2-year PostDoc position in *neurobiology* and *computational image analysis*

Project summary

Tunneling nanotubes (TNTs) are thin membranous connections that have gained significant scientific attention as a novel mechanism of intercellular communication for providing a continuous cytoplasmic bridge between cells. By allowing versatile cell-to-cell transport of cargo (e.g. organelles, viruses, and proteins), TNTs have been associated with a wide range of physiological processes and pathological conditions. Unfortunately, due to a lack of a TNT-specific marker, evidence that these structures exist *in vivo* is scarce.

The *Zurzolo lab* has established the presence of TNT-like connections in between developing cerebellar granule cells using state-of-the art serial sectioning scanning electron microscopy and 3D image analysis techniques in collaboration with the Litchtman lab (Harvard University) (*Cordero-Cervantes et al, under submission*). However, the origin of these connections remains ambiguous.

This interdisciplinary project proposes to investigate whether these connections are mitotic in origin or *de novo* TNTs and what is their function during development, using live *ex vivo* brain slices. Going further, the project will dissect the morphological characteristics of these connections using elaborate computational image analysis methods.

The work will involve immunohistochemistry approaches to immunolabel the cerebellar sections using midbody markers such as AuroraB kinase; and confocal and super-resolution microscopy to assess its expression location and distribution in the region of interest. In a complementary approach, in collaboration with the Livet lab (Institut de la Vision), we use transgenic mouse that combines Brainbow technology with Cre-recombinase expression in neural progenitors to create a faithful lineage tracing by mosaic analysis. Multicolor clonal tracking will be performed on acute cerebellar slices using confocal and STED microscopy (coll. with the DiGregorio lab, Institut Pasteur), to assess whether clonal pairs identified by the expression of identical color marker combinations are connected. Furthermore, computational image analysis pipelines will be designed to automatically identify, extract and analyze the TNT-like connections in collaboration with a postdoc in the lab (*Khare and Zurzolo, in preparation*). Acquired 3D image stacks will be segmented using machine learning/deep learning image segmentation methods. Finally, patch-clamp to assess dye-coupling will be used in a parallel approach to investigate the interneuronal connectivity in these ex-vivo brain slices.

The post-doc will benefit of an interdisciplinary environment thanks to ongoing collaborations with Institut Pasteur campus labs of David DiGregorio and Jean Baptiste Masson, as well as with Jean Livet of Institut de la Vision, Paris, to carry out some of the tasks in the project.

Desired skills

We are seeking to hire outstanding, enthusiastic and autonomous postdoctoral scientist eager to work on an interdisciplinary project. Specific interest in computational image analysis as well as microscopy will be advantageous. A background in computational biology/image analysis with fundamental understanding of neuroscience is required. Experience in programming (preferably in python) as well as experience in handling/sectioning tissues, confocal microscopy and knowledge in neuroscience will be very useful.

Further information

The position is open immediately and is funded for two years (possibly extensible) by the Equipe FRM grant to Prof. Zurzolo. Candidates should apply by sending a CV, a motivation letter as well as the name and contact details of at least two academic references to chiara.zurzolo@pasteur.fr.

Lab full link &publications: https://research.pasteur.fr/en/team/membrane-traffic-and-pathogenesis/