Modelling the dynamics of a biological tissue in vivo

Developing embryos achieve morphogenesis by exploiting cellular forces in a coordinated and oriented manner to generate deformations leading to shape acquisition. To understand these morphogenetic processes the mechanical equilibrium must be described and the behaviour of biological tissues characterised in vivo using a reverse engineering approach. One of the essential tools to achieve this goal is laser nanoablation which can be used to generate cuts in membranes or cytoskeleton of cells to locally modify the mechanical equilibrium; the mechanical properties of the biological tissue can then be inferred by tracking the induced deformation.

During this internship the student will first perform laser nanoablation in the cytoskeleton of C. elegans epidermal cells during morphogenesis at IGDR (Rennes); the induced deformation will be observed at various timescales, corresponding respectively to the relaxation of elastic constraints and deformations due to the forces generated by the cell cytoskeleton. This behaviour will be correlated with the cytoskeleton organisation observed using super-resolution microscopy. Then the student will model these nanoablation experiments using analytical and/or numerical approaches at Liphy (Grenoble).

Candidate profile:

- Physicist interested by the behaviour of complex materials.
- No biological knowledge required.

Internship organisation:

- Laser nanoablation will be performed at IGDR (Rennes) supervised by Grégoire Michaux (2 months). The equipment to perform experiments is available on the MRic facility.
- Modelling at LIPHY (Grenoble) supervised by Jocelyn Etienne using analytical/numerical methods (2 months).
- Monthly internship allowance: 543,60€.

Contacts:

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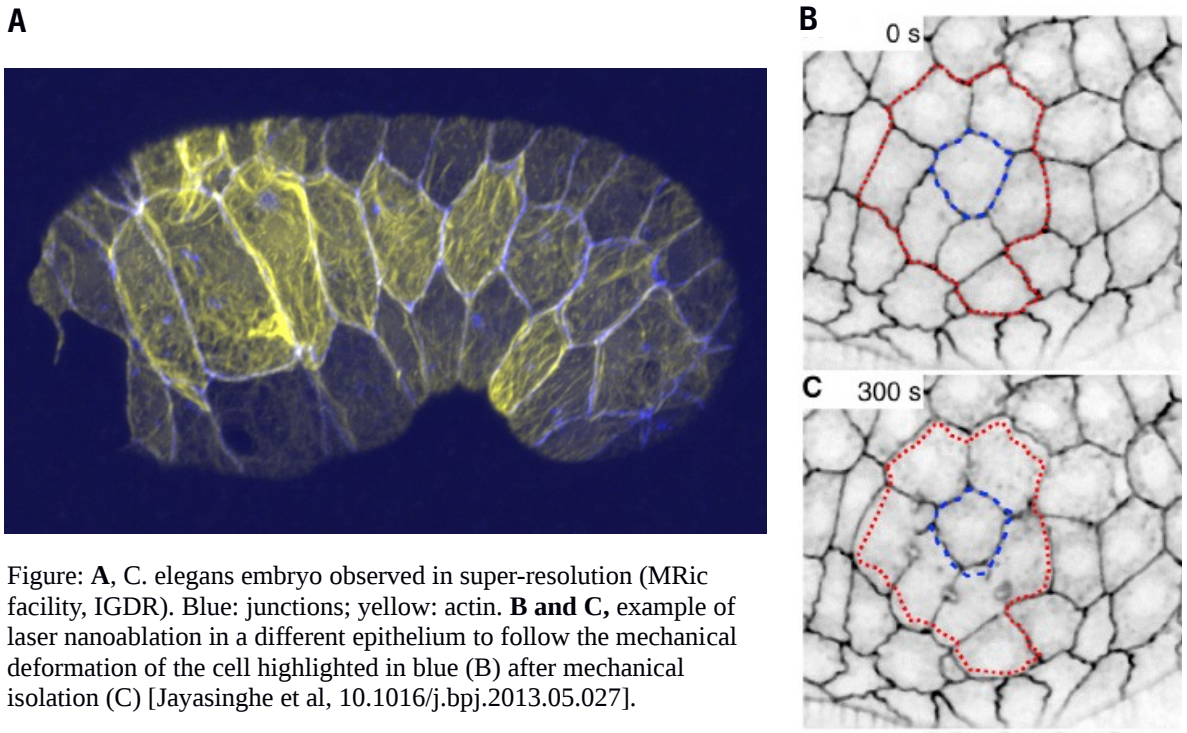

Figure: **A**, C. elegans embryo observed in super-resolution (MRic facility, IGDR). Blue: junctions; yellow: actin. **B and C,** example of laser nanoablation in a different epithelium to follow the mechanical deformation of the cell highlighted in blue (B) after mechanical isolation (C) [Jayasinghe et al, 10.1016/j.bpj.2013.05.027].