Laboratoire d'Optique et Biosciences

Dr. Nicolas David

Cell migration and actin dynamics in the zebrafish embryo

Cell migration is key to physiological events such as embryonic development, wound healing and immune cell function. It also plays a role in pathological processes such as the formation of metastasis when tumour cells acquire migratory properties. In our team, we use the zebrafish embryo to study cell migration *in vivo* and to understand the cell movements that will shape the embryo. The zebrafish embryo is a very powerful model of study that can combine simple genetic and functional approaches with excellent 3D imaging.

As a cell move, it extends its plasma membrane forward at the leading edge. Actin polymerisation under the membrane generates the driving force allowing the membrane to move forward. Controlling the dynamics of actin at the leading edge is thus critical to fine tune cell migration (speed, direction, persistence). Therefore actin dynamic is finely regulated by positive and negative feedback loops. However, only few of these feedback loops have been identified and properly characterised. In order to dissect the feedback loops that control these mechanisms, new regulators of actin dynamics have recently been identified by the lab of A. Gautreau with which we collaborate.

The aim of the internship is to study the *in vivo* function of one of these new regulators, BAIAP2L1, during cell migration and embryonic development. The student will establish the expression profile of BAIAP2L1 and initiate its functional characterisation by analysing the effects of its loss of function (morpholino) on embryonic development and migratory properties (speed, protrusions, persistence, mean square displacement, etc.). The methodology of this project, already successfully applied in the lab, is based on the analysis of transgenic lines expressing a fluorescent protein in migrating cells, combined with 3D imaging techniques to analyse cell migration in the living embryo (confocal microscopy, two-photon microscopy and light sheet microscopy).

Technical Methodology:
Molecular Biology (RT-PCR, cloning, *in vitro* transcription), embryology (micro-injection), imaging (confocal, two-photons, light sheet).

Environment: The internship will take place in the Advanced Microscopy pole of the Lab for Optics and Biosciences at Ecole Polytechnique (LOB). This structure brings together experts in microscopy and biology, providing a great environment for multidisciplinary interactions.
https://portail.polytechnique.edu/lob/en/research/advanced-microscopies-tissue-physiology

Dates: 8 weeks minimum, from March, 1st 2020.
Supervision: Sophie Escot.
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Recent publications from the team:

1. Boutillon, A., Giger, F. A. & David, N. B. Analysis of In Vivo Cell Migration in Mosaic Zebrafish Embryos. *Methods Mol. Biol.* **1749**, 213–226 (2018).
2. Giger, F. A. & David, N. B. Endodermal germ-layer formation through active actin-driven migration triggered by N-cadherin. *Proc. Natl. Acad. Sci.* **114**, 10143–10148 (2017).
3. Giger, F. A., Dumortier, J. G. & David, N. B. Analyzing In Vivo Cell Migration using Cell Transplantations and Time-lapse Imaging in Zebrafish Embryos. *J. Vis. Exp.* **53792**, 1–10 (2016).
4. Dumortier, J. G. & David, N. B. The TORC2 Component, Sin1, Controls Migration of Anterior Mesendoderm during Zebrafish Gastrulation. *PLoS One* **10**, e0118474 (2015).
5. Dang, I. *et al.* Inhibitory signalling to the Arp2/3 complex steers cell migration. *Nature* **503**, 281–4 (2013).
6. Dumortier, J. G., Martin, S., Meyer, D., Rosa, F. M. & David, N. B. Collective mesendoderm migration relies on an intrinsic directionality signal transmitted through cell contacts. *Proc. Natl. Acad. Sci. U. S. A.* **109**, 16945–50 (2012).