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Shape and dynamics of tip growing cells

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Walled cells have the ability to remodel their shape while sustaining an internal turgor pressure that can reach many atmospheres. I will describe how we may treat a tip growing cell as an osmotic engine which elongates via the assembly and expansion of cell wall in the apical region of the cell. A simple model that couples transport to growth allows us to determine the radius of the pollen tube and its growth velocity in terms of the turgor pressure and the secretion rate and rheology of the cell wall material, and results in simple scaling laws for the geometry and dynamics of the cell. We find that a single dimensionless parameter, which characterizes the relative roles of cell wall assembly and expansion, is sufficient to explain the observed variability in pollen tube shapes and also provides a framework for the comparative study of pollen tubes and fungal hyphae in an evolutionary context.