Novel cell-based model of the generation and maintenance of the shape and structure of the multi-layered shoot apical meristem of *Arabidopsis thaliana*

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One of the central problems in animal and plant developmental biology is deciphering how chemical and mechanical signals interact within a tissue to produce the final form, size, structure and function of an organ. To address this problem, a novel, multi-scale, cell-based computational model of the stem cells of the shoot apical meristem (SAM) of *Arabidopsis thaliana* is developed and calibrated using experimental data. Novel features of the model include separate, detailed descriptions of cell wall extensibility and mechanical stiffness, deformation of the middle lamella and increase in cytoplasmic pressure generating internal turgor pressure. The model is used to test a novel hypothesized mechanism of formation of the shape and structure of the growing, multilayered SAM. It combines contributions of mechanical properties of sub-cellular components of individual cells determining anisotropic cell expansion across three different SAM layers, and varied cell growth rates based on WUS concentrations of individual cells. This suggests a possible novel SAM growth mechanism to be tested in experiments.