Postdoc –Random access two-photon optical voltage recording to study cerebellar interneuron coding in behaving mice
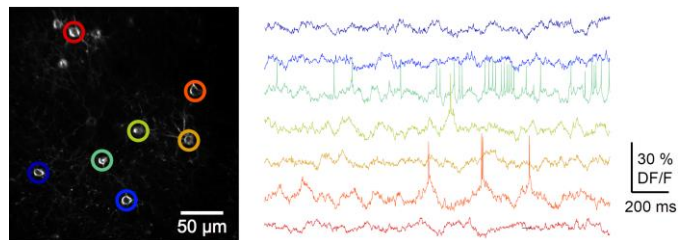
IBENS, Ecole Normale Supérieure, Paris, France

The Bourdieu and Dieudonné groups at the Institute of Biology of the École Normale Supérieure (IBENS), are seeking one talented postdoctoral scientist interested in using two-photon optical voltage recording at the cellular level to study inhibitory cerebellar microcircuits in behaving mice.

The work will be carried out within the framework of a project funded by NIH BRAIN Initiative. Candidates should have experience in *in vivo* 2P based functional imaging, surgery and data analyses, and should be motivated to work within an interdisciplinary research program. Previous experience in one or several of the following topics would be an asset: quantitative approaches for data analysis, viral transduction and associated genetic strategies, cerebellar microcircuits and electrophysiology/patch clamp.

Project. The successful candidate will develop a project, using advanced two-photon fluorescence microscopy (TPFM) for *in vivo* voltage recording of neuronal activity. Specifically, we propose to probe cerebellar microcircuit input-output relationships during a postural control behavioral task established in the group. Cerebellar interneurons fire at high frequencies (up to 100 Hz) while generating very little spike-associated calcium transients. They are also very difficult to probe with conventional electrophysiological techniques *in vivo*. Thus, optical voltage recordings provide a unique and novel window into cerebellar microcircuitry functioning and sensory-motor processing.

The IBENS groups have pioneered the use of acousto-optic deflectors (AODs) in TPFM for random-access of selected points of interests at kHz frame-rates. This technique permitted the first two-photon optical recording of Genetically Encoded Voltage Indicators (GEVI) (Villette, Charvarha et al, Cell, 2019; Liu,Lu,Villette et al. Cell, 2022). To interrogate neurons in 3D we recently developed Custom-Access Serial Holography (3D-CASH,

Akemann et al., Nature Methods 2022), recording calcium activity in a hundred neurons at 200Hz. The project will go one major step further in using 3D-CASH to record optically the voltage signals of multiple cells in 3D and will benefit from a new version of 3D-CASH incorporating temporal focusing. During the project the candidate will participate in the assay of improved versions of GEVIs developed in the lab of Francois St-Pierre (Baylor College of Medicine), and co-PI of this BRAIN initiative grant

Environment. The Institute of Biology of the École Normale Supérieure (IBENS) is located on the main campus of the Ecole Normale Supérieure in the heart of Paris (Latin Quarter). The IBENS is dedicated to fundamental research at the frontline of the Life Sciences. It gathers 29 research teams grouped in 4 sections (functional genomics, developmental biology, neuroscience, ecology and evolutionary biology). The Bourdieu and Dieudonné's teams have extensive expertise in *in vivo* multiphoton functional imaging to study neuronal network dynamics, respectively in the sensory cortices and in the cerebellum. The candidate will have access to dedicated optics rooms with functional microscopes, in-house staff supported Fab Lab and mechanical workshops, L2 surgery facilities, and storage/computing servers. The appointment will be for 24 months with possible extension, funded by the NIH BRAIN Initiative. Salary will be according to the CNRS rules and depending on experience. Starting date will be in Spring 2024 with some flexibility.

Contact. More information about the projects and work environment can be requested informally via email. Interested candidates should apply before June 2024 by sending a short motivation letter with two emails contact for references and CV to Laurent Bourdieu (laurent.bourdieu@ens.fr), Stéphane Dieudonné (dieudon@biologie.ens.fr) and Vincent Villette (vincent.villette@bio.ens.psl.eu). Applications will be reviewed on a rolling basis. For more information on research at IBENS, please visit: https://www.ibens.bio.ens.psl.eu (teams Laurent Bourdieu and Stéphane Dieudonné).