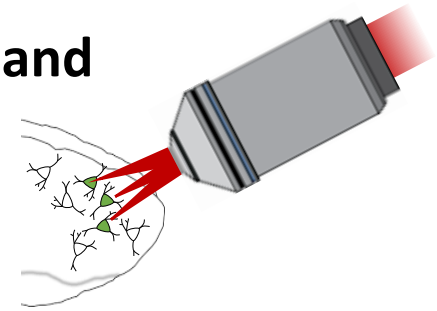
Fast two photon microscopy and patterned photo-stimulation



The institute…

The Hearing Institute (Institut de l'Audition, IdA) is a new center for basic and translational neuroscience research in the field of hearing, which opened in 2020 at the initiative of the Fondation Pour l'Audition and the Institut Pasteur. The overarching goal of the Institute is to elucidate the principles underpinning the workings of the auditory system, auditory perception and cognition from the molecular to the cognitive level. Optical techniques are key for this endeavor. The Institute is therefore setting up, a state-of-the-art imaging facility, which is now equipped with modern confocal microscopes for structural investigation of ear and brain tissues in vitro. However, the facility does not provide any equipment for imaging deep tissues *in vivo,* which is necessary to bridge the molecular and system scales and understand how cellular assemblies, in the ear and in the brain, construct the hearing function. To cope with this major issue, this project aims at building a versatile shared two-photon microscope for measurements and manipulations of the neural networks of the central auditory system and for optical investigation of 3D cochlear organoids.

The project…

The aim of the project is to build a completely homemade two-photon laser microscopy system featuring patterned illumination for photostimulation and free rotations around the sample. The system will be custom-built at low cost and tailored to the needs of five core teams in the institute. The majority of the elements has been bought. The student will design, mount, align and characterize the system.

This unique instrument will be used in particular for the observation of neural network activity through thousands of neurons and for the design of stimulation patterns allowing to reproduce artificially observed activity patterns. The combination of these two features will allow investigating the causality of specific neuronal activity patterns for auditory perception, and thereby identify the neural substrate of perception, but also provide new avenue for cochlear electrophysiology and development studies. It will, as well, open new opportunities to investigate high level properties of the auditory system such as its lateralization and plasticity in the context of hearing restoration.

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