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TEMASEK LIFESCIENCES LABORATORY

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22 May 2023 (Mon), 4pm
Seminar Rm 05-41 (Level 5)

Hosted by: Dr YIN Zhongchao

Are plants balloons? A biomechanical perspective on plant morphogenesis.

Dr Yuchen LONG
National University of Singapore, Singapore

Dr Yuchen Long acquired his PhD in plant developmental biology in Utrecht University, the Netherlands, and his postdoc training in plant biomechanics in ENS de Lyon, France. Currently, Long is an assistant professor in the Department of Biological Sciences, National University of Singapore, and his lab is interested in the interdisciplinary study of biological forces and their functions in plant development.

Growth of an organism is ultimately a biomechanical process. In plants, the major biomechanical forces are the cellular pressure, or “turgor pressure”, and the resulting cell wall tension. Specifically, osmosis causes cellular pressure build-up and stretches the cell walls to expand, leading to many biophysicists compare plant cells to “water-filled balloons”. Despite this analogy, the precise role of tissue hydraulics in plant meristematic tissues remains elusive. Here, by combining micromechanical measurement, 4D confocal live imaging and physical modelling, we demonstrate that cellular pressure is highly heterogeneous within the shoot apical meristem (SAM) of the model plant *Arabidopsis thaliana*. We further suggest that the coupling of tissue mechanics and hydraulics can predict various growth modes that cannot be recapitulated by previous models. Together, our results reveal cell pressure as a source of patterned heterogeneity and illustrate links between tissue geometry, mechanics, and growth, with potential roles in tissue homeostasis and morphogenesis.

Recent Publications:

1. Ali O, Cheddadi I, Landrein B, Long Y (2023) Revisiting the relationship between turgor pressure and plant cell growth. New Phytol, 238: 62-69.
2. Nieves-Cordones M, Azeem F, Long Y, Boeglin M, Duby G, Mouline K, Hosy E, Vavasseur A, Chérel I, Simonneau T, Gaymard F, Leung J, Gaillard I, Thibaud JB, Véry AA, Boudaoud A, Sentenac H (2022) Non-autonomous stomatal control by pavement cell turgor via the K+ channel subunit AtKC1. The Plant Cell 34: 2019–2037
3. Long Y*, Cheddadi I, Mirabet V, Mosca G, Dumond M, Traas J, Godin C & Boudaoud A* (2020) Cellular heterogeneity in pressure and growth emerges from tissue topology and geometry. Curr. Biol. 30(8): 1504-1516.e8.