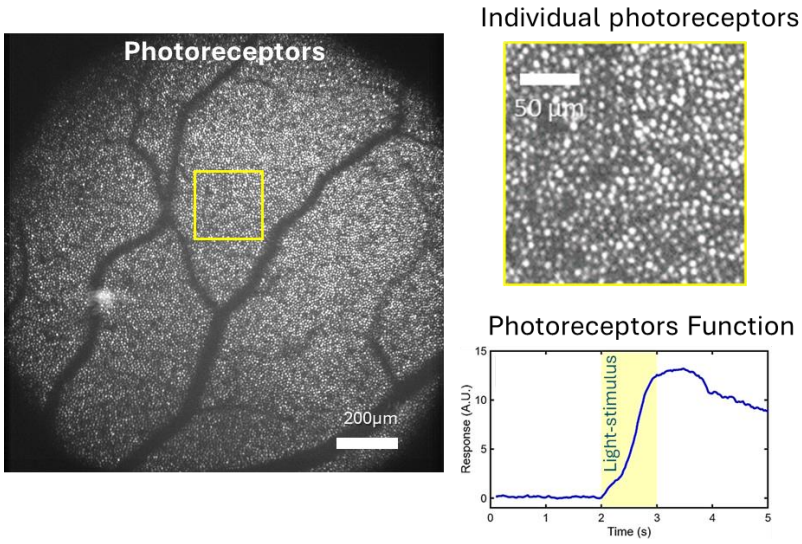
M2 Internship proposal – European project

Laboratory: Institut Langevin (1 rue Jussieu, 75005, Paris)
Supervisor: Pedro Mecê (pedro.mece@espci.fr)

Internship title: **Volumetric High-Speed Functional Imaging of the Living Human Retina**

Context: This Master 2 internship is part of the European project ERC MIRACLE-AD (principal investigator: Pedro Mecê). The project aims to unravel the mechanisms of neurovascular coupling (NVC) — the process linking neuronal activity to local blood-flow regulation — whose early dysfunction is thought to be one of the earliest hallmarks of Alzheimer's disease (AD).

Because the retina is the only optically accessible part of the central nervous system, it provides a unique opportunity to investigate these mechanisms directly and non-invasively in humans. By combining advanced optical imaging and data-driven analysis, MIRACLE-AD seeks to characterize the functional dynamics of retinal neurons and microvessels at the cellular scale and to identify early optical biomarkers of Alzheimer's disease.



In this context, our group has recently developed a **new modality of Full-Field Optical Coherence Tomography (FF-OCT)** that enables **high-speed volumetric acquisition**. This innovative system opens the possibility of probing the function of **photoreceptors and other retinal neurons in vivo** at nanometric precision.

Internship objectives: The goal of this internship is to develop new image-processing tools associated with a next-generation Full-Field Optical Coherence Tomography (FF-OCT) system designed to probe human retinal neuronal function (see figure above).

The intern will contribute to the following objectives:

1. **Develop an algorithm** for volumetric image alignment.
2. **Design an image-processing pipeline** to extract functional signals from individual retinal neurons.
3. **Participate in image acquisition** and integration of new features into the FF-OCT system.

Environment: This work will be carried out in close collaboration with researchers, engineers, clinicians, and PhD students from the Institut Langevin (ESPCI Paris – PSL) and the Paris Eye Imaging Group at the Quinze-Vingts National Ophthalmology Hospital (Paris). The internship offers an exceptional interdisciplinary environment at the interface between optics, image processing, and neuroscience.

Internship duration: **M2**: 5-6 months

Possibility to continue in a PhD program: Yes.

How to apply? Interested applicants should send a **CV**.