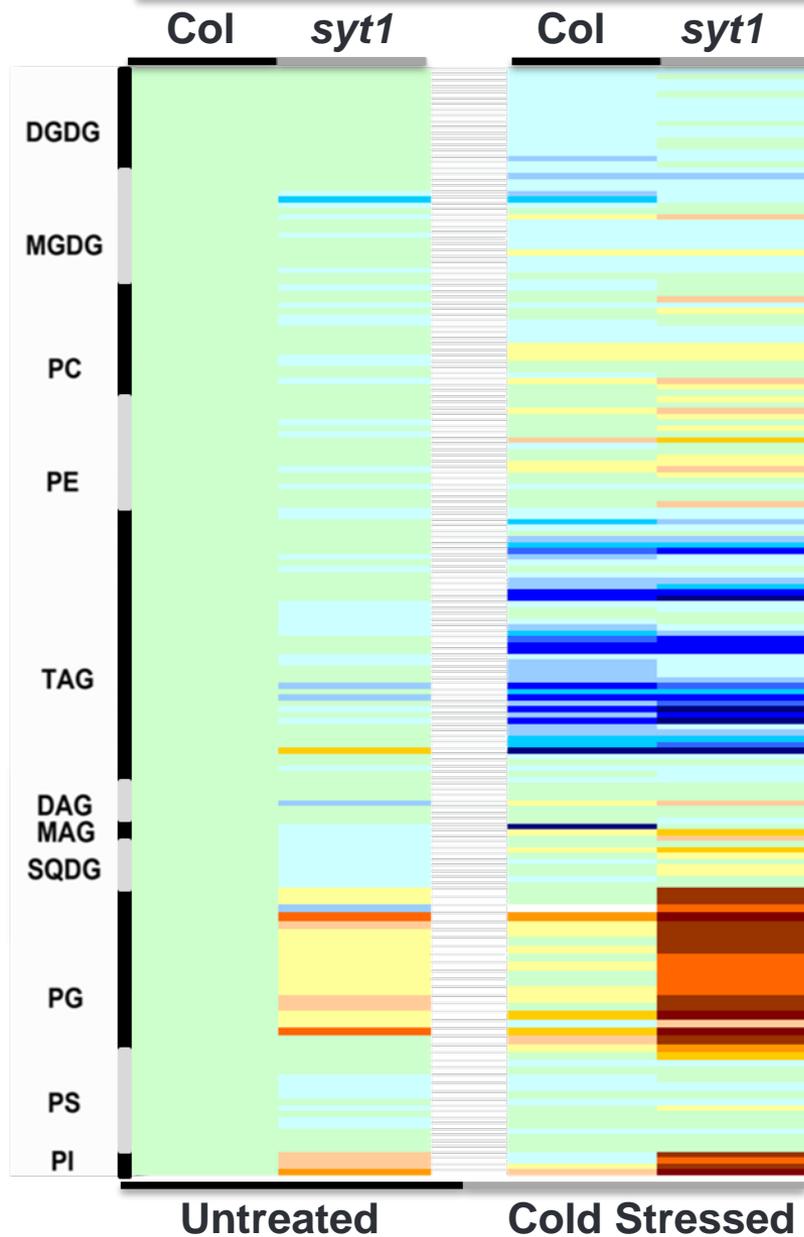


Known functions of ER-PMCS in yeast and mammals



1. Ca^{2+} homeostasis
2. Lipid homeostasis
3. Stress response

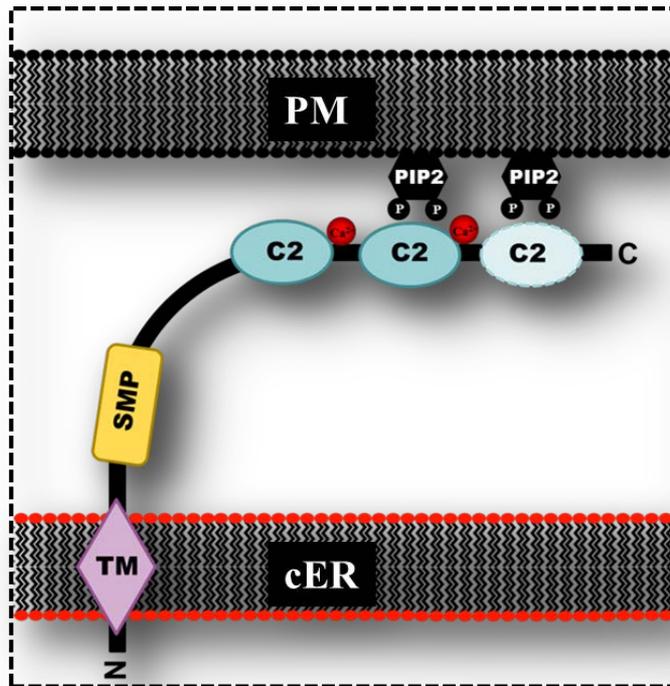
The *syt1* lipid changes are associated with cold stress sensitivity



SYT1 is involved in cold tolerance

Are Arabidopsis SYTs the orthologs of tricalbins and extended synaptotagmins?

- SYT1 has the proper subcellular localization.
- SYT1 has equivalent functions.



- It is required for Ca^{2+} and lipid homeostasis.
- It binds phospholipids.
- It has roles in stress tolerance.

Acknowledgements



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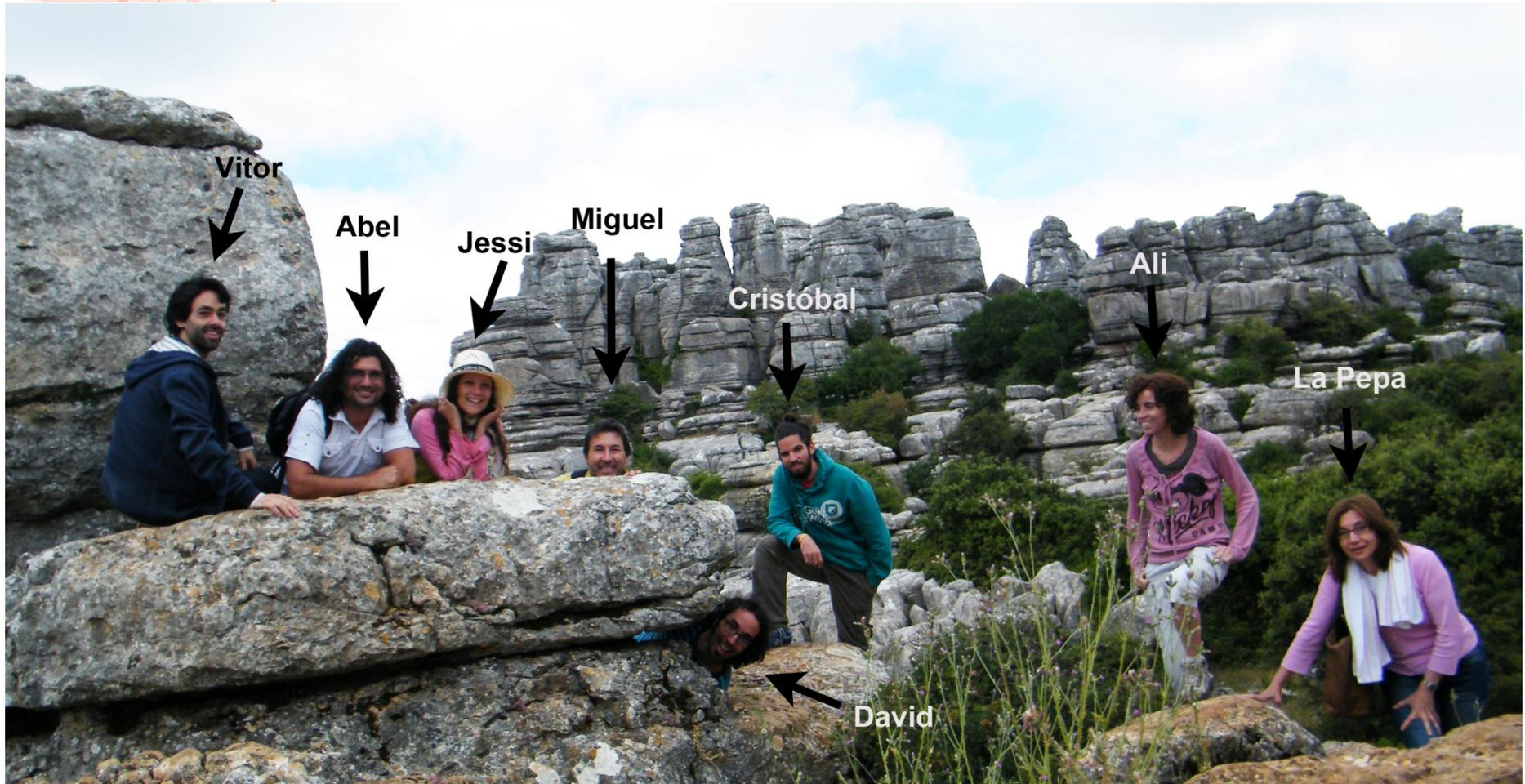
Sonia Osorio
Lothar Willmitzer



UPSC Umea

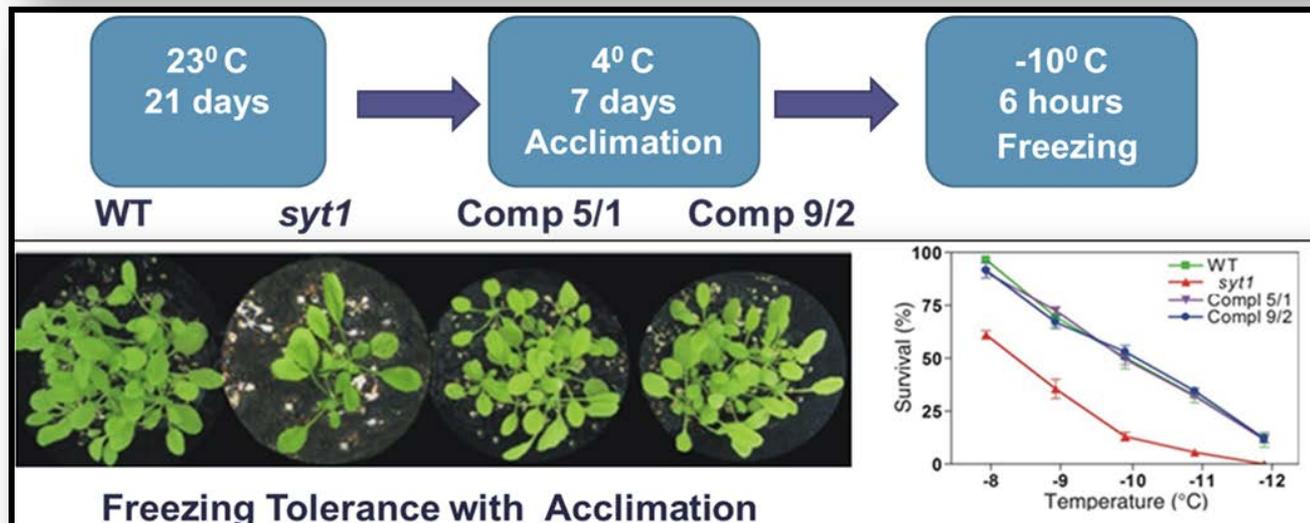
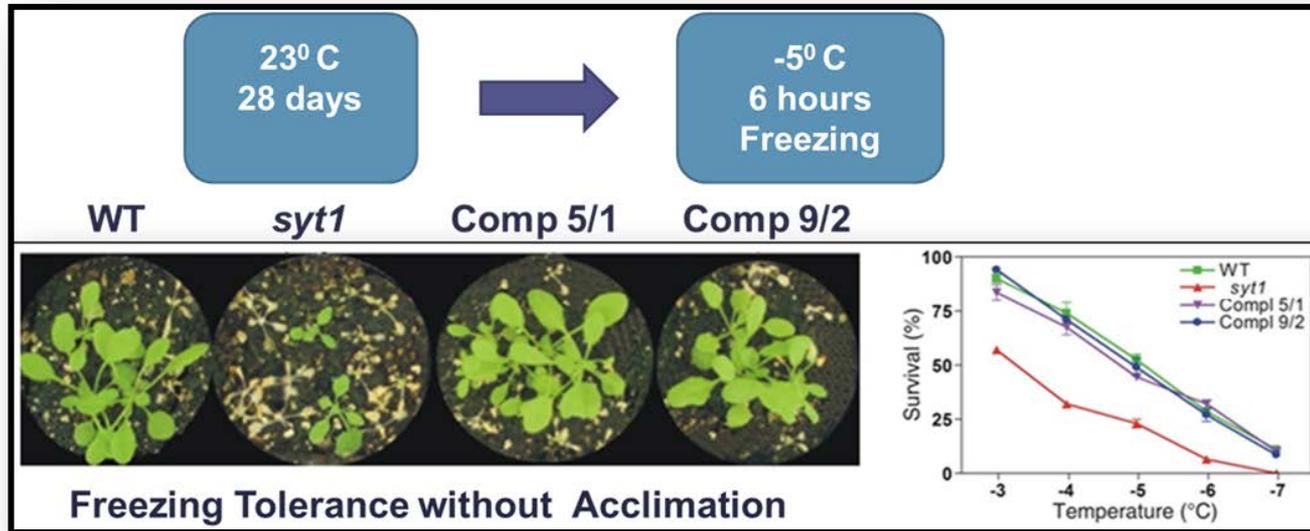
Stephanie Robert

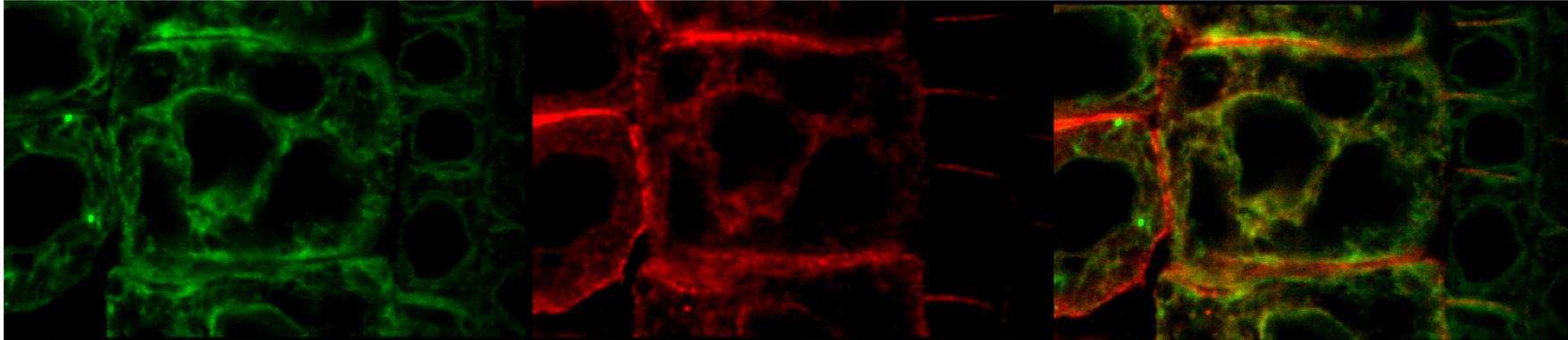
Thank you!



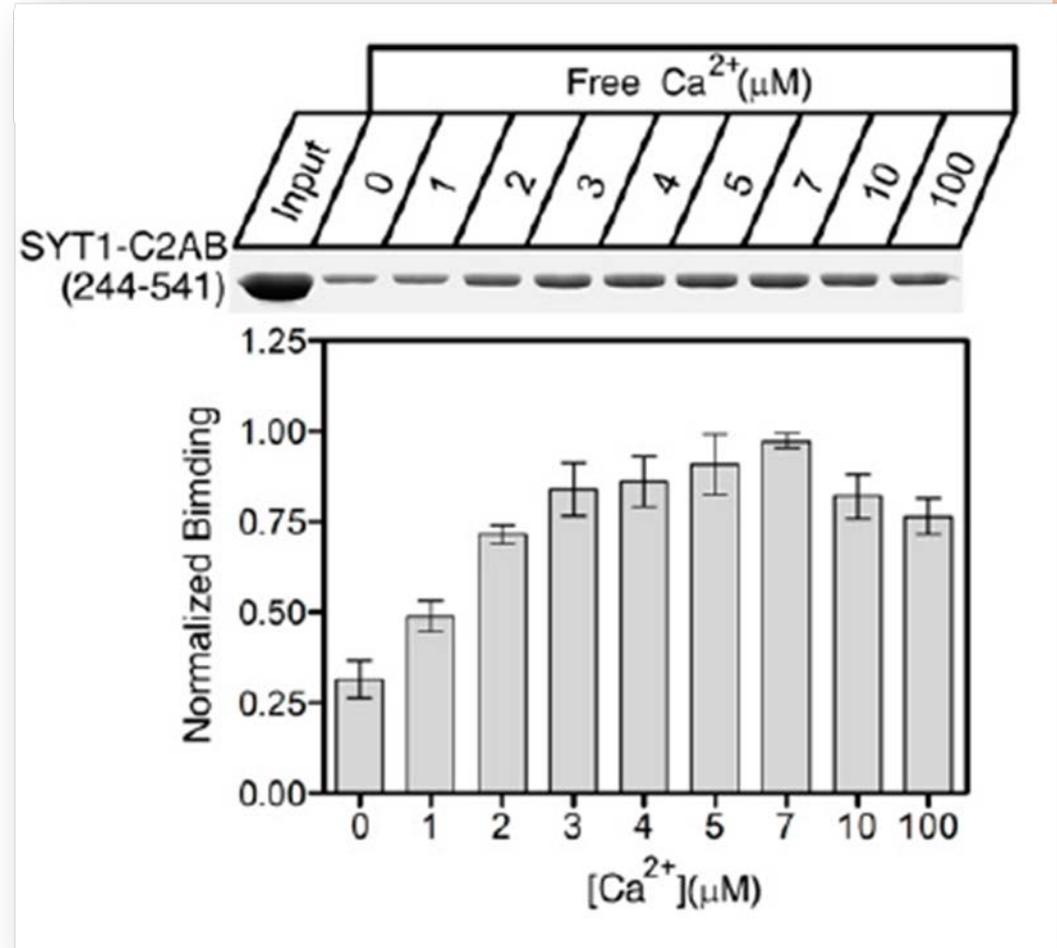
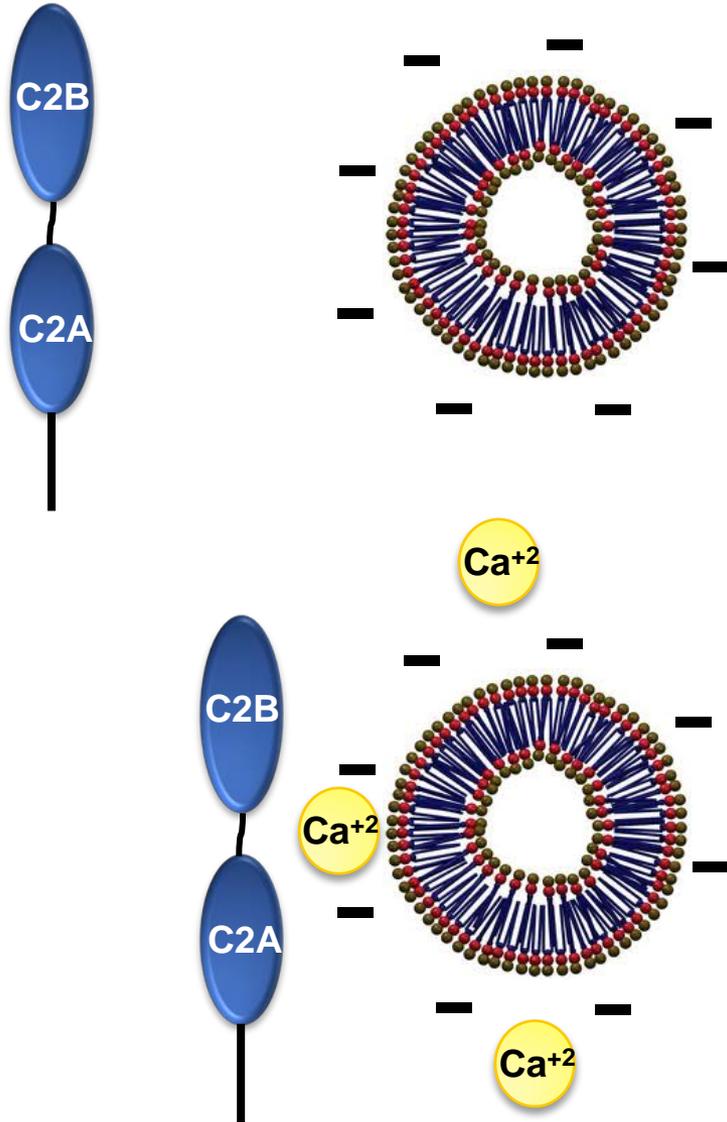


The *syt1* lipid changes are associated with cold stress sensitivity

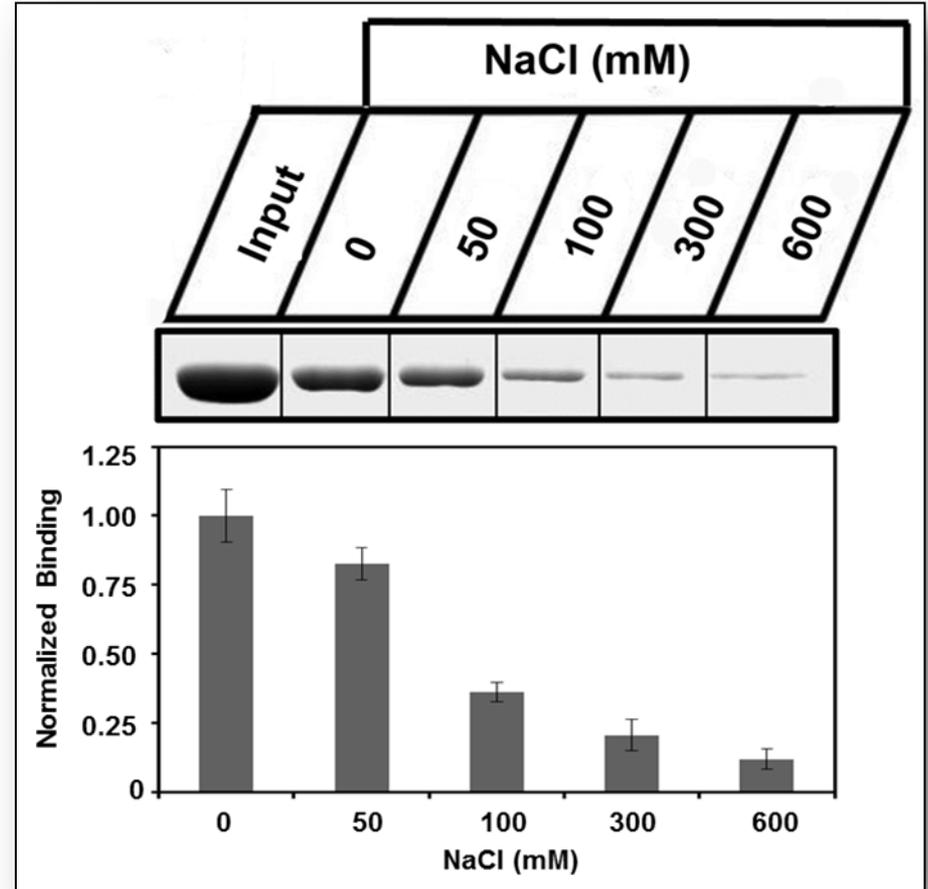
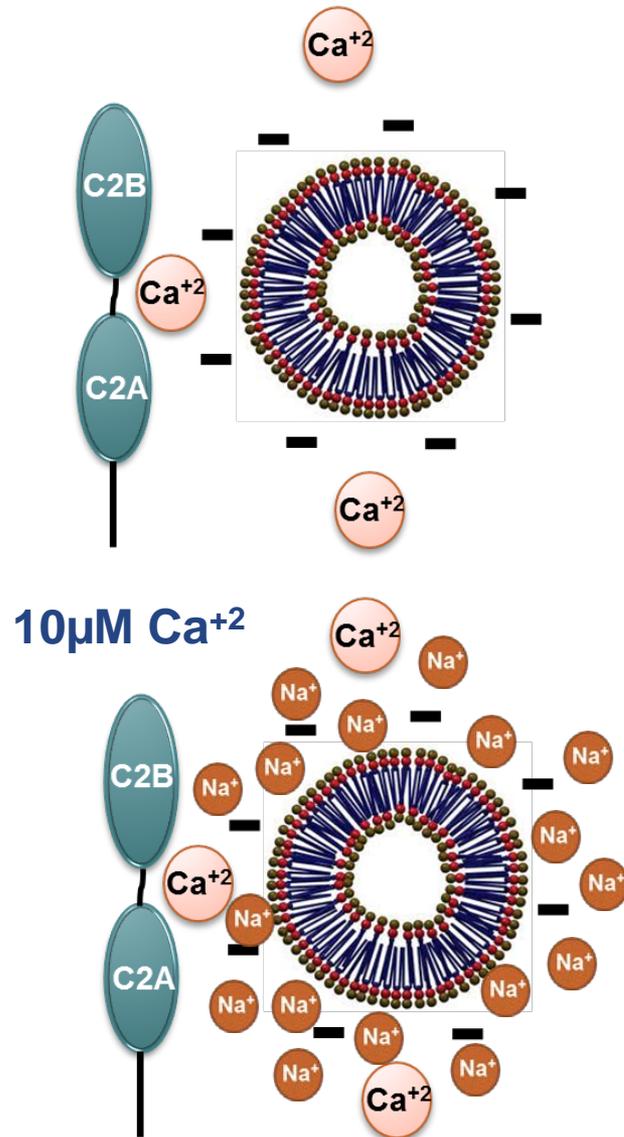




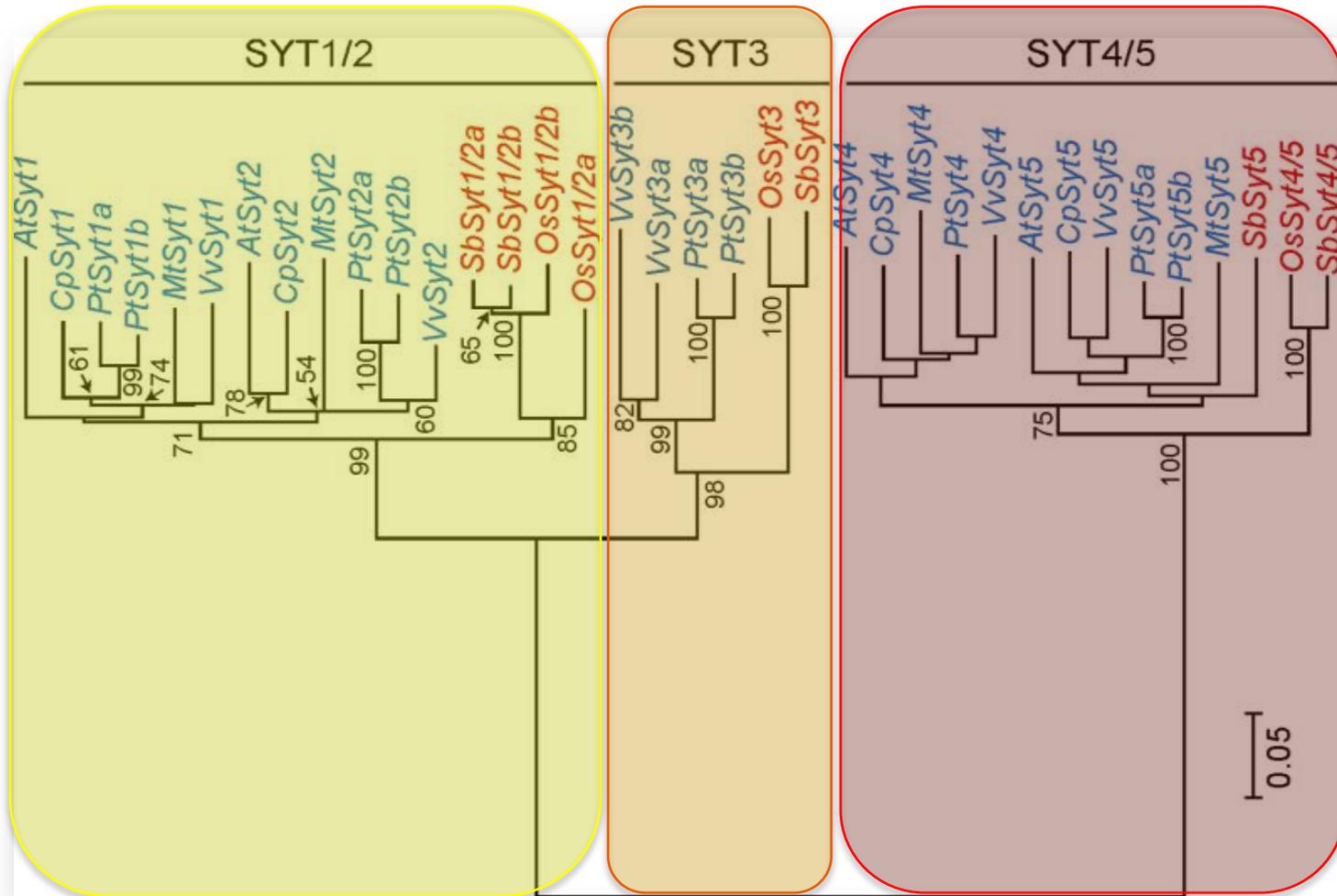
SYT1 BINDING TO PS: Ca^{2+} DEPENDENCY



SYT1 Binding to PS: Ionic Competition



Plant synaptotagmin families



SYT1 binds PtdIns(P)s and PGs in a Ca²⁺ independent manner

