# PHYSICAL MATHEMATICS SEMINAR

## MORPHOGENESIS AND EVOLUTIONARY STRATEGIES OF TIP GROWING CELLS


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**ABSTRACT**:

Walled cells have the ability to remodel their shape while sustaining an internal turgor pressure that can reach values up to 10 atmospheres. This requires a tight and simultaneous regulation of cell wall assembly and mechanochemistry, but the underlying mechanisms by which this is achieved remain unclear. Here we study the interplay between growth and mechanics in shaping a walled cell, in the particularly simple geometry of tip growing cells, which elongate via the assembly and expansion of cell wall in the apical region of the cell. We describe the observed irreversible expansion of the cell wall during growth as the extension of an inhomogeneous viscous fluid shell under the action of turgor pressure, fed by a material source in the neighborhood of the growing tip. This allows us to determine theoretically the radius of the cell and its growth velocity in terms of the turgor pressure and the secretion rate and rheology of the cell wall material. We derive simple scaling laws for the geometry of the cell and 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 shapes of tip growing cells. More generally, our description provides a framework to understand cell growth and remodeling in plants (pollen tubes, root hairs, etc.), fungi (hyphal growth and fission and budding yeast) and some bacteria, in the context of both tip growth and diffuse growth."


**TUESDAY, NOVEMBER 10, 2009**
**2:30 PM**
**Building 2, Room 105**

*Refreshments at 3:30 PM in Building 2, Room 290*
*(Math Department - Common Room)*


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