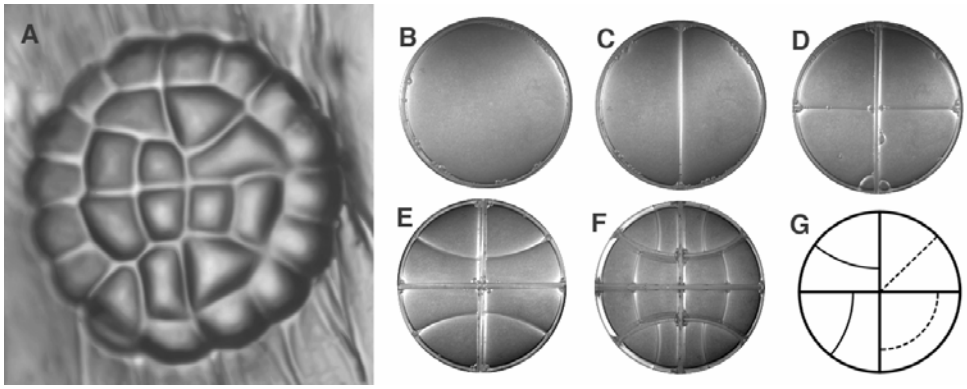
PHYSICAL MATHEMATICS SEMINAR

CELL MORPHOGENESIS – WHAT WE HAVE LEARNED FROM RUBBER BALLOONS AND SOAP BUBBLES

JACQUES DUMAIS
Department of Organismic and Evolutionary Biology
Harvard University

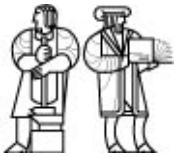
ABSTRACT:

Cells acquire a wide range of forms and sizes, often reflecting the intricate functions they serve. Although cells are complex, many of their characteristic geometrical features are dictated by well-known physical laws. The idea that simple physical models can shed light on fundamental cell biology problems can be traced back to D'Arcy W. Thompson's masterpiece "On Growth and Form". I will present three examples from plant cells. The first example is tip growth. Tip-growing cells form long cylinders with growth located at one end of the cylinder. The surface expansion profiles are mimicked very closely by the deformation of cylindrical rubber balloons thus suggesting a close parallel between rubber elasticity and the growth mechanism in these cells. The second example is cell division in tissue layers. As Thompson pointed out, and as I will show experimentally, the mitotic plane obeys the same rules as soap films. A third example is the folding of pollen grains; which, in its simplest form, admits an exact inextensional solution. For all of these examples, I will emphasize how whole cell mechanics is supported at the subcellular and molecular level.



TUESDAY, DECEMBER 5, 2006
2:30 PM
Building 4, Room 270

Refreshments at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)



Massachusetts Institute of Technology
Department of Mathematics
Cambridge, MA 02139