

Master project, Alain Destexhe lab, CNRS, Paris-Saclay Institute of Neuroscience

“Dendritic fluids”

The dynamics of single neurons is well described by cable equations, which describe the flow of electric events in the neuron and its integrative properties. Cable equations are usually derived from an electric (RC circuit) analogue of the membrane, but this description makes a number of assumptions which are untrue in neurons, due to the slowness of ionic charges that define the membrane potential. In this project, we would like to examine the possibility of describing neurons from fluid dynamics considerations, ie Navier-Stokes equations. We have preliminary results showing that cable equations can be derived from Navier-Stokes, under certain approximations (for example linear and incompressible fluids). This approach may lead to a more appropriate description of neurons, where the slowness of charge transport is more correctly taken into account than a RC-circuit analogy. Consequences for the integrative properties of neurons will be examined.

The project will be supervised by Alain Destexhe (DR), together with two postdocs in the lab. It may be continued as a PhD thesis, as a function of the interest of the candidate.

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