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COMPUTING A TISSUE

MODELING MULTICELLULAR SYSTEMS

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Coupling mechanical and hydraulic processes in multicellular models of plant development

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Up to now, models of organ morphogenesis in plants have mainly focussed on the regulation of cell wall mechanical properties at cellular level, such as rigidity and mechanical anisotropy. However, growth is primarily powered by water fluxes and cell turgor.

In this work, we propose a new multicellular model to study the interaction between the hydraulic and mechanical processes involved in tissue development. In this model, turgor pressure appears as a flexible variable that can mediate between various growth constraints. We show that the coupling of both processes exhibits new emergent properties that can help interpret different aspects of morphogenesis in plant organs. In particular, in specific areas of the parameter space, the system can be interpreted as a new type of lateral inhibitory mechanism that could contribute to the amplification of organ shape differentiation.

