# Mechanics of feather pattern formation

Ph.D. project (3-year fellowship)

***IBDM, Turing Center for Living Systems, Marseille***

Animals exhibit an exquisite diversity of adaptive patterns. What mechanisms produce such variation while ensuring pattern stability?

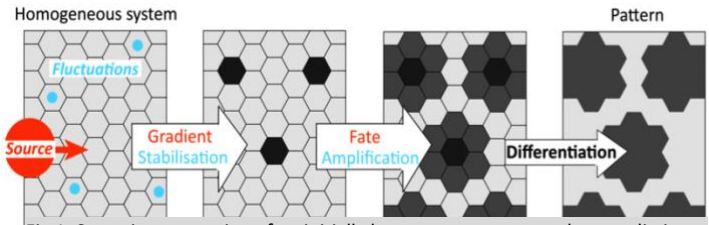
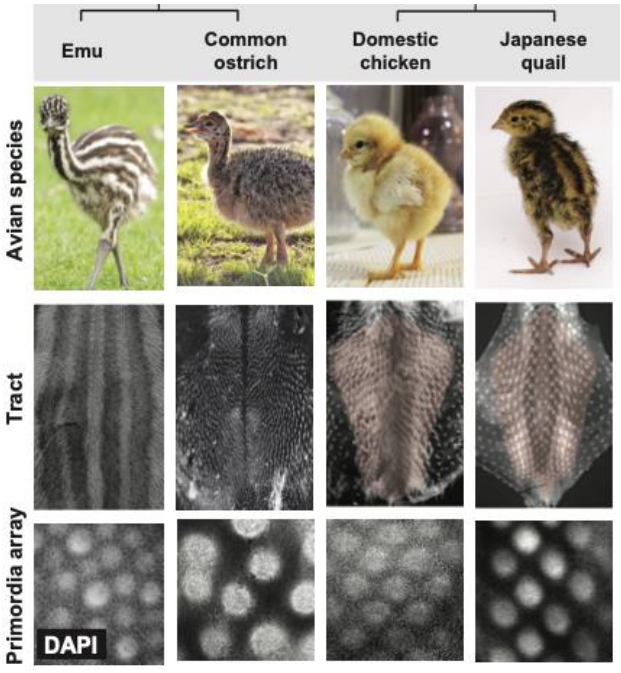



Fig 1: Stepwise patterning of an initially homogeneous system by two distinct models: in red, a chemical source produces a graded signal that instructs cells and defines their state; in blue, self-organization processes transform fluctuations into spatial references through stabilization/amplification.

Several mechanisms, including reaction-diffusion or morphogen-mediated, have been proposed to explain this variation but have been poorly tested experimentally (Figure 1).

In this project, we propose to study candidate pattern-forming processes by exploiting inter-species variation in patterns formed by feather precursors (primordia) in birds (Figure 2). Their origins are both chemical and mechanical. The Ph.D. student will characterize cellular and mechanical mechanisms controlling primordia aggregation. They will assess mechanical stresses in the developing epidermis and dermis using two approaches: (1) force inference, which consists in inferring local and global forces from the topology and geometry of cell contacts in fluorescence images; (2) deformable microbeads that are inserted in the tissue and whose deformations are mapped in space and time. Local and global mechanical perturbation experiments, in particular by laser ablation, will allow us to determine the role of mechanical stresses in pattern generation. In addition, we will alter the contractility and motility of cells using drugs. We will thus be able to identify the mechanical basis of the self-organization of primordia and their contribution to the variability and fidelity of the patterns.




The project will be carried out in a biophysics lab that combines experimental and theoretical approaches in collaboration with the groups of Marie Manceau (Collège de France, Paris) and mathematicians Thomas Lepoutre (INRIA Lyon) and Jonathan Touboul (Brandeis Univ, USA).

**Expected profile of the applicant:**
The project requires a solid background in physics, computational skills, and a strong interest in living systems.

**Start Date:** June 2023 – October 2023. The project is funded for three years.

**Team***: Physical Approaches to Cell Dynamics and Tissue Morphogenesis*

**To Apply:** Informal inquiries are welcome. We invite applicants to submit a letter of interest, a statement of prior research experience and professional interests, a CV, and contact information for 2 professional references to PF Lenne, pierre-francois.lenne@univ-amu.fr and R Clément raphael.clement@univ-amu.fr.