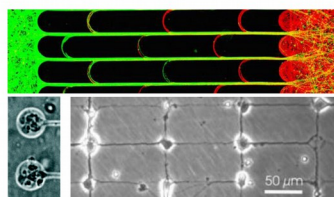
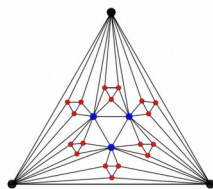


# Modeling Neuronal Networks Robustness under Neurodegenerative attacks

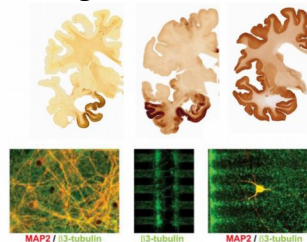
Graphical Abstract : Multi-nodal Networks under Degenerative Insults



Living multi-nodal constrained Networks



In Vitro and In Silico Disease Modeling



In Vitro Prion Spread and Network Dysfunction

This internship, and possibly a thesis, aims to start modeling the robustness of neuronal networks to neurodegenerative attacks of various kinds. We would like to see how different topologies affect the resistance of neuronal activity under degradation of the network itself.

Based on the observation that neurodegenerative disease such as Prion Disease or Parkinson Disease spread along specific neuronal networks motifs *in vivo*, the aim of our project is to challenge the hypothesis that specific neuronal network topologies induce variable vulnerability or robustness toward propagating neuronal dysfunctions.

This internship aims to prepare a larger project that will include experimentation in collaboration with other specialized labs. The goal is to model and understand the impact of topology in activity-dependent neuronal survival in normal and diseased conditions by means of the combination of cell biological approaches, reconstruction of multi-nodal neuronal networks on micro-chips and of *in silico* simulation.

We propose to implement neuronal networks models exhibiting generic topological properties (e.g., hubs, rich-club, clustered versus distributed connections) described in both theoretical neurosciences and connectomic studies and that are predicted to exhibit specific disease associated hallmarks such as robustness toward attack. We will implement various degradation models of the network and simulate neuronal activity with established techniques in the lab.

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**Keywords : theory, neuronal simulation, neurophysics, complex networks**

**Required skills : programming in python (C++ would be a plus), statistical physics, dynamical systems, basis in graph theory and neuroscience.**