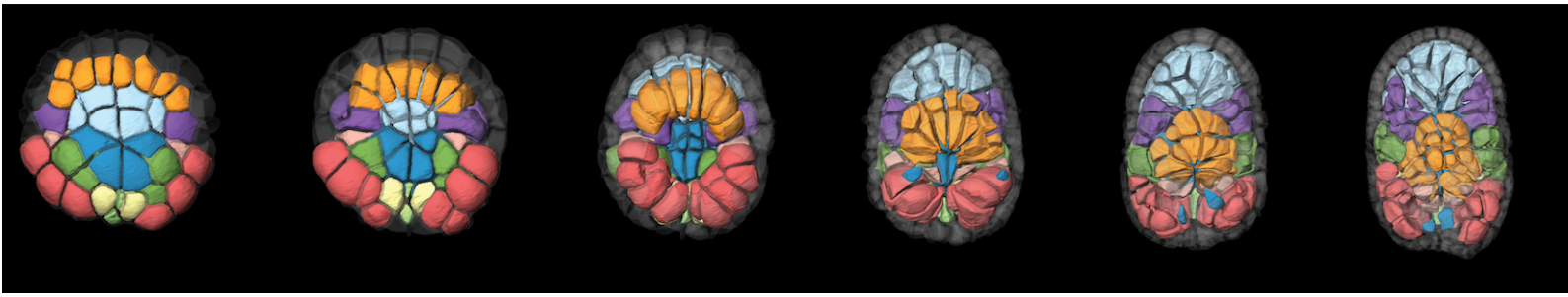

Experimental analysis of natural and experimental variation in morphogenetic trajectories during ascidian development

A 2-year interdisciplinary post-doctoral project to be carried out in the Tunicate team of the Centre for Research in cell Biology of Montpellier (CRBM, Montpellier, France)

The embryonic development of ascidians, a group of marine invertebrates, is remarkably invariant, at the single cell level, between individuals of a given species and between species, even if they diverged up to 400 MY ago. Ascidian genomes, however, evolve particularly rapidly. To understand this paradox, we are combining experimental, mathematical and physical approaches to explain the remarkable precision and evolutionary stability of ascidian embryonic morphologies.

We are seeking to hire a new post-doctoral colleague to experimentally test the hypothesis, derived from dynamical systems theory, that the extent of inter-individual natural variation and robustness to experimental perturbations are anticorrelated during development.

This project will initially involve the live light-sheet imaging of wild-type transparent embryos of the ascidian *Phallusia mammillata*, pre-injected with mRNA for fluorescent membrane markers (see Guignard, Fiuza et al, 2020). These imaging datasets will be computationally reconstructed using efficient automated tools developed by the team and its collaborators (including ASTEC, MorphoNet) and analysed to characterize the structure of natural variation along developmental trajectories. These data will then be compared to a temporal analysis of the robustness of the developmental program to specific or pleiotropic experimental perturbations (environmental: temperature, water salinity; genetic: chaperones, signalling pathways...).

In a second step, we will test whether evolutionary bifurcations map to points of highest natural variation in ascidians. For this, we will extend our imaging analysis of inter-individual and inter-species variation to fixed and cleared embryos of a different genus of ascidians, *Molgula*, in which several closely related species show alternate developmental trajectories (tailed vs tailless).

Throughout the project, the hired post-doc is expected to establish strong links with collaborative computational teams in Montpellier (LIRMM, Emmanuel Faure) and Sophia Antipolis (Morpheme, Grégoire Malandain) and a statistical physics team at Northwestern University (Madhav Mani), in the Chicago area.

Ideal candidates are cell and developmental biologists keen to enter the interdisciplinary field of quantitative biology, physicists keen to develop experimental skills in biology, or scientist with a mixed biology and physics training. Some experience with marine/ascidian embryos would be a plus, but is not required. The project can be adapted to the scientific background of the selected candidate. Candidates are expected to be driven by science and have a very strong track record of previous academic work. Our team promotes equal employment opportunities.

To apply, please contact Dr. Patrick Lemaire (patrick.lemaire[at]crbm.cnrs.fr) with a motivation letter for the project, a CV and the names and contact details of 2 academic referees, including the PhD supervisor. A working knowledge of English (B2) is needed, there is no prerequisite in French. The position will remain open until filled. Starting date is between fall 2023 and spring 2024.

References linked to the project:

1. Guignard L. *, Fiuza U.-M. *, Leggio B., Laussu J., Faure E., Michelin G., Biasuz K., Hufnagel L., Malandain G. #, Godin C. #, Lemaire P.# (2020) Contact-area dependent cell communications and the morphological invariance of ascidian embryogenesis. Science, 369 :6500 eaar5663

2. Leggio, B; Laussu J; Carlier, A; Godin, C; Lemaire, P and Faure, E (2019) MorphoNet: An interactive online morphological browser to explore complex multi-scale data. Nat Commun. 10(1):2812