Peering inside tumorous cell aggregates with optical fibers

Research internship (2026)

Laboratory: Laboratoire Interdisciplinaire de Physique (LIPhy), Grenoble, France
Supervisors: Dr. Dorian Bouchet & Dr. Giovanni Cappello
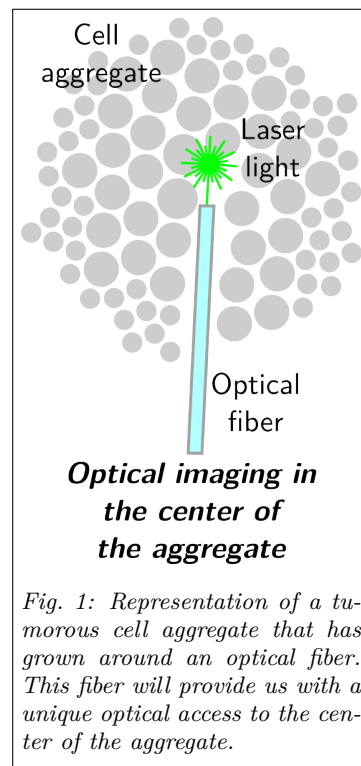
Project description

Determining the internal dynamics of tissues is essential to understand how living organisms develop. However, in thick tissues such as large tumorous cell aggregates, multiple scattering of light in the tissues makes it very difficult to get clear images of the center of the aggregates [1]. This is a major hurdle that prevents us from fully understanding how these aggregates grow and die.

The main objective of this project is to **image inside a tumorous cell aggregate using an optical fiber**. By making the cell aggregate grow at the apex of an optical fiber, we will be able to use this fiber for guiding light waves in and out the aggregate. Thanks to recent breakthroughs in controlling light propagation in multimode fibers [2], we will then be able to use this light in order to make, for the first time, clear images of the dynamical processes occurring deep within such aggregates.

At an initial stage, the project will involve making a cell aggregate grow at the apex of a multimode optical fiber. At a later stage, an optical system will be built to make a clear image of the center of the aggregate via the fiber. This project will be implemented at the Laboratoire Interdisciplinaire de Physique in Grenoble, within the OPTIMA team (which develops novel optical imaging techniques) and the MICROTISS team (which studies how cells respond to mechanical stimuli).

During this interdisciplinary internship, the student will learn experimental skills in biology (how to make cell aggregates grow) and in optics (how to build a optical setup). He/she will also improve his/her skills in programming (Python), in writing scientific reports (LaTeX) and in presenting scientific results.

Optical imaging in the center of the aggregate

Fig. 1: *Representation of a tumorous cell aggregate that has grown around an optical fiber. This fiber will provide us with a unique optical access to the center of the aggregate.*

Profile of the candidate

This project can be carried out as a M2 internship or as a Graduate School internship. Candidates with academic backgrounds in physics or engineering are expected. Specific skills in optics and programming (Python, Matlab,...) will be a strong advantage for the project.

For further information

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References:
[1] B. Brunel *et al.*, New Journal of Physics **19**, 073033 (2017)
[2] H. Cao *et al.*, Advances in Optics and Photonics **15**, 524-612 (2023)