PhD Program 2017, team of **Anne-Cécile Reymann.**

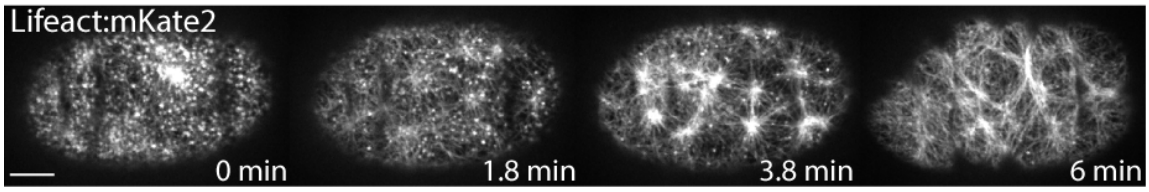
3 year PhD at the biophysic / cell biology interface.
Specialty: cell biology/imaging/quantitative biology

Title: **From molecules to active gel like material, building the actin cortical layer of *C. elegans* early embryos.**

Cell architectures equilibrate and remodel perpetually. The actin cortex, submicron network under the cell membrane consisting mostly of actin filaments and myosin molecular motors but also using a wide palette of molecular building blocks is key in maintaining such dynamical equilibrium by constant assembly-disassembly processes. This active material allows cells to maintain their shape, produce or sense forces. My team studies the **biophysical properties of the actomyosin cortex in early *C. elegans* development.** We aim to reveal how these properties are regulated and change over time to control early morphogenesis processes during the first few divisions of the *C. elegans* embryo. My team will be fully **interdisciplinary at the interface of biochemistry, cell biology and physics**. The idea is to back up hypothesis rising from direct *in vitro* observation using high resolution confocal spining disk with *in vitro* reconstitution with purified proteins and *in silico* numerical simulations whenever possible. This will allow us to cross scales from molecules to large-scale coherent material and open up new insights into the understanding of the architectural orchestration and regulation of actin cytoskeletal structures.

The specific aim of this PhD will be to fully understand the process of cortical actin assembly and answer the how/when/where questions related to it. We will start by characterizing the molecular orchestration of actin and actin binding molecules during the cortical assembly process in the *C. elegans* early embryo. Focus will specifically be given to the known main actor of actin nucleation at this stage, namely the formin CYK-1. This study will be conducted and compared in different spatio-temporal context (oocyte to zygotic transition, polarization, first division or cortical homeostasis) and especially compared in between sisters cells of the developing embryo.

During *C. elegans* development, nearly every division produces daughter cells with different developmental trajectories through a remarquable invariant cell lineage. *C. elegans* has thus become an excellent model system for studying cellular symmetry breaking in a developmental context. In the early embryos, the initial series of asymmetric early divisions are crucial for generating diversity in cell sizes, cell contents and cell fates, thus producing the 6 founder cells and establishing the three main body axes of the embryo between the 1 to 6 cells stage. In some cases, these differences are imposed on daughters before or after division through inductive signals, but many of these divisions are intrinsically asymmetric, an initial symmetry-breaking step creates polarized distributions or activities of factors that control developmental potential. The proposed project will tackle this aspect focusing on the cellular cortical layer that both undergoes some asymmetric segregations of its constituents but is also a main driving force during these processes.



Actin dynamics in the C. elegans one-cell embryo during the initial cortical assembly process post fertilization. Scale bar 10 µm.