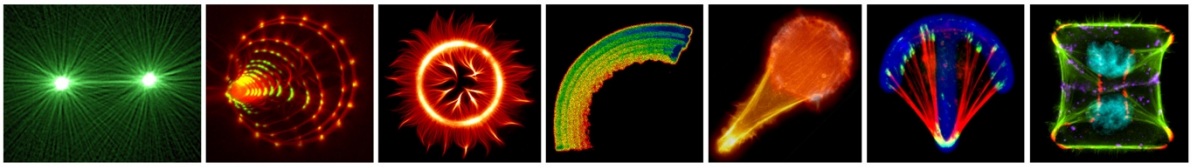


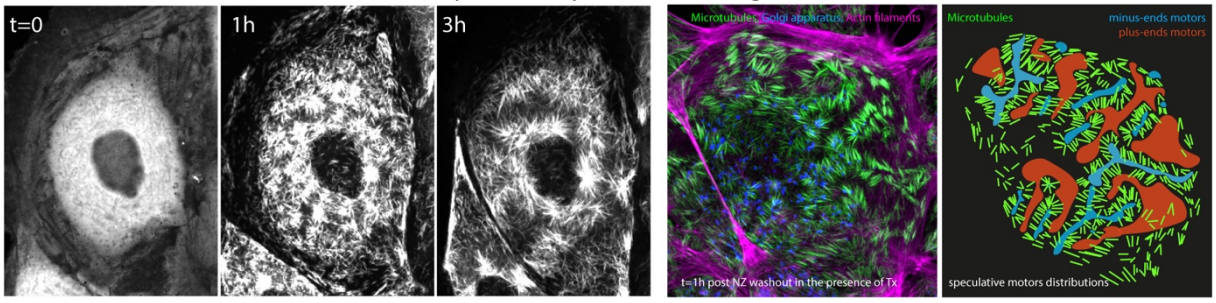
3-6 months **master 2** internship in the CytoMorphoLab in Paris

Self-organization of cellular microtubule networks

Microtubules produce mechanical forces as they grow and shrink. They also support the forces produced by molecular motors. The spatial distribution of these two sets of forces orients intra-cellular transport, positions organelles, and thereby determines the cellular compartmentation and polarity.

The architecture of microtubule network depends on two main contributions: the **templated growth**, which is defined by the amount and localization of microtubule nucleators, and the **self-organization of microtubule and motors**, which depends on the concentration of various motors and the number and length of microtubules. This contribution has been much studied in the spindle formed by microtubules during mitosis, but is relatively uncharacterized in interphase although it is central to most cell functions.

We recently managed to define some working conditions allowing us to turn down the templated growth and highlight the self-organization of microtubule and motors. To our surprise, we found that components could self-pattern themselves into multiple domains, containing either plus-end or minus-end directed motors, separated by bundles of aligned microtubules.



We propose to further explore these conditions and define the phase diagram defining the number and shape of these domains. This internship will serve as a basis to define a deeper study of this process in various cell types and their evolution as cells progress from a proliferating to a differentiated state (ie as the self-organization progressively replaces the templated growth).

Contact : manuel.thery@cea.fr, Laurent.blanchoin@cea.fr

Most recent publications of the CytoMorpho Lab on this topic:

Compressive forces stabilise microtubules in living cells.
Li Y, Kučera O, .., Blanchoin L, Théry M. ***Nature Materials***, 22(7):913-924, 2023.

Microtubules self-repair in living cells.
Gazzola M, Schaeffer A, … Blanchoin L*, Théry M*. ***Current Biology***. 33(1):122-133.e4, 2023.

Actin network architecture can ensure robust centering or sensitive decentering of the centrosome.
Yamamoto S, Gaillard J, …, Blanchoin L*, Théry M*. ***EMBO Journal***, 41(20):e111631, 2022.

Actin-microtubule dynamic composite forms responsive active matter with memory.
Kučera O, Gaillard J, Guérin C, Théry M*, Blanchoin L*. ***PNAS*** ;119(31):e2209522119, 2022.

Acto-myosin network geometry defines centrosome position.
Jimenez AJ, Schaeffer A, …, Blanchoin L, Théry M. ***Current Biology,*** 31(6):1206-1220.e5, 2021.

Self-repair protects microtubules from their destruction by molecular motors.
Triclin S, Inoue D, SL, Blanchoin L*, Théry M*. ***Nature Materials,*** 20(6):883-891, 2021.