XVI RBMP, Seville 14th-16th September 2022

Calling for reinforcements: the role of TTL proteins 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]

[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.

Presenting author: Francisco Percio (franciscopercio@uma.es)

Cellulose is the most abundant organic compound of all biomass on Earth[1], with highly relevant roles in plant development and defence. Hence, it is essential to understand the regulation of its biosynthesis to improve the crop's tolerance to biotic and abiotic stresses.

Tetratricopeptide Thioredoxin-Like (TTL)[2] proteins have been identified as new players in regulating the cellulose synthase complex (CSC), uncovering their dynamic association with the CSC under cellulose-deficient conditions[3]. We show that TTLs are essential to maintain cellulose synthesis under salt stress, mediated by a reinforced cortical microtubule array and the stabilization of the CSCs at the plasma membrane. To perform this, TTLs interact with Cellulose Synthase 1 and promote microtubules polymerization. This dynamic behaviour of TTLs is not specific to salinity stress, and other factors that cause defects in cellulose also cause the re-localization from the cytosol to the CSC. We conclude that TTLs act as intermediates between stress sensing and the regulation of cellulose biosynthesis to overcome adverse environmental conditions.

We are now investigating how changes in phosphorylation of the Intrinsic Disordered Region at the end terminus of TTLs regulate their activity and dynamic localization.

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)

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, UMA20-FEDERJA-023) to NRL and MAB respectively, 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”.