Overcoming stress: new insights in the regulation of cell wall biosynthesis

Percio, Francisco[1]; Kesten, Christopher[2,3]; García-Moreno, Álvaro[1]; Amorim-Silva, Vitor[1]; Castillo, Araceli G.[1]; Ruiz-López, Noemi[1]; Sánchez-Rodríguez, Clara[2]; Botella, Miguel A.[1]

Presenting autor: **Francisco Percio** (franciscopercio@uma.es)

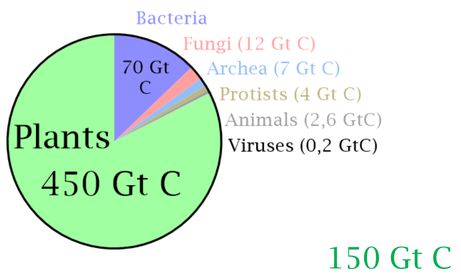
[1]Instituto de Hortofruticultura Subtropical y Mediterránea, Universidad de Málaga-Consejo Superior de Investigaciones Científicas (IHSM-UMA-CSIC), Campus de Teatinos, Málaga E-29071, Spain

[2]Department of Biology, ETH Zurich, 8092, Zurich, Switzerland.

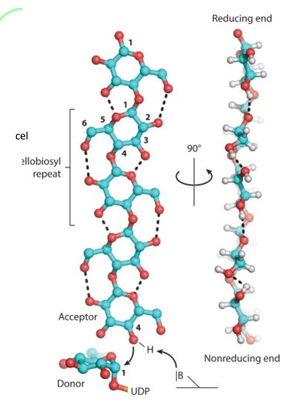
[3]Department for Plant and Environmental Sciences, University of Copenhagen, 1871, Frederiksberg C, Denmark.

Introduction

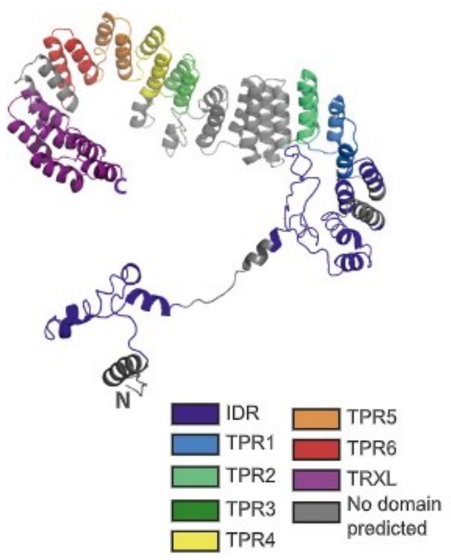
Cellulose is the major polymer in Earth biomass[1] (but the regulation of its biosynthesis is poorly understood)



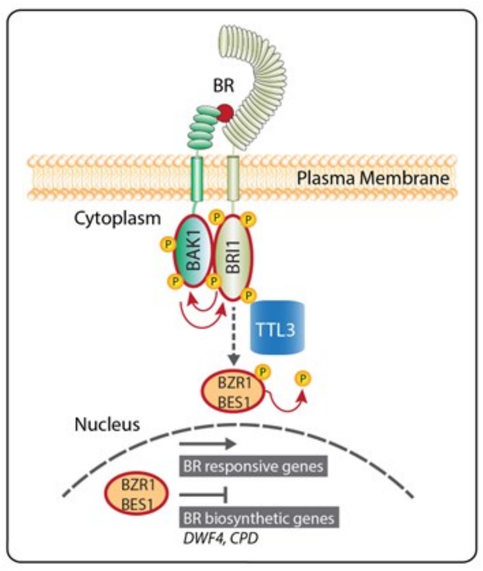
150 Gt C Cellulose



Tetratricopeptide thioredoxin-like (TTL) proteins have been previously described as scaffold proteins for brassinosteroid signaling components[2]



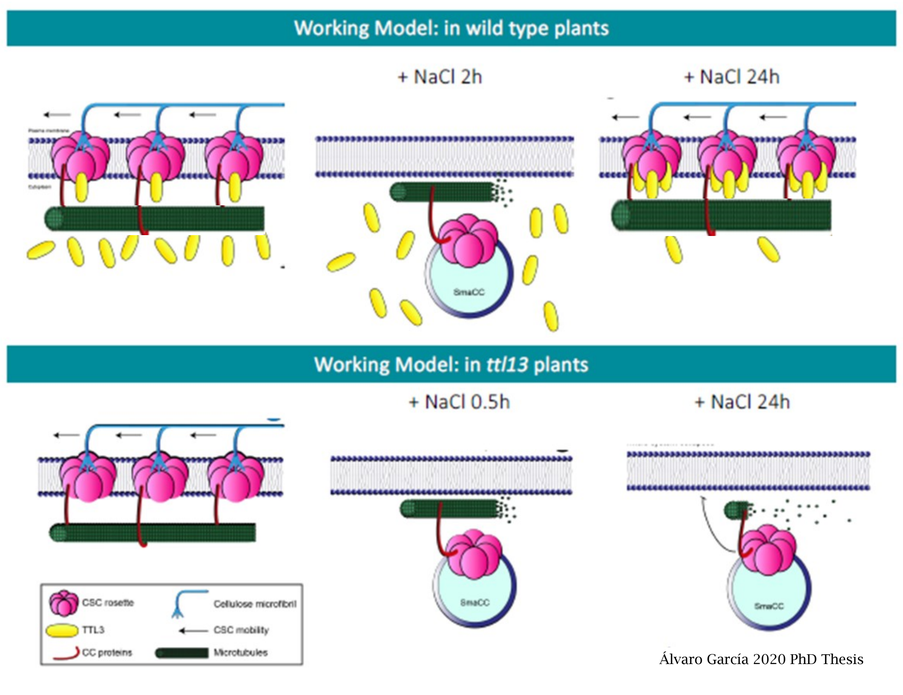
Structural model and domains of TTL3 protein predicted by I-TASSER and processed by PyMOL[2].



Protein interaction and phenotype studies show that TTL proteins associate with most BR signaling components acting as scaffold to promote responses to BR sensing[2].

Conclusions

TTL proteins[2] support CSC relocalization during stress[3]



Álvaro García 2020 PhD Thesis

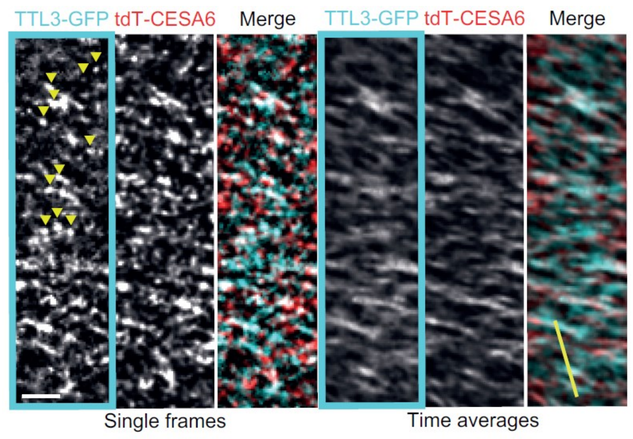
Salt stress causes microtubules depolymerization and cellulose synthase complexes (CSC) internalization. **TTL proteins are needed to CSC recovery** to the plasma membrane[3].

Further studies are needed to elucidate the mechanism for the relocalization and signaling towards TTL proteins[3].

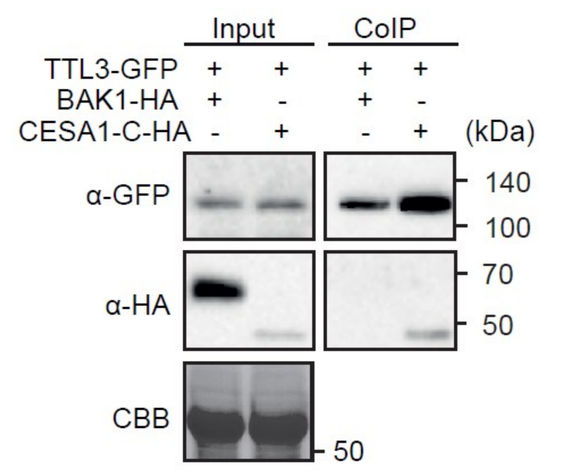
Main Results[3]

1 ***ttl*** **mutants show cellulose deficient phenotype (reduced root growth and isotropic cell expansion) under salt stress and cellulose biosynthesis inhibitor isoxaben.**

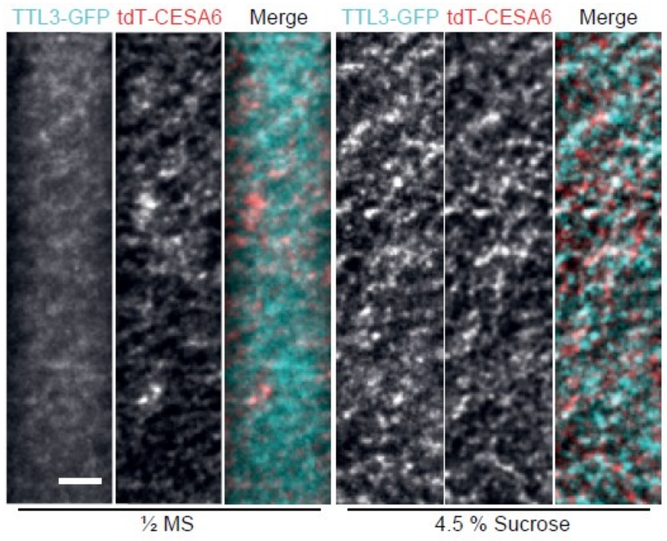
2 ***ttl1ttl3*** **mutant shows defficient cellulose synthases and microtubules recovery after salt stress.**



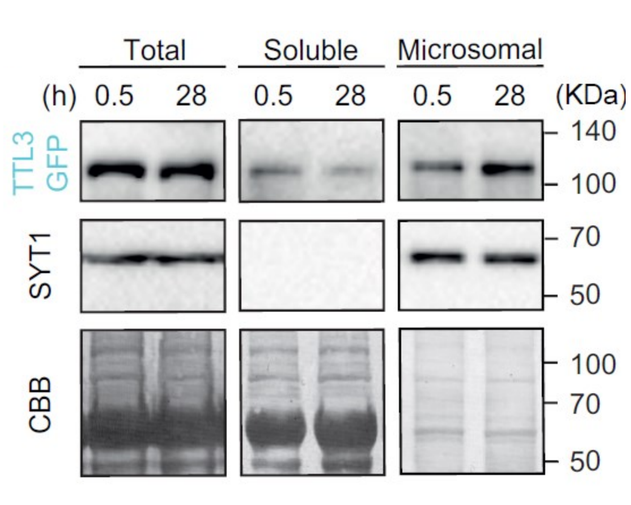
3 ***TTL3-GFP colocalizes and shows the same movement as TdT-CesA6 in spinning disk confocal microscopy.***



4 ***TTL3 shows interaction with CesA proteins both by COIP and Y2H assays (data not shown).***



5 ***TTL3-GFP translocate from citoplasm to plasma membrane associating with CSC because of high sucrose conditions (inhibiting cellulose biosynthesis) and sal stress (data not shown) .***



6 ***TTL3-GFP protein quantity increases in microsomal fractions while decreases in soluble fraction of Arabidopsis seedlings after 28 hours of salt stress.***

Bibliography

1. Bar-On, Y. M., Phillips, R. & Milo, R. The biomass distribution on Earth. *Proc. Natl. Acad. Sci. U. S. A.* **115**, 6506–6511 (2018).
2. Amorim-Silva, V. *et al.* TTL proteins scaffold brassinosteroid signaling components at the plasma membrane to optimize signal transduction in arabidopsis. *Plant Cell* **31**, 1807–1828 (2019).
3. Kesten, C. *et al.* Peripheral membrane proteins safeguard cellulose synthesis during stress. (2022, **submitted**)

Fundings

This work was funded by the Spanish Ministry for Science and Innovation (MCIN/AEI/10.13039/501100011033) (PGC2018-098789-B-I00) and (PID2019-107657RB-C22) to MAB, NRL and AC respectively. The Andalusian Research Plan co-financed by the European Union (PAIDI 2020-PY20_00084) to MAB and Junta de Andalucía UMA-FEDER project (grant UMA18-FEDERJA-154) to NRL, and the Swiss National foundation to CSR (SNF 31003A_163065/1 to AM). CK was supported by a Peter und Traudl Engelhorn-Stiftung fellowship, an ETH Career Seed Grant (SEED-05 19-2) of the ETH Foundation, an Emerging Investigator grant (NNF20OC0060564) of the Novo Nordisk Foundation, and an Experiment grant (R346-2020-1546) of the Lundbeck foundation. AGM and FP were supported by BES-2015-071256 and FPU19/02219 fellowships respectively, and meeting attendance was supported by Plan Propio de Investigación, Transferencia y Divulgación Científica de la Universidad de Málaga (UMA). VAS was supported by an Emerging Investigator research project (UMA20-FEDERJA-007) and co-financed by the "Programa Operativo FEDER 2014-2020" and by the "Consejería de Economía y Conocimiento de la Junta de Andalucía".