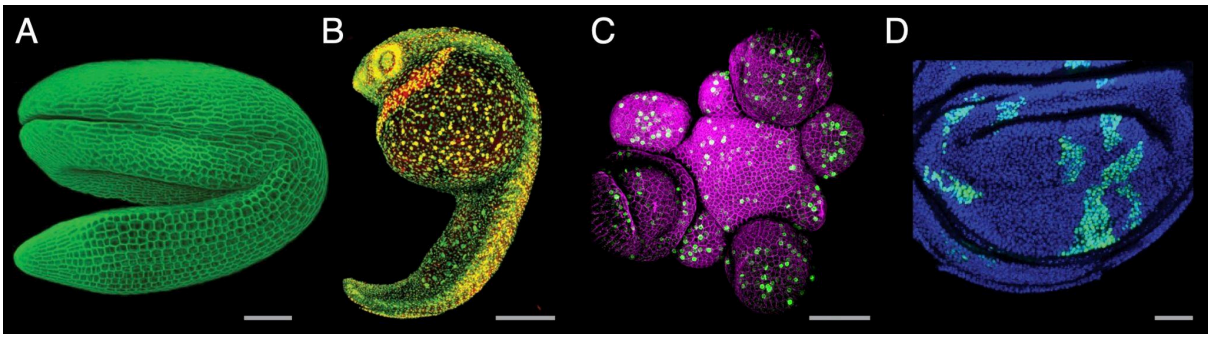
Physics of Morphogenesis in Living Organisms

Organizers: Emily GEHRELS (CINaM, Marseille), Raphaël CLEMENT (IBDM, Marseille), Jean-François RUPPRECHT (CPT, Marseille)
Support: This mini-colloquium is supported by the GDR Applications Quantitatives du Vivant and by the division of Physics and Life of SFP.

Biological organisms develop their complex mature forms through the process of morphogenesis. During morphogenesis, cell-scale interactions lead to the development of shape at the tissue and organism scale. These interactions can be mechanical or biochemical in nature, or involve an interplay between the two.

Some examples of such processes include: genetic programming that directs the expression of force-generating motor proteins, which can in turn feed back on transcription rates, and morphogens that can signal at a distance to establish spatial patterns. The mechanical properties or boundary conditions of a system can also instruct how it responds to local and long-range forces. Physics provides a natural language to integrate these biological interactions into a single formalism and help make sense of the emergence of form.

The goal of this mini-colloquium is to present the state of the art of the different physical mechanisms that underlie the creation of form in developing organisms by exchanging about different examples of morphogenesis across systems, from single-cells to large complex organisms, and in *in vitro* and *in vivo* systems.



(A) Projection of a confocal stack of a complete Arabidopsis embryo. Scale bar 100 µm. (Bassel et al, PNAS 2014). (B) Confocal micrograph of a living Zebrafish embryo, 22 hours post-fertilization. Scale bar 400 µm. (Frederique Ruf-Zamojski, Nikon Small World). (C) Arabidopsis shoot apical meristem with a cell-division marker expressed in green. Scale bar 40 µm. (Weibing Yang, Sainsbury Laboratory). (D) Wing disc from Drosophila late third instar larvae bearing clones of mutant tissue (light blue). Scale bar 50 µm. (Parker and Struhl, PLOS Biology 2015).

Practical notes:
We expect the session to last 3 hrs, with 1 invited speaker (40') and 9 contributed talks (12'+3'). We aim to have presentations on a broad range of systems with an objective of gender parity among the speakers.