3-year PhD 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 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 PhD candidate will use immunohistochemistry approaches to immunolabel cerebellar sections using a midbody marker such as Aurora B kinase, and confocal- and super-resolution microscopy to assess its expression location and distribution in the region of interest. Secondly, the candidate will design computational image analysis pipelines to automatically identify, extract, and analyse identified connections. The candidate will work closely with a postdoctoral scientist in the lab (*H. Khare*) in the lab to segment 3D image stacks using machine learning/deep learning approaches.

The student 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 looking for an outstanding student, motivated, curious, and autonomous, eager to work on an interdisciplinary project. Specific interest in microscopy as well as computational image analysis will be advantageous. Training in cell biology / neuroscience is required. Strong desire to learn and apply tissue handling/sectioning, immunohistochemistry as well as confocal and super resolution microscopy is expected. Basic understanding of programming in python will be a plus.

Further information

The position is funded for three years by the Equipe FRM grant 2021 to Prof. Zurzolo with starting date 1 October 2021. 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/

Selected publications:

- Cordero Cervantes & Zurzolo, 2021. Peering into tunneling nanotubes-The path forward. EMBO J. PMID: 33646572
- Sartori et al., 2019. Nat. Comm. Correlative cryo-electron microscopy reveals the structure of TNTs in neuronal cells. PMID: 30664666
- Gousset et al., 2009. Nat. Cell Bio. Prions hijack tunnelling nanotubes for intercellular spread. PMID: 19198598 DOI: 10.1038/ncb1841