

Mechanics of feather pattern formation

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

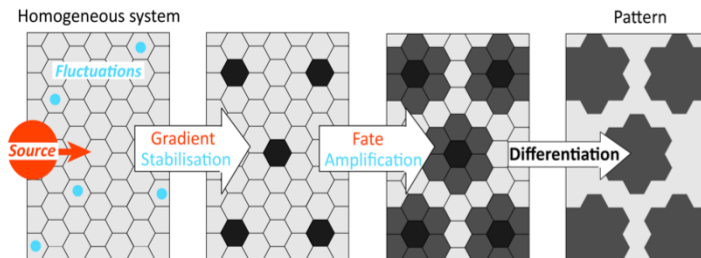


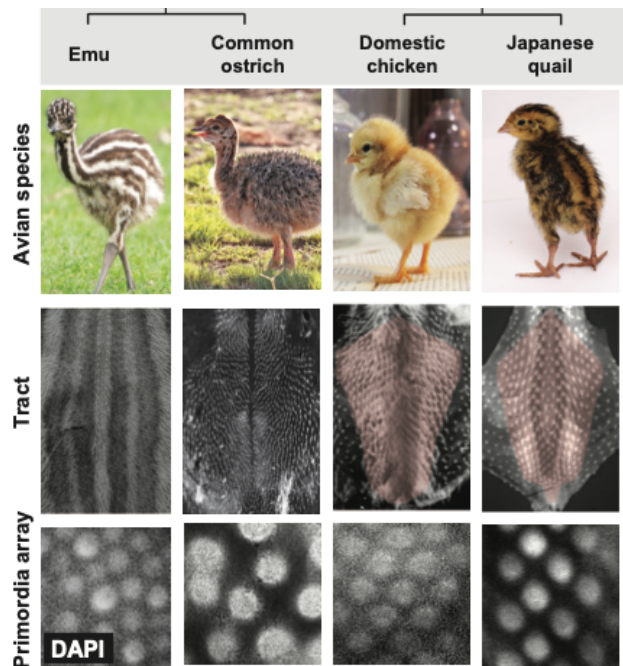
Fig 1: Stepwise patterning of an initially homogeneous system by two distinct models: in red, a chemical source produces a graded signal that instructs cells and defines their state; in blue, self-organization processes transform fluctuations into spatial references through stabilization/amplification.

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

Their origins are both chemical and mechanical. The intern will characterise cellular and mechanical mechanisms controlling primordia aggregation. He/she 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 microdroplets that are inserted in the tissue and whose deformations are mapped in space and time.

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

The project requires a solid background in physics, computational skills and a strong interest in living systems. The project will be carried 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). This master project may lead to an ANR-funded PhD.



Keywords: complex systems, advanced microscopy, image analysis, cell mechanics, developmental biology, physical models.

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

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