DISTINGUISHED LECTURE in BIOLOGICAL ENGINEERING

“Ions in Solutions and Channels: the Plasma of Life”

Monday – November 21, 2016 – 12h15
EPFL – room SV1717

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host: Prof. Aleksandra Radenovic

Abstract:
Biology occurs in ionic solutions that are plasmas in both the physical and biological meanings of the word. Ion channels are proteins with a hole down their middle that conduct ions (spherical charges like Na⁺, K⁺, Ca²⁺, and Cl⁻ with diameter ~ 0.2 nm) through a narrow tunnel of fixed charge (‘doping’) with diameter ~ 0.6 nm. Ionic channels control the movement of electric charge and current across biological membranes and so play a role in biology as significant as the role of transistors in computers: almost every process in biology is controlled by channels, one way or the other.

Ionic channels are manipulated with the powerful techniques of molecular biology in hundreds of laboratories. Atoms (and thus charges) can be substituted a few at a time and the location of every atom can be determined in favorable cases. Ionic channels are one of the few living systems of great importance whose natural biological function can be well described by a tractable set of equations.

Ion channels can be studied by Poisson-Drift diffusion equations familiar in plasma and semiconductor physics—called Poisson Nernst Planck or PNP in biology. My collaborators and I have shown how the relevant equations can be derived (almost) from stochastic differential equations, and how they can be solved in inverse, variational, and forward problems using models with only a handful of parameters that do not change even when concentrations change by a factor of 10⁷.

Sandwiches will be provided

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