

Internship subject

Tissue growth and homeostasis in limited resources conditions

Summary

Objective: Evaluate how the nutrients availability and mechanical stresses interplay to determine the final size of a colony of eucaryotic cells, both in 2D cell culture and in 3D multicellular aggregates.

Context: The mechanism by which cells measure the size of the organ in which they are embedded, and arrest their growth when the final size is reached, is a long-standing problem in developmental biology. The role of mechanics in this feedback is considered important. However, considering only mechanics is not sufficient to predict the finite asymptotic size ('size control'). A recent work modified the classical framework¹ by including an energetic cost associated with growth, leading to the physical effect of size control. The proposed model capture several experimental observation, such as the final size, the residual stress profile and the emergency of a necrotic core in multicellular aggregates.

Student Contribution: To test the theoretical hypotheses, the student will establish a protocol to grow cell colonies in 2D and 3D, under controlled conditions, both in terms of resources availability and mechanical stress. The internship will be held in close collaboration with the LiPhy theory group.

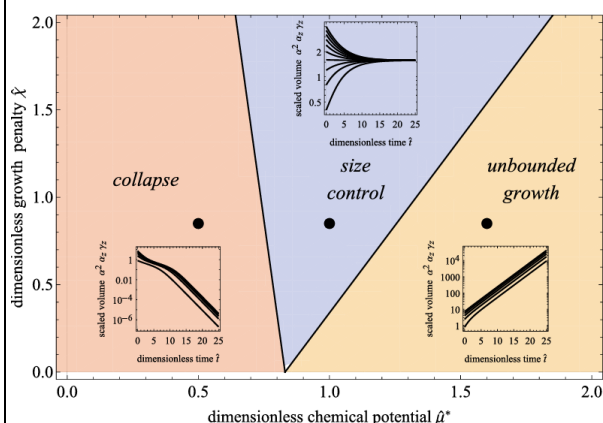


Figure : Dynamics and final size of a growing cell colony. The theory “opens up” a blue region in which a finite non-zero final size is reached, independently of initial. This region is placed between the red “collapse” and the yellow “exponential growth” regime predicted by previous models.

Related Publication by the team

- (1) Mechanical feedback in regulating the size of growing multicellular spheroids.** A. Erlich & P. Recho; *Journal of the Mechanics and Physics of Solids* (2023) 178, 105342

Background and skills expected

The student should be either a physicist or a biologist, who would like to work at the interface between the two disciplines.

Competences that will be acquired during the internship: Cell culture and manipulation, microfluidics, microscopy and data analysis.

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Team/Group : MOTIV / MicroTiss

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