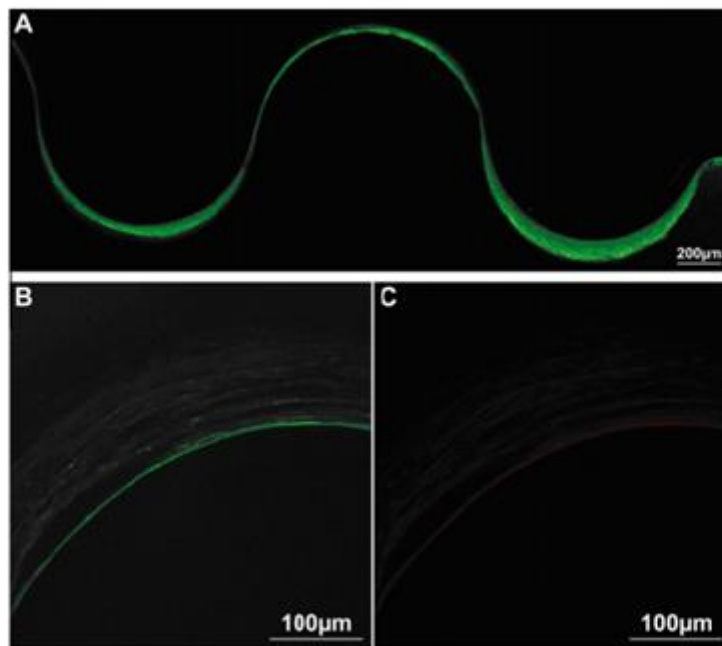


# Modelling the role of surface stress on the kinetics of tissue growth in confined geometries

## Abstract

In a previous paper we presented a theoretical framework to describe tissue growth in confined geometries based on the work of Ambrosi and Guillou [Ambrosi D, Guillou A. Growth and dissipation in biological tissues. *Cont Mech Thermodyn* 2007;19:245–51]. A thermodynamically consistent eigenstrain rate for growth was derived using the concept of configurational forces and used to investigate growth in holes of cylindrical geometries. Tissue growing from concave surfaces can be described by a model based on this theory. However, an apparently asymmetric behaviour between growth from convex and concave surfaces has been observed experimentally, but is not predicted by this model. This contradiction is likely to be due to the presence of contractile tensile stresses produced by cells near the tissue surface. In this contribution we extend the model in order to couple tissue growth to the presence of a surface stress. This refined growth model is solved for two geometries, within a cylindrical hole and on the outer surface of a cylinder, thus demonstrating how surface stress may indeed inhibit growth on convex substrates.



**Fig. 1.** Experimental evidence for the asymmetry between growth on convex and concave surfaces. (A) A stack of confocal images of tissue stained for actin (green) on a wave-like substrate with the scaffold below and medium above. (B, C) a stack of three slices deep in the tissue showing the high concentration of actin (B, green) and myosin (C, red) at the tissue-medium interface. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)